Veterinary Public Health and Zoonotic Disease Control in SAARC Countries

SAARC Agriculture Centre
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Editors
Dr. S. K. Pal
Deputy Director, SAC
Dr. Md. Nure Alam Siddiky
Program Officer, SAC

SAARC Agriculture Centre
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Foreword

It is well accepted that veterinary public health, food hygiene and zoonoses control are very much essential in order to improve human health and the environment. Poverty is thought to be one of the risk factors for zoonoses and food borne diseases with both rural and urban consumers. Consumers should have safe food of animal origin including fish. Veterinary public health involves attention to the risks at the level of both production and consumption of food. This also involves the risks of transmitting zoonotic diseases; risks of occupational health hazards and environmental health as these may affect the health status of domestic as well as companion animals. It is indicated that human health has a relationship with the health of animals and their products. Human beings can contact diseases from animals and fishes causing considerable illness, suffering and death. It makes good sense, for both economic and public health reasons, to prevent, control, and when possible eradicate animal diseases that affect man. There have been serious threats of zoonotic diseases such as TB, Para TB, Anthrax, Brucellosis Toxoplasmosis, Leptospirosis, Rabies, Cysticecorosis, Echinococcosis, Toxocariosis while Nipha, Campylobacter, Salmonellosis, E. coli and fungal infections are of more recent problems. There is also serious risk of avian influenza and mad cow disease that needs immediate attention.

SAARC Agriculture Centre has been taking the initiatives for synthesizing information of SAARC member states on veterinary public health and zoonoses control at regional level. In this endeavor the Centre has initiated a program on “Veterinary Public Health and Zoonotic Disease Control in SAARC Countries” during 2010 and requested the respective member states to nominate focal point expert on the above subject to prepare the country status report. Centre received five country status reports prepared by focal point experts from five member states namely, Bangladesh, India, Nepal, Pakistan, and Sri Lanka. These country status reports are compiled in this book to highlight delivery of different functions of veterinary public health including zoonoses control and food safety in SAARC member states. Attempt has been made to provide the existing infrastructure and set up of veterinary and human health undertaking the milk, meat and fish inspections to ensure their safety all levels of their production as well as issues related to tissue residues. The disease surveillance system in SAARC member states with special reference to early detection of zoonotic diseases has also been discussed. The roles and responsibilities of partner organizations and their coordination mechanism are also highlighted. Efforts were made to use simple and understandable language to share the information about production, manufacturing, processing and marketing of food of animal origin at all levels.

Dr. Abul Kalam Azad
Director
SAARC Agriculture Centre
Executive Summary

The human and infectious diseases have extremely close relationship since their creation and the world will continue to witness epidemics till the life exists on earth. About one infectious disease has been experienced every year during recent past and the scientists has reported that out of total 1415 known infectious diseases of human 868 (61%) are of zoonotic importance. The most recent outbreaks especially Severe Acute Respiratory Syndrome (SARS), West Nile Virus (WNV), Highly Pathogenic Avian Influenza (H5N1) Swine Flu, Nipah virus and Anthrax have proved a strong association of human and livestock including wild life. This increased human-animals interface has put livestock producers, consumers of livestock products, and traders and processors of livestock products at higher risk of contracting zoonotic diseases while contributing significantly to the total disease burden. So the importance of collaborative research and effective veterinary and health services has increased manifold for the prevention and control of zoonoses. This situation necessitates the establishment of effective partnerships between human health and veterinary administration and services aiming to improve health and well being of the public in the context of “One World-One health” concept. This multidisciplinary approach to combat the threats to human health has thus introduced a relatively new term called “veterinary public health”

Veterinary Public Health is the contribution to the complete physical, mental and social well being of human through an understanding and application of veterinary medical science. The scientist and the experts have the considered view point that the current era has all the critical forces and essential factors that provide enabling environment for the emergence, re-emergence and acceleration of zoonoses which in turn, may result in drastic consequences in a very limited time frame across the globe.

The SARS epidemic in 2002, highly pathogenic avian influenza (H5N1) in 2003 swine flu in 2008 and anthrax in 2010 have pointed out the gaps and deficiencies in planning and responding to health emergencies even in most advanced health care systems in the SAARC countries as well as in the global perspectives also. This situation over and above created the need for (a) prompt and open reporting of infectious events having potential for world wide spread due to globalization and fast traveling means; (b) risk communication; (c) effective multi-sectoral collaboration and partnerships to know the answers of unknown questions about the emergence or reemergence of zoonoses and about the crossing of species barrier from animal to human.

Keeping in view the significant role of veterinarian in safeguarding the human health and well being World Health Organization (WHO) has emphasized the member countries to establish an independent veterinary public health organization to face the challenges of zoonotic disease.

The core domains of veterinary public health (VPH) include:

- Diagnosis, Surveillance, epidemiology, control, prevention and elimination of zoonoses;
- Food safety;
- Management of health aspects of laboratory animal facilities and diagnostic laboratories;
- Biomedical research;
- Health education and extension;
- Production and control of biological products and medical devices;
- Management of domestic and wild animal populations;
- Protection of drinking-water and the environment; and
- Management of public health emergencies.

In SAARC countries Veterinary Public Health Services and zoonotic disease control system are more or less similar. In the current situation, disease surveillance, disease reporting and information, disease risk analysis of foods of animal origin, inspection and certification services for import / export of live animals and their products as well as for local consumption are mainly performing. Ministry of Health, Ministry of Livestock, Ministry of Food and Agriculture, Ministry of Local Governments and Ministry of Environment are performing various functions of veterinary public health within their respective mandate and legislative jurisdiction.

South Asian Free Trade Agreement (SAFTA) requires the countries in the region to have developed a uniform regulatory framework coinciding with international standards put forward by WTO, OIE and Codex alimentarius. National Contingency plan for livestock disease epidemics and harmonization of standards of products of animal origin are on the top priorities of the SAARC agenda. Harmonization and standardization of veterinary education at region level has been anticipated to ensure competent professionals for the regional services.

Highly Pathogenic Avian Influenza (HPAI), Foot & Mouth Disease (FMD) and Peste des Petits Ruminants (PPR) have been recognized three trans-boundary animal diseases to be contained through regional collaboration. During the 13th SAARC summit in 2005 it was agreed to establish Regional Support Unit (RSU), Regional Epidemiological Center (REC) and three diagnostic reference laboratories through collaboration with OIE and FAO under Global Framework for containment of trans-boundary animal diseases (GF-TADs). In assistance with European Union these initiatives is going on under Regional Cooperation Program on Highly Pathogenic and Emerging Diseases (HPED) in South and South East Asia.

The one world one health concept is not well perceived in SAARC countries so far because of low sensitization on the part of policy makers and little realization on the part of stakeholders including physician, veterinarian, ecologist, environmentalist and other related scientific disciplines or organizations. The major constraints in this regard are the absence of single entity under which professionals belong to different discipline can work together for one health, weak legislative coverage for collaboration between ministries having their own mandate providing health, veterinary and environment related services and the traditional mindset that the people employed in one ministry or organization think others alienated and show sometimes reluctance to share information and limited financial and human resources.
Despite above mentioned constraints, SAARC countries has observed an exemplary collaboration in all aspects of control of Highly pathogenic avian influenza (HPAI) during 2003-2008 due to which an effective HAPI surveillance system and rapid response system were developed and resultantly only one confirmed casualty was recorded despite the wide spread of infection of HPAI in poultry population. Similarly a few other efforts or initiatives have also been taken aiming directly or indirectly to achieving the objectives of the one world one health concept.

Diversification of veterinary public health services and zoonotic disease prevention and control strategies in SAARC countries will help all stakeholders to combat trans-boundary animal diseases. Multidisciplinary approach, regional collaboration, cooperation, networking is demand for the time to control zoonoses.

This report on “Veterinary Public Health and Zoonoses control in SAARC Countries” is compiled for South Asian Association for Regional Cooperation (SAARC) with the following objectives:

- To share knowledge about safe food of animal origin including fish;
- To share knowledge about zoonotic disease reporting system-linking abattoirs with national and regional coverage;
- To share knowledge about sanitation and meat hygiene (beef, mutton, pork, chicken, ducks etc.) for market access;
- To share knowledge about preventing environmental pollution in SAARC countries.

Five country status reports from Bangladesh, India, Nepal, Pakistan and Sri Lanka prepared by experts from respective countries are compiled here to share the information in order to realize the one world one health concept in SAARC countries. These country documents provide essential information regarding this issues which would be helpful for SAARC nations to overcome zoonoses as well as TADs.

For Bangladesh following guideline proposal and recommendations would assist in developing participatory approaches and strengthen VPH issues and key activities of VPH concerns.

1. “VPH Forum” should be formed by the public health veterinarians to deal with the progress of VPH activities
2. In Bangladesh we need to introduce improved method of food handling and processing practices so that our meals could be more wholesome, varied, well balanced and made available all the year round, instead of only seasonally.
3. Since public health problems may arise from pathogens originating from an animal or from products of animal origin and from the production of domestic and commercially processed food products (e.g., fast foods and other varieties of food items, varieties of packaging, wrappers and containers), it will therefore be essential to improve technical intelligence and develop laboratory methods, criteria and operational procedures for the protection of public health. Progress in these areas depends on the integration of microbiological and pathological study and research
with investigation and epidemiological surveillance and monitoring that contribute to hazard analysis critical control point.

4. Health authorities alone cannot solve the problems of consumers protection and food safety. They will need a national commitment and collaboration of different ministries, organizations, institutions, and agencies concerned with livestock, agriculture, fisheries, finance, planning, commerce, and industry. It is therefore imperative that a national food policy should be adopted as the bases for short and long term planning and continuous support for pre-harvest and post-harvest food safety.

To reach this objective the following points must be kept in view:

- Promotion of increased production and adequate use of raw food materials, products and by products - all having their economic values
- Building up community participation and consumer education in which consumers should be made known of their rights, privileges, and responsibilities under the food law. They should participate in different program organizations and applications relating to food hygiene practices. The consumers can help the inspectors and government officers seeking food safety system. The veterinary food inspectors should not be viewed as policeman, but rather as an adviser. They should be able to give instruction to food producers and handlers in good manufacturing practices.
- Processed quality foods should be made available to the public and as such people need to change their food habits. A food processor must therefore think of utility and likewise of potential hazards.
- Minimization of food losses during production, processing, storage, transportation and marketing stages
- Ensuring satisfactory quality of foods by preventing distribution of unhygienic, contaminated, spoiled and adulterated foods, which are harmful to health or packaged or labeled in such a way as to mislead the consumer.
- Improving and expanding food inspection and compliance program as well as analytical control service in order to ensure that foods sold to the public is free of adulterants, chemical and biological contaminants, that it complies with existing compulsory quality standard, that its composition reflects the statements on the label.
- Fostering adequate development of food industries and thereby protecting the existing local industry as a means of generating significant amounts of foreign exchange from export of foods.
- Strengthening sanitary control of foods through the systematic coordination of all governmental services active in the sector at national, regional and municipal levels. To do so uniform standards should be encouraged for the orderly marketing of food and food products and for the effective application of food laws. Inspectors occupy a key position in the food control service and should therefore be well trained, impartial, and immune to corruption.
- Providing training to professionals (veterinarians, microbiologists, epidemiologists, food technologists, sanitary engineers, food chemists, legal experts and bio-
statisticians) and non-professionals (food inspectors, laboratory technicians, administrative staffs) for the governmental and private sectors who are associated with production, marketing and quality control of foods and simultaneously are involved in the dissemination of information useful to the development of these activities.

5. Since the communicable disease outbreak anywhere in developed or developing countries could potentially call for an emergency of national, inter-country regional and international public health concern, the International organizations FAO/WHO/OIE recognize this phenomenon that threaten the world’s population. As such they developed a common platform named GLEWS (Global early warning system) for the international community and stakeholders to assist in prediction prevention and control of animal diseases including zoonoses. Recently in addition to Zoonoses and food-borne diseases the WHO for animal health (OIE) missions related to the prevention and control of infectious animal diseases have focused on the human and animal health risks related antimicrobial resistance. The concept of the focus is to undertake surveillance study of bacterial resistance, monitor the antimicrobial usage, suggest for prudent use of antimicrobial agents and employ laboratory methodologies for antimicrobial testing.

In context of identified lacking, the VPH activities in Bangladesh should adopt the following measures

(i) A national surveillance system and monitoring program for safety of foods of animal origin (meat, milk, egg and fish etc) and promotion of animal welfare
(ii) Development of an appropriate risk assessment methodology, for the potential impact on public health and antimicrobial resistance bacteria of animal origin threatening health and hygiene
(iii) The harmonization of technical guidelines provided by International Organizations would of value for the improvement of the legal framework and development of required resources of Veterinary services
(iv) Technical assistances from international agencies may be sought in the establishment of laboratories to achieve the highest quality isolation, identification, sero-typing of etiological agents and antibacterial susceptibility testing results
(v) Training courses on surveillance, outbreak detection and epidemiological study and response are essential for the success of national VPH programs for the prevention, surveillance and control of zoonoses and food-borne diseases and food safety.

6. Regarding TAD, the SAARC member countries should build coordinated effort and meet the challenges and share each other their existing and future national responsibilities for reporting diseases, and introduce mechanisms to increase the transparency, accuracy and completeness of the data.

In-country and inter-country national organizations should be encouraged to exchange data and develop policies for the **SAARC Trans-boundary Surveillance of Zoonotic Diseases**. Generally, medical and veterinary surveillance programs should be coordinated at all levels.
7. The following Theme development for the National Strategic Plan/Approaches of Infrastructure and VPH Program Implementation would be of value.

**Theme I: Formation of Veterinary Public Health Forum**

**Theme II: Establishment of National Communicable Disease Center**

**Theme III: Foundation of National Institute of VPH Studies**

**Theme I: Veterinary Public Health Forum**

This is to be created as a non-political society run by the public health veterinarians which would devote activities relating to veterinary public health, contribute to the human and animal well-being, give suggestions to develop policies, guidelines, operational research and strategies for the control of zoonotic and food-borne diseases and disseminating relevant information obtained from experts in public health, veterinary science and other scientific disciplines, to food industrialists, consumer groups and the public.

**Theme II: National Communicable Disease Center**

This is to be developed constituting four different cells. These cells would be able to address the needed sustainable surveillance system, monitoring VPH issues, prevention, control and eradication of animal and zoonotic diseases, as well as food-borne diseases, assessment of risks and socio-economic impacts of communicable diseases, food safety and food security.

Other functions of the cell would be database risk assessment, disease awareness, cost-benefit analysis of control strategies and improving to build technical capacity, development of standards, policies and plans and management of inter-country VPH programs in close collaboration with SAARC partner countries. The four cells to be built up may comprise:

1. Surveillance and information system cell
2. Monitoring cell
3. Database cell
4. Inter-country coordination and collaboration cell

**Theme III: National Institute of VPH Studies**

This is to be founded where promotion of basic and applied research will be undertaken to meet the challenges of VPH. This unit would be designed to have section of information technology and academic and technological facilities for VPH professional development.

**For Indian Situation following conclusion and recommendation can be drawn**

- The responsibilities of veterinary public health are shared by more than one department/organization along with inadequate legislation for veterinary public health and food safety.
- Efforts are in progress to review veterinary public health and food safety laws both at State and national level.
- There is a need to establish a suitable authority to undertake such issues for better implementation by making a coordinated body both from human and veterinary health under one umbrella which could coordinate and undertake all core functions of veterinary public health in the country with the following objectives:
• Designing and implementing a uniform health information system across the country.

• Strengthening of networking of all the units in the field of electronic access and training to strengthen technical expertise of veterinarian and administrative infrastructure.

• Common disease surveillance system and enhanced communication between all the ministries responsible human and veterinary health.

• Strengthening of infrastructures of all the national and state diagnostic laboratories/ institutions along with disease reporting system.

• Reduction in food-borne diseases by adopting strict hygienic measures by implementing different existing legislations.

• Adoption and implementation of good laboratory practices, good manufacturing practice, HACCP and other codes.

• By undertaking coordinated research projects/schemes for better understanding problems of multiple interfaces of human, animal (livestock and wild life) and environment to assess the impacts of interactions of humans/animal/ environment.

• Uniform veterinary education including public health courses at the graduate and post graduate level with establishment of effective collaboration and linkages between the veterinary and medical institutions and practitioners to ensure health and well being of the public.

For Nepal situation following activities urgently needs to be taken care of to control zoonotic diseases in Nepal:

- Legislation/Acts to control zoonoses in Nepal
- Prevention and control of zoonoses through surveillance and research
- Strengthen inter-institutional global frameworks for early detection and containment
- Refine existing and develop new tools for control strategy selection
- Promote new concepts for zoonose prevention
- Regional co-operation for the control of zoonotic and priority trans-boundary diseases
- Global one world one health policy should be implemented.

For Pakistan condition following measures needs to be taken care of to controle the zonotic diseases:

- Inadequate legislation for veterinary public health and food safety existed and the functions of veterinary public health are shared by more than one department / organization. Efforts are underway to review veterinary public health and food safety laws both at provincial and national level. For instance, Government of
Punjab is in process of creation of milk and meat safety agency and is updating the laws on food inspection and disease surveillance system with their jurisdiction.

- M/O Livestock & dairy development is in process of creation of a “Veterinary Public Health and Food Safety Authority”. Once it is created, it will take over and or coordinate all core functions of veterinary public health with the following objectives:
  
a. Health information system will be designed and implemented across the country.

b. Electronic access and networking and training to information to strengthen technical expertise of veterinarian and administrative infrastructure.

c. Common disease surveillance system and enhanced communication between ministries of health, agriculture, wildlife, environment and livestock will be developed.

d. Impacts of interactions of humans/animal/environment and the better understanding of multiple interfaces of human, animal (livestock and wildlife) and environment will be researched through coordinated projects.

e. Food and water safety programs will be developed aiming to control zoonoses,

f. Codes of good manufacturing practice, HACCP and other similar auditing systems will be developed and implemented.

g. Uniform veterinary education while including the public health courses at the graduate and post graduate level will be ensured and effective collaboration between the veterinary and medical institutions and practitioners will be established to ensure health and well being of the public.

Under Sri Lankan situation even though multi sectoral and multi disciplinary approach exists, there is no overall cohesive strategy and collaborative mechanism to execute prevention project and programmes to control emergence of food borne diseases, zoonoses and their surveillance in Sri Lanka. Existing health and Animal health management polices do not address the quick detection and control and response to the emerging and reemerging zoonoses and food safety issues.

The rise of emerging and remerging infectious zoonotic diseases and food born infections are becoming a big threat to human life worldwide. To win this situation stern strategies are to be implemented while ensuring the biological integrity of the Earth. This requires interdisciplinary and multi-sectoral approaches to disease surveillance, monitoring, prevention, control and mitigation by establishing food security and food safety while concentrating on environmental conservation more broadly. It is clear that no single discipline or sector has enough knowledge and resources to prevent the emergence or resurgence of diseases in today’s globalizing world. So broader understanding of health and
Disease demands a unity of approach which is achievable only through a consensus of human, domestic animal and wildlife health sectors which is in other word expressed as One Health.

Under such circumstances, it is necessary to recognize and establish the essential link between human, domestic animal and wildlife health and environmental sectors within each local authority jurisdiction with sound policy and implementation of programs and projects, jointly. In order to break the barriers among agencies, individuals, specialties in all these sectors, to launch sound veterinary public health practices in Sri Lanka.

- The guidelines prepared jointly by WHO, and FAO, OIE (15) for establishing collaboration between Animal and Human sectors at the country level, to be followed and implemented early to enhance coordination in between human, animal and environment sectors with their participation with Local authorities, in surveillance, information sharing, early response, risk reduction, and collaborative research.

- Sufficient legal framework and organizational structure to be developed and implemented to enable veterinarians and medical officers, to involve in public health activities jointly within the local government jurisdictions.

- Present legislations (Animal disease Act, Veterinary Practitioners Act) are to be updated to accommodate zoonoses and food safety issues as recommended in OIE PVS country report and OIE Guidelines on veterinary legislation (19).

- The veterinary and medical laboratories and professionals in those institutes should be made responsible to work together towards a common goal by sharing the knowledge and skills and information and other resources by developing good understanding and cohesive working culture towards zoonoses and food safety issues.

- Diagnostic Facilities for newly and reemerging Trans boundary diseases are to be developed and specific reference laboratories are to established for each important zoonoses by twinning with relevant world reference laboratories. An exchanging of scientists among such laboratories is to be encouraged and supported.

- Farm to Folk approach to be adopted in public health risk analysis procedures in all foods of animal origin. Guide lines prepared by OIE for good farm management practices are to be implemented, for general farm management, Animal health management, veterinary drugs and biological, animal feeding and Watering, Environment and infrastructure, animal and product handling.

- Animal health sector should have a special emphasis on the surveillance of zoonoses and reporting in their Animal Health Information system and Database which to be shared with medical counterparts and to be open for the general public locally and globally.

The veterinary epidemiology unit to be strengthens and strong link to be developed with medical epidemiology unit, and collaborative research to be encouraged.
Veterinary Public Health and Zoonotic Disease Control in BANGLADESH

Professor Dr. Muhammad Mufizur Rahman
Department of Microbiology and Hygiene
Bangladesh Agricultural University
Mymensingh
Email: micro_rahman@yahoo.com
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1. Introduction

In the 19th century Robert Virchow, the German physician and pathologist first felt that there exists no dividing line between animal and human medicine. Later on both medical and veterinary workers observed the impact of animal diseases and ecological change on public health. The great epidemiologist Schwabe in 1984 first noticed and pioneered the active integration of human and veterinary medicine (1). He not only emphasized the increasing interdependence of animals and their products with human health problems but encouraged both the medical and veterinary professions to take action of combined effort to prevent these diseases from occurring. It is obvious that there exists a complex correlation between human health, animal keeping and animal health and as such the Veterinary Public Health (VPH) is getting increasing importance.

In recent years immense changes have occurred in animal farming system, production processes and agricultural structures. The loss of border controls within countries and the globalization of trade have led to an increasing trade in animals and products of animal origin (2). The interdependence of humans, animals, and their environment has never been more important than at the present time. In our global world, the free easy movement of people and animals has vastly increased, and along with it, there has been a corresponding exponential increase in the risk of exposure to zoonotic agents (3). In fact, of the 1,400 pathogens affecting humans, 800 originate in animals (4). The most prominent issues stressing pressure on global health today include the dramatic emergence and spread of zoonotic diseases, contamination of food, water and soil, bio-terrorist events, and degradation of resources and habitats. The epidemiologists group of the World health Organization (WHO) believed that in the last 30 years the prevalence of infectious disease has increased such that 75% of the emerging infectious diseases in humans are of animal origin.

Historically, the Food and Agriculture Organization (FAO) of the United Nations has always recognized the importance of VPH as an integrated component of human health care and animal health services. In international meetings and consultations, FAO has pledged to collaborate in controlling zoonotic diseases and promote the concept of VPH. On the other hand the World Organization for Animal Health (OIE), which was created in 1924 under the name Office International des Epizooties, is undertaking the charge of setting international standards and guidelines for animal health and welfare. The founding of the World Health Organization (WHO) program in VPH dates back to the First World Health Assembly in 1948, at which rabies and brucellosis were discussed and various actions were proposed. In the following years, WHO was engaged in combating zoonoses of major public health and economic importance, improving food hygiene practices, and training personnel for VPH activities. By its very nature, the VPH program in WHO has been closely linked with various aspects of the work of the Food and Agriculture
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Organization of the United Nations (FAO) and the Office International des Epizooties (OIE) in relation to zoonoses, food safety, and the public health aspects of trade in animals and animal products. VPH activities are currently implemented by WHO Headquarters through the Department of Communicable Disease Surveillance and Control (CSR) in close collaboration with the Food Safety program. The OIE develops health and welfare standards in order to safeguard the food supply and ensure the health security of the world trade in animals and animal products within the framework of the World Trade Organization (WTO) Sanitary and Phyto-sanitary (SPS) Agreement.

Veterinary public health is although considered an international public good of paramount and increasing importance, but it does not fit on a single organization template because its responsibilities, functions, activities and resources are dispersed throughout a host of agencies and sectors, particularly health and environment. The FAO/WHO/OIE Experts and WHO study group strongly felt the necessity of liaison functions on undertaking operational responsibilities to provide technical cooperation to national and sub-national levels. As mentioned above VPH aims to protect human health, animals and the environment from the risks that are rapidly evolving as a result of the dramatic changes of a good number of factors relating intensification of farming methods, food production chain, trade, travel and movement, interaction between human and animals, natural and man-made disasters and emerging and reemerging of zoonotic diseases. The Expert consultation recognized that the majority of developed countries have surveillance systems in place to detect and control major zoonotic diseases at national and sub-national levels. In developing countries and those countries in transition particularly the South Asian Association for Regional Cooperation (SAARC) countries whose infrastructures require rebuilding, provide general VPH services, establish surveillance systems and monitor disease control programs are likely to be deficient at all levels. It would therefore be very much justified for developing country like Bangladesh to formulate objective concerning development of National VPH programs as well as regional joint venture collaboration of SAARC countries with clear prioritization of issues which may include control of animal diseases, zoonoses, food hygiene, environmental protection and assistance in the management of emergencies. In this viewpoint it has been emphasized by the Local experts that VPH in Bangladesh would have to develop against a rapidly changing background of population growth, increasing urbanization, an increasing poverty and technology gap between developed and developing countries as well as changes in land use, the environment and climate.

Bangladesh Veterinary Service having very poor or rudimentary institutional VPH program and VPH infrastructure has amply realized the importance of VPH and has been thinking seriously to expand this field for establishing a sustainable VPH development policy. The disease surveillance system in this country is almost non-existent. Although the Veterinary Public Health Unit in the Director of Livestock Services (DLS) has the mandate to perform diagnosis, surveillance and control of zoonotic diseases, ensure food
safety of animal origin, and liaison with the Health Department, but the Unit is however, suffering from serious shortages of human capital, funding and laboratory facilities. It has no legal framework to implement its mandate. Coordination between animal and human health bodies is virtually non-existent (5, 6). The figure 1 below outlines the major deficiencies in approaches to VPH in Bangladesh. The present paper addresses relevant problems and constraints of VPH in Bangladesh that need to be overcome and to ask for help, coordination and collaboration of international organization and SAARC countries to promote and build the capacity for the spectrum of important VPH issues contributing to zoonoses, food-borne disease control and food safety thus fostering better and living condition.

Figure 1 Major deficiencies in present approaches to VPH in Bangladesh
2. VPH Horizon is Widening: Bangladesh is in Infancy

2.1 Consensus recognition and expanding horizon of VPH

Veterinary Public Health has been recognized as the cardinal part of public health where the human health and human well-being are the central tasks. These tasks being the basis and prerequisite for the production of safe, sound and wholesome foods are now a global concern. Attainment of the goal “Health for All by the year 2000” is thus inextricably connected with this recognition which is beset with essential strategies related to improvement of human health and environment. The new consensus definition of VPH (“The contributions to the physical, mental, and social well being of humans through an understanding and application of veterinary medical science”) in particular is pivoted round the comprehensive application of professional veterinary skills, knowledge and resources and concerns not only the physical well-being of humans, but also includes the role of animals for the mental and social well-being of humans.

The horizon of VPH is expanding rapidly and based upon the present veterinary skills, knowledge and resources it has been consensually recognized now as an essential field in public health activities all over the world. The chief aim is to protect and improve human health and welfare. In the past this discipline at the beginning was evolved only to deal with three different issues:

• First issue: to combat animal diseases
• Second issue: to perform meat inspection and
• Third issue: to take limited measures to control zoonoses

At the present time VPH encompasses a wide variety of professional areas linking the three elements within the ‘health triangle’ 7, such as

• Control of zoonoses
• Control of food-borne pathogens and chemical residues
• Environmental risks caused by companion animals of humans, animals and the environment, with all their interactions, with the goal of guaranteeing a safe and wholesome food supply, protecting human wellbeing and conserving the environment.

2.2 Veterinary profession in the midst of a new world

King 8 finds the veterinary profession itself in the midst of a new world order which is today exquisitely inter-connected culturally, economically, socially, and professionally. As a consequence, societal needs and expectations of the profession are more demanding. Veterinarians all over the world should play important roles in five intersecting domains of work shown in the figure 2 below.
2.3 VPH in the current global health challenges and critical issues

The current global health challenges have prompted a call for more pivotal obligations, opportunities, and contributions of veterinarians to make in enhancing public health, recognizing and responding to zoonotic disease transmission, maintaining food and water quality, and promoting wildlife and ecosystem health. Realizing the widening horizon of VPH Osburn et al. (9) indicated the emerging critical global issues of occurrences that received veterinary attention and rendered unique veterinary services. Veterinary profession is no more within the boundary of clinical practice and meat inspection, rather it has spread tremendously. Its responsibilities, functions, activities and resources are dispersed very widely throughout the horizon of health, environment and animal-agriculture. The examples given by the above authors as presented below briefly illustrate health risk factors and pinpoint the specialized VPH services and the worthy operational responsibilities needed to overcome the barriers:

The Barriers

2.3.1 International trade and travel

Example: Inadequate inspection of cargos worldwide lead entry of infected animals, insect vectors, and diseased plant products undetected into geographic areas where natural parasites, predators, may be absent and host resistance is lacking. The Asian tiger mosquito, Aedes albopictus, a vector of the dengue fever virus, has been introduced in

![Figure 2: Five intersecting domains of work of VPH](image)
the USA through the imported used tyres. Since one-sixth of all international trade is agricultural and mostly coming from the developing world, it is assumed that this trade carries with it the risk of trans-boundary disease movement and incursions into new areas. Moreover the Livestock and Livestock products from the developing world are economically attractive, but often the regulatory infrastructure is insufficient to provide reliable assurances that the goods are disease-free. Due to the huge volume of trade, it becomes impossible many a times to avoid illegal importations embedded within the midst of those that are legal. A prominent example is the foot and mouth disease outbreak that devastated the UK in 2001. It originated from a container load of Chinese meat that was described as something else on the bill of lading. Millions of containers were unloaded at various ports around the world, but it was not possible for inspectors to peer into every one.

2.3.2 Global climatic image

Example: It has been established that the occurrence of more spread of Vector-borne zoonotic diseases such as yellow fever and certain encephalitides is found as the geographic range of their mosquito vectors increases. Warming temperatures, considerably long rainy season and shorter winters play promising role in the establishment of the tropical diseases dengue and malaria in more temperate areas of the world.

2.3.3 Habit destruction

Example: The driving force of animal habit destruction that is deforestation leads the wildlife reservoirs of zoonotic diseases to find their habituation to come into closer proximity with humans. The sudden emergence of Nipah virus disease in pigs and humans in Southeast Asia in the late 1990s may have been caused by rapid deforestation. The natural reservoir for Nipah virus appears to be fruit-eating flying foxes (bats in the genus Pteropus). As deforestation reduced their native food sources, flying fox populations were thrust into closer contact with commercial fruit orchards and fruit trees on pig farms, where the virus spread to pigs and then to humans. Recently in Bangladesh bats were found to be reservoir of Nipah virus.

2.3.4 Overpopulation

Example: As human populations increase and encroach upon wildlife habitat, people get more contact with wild animals and the diseases they carry. Population pressures increased the consumption of bush meat; as a result they are more exposed to infected blood and tissues during butchering.

2.3.5 Ecotourism

Example: Tourism activities can introduce diseases to wildlife. Serious diseases such as malaria, measles, and tuberculosis were among those most likely to be transmitted to gorillas by human visitors.
2.3.6. Food safety
Example: A good number of emerging infectious zoonotic diseases threaten the safety of our food supply. The control of these diseases requires the collaborative efforts of various agencies. Veterinarians, public health and human health professionals all should continually work together in the trace-back and control of food-borne illnesses. Reducing the microbial load entering the food chain by implementing herd, flock and health initiatives reduces the challenge on food safety management systems and controls in food processing plants, commercial catering establishments and in domestic kitchens. Changing consumer lifestyles are creating a demand for more ready-to-cook and ready-to-eat meals, and this is adding more steps to the food chain, presenting more opportunities for things to go wrong.

2.3.7. Intentional adulteration of foods
Example: Intentional adulterants in foods are causing health hazard world wide. Recently Melamine, along with cyanuric acid, contains relatively large quantities of nitrogen, so it is sometimes illegally added to food to increase the perceived protein content. In 2004, a large number of pets in Asia developed renal disease which was initially attributed to fungal toxins but later associated with the presence of melamine in pet food. In 2008, a severe renal condition occurred in China involving hundreds of thousands of young children consuming infant formula (milk substitute). Melamine was again detected in the formula. The role of veterinarians was critical in identifying the presence of the adulterant in foods, which in turn notified the world to the use of melamine as a cause of acute renal disease. In 2009 melamine was thought to be present in many china brand infant milk imported by Bangladesh and was withdrawn from the market. Melamine was imported as a contaminant in rice gluten, incorporated into pet food, and caused thousands of dog and cat illnesses in North America. But this is minor event compared to the 13,000 infants hospitalized as a result of melamine getting into cow’s milk. In 2005, in one of the largest food recalls ever to take place in the EU, processed food containing chili contaminated with the carcinogenic dye Sudan Red was taken off the market in several countries. The Sudan Red was added by four spice-exporting companies in India to brighten the color of the chili, creating the impression that the product was fresher than it actually was. In the recent year 2008-2009 shrimps of Bangladesh exported to developed countries were banned due to the presence of antibacterial substance.

2.3.8. Biodefence
Example: There are some zoonotic diseases not familiar to the general medical community but these exist as potential agents of bio-terrorism against human populations. Zoonotic bio-terrorism agents need to be seriously considered as these can target agriculture, causing economic disruptions and undermining consumer confidence in food supplies. Incidents that were linked to chemical rather than bacterial contamination highlight how vulnerable the food chain is to deliberate contamination. The legislation
designed to prevent such contamination is contained in the Bio-terrorism Act (2002). The Act stipulates the legal requirements for registering food facilities (both domestic and foreign), notifying the Food and Drug Administration of food shipments, and creating and maintaining records to determine the immediate previous sources and the subsequent recipients of food. The threat of bio-terrorism and emerging infectious diseases has stimulated various public health agencies to recommend promptly enhanced surveillance activities to supplement existing surveillance plans. Furthermore, the concept of agro-terrorism has also emerged, emphasizing the potential major risk that the economy of a country could be massively disrupted by the introduction of highly contagious infectious disease outbreaks into the livestock or wildlife populations.

From the foregoing discussion it is clearly evidenced that the veterinary profession has found itself in the midst of a new world order. It is now an important part of the world that is exquisitely interconnected culturally, economically, socially, and professionally. As a consequence, societal needs and expectations of the profession are more demanding. As observed keenly by King (8) at the present day the widening horizon of veterinary profession has been made involved in the following critical issues:

- Food safety
- Food security
- Antimicrobial resistance
- Environmental degradation and sustainability
- The growing carbon footprint and huge energy demands of animal agriculture
- The vulnerability of animals due to intensified production systems
- Movements of exotic animals and their products
- Bio- and agro-terrorism
- The role of wildlife in disease transmission
- Food-borne, water-borne and vector-borne diseases
- The emergence and reemergence of new zoonoses
- The global trade of food and animals, including the unprecedented demand for proteins of animal origin, which is projected to increase 50% by 2020

2.4. VPH Horizon of wealthy and less wealthy societies

In all developed countries the need for awareness of the importance of VPH within the ‘The One Health’ initiative has been established to address many of the challenges described above. But ‘the One Health’ Initiative will only be successful if there is both interdisciplinary co-operation and a strong foundation of holistic activities across the spectrum of VPH issues (10). Among all developing countries Bangladesh still is in infancy in this respect. However the country should have common professional linking to
achieve improved VPH service, building infrastructure and keeping pace with rapid
growth and development. In order to promote VPH service Bangladesh needs help,
coordination, cooperation and collaboration of developed countries with highly
developed veterinary portfolio of services and activities as well neighboring SAARC
countries for any joint venture activities of mutual interest.

In spite of the above mentioned common professional linking and thinking there are
many differences among countries implementing veterinary public health and
recognizing its importance. The developed countries with a wealthy to rich society have
highly organized agricultural production systems, and industrialized production of foods
of animal origin, strong framework of legislation governing the areas of public health and
animal disease control. In comparison Bangladesh being a developing country and
belonging to less wealthy society has virtually no organized agricultural society and
system nor any systematic government support for the improvement of livestock, food
production of animal origin or organized campaigns against animal diseases. In wealthy
societies VPH has developed into preventive population medicine which is population-
oriented. Here epidemiological tools are used and risk analysis is reliably assessed and,
whenever possible, policy decisions may be based on calculations drawn from
mathematical models. In this society it is not enough that food should be safe only, but it
should also improve health by being fortified with extra vitamins and minerals,
preferably be enriched with pre- and probiotics and be produced with no negative effects
on the environment and optimal animal welfare. The characteristic of wealthy society is
‘food acceptance’, i.e. acceptance by the public that a product is suitable for consumption
(7). On the contrary in the less wealthy societies of developing countries like Bangladesh
inspection of foods of animal origin (meat, milk egg, fish etc), the destruction of
carcasses unfit for human consumption and rendering, disposal of wastes are not well
organized. Quality assurance systems based on Good Manufacturing Practices (GMP),
Hazard Analysis Critical Control Points (HACCP) or good veterinary practice do not yet
exist. Bangladesh with rudimentary establishment in this area does not deal primarily
with meat and milk inspection. Disease control and prevention programs if present, this is
in the paper and superficial for few major zoonoses. There is little emphasis on
preventing human diseases and eradicating animal diseases. The diagnostic veterinary
skills (pathology, laboratory analysis and diagnosis and clinical experience) are lacking
and do not form the basis of the veterinary public health system.

The FAO/WHO/OIE emphasizes the need of both the wealthy and less wealthy
societies to improve bio-security measures to control the emergence and spread of
infectious diseases. Unfortunately, levels of bio-security vary depending on the economic
and health conditions of communities and the types of farming systems practiced. Poor
communities like Bangladesh often lack the necessary resources to access public and
veterinary health services. Moreover Poor sanitary conditions, inadequate resources and
inefficient management practices tend to result in numerous infectious agents becoming
endemic. Prevention of bio-terrorism (or agro-terrorism) is also a global public good, but Bangladesh is still in infancy. Wealthy societies of developed countries must take this VPH issue into consideration and surveillance and response strategies for infectious diseases must be directed against all potential emerging infections, both natural and deliberate (11). To prevent and respond to the recent avian influenza epizootic it has been shown that many countries as well Bangladesh were unprepared to deal with this type of disaster. In many cases, countries could not afford to sufficiently invest in their Veterinary or Public Health Services. Even if the Veterinary Services lie at the heart of intervention actions, they require a strong partnership with Public Health Services and Environment/Wildlife Services.

Both the OIE and FAO prefer the new concept of ‘One World, One Health’, rather than ‘One Medicine, One Health’. Since the OIE has a global mandate for animal health and welfare, there will never be only ‘One Medicine’: human and veterinary medicines can evolve hand in hand, but for philosophical and economic reasons there will always be differences between them. Nevertheless, veterinary medicine is increasingly working at the interface between human and animal health and is of course deeply involved in the prevention and control of zoonoses (the majority of emerging infectious diseases of humans are of zoonotic origin). The human and the veterinary medical professions of both developed and developing countries not only have to collaborate, but also have to understand each other’s cultures and practices so as to be able to plan and execute joint programs and policies. The pivotal relationship between public health and veterinary science is illustrated in the figure 3 below (12).

![Figure 3: Relationship between Public Health and Veterinary Science](image-url)
Veterinarians all over the world must be on the front line of the surveillance and control of diseases at their animal source. Animal diseases not transmissible to humans can have a serious impact on the production of foods of animal origin and undermine food security. As food security is also a public health concern, the concept ‘One World, One Health’ encompasses many non-zoonotic diseases. The One Health Initiative has been established to address many of the challenges described above. But the One Health Initiative will only be successful if there are both interdisciplinary co-operations (10).

2.5. Common platform for professional linking to achieve improvement of VPH spectrum

Although the VPH profession has achieved many successes, its significant benefits to human health – through its contributions to the above five domains of maintaining and improving animal health, but the most serious challenge to VPH today is to meet the changing needs of a global society with growing and diverse expectations. To help ensure success, both the developed and developing countries should jointly take venture to create and align the diverse sectors of VPH profession, build a sense of global community and create a unifying purpose and an expanded portfolio of exciting possibilities and new services in biomedical research, public health, environmental and ecological health, and today’s global food systems, in addition to our more traditional roles in animal health and care – thus better preparing the profession for the next profound metamorphosis (7). The interdependence of humans, animals, and their environment has never been more important than now. The most prominent issues putting pressure on global health today include the dramatic emergence and spread of zoonotic diseases, contamination of food, water and soil, bio-terrorist events, and degradation of resources and habitats.

Current global health challenges have prompted a call for more holistic, collaborative, action-oriented approaches toward the goal of logical and practical solutions. The scope of VPH is clearly multidisciplinary, involving not only veterinarians in both governmental and non-governmental sectors, but also other health professionals and scientists as well as paraprofessionals who treat, control or prevent diseases of animal origin. In order to achieve the maximum benefit from VPH a team approach to problem solving, research, control programs and communication is very much essential ensuring that the veterinary contributions to the improvement of human health would be both significant and sustainable. Due to the fact that the horizon of VPH is widening, as part of its mandate to improve VPH worldwide, the OIE has following six primary objectives which should be given importance and made possible to be implemented by both developed and developing countries like Bangladesh as far as practicable.

1. Surveillance and control of animal diseases
2. Transparency of animal health information
3. Safeguarding trade and consumers
4. Animal welfare and well-being

5. Continuing education of veterinarians to maintain and improve the competence

6. Veterinary statutory bodies to strengthen the animal health policies and activities of their national Veterinary Services and help foster recognition of the importance of veterinary activities for society as a whole at global level.

In addition to above scenario and paramount demand of VPH the changing wealthy society and expanding VPH issues and activities include aquatic animal welfare and ethics as a result fish are not only used as food but increasingly used as display animals in zoos and public aquariums. Fish are regularly included in animal welfare in the UK and other European countries. The Canadian Council on Animal Care has been in the forefront of providing care and husbandry guidelines for fish used in research.

**Horizon of VPH of New World and Bangladesh at a Glance**

<table>
<thead>
<tr>
<th>New World</th>
<th>Bangladesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness of the importance of VPH within the 'The One Health' initiative has been established to address many of the challenges</td>
<td>Bangladesh still is in infancy in this respect.</td>
</tr>
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<td>Highly organized agricultural production systems and industrialized production of foods of animal origin</td>
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<tr>
<td>VPH has developed into preventive population medicine which is population-oriented</td>
<td>VPH is poorly developed</td>
</tr>
<tr>
<td>Epidemiological tools are used and risk analysis is reliably assessed and, whenever possible, policy decisions may be based on calculations drawn from mathematical models.</td>
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</tr>
<tr>
<td>Quality assurance systems based on good manufacturing practices, hazard analysis critical control points (HACCP) or Good Veterinary Practice or Good Manufacturing Practice are strongly implemented</td>
<td>These systems do not yet exist.</td>
</tr>
<tr>
<td>The Diagnostic Veterinary Skills (microbiology, pathology, laboratory analysis and diagnosis and clinical experience) are highly developed and form</td>
<td>The Diagnostic Veterinary Skills (microbiology, pathology, laboratory analysis and diagnosis and clinical experience) are lacking or very poor and do not form the basis</td>
</tr>
</tbody>
</table>
New World

the basis of the veterinary public health system. There is both interdisciplinary cooperation and a strong foundation of holistic activities across the spectrum of VPH issues with greater emphasis on preventing human diseases and eradicating animal diseases.

Bangladesh

of the veterinary public health system. Disease control and prevention programs if present, this is in the paper and superficial for few major zoonoses. There is little emphasis on preventing human diseases and eradicating animal diseases.

3. Scope of VPH in Bangladesh

3.1 Increasing Importance

There exists a complex correlation between human health, animal keeping and animal health and as such the Veterinary Public Health is getting increasing importance. In recent years immense changes have occurred in animal farming system, production processes and agricultural structures. In Bangladesh the loss of border controls within countries and the globalization of trade have led to an increasing trade in animals and products of animal origin. As a consequence there appears the demand and imperative need for new and elaborate surveillance strategies. It is evidenced that the active surveillance of animal diseases and their distribution routes is one of the major tasks of veterinary public health and therefore it includes the analysis of the risk for humans and provides measures for the protection of human health. In light of this perspective Veterinary Public Health like in many other developing countries is also getting increasing importance in Bangladesh and this is because of the development of health awareness among the government, politicians, professionals, academicians, environmentalists, industrialists, and health conscious public. The changes which are now occurring in animal production processes and agricultural structures in Bangladesh have contributed to evolve VPH activities. Moreover there is a great demand of new and elaborate surveillance strategies due to the loss of border controls within the SAARC countries and the globalization of trade that have led to an increasing trade in animals and products of animal origin. Thus the active surveillance of trans-boundary animal diseases and their distribution routes in Bangladesh is at the present time one of the major tasks of veterinary public health. It includes the analysis of the health risks for humans and animals and provides measures for the protection of human and animal health that is prevention and control of zoonoses and food safety.

3.2 Essential Coverage

The scope of VPH is a clearly multidisciplinary approach, involving not only veterinarians in both governmental and non-governmental sectors, but also other health professionals and scientists as well as paraprofessionals who treat, control or prevent diseases of animal origin. In Bangladesh the rapidly increasing trade in foods, at both the local and international level, particularly exports of shrimps to European countries and
fish, vegetables in the Middle East countries is resulting in increased attention to bio-
security and the potential transmission of diseases of animal health importance via the
food and feed chain. In shrimp production Bangladesh has already entered into global
markets, which prompted the shrimp producers to develop programs for economic
viability and sustainable level of shrimp culture and here the water environment friendly
management plays a vital role in obtaining bio-security. It is also evident in this country
that more and more intent is placing on the responsibility to dairy and meat industries for
ensuring “bio-security” in relation to human and animal health and the Bangladesh
government veterinary services are now having keen interest to exercise their
responsibilities in a cost-effective, independent, transparent and interdisciplinary manner.

In Bangladesh inspection of slaughtering animals can provide a valuable
contribution to surveillance for specified diseases of animal health importance
particularly exotic diseases. In recent years the broiler industry has emerged as one of the
promising animal resources of the country and generated not only to yield potential
sources of earning, but also evidenced to meet up virtually the increasing demand of
animal protein. Due to the flourishing establishment of modern poultry farms many
entrepreneurs are encouraged to set up poultry processing plants. They understand the
economic viability, hygienic status and utility of dressing operations, increasing
consumers’ demands, and acceptance of production of wholesome good quality dressed
and packaged poultry meat. As a consequence poultry meat packing plants are on-coming
in the country. Recently some farms in a limited way started functioning in producing
dressed birds in plants. Among these Aftab enterprises, Biman poultry limited, few native
agro-sectors, and domestically developed small scale farms have already introduced
dressing of birds in their own processing units. These dressed and packaged birds are
now appearing in different departmental and grocery stores of marketing channels of
Dhaka and elsewhere in the country. It is unfortunate that in Bangladesh there exists no
veterinary service and regulation governing meat inspection and post-mortem judgment
of slaughtered poultry, particularly dressed or processed birds. Routine ante-mortem and
post-mortem examinations are not practiced in food animals - large or small and this is
similarly applied to poultry. From public health point of view public health veterinarians
as meat inspectors are not employed for the purpose who, could detect diseases and give
suggestive guideline of post-mortem judgments.

3.3 The Way Forward

The world is changing fast and new diseases are emerging and reemerging across the
globe. Many of these new diseases can be linked to animals or changes occurring in
environmental conditions. With the ease of travel across the world, now more than ever
we are becoming a global community. Because of this, it has now become very important
to include the development of veterinarian public health services in promoting and
protecting human health. Bangladesh government has launched a collaborative effort and
established increased approach and joint venture activities with the World Organization
for Animal Health (OIE) and the Codex Alimentarius Commission (CAC) in respect of
capacity building for surveillance and control of zoonotic diseases, and food safety. Bangladesh being one of the institutions because of its strong impact on livestock, agriculture, trade, complexity of environment, market access, food chain and human welfare, has agreed upon the decision of International fora, who emphasized the need to prevent and control of Trans-boundary Animal Diseases (TADs). In view of this perspective Bangladesh Government is willing to contribute to the strengthening of confidence between its neighbors, particularly SAARC country members through transparency, implementation of consensual and harmonized methodologies and common work with respect to VPH activities, zoonoses prevention and control and food safety. Towards this aim, the cooperation among SAARC countries and International forum is essential, and cooperation and communication among stakeholders remain a key issue. In addition to the above issue due to globalization and internationalization of trade, issues with respect to antimicrobial resistance should be considered to ensure food safety.

Cardinal Scope of VPH in Bangladesh

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<th>Essential Coverage</th>
<th>The Way Forward</th>
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4. Major Obstacles of VPH Delivery Services in Bangladesh

The implementation of VPH in developing country like Bangladesh faces a number of difficulties. The major of these as observed and identified are related to the following matters:

4.1 Prerequisites to be met

- **Defined mandate:** Lack of a clearly defined VPH mandate and associated legislation,
- **VPH responsibility:** The fact that no government agency has specific responsibility for VPH.
- **VPH program prioritization:** The implementation of VPH programs which has been further hampered by the lack of priority-setting and resources including trained professionals and auxiliary staff, and the lack of reliable data
- **VPH Services:** The VPH services are unable to meet the needs and demands of the public and the livestock industry
- **VPH decentralization:** The decentralization of a number of VPH responsibilities to municipalities
- **VPH Units:** The disease surveillance system is almost non-existent. The Veterinary Public Health Unit in the DLS has the mandate in the paper to perform diagnosis, surveillance and control of zoonotic diseases, ensure food safety of animal origin, and liaison with the Health Department. The Unit is however, suffering from serious shortages of human capital, funding and laboratory facilities. It has no legal framework to implement its mandate. Coordination between animal and human health bodies is virtually non-existent.
- **Bio-security establishment:** There are at present no guidelines for environmental protection and bio-security when establishing animal farms.
- **Quality Vaccine and Vaccination:** The quality and quantity of vaccines produced and delivered by the DLS are inadequate. The use of subsidies in vaccine production in the present form is a possible deterrent to private investors.
- **Vaccination target plan:** There is no independent authority to check the quality of domestically produced or imported vaccines. Vaccination is done in a haphazard manner without any strategic plan for controlling the targeted diseases. There are no provisions for movement control and quarantine during disease outbreak or epidemics.
4.2 Lacking need to overcome

- **Shortage of qualified personnel**: Limited human and economic resources and VPH activities have focused on one or two of the most important zoonotic diseases.

- **Non-availability of Funds**: VPH activities have difficulties in competing for funds with the veterinary services, which give priority to those diseases considered being of greatest socioeconomic and public health importance.

- **Inadequate diagnostic facilities**: Field staff lack the knowledge for diagnosing diseases, and laboratory facilities for confirming diagnoses are least developed and mostly unavailable.

- **Improper Data reporting and analysis**: There is a lack of coordinated program for ensuring collaboration between all stakeholders that impede efforts to improve diagnosis, and prevent the reporting of data from the field to epidemiological units responsible for VPH-related surveillance.

- **VPH programs rudimentary**: The concept and scope of the VPH programs are not revised to give greater emphasis to food safety and quality, and methodologies are not being developed for a “farm-to-table” approach. VPH-related subjects have only recently been included in veterinary curricula.

- **Legislation and regulation underdeveloped**: VPH program is introduced, but poorly managed because the necessary legislation is lacking and regulatory guidelines are rudimentary.

4.3 Innovations and vigilance to build

- **Guidelines, legislation and strengthening**: The development and introduction of the necessary guidelines and legislation are the preconditions for creation of the environment and momentum for the strengthening of the VPH program.

- **Central authority in charge of VPH programs**: There should be a central authority in charge of VPH programs, and VPH-related activities.

- **Improvement in existing and new VPH programs**: There are few programs for the control and prevention of zoonoses that deal with both human and animal aspects, such as the rabies and brucellosis control program. Activities have been limited mostly to the implementation of canine rabies control through standard potential vaccination in selected communities. This program is assumed to cover about 10 to 15 of the total target dog population because of financial constraints and competing priorities, such as the campaign to eliminate foot-and-mouth disease. Improvement in these and other new programs are essential.
• **VPH activities focusing:** Veterinarians in the armed forces are responsible for food hygiene and sanitation and for providing veterinary services only within the armed forces. Their activities regarding VPH could be focused to the public.

• **Meat Inspection Commission:** There exists no national Meat Inspection Commission under the Directorate of Livestock Services that regulates the flow of livestock and meat products, both locally produced and imported, through various stages of marketing and are responsible for the accreditation of livestock and poultry-processing plants. This needs improvement.

• **VPH link to medical profession:** The veterinary research institute or Bangladesh Livestock Research Institute (BLRI) has not been actively involved in VPH programs, such as concerned with zoonotic diseases and food safety. The research institute also does not serve as the referral centre for the diagnosis and surveillance of human and animal diseases etiological agents. Its activities do not include field operations research, laboratory-, hospital- and community based studies on disease interventions, and the improved diagnosis and surveillance of emerging zoonoses. The institute is not linked to the medical profession in the prevention and control of zoonoses in the country. It is hoped that this type of institute would deal more with VPH activities.

• **Building Collaboration between Ministries:** There is very limited collaboration between Ministry of Health and Ministry of livestock at all administrative levels. The VPH problems facing Bangladesh are hampered by inter-professional non-communication and non-collaboration. These conditions must be wiped out.

• **Profiling VPH systems and activities:** The World Health Organization (13) indicated that the profiling public health workforce should include ‘strategic, organized and inter-disciplinary application of knowledge, skills and competencies necessary to perform essential public health services and other activities to improve the population’s health’. People from a wide range of occupational backgrounds, e.g., public health personnel from medical, veterinary, dental, nursing, environmental science and other areas are engaged in health improvement, health protection and health and social care. In Bangladesh there are five national-level public health institutes, including four in the public sector and recently the BRAC University and the Asian University started degrees in public health. Although it is agreed all over the world and the WHO profiling clearly mentioned that the public health veterinarians could play key role to the development, improvement and efficient
functioning of public health system, but unfortunately in Bangladesh there is no existence of Veterinary Public health which could perform collaborative activities in well being of human for health promotion, prevention of and control of emerging and reemerging zoonoses, food safety and consumers protection. These activities must be built.

- **Formulating Coordinated programs:** There is no coordinating unit in either the Health or the Veterinary Department, to enhance cooperation and subsequently strengthen and provide direction for VPH programs in the country.

- **Initiating Collaborative VPH programs for SAARC:** There does not exist a regional effort for collaborative VPH programs, either for SAARC or Asia or South-East Asia or Asia-Pacific Regions. Collaborative VPH programs must be initiated.

5. Situation of VPH, Animal Diseases, their Prevention, Control and Eradication Measures in Bangladesh

5.1 Disease Aspect

Animal diseases are classified by the OIE as list A and list B and other diseases. List A diseases are transmissible diseases which have potential for very serious and rapid spread, irrespective of national borders. These are of serious socio-economic or public health consequences and are of major importance in the international trade of animals and animal products. The List A diseases comprise 15 infectious diseases and the diseases which in particular are of importance in Bangladesh for ruminants and poultry include: Foot and mouth disease (FMD), Rinderpest, PPR, Sheep pox and Goat pox, Newcastle disease (ND) and highly pathogenic Avian influenza (14). List B diseases are transmissible diseases which are considered to be of socio-economic and/or public health importance within countries and which are significant in the international trade in animals and animal products. List B diseases refer to diseases within different animal species and consist of 68 diseases. Some list A and B diseases of importance in Bangladesh for the livestock sector dominated by the ruminants and poultry are shown in the table below.

<table>
<thead>
<tr>
<th>Name of List A diseases</th>
<th>Domestic ruminants affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foot and mouth disease</td>
<td>All ruminants</td>
</tr>
<tr>
<td>Rinderpest</td>
<td>Cattle and buffalo</td>
</tr>
<tr>
<td>Peste des petits ruminants</td>
<td>Sheep and goats</td>
</tr>
<tr>
<td>Sheep and goat pox</td>
<td>Sheep and goats</td>
</tr>
<tr>
<td>Lumpy skin disease</td>
<td>Cattle</td>
</tr>
<tr>
<td>Name of List B diseases</td>
<td>Domestic ruminants affected</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Anthrax</td>
<td>All ruminants</td>
</tr>
<tr>
<td>Leptospirosis</td>
<td>All ruminants</td>
</tr>
<tr>
<td>Rabies</td>
<td>All ruminants</td>
</tr>
<tr>
<td>Para-tuberculosis</td>
<td>All ruminants</td>
</tr>
<tr>
<td>Bovine brucellosis</td>
<td>Mainly cattle and buffalo</td>
</tr>
<tr>
<td>Bovine tuberculosis</td>
<td>Mainly cattle and buffalo</td>
</tr>
<tr>
<td>Bovine babesiosis</td>
<td>Cattle and buffalo</td>
</tr>
<tr>
<td>Hemorrhagic septicemia</td>
<td>Cattle and buffalo</td>
</tr>
<tr>
<td>Caprine and ovine brucellosis</td>
<td>Sheep and goats</td>
</tr>
<tr>
<td>Enzootic abortion in ewes</td>
<td>Sheep</td>
</tr>
</tbody>
</table>

The animal disease situation in Bangladesh reflects the geographical location of the country, the climatic conditions, husbandry practices and the application of animal disease control measures. A number of OIE list A and List B diseases are reported to be endemic or frequently occurring in Bangladesh. The above table 1 information is on diseases reported to occur in ruminants. In addition to the reported cases or outbreaks in ruminants of OIE list A and list B diseases a number of other diseases have been reported to create problems. Some of these are Black quarter (C. chauvei infection), contagious ecthyma (para-pox virus infection), Salmonellosis and parasitic diseases. The diseases reported in poultry are presented in the table 2 below.

**Table 2. Information on reported OIE list A and B diseases in poultry in Bangladesh (Westgaard, 2003)**

<table>
<thead>
<tr>
<th>OIE list A diseases</th>
<th>Poultry affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newcastle disease</td>
<td>All poultry species</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OIE list B diseases</th>
<th>Poultry affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infectious Bursal disease (Gumboro disease)</td>
<td>Clinical disease in chickens</td>
</tr>
<tr>
<td>Marek’s disease</td>
<td>Mainly fowl</td>
</tr>
<tr>
<td>Avian mycoplasmosis</td>
<td>Fowl and turkeys</td>
</tr>
<tr>
<td>Fowl typhoid and pullorum disease</td>
<td>Mainly chickens</td>
</tr>
<tr>
<td>Avian infectious bronchitis</td>
<td>Mainly chickens</td>
</tr>
<tr>
<td>Fowl cholera</td>
<td>All avian species</td>
</tr>
<tr>
<td>Duck virus enteritis or duck plague</td>
<td>Ducks and geese</td>
</tr>
<tr>
<td>Duck virus hepatitis</td>
<td>Mainly ducklings</td>
</tr>
</tbody>
</table>
The commercial poultry sector which is primarily depending on imported chickens has in recent years experienced outbreaks of several infectious diseases presently as causing problems in Bangladesh. These diseases recorded include:

- Chicken anemia virus infection
- Egg drop syndrome
- Avian infectious laryngotracheitis

In Bangladesh the scenario of preventing or control of disease is not well organized and do not meet the required global standard. When a disease occurs in domestic holding mostly in rural areas or in small holding in urban regions, at formal and informal farms the typical picture is handled in two ways:

- **Way no. 1.** If the owner is capable to prevent or control the introduction of a disease he takes intervention of treatment or bio-security measures as per suggestion of the locally available veterinarian
- **Way no. 2.** On the other hand if the owner is incapable he lets the diseased animals ‘live with the disease’

The main objectives of disease control in Bangladesh are two fold and are still centered

(i) To minimize the prevalence of existing disease and
(ii) To reduce the morbidity and mortality rate from clinical disease.

There are poorly developed surveillance monitored program to adopt the principles of disease control. Only in limited cases reducing infection pressure and reducing the effect of risk factors that increase susceptibility to disease are practiced. The Government has some targeted vaccination programs for enhancing immunity to few infectious diseases. Veterinarians are given appointment at central, regional and local administrative levels in order to detect diseases, provide treatment and ensure that animal disease control measures and control programs are being implemented in accordance with the provisions of the prevailing legislation. There exists poorly defined epidemiological knowledge. In Bangladesh Directorate of Livestock services there is still great scarcity of accurate and reliable epidemiological data on livestock and poultry diseases relating to the effective delivery of prevention and control programs. In addition there is lack of suitably trained individuals at all levels and lack of VPH infrastructures to establish and implement comprehensive animal disease and zoonoses control and eradication program. Adequate resources are not available and this has been recognized as the major issue for not to be able to effectively and efficiently address the needed surveillance, monitoring, prevention, control and eradication of animal and zoonotic diseases and set up the diagnostic laboratories meeting the levels of international standards prescribed by OIE and codex. Extension Delivery Services for the livestock services provided by NGOs are available, but these are inadequate and not related to VPH.
5.2 Legal Framework

The role of veterinary service particularly official veterinary service has been changing and it is tilting towards regulatory affairs related to animal health, animal welfare, human health and food safety and conservation and protection of nature. Bangladesh is yet to develop a unified Food Safety Administration System and to formulate a Food Safety Policy (15). The Ministry of Fisheries and Livestock and Directorate Livestock services in very recent years have shown keen interest in the preparation of new legislation within the circle of animal production, animal health, veterinary public health and animal welfare. The existing legislation consisting of seven categories are applicable to within the framework of three areas, such as livestock production, animal health and animal welfare. The legislations adopted in different years before the inception of Bangladesh are listed in chronological order in table 3 below.

Table 3. List of the Legislation for the Livestock Sector existed in Bangladesh before independence

<table>
<thead>
<tr>
<th>Areas of livestock covered by legislation</th>
<th>Year of adoption of legislation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Livestock production</strong></td>
<td></td>
</tr>
<tr>
<td>The Cattle Trespass Act</td>
<td>1871</td>
</tr>
<tr>
<td>The Animals Slaughter (restriction) and Meat Control Act</td>
<td>1957</td>
</tr>
<tr>
<td><strong>Animal Health</strong></td>
<td></td>
</tr>
<tr>
<td>The Livestock Importation Act</td>
<td>1898</td>
</tr>
<tr>
<td>The Glanders and Farcy Act</td>
<td>1899</td>
</tr>
<tr>
<td>Diseases of Animals Act</td>
<td>1944</td>
</tr>
<tr>
<td>The Veterinary Practitioners Ordinance</td>
<td>1984</td>
</tr>
<tr>
<td><strong>Animal welfare</strong></td>
<td></td>
</tr>
<tr>
<td>The Cruelty to Animals Act</td>
<td>1920</td>
</tr>
</tbody>
</table>

The legal regime on the livestock sector dates back in the nineties. The latest of the law framework was done in 1984. The Ministry of fisheries and Livestock and Directorate of Livestock services took initiatives to update the legislation framework. The Laws in force and new laws title are presented in table 4 below.

In addition to the above mentioned areas there is no specific law to deal with livestock production, processing, quality control and marketing of livestock and animal products. There is neither any law nor any provision of Codes of Practice implemented to determine the quality of foods and provide consumers protection. However Bangladesh Standards and Testing Institution (BSTI) are trying to adopt specifications for the foods of animal origin. These are:

- Bangladesh Standard for Handling, Processing, Quality Evaluation and Storage of Poultry
- Bangladesh Standard Specification for Mutton and Goat Meat (Chevon) – fresh, chilled and frozen
- Bangladesh Standard for Methods for Detection of Bacteria responsible for Food Poisoning
- Bangladesh Standard Specification for Dressed Chickens
- Bangladesh Standard Specification for Beef and Buffalo Meat – fresh, chilled and frozen
- Bangladesh Standard Specification for Milk and Milk Products including Infant milk.

### Table 4. List of the Legislation for the Livestock Sector in Bangladesh now in force and new laws title

<table>
<thead>
<tr>
<th>Areas of livestock covered by legislation and Laws include</th>
<th>Year of adoption of legislation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cattle Trespass</strong>&lt;br&gt;Laws include&lt;br&gt;Cattle Trespass Act, Prevention of Trespass Ordinance</td>
<td>1871, 1959</td>
</tr>
<tr>
<td><strong>Cruelty to Animals</strong>&lt;br&gt;Laws include / in force&lt;br&gt;Cruelty to Animals Act&lt;br&gt;The society for the Prevention of cruelty to Animals Ordinance</td>
<td>1920, 1962</td>
</tr>
<tr>
<td><strong>Animal Production</strong>&lt;br&gt;Laws include / in force&lt;br&gt;The Bangladesh animal Feed Act</td>
<td>2002</td>
</tr>
<tr>
<td><strong>Animal Protection and Development</strong>&lt;br&gt;Laws include / in force&lt;br&gt;The Animals Slaughter (Restriction) and Meat Control Act&lt;br&gt;New Law titled the Animal Slaughter Restriction ad Meat Inspection Act</td>
<td>1957, 2003</td>
</tr>
<tr>
<td><strong>Livestock Importation</strong>&lt;br&gt;Laws include / in force&lt;br&gt;The Livestock Importation Act&lt;br&gt;New Laws titled the Bangladesh Animal Quarantine (Import and Export of Animal products) and the Animal and Animal product Quarantine Act. The Animal Quarantine Act enacted (Act no-VI of 2005) by the Parliament, but quarantine stations, manpower and funds to enforce the Act are not in place yet. Laws and Regulations are essential for high quality service delivery and quality assurance of products for trade. Some laws and regulations are in place but overall regulatory framework and implementation remain very weak.</td>
<td>1888, 2002</td>
</tr>
</tbody>
</table>
### Areas of livestock covered by legislation and Laws include

<table>
<thead>
<tr>
<th>Animal Disease/ Health/Welfare</th>
<th>Year of adoption of legislation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Laws include / in force</strong></td>
<td></td>
</tr>
<tr>
<td>The Bengal Diseases of Animals Act</td>
<td>1944</td>
</tr>
<tr>
<td>The Glanders and Farcy Act</td>
<td>1899</td>
</tr>
<tr>
<td>The Animal disease Act</td>
<td>2003</td>
</tr>
<tr>
<td>The Bangladesh Zoo Act</td>
<td>2003</td>
</tr>
<tr>
<td>Bangladesh Fish and Animal feed Act</td>
<td>2006</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Livestock Research</th>
<th>Laws include /in force</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock Research Institute Ordinance</td>
<td>1984</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Livestock Institutional Development in force</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>The Bangladesh Veterinary practitioners ordinance</td>
<td>1982</td>
</tr>
</tbody>
</table>

| Agriculture Produce Act | 1937 |
| Import and Export(Control) Act | 1950 |
| The Customs Act | 1960 |
| Bangladesh Pure food Amendment Act | 2005 |

### 6. VPH Issues Related to Food Safety is a Growing Concernment in Bangladesh

Bangladesh being a significant agricultural nation has recently set goals for domestic consumption and increasing export of fresh and processed foods, but adequate food safety control has not been achieved to enter the European and global markets. The present scenario of check and quality management of food product of this country is unfortunately still not under the impact of World Trade Organization (WTO) negotiations and agreement. It has now become a matter of the greatest concern that food habits of our people are changing in faster rate and they are increasingly depending on convenience foods in supermarkets, street restaurants or floating food shops, ambulatory sales and vendors. At the same time food technologies are also changing our food choice and introducing newer food items, as a result there are possibilities of more and more incidences of food-borne infections and intoxication. The potential food hazard can get incriminated and the public health may be threatened. It is now agreed that to ensure quality and safety of foods in this country ‘from farm to table’ pre-harvest and post-harvest hygienic functions are important. If ‘on-farm’ exposure to food-borne hazards due to pathogens and residue producing chemicals are prevented, they do not enter and persist in the food chain. This primary prevention enhances pre-harvest food safety. If the food is protected from contamination throughout the post-harvest period and processed to
prevent and eliminate food-borne hazards, the post-harvest food safety is achieved. “Open Dating” on a food product is a date stamped on the package of a product to help the store management determine how long to display the product for sale. It is a quality date, not a safety date. In Departmental food shops in Bangladesh sometimes packaged perishable foods are found, but “Open Dating” is rarely found primarily on perishable foods such as meat, poultry, eggs, and dairy products.

6.1 Situation of safety of foods of animal origin in Bangladesh

Today production of meat foods in meat processing and packing plants like other food manufacturing industries, are going through a phase of structural rationalization. The sanitary conditions and technologies within pre-harvest and post-harvest food safety boundaries are improving. The public has started to question the quality of foods in a wider sense, as they are appearing in increasing numbers in supermarkets and retail grocery stores. Veterinary medicine is now no more basic activities of treatment. Like developed countries, universities and veterinary schools are not producing veterinary food hygienists to deal with matters of health aspects and demands of consumers’ protection. It is therefore the time for us to realize veterinary responsibilities for the well being of man that fits into the full spectrum of “healthy animals (ante-mortem examination) ➔ safe meat foods (post-mortem examination) and ➔ healthy people (Good quality wholesome meat consumption)”.

The world is approaching a liberalization involving a minimization of trade barriers, so that input control will no longer be present and all partners would agree with a uniform hygiene in pre-harvest and post-harvest handling. In recent years we experience complex changes in production, processing, storage, distribution, marketing and serving of foods. High standards of hygiene at abattoir, improved dressing procedures and sophisticated quality control for holding meat foods under cold chain and refrigeration for extended period are established in many countries to assure food safety and consumers’ protection. Prime cuts of meats are now packaged to specification to local needs and of overseas customers. These are transported and chilled in air-tight bags of multilayer polyethylene and plastic to prevent spoilage. In our home country the government is encouraging the private sector to put the meat processing and marketing into the context of industrial standard keeping in view the cost effectiveness and public health issues, so that we can enter the global trade. In recent years a modern abattoir namely Bengal Meat Ltd has been established to offer consumers wholesome meat.

Meat-borne diseases and problems relating to the sanitary and microbiological quality of meat foods continue to be of major interest and great concern in this and other countries of the world. It is evident and well recognized that conditions of pre-harvest and post-harvest handling and mechanical, physical, chemical and microbial effects owe to the leading causes of reduced shelf life, deterioration and spoilage of meat foods involving the occurrence of potential risks of health hazards. Many new problems are coming up and have been created due to recent developments in handling, processing,
packaging, distribution and storage. To meet this challenge in Bangladesh we feel for accommodation of an effective and integrated program that will serve as a guide to academic students and field professionals, whose responsibilities would be subsequently to provide producing a safe and good quality meat to consumers. One of the important tasks today has therefore been centered in imparting education in veterinary public health and food hygiene and to train veterinarians who apply their veterinary knowledge and skills in promoting to the welfare of animals and human communities. There is now a greater awareness all over the world regarding the role of veterinary public health in improving the quality of animal products.

The situation of hygiene and production of foods of animal origin in Bangladesh is briefly presented below.

6.1.1 Meat from food animals

6.1.1.1 Present Status and Public Health Implications

Although the supply of meat constitutes for all communities especially for towns and cities a factor of pronounced economic, hygienic and public health importance, but the situation of meat production and supply in terms of handling, slaughtering and dressing of food animals in Bangladesh takes place in a very disorganized way and in unsanitary conditions. Most meat in Bangladesh is handled under unsatisfactory sanitary conditions in both rural and urban areas. Enforcement of legislation relating to slaughtering or meat inspection is weak. There is generally poor pre-slaughter conditions, sanitation, removal of waste materials, and disposal of offal (16). Ante- and post-mortem meat inspection programs are not primary responsibilities of National Veterinary Services in Bangladesh; as a consequence inspection procedures are not designed according to a risk-based approach and management systems that reflect international norms. It is clear that veterinary inputs to ante- and post-mortem inspection achieve a duality of public health and animal health objectives in developed countries, but unfortunately in Bangladesh there is no scientific evidence linking traditional ante- and post-mortem inspection with measurable outcomes in terms of human health.

In Bangladesh there are many self-made field abattoirs in rural and urban areas, small towns and even in cities slaughtering is still carried out by unauthorized butchers in fields, bushes, backyards or at some street corners, where killed animals are skinned, eviscerated and dressed. The dressed carcasses are made into various cuts and portions and sold to customers. There are an estimated 192 improvised slaughter houses at district level, 1215 at Upazilla level and more than 3,000 slaughtering points in hats and bazaars as well as by road sides of cities and towns. There is neither any pre-slaughter care nor ante-mortem examination nor any humane method of slaughter (post-harvest food safety). Post-harvest food safety and post-mortem examinations are not at all practiced and these do not constitute integral parts for the hygienic production of meat. The public due to unawareness and due to non-enforcement of laws many a times buy meat which cannot ensure protection to consumers from the effect of potential danger of inferior
quality meat. The finished products so prepared are transported to meat stall by rickshaw, cart or shoulder carriage, often lying on unclean surfaces and exposed to health hazardous agents. When blood, ruminal and intestinal contents are wasted, these are either left where the slaughter has taken place or washed down a drain to eventually end up in a pond or a watercourse. Experts suggest that the slaughterhouse management followed in this country need to be improved which could ensure production of good quality carcasses and safe meat, whether the act of slaughtering is performed in rural conditions or at convenient places or at farms or in slaughter slabs or slaughterhouses. FAO is promoting activities to establish ideal slaughter slabs or slaughterhouses in some countries, because this would increase the availability of quality meat and improve utilization of by-products and generate intervention activities for obtaining food security and safety.

In Bangladesh cattle are generally dressed on their backs on a flat ground surface, using removed hide a surface to separate meat portions from the concrete or dust. Evisceration of cattle is also performed in the prone position. Although it would be desirable to dress the carcass on a dressing cradle and hoist to an overhead rail for final hide removal, evisceration and final carcass preparation, but unfortunately this is not given attention. In modern slaughtering plants, after stunning and bleeding, carcasses are suspended by the hind legs. Regardless the method used for dressing (suspension, dressing cradle or floor), great care must be taken to prevent undue contamination. In view of this fact there should be implementation of projects on slaughterhouse construction and modern technology for obtaining safe meat food. To do so the concerned veterinary public authority should advocate for the use of dressing operations on rail and the whole system is to be run in chain-driven. The equipments and machinery needed for proper operations of the meat plant cannot be curtailed, if we really want to get rid of health hazardous agents at different stages and points. The evisceration point in the dressing operation or procedure is the significant location where very high potential of contamination is likely to occur. Moreover during hide removal, dropping, rodding, placing viscera into vehicles, washing of carcasses all contribute to application of hygienic measures and proper techniques in which appropriate equipments and instruments will be absolutely necessary and this is very important for obtaining hygienically produced meat. Proper use of equipments will aid in preventing contamination of the dressed carcass, maintaining a satisfactory sound environmental condition and establishing a good manufacturing practice. In every stage of the above mentioned operations there is absolutely lacking in activities indispensable to attain food safety and eliminate health risk factors. It is therefore recommended that the concerned authority should introduce and enforce ‘Hygienic codes of practices’ and follow Hazard Analysis Critical Control Point (HACCP) principles; otherwise the wholesomeness and quality of the final meat products will be questioned and cannot be aimed at ensuring food safety.
The importance of careful handling of meat animals before slaughter cannot be exaggerated, for unsuitable conditions of transport lead to injury, bruises, lameness, fatigues, suffocation, transit fever, convulsions, diarrhea, and death. It is interesting to note that in Bangladesh the percentage of occurrence of diarrhea is remarkable in all species of animals when they are brought by driving on the hoof (cattle 38.44%; buffalo 15.16%) or transported by trucks (buffalo 30.80%; sheep 29.26% and goats 21.14%). The disease is more pronounced in goats when they are transported by boats. Most animals arrive at the slaughtering point are seen with exhaustion, fatigues and stress conditions. As a result meat obtained from these animals cannot be regarded as free from potential threat of health risk factors. In order to get wholesome meat for human consumption and prevent potential danger of inferior quality meat the country needs to give attention to meat inspection regulations and systems, which will focus on animal diseases as well as public health issues. The implementation of the inspection system is the intervention activities required for obtaining food safety. The public health aspect of meat focuses attention to the fact that undoubtedly meat after slaughtering and dressing of food animals under Bangladesh conditions carries an extremely high initial contamination loading, which is exacerbated by poor transport and retailing conditions. Improved hygienic conditions (post-harvest food safety) during slaughtering, evisceration and dressing will reduce initial microbial load and there will be minimization of contamination. However this improvement resulting from intervention activities is likely to be undermined if hygienic practice is not maintained throughout the distribution and retailing chains and inherent low temperature storage (16).

Product quality of meat and meat products depends on the hygienic status of the carcass meat used for processing – the ultimate goal is to offer consumers wholesome sound meat foods. To get remedy from the present situation it is therefore evident that a proper way of improving slaughter hygiene and introduction of effective meat inspection programs are indispensable and urgently needed to prevent entry of diseased agents contaminating meat into the food chain. The country obviously needs slaughterhouses with meat processing plants. The project initiated by Government and Nongovernmental organizations Agro Industries Ltd., if implemented would certainly improve not only the dietary intake of people, but also supply safe and wholesome meat, strive to export processed meat products to Middle East, Southeast. Asian countries, Brunei and encourage more efficient utilization of organic meat by-products.

6.1.1.2 Consumers Demand and Quality

Understanding the consumer market in Bangladesh is not an easy task, as human attitudes and perceptions are diverse and entangled in a constant state of flux. Consumer preferences are subject to change and can be affected by factors such as income, size of household, gender, age, geographic region and ethnicity. It has become clear to everybody that consumers give value to taste and quality, as a result food industries are being pressed for reviewing their strategies and attempting to deliver products that offer
better value to consumers. Consumers also want better convenience, packaging, menu versatility, and value-added attributes.

A recent survey of retail market of meat revealed a strong trend toward more branded, value-added products being offered to consumers. Most of the meat produced and available in our country is sold by retail butcher shops to general consumers as fresh meat (unchilled). This meat is cooked in the household in different ways according to tastes and preferences. The production of processed meat is almost negligible. However, recently the dynamics of consumers’ attitude are rapidly changing in favor of processed meat products especially in metropolis and big cities. Several traditional meat products like meat kabab, samosa, kopta, tikka etc. have been able to create an impact on the urban consumers. In big cities there is an ever increasing demand for ‘ready to cook’; ‘ready to eat’, ‘heat and serve’ and ‘take away home’ convenience or fast foods. The growth of fast food shops, supermarket meat corners, departmental stores, restaurants, hotels is attributed to the rapid urbanization and changing life-styles. It may be pointed out that the increase in consumption of value-added processed meat products is closely linked with increase in disposable income and growth of urbanization. The present demand of supermarkets, household consumers, hotels, restaurants, army, navy and other defense departments for catering requirements of meat and meat products focus attention to tailor the food items in plants under Quality, Standard and Acceptability (QSA) concept according to demand. In addition to our native demand, we could strive to export meat products rather than fresh meat. Western type meat products like Sausages, Frankfurters, Salami, Hot dog, Meat patties, Burgers, Luncheon meat, Liver paste etc are popular items which can be prepared here for our domestic consumption in big cities and these could be export items as well. We need to know the consumption pattern of meat products in importing countries. A shift from primary products to value-added products will definitely generate more employment. If we can produce quality product and enter global marketing as per Code of Practice of importing countries we would be able to earn more foreign exchange and the industry's efficiency will be of more viable nature.

The Household consumption survey calculated that average per capita daily intake of beef in our country is about 5.2 g per day and mutton 0.9 g per day. When calculated across the population those figures indicate a consumption of some 49,000 tons of mutton and 226,000 tons of beef per annum. The Household survey did not include Eid festival slaughter. The impact of slaughter for Eid festival has been estimated to be 40% of the total annual slaughter. If this is included then the total annual consumption of beef and mutton could rise to 445,000 tons. Moreover the demand of supermarkets, hotel, restaurants and Defense department for quality meat has been surveyed. If we include the total demand of all sections and if we could double the daily intake of people then we need to supply annually 8,00,000 tons. The establishment of project of the meat plant would be capable to meet the actual demand of the country and the gap could be filled up in due course.
6.1.1.2.1 The feasibility of establishment of abattoir

The feasibility of establishment of abattoir in Bangladesh entails three emergent impacts

6.1.1.2.1.1 Economic impact

- The fragmentation of traditional meat production results in the poor recovery of by-product
- Due to low slaughter numbers at any single location blood and intestinal contents are in general not being collected and utilized. The opportunity to recover these products as a feed source or fertilizer is being lost.
- Hide trimmings, horns, hooves, hair and bone are not collected in any manner. Some areas around the tanneries collect hide trimmings, fleshing materials, bones, bristles and hairs occasionally and these are utilized in a very small scale in a cottage industry environment.
- Some 40,000 tons of raw blood equivalents to 5000 tons of dried blood with an average 80% protein content are being wasted.
- It is estimated that 40% of this material (16,000 tons of raw blood and 2,000 tons of dried blood) are produced on the 3 days of Eid festival.
- It is known that blood contains a valuable lysine source – a protein supplement for poultry production. To get this in feed the collected blood is boiled ⇒ coagulated ⇒ drained ⇒ dried ⇒ and mixed with rice or wheat bran.
- There could be up to 100,000 tons of wet rumen contents produced resulting in some 12,000 tons of dried material (8-20% protein). This material could be utilized for pig ration as well as in preparing compost and fuel gas in biogas system.
- Lack of policy making or indifferent in setting to minimize controllable damage of hides and skin due to poor flaying and poor preservation and transportation.

6.1.1.2.1.2. Public health impact

- Ante-mortem and Post-mortem meat inspections do not exist.
- Improved hygienic condition during slaughtering, dressing distribution and retailing operations are not practiced.
- Methodology of detection of diseases and control of hygienic quality are least developed.
- Cold chain system – (chilling, refrigerated transport, frozen storage etc), hygienic processing and packaging are ignored.
- Appropriate Legislation or Act of ‘Meat Inspection and Hygienic production’ need to be developed and implemented.
6.1.2.1 Environmental impact

- Slaughtering wastes are discharged into the environment, drains and watercourses
- Rendering plants to utilize by-products is not present; as a result the BOD load and other hazardous materials cause environmental pollution
- Tannery wastes causing pollution

6.1.2.2 Future prospect development

For a long time meat industry has remained confined to a very small section of people in our country and the traditional form of meat production rests on the hands of butcher workers. These people have very little knowledge about wholesome meat production and effective utilization of valued slaughterhouse by-products. In the present situation the industry is largely based on spent animals. Most animals are utilized for meat production after losing their economic validity in the primary fields. The concept of meat type animals is yet to take roots in our country; although an awareness and awakening response from the concerned authority in this regard is discernible. At present there are about more than hundred municipality-authorized or licensed slaughterhouses / slabs / points in the country. According to International Standards and Specifications these do not meet the Codes of Hygienic Practices. During the past few years the establishment of modern abattoir complexes has been proposed and until recently few projects on mechanized abattoirs initiated by public sectors are nearing completion. Since there is an export potential of ‘Halal meat’ in Islamic countries, Bangladesh could emerge as a prospective country. Therefore there is an urgent need to establish modern and hygienic abattoir with cold chain facilities solely for export purposes and rendering plants for utilization of by-products. It is hoped that these developmental activities will improve the present hygienic crisis of meat sector and promote effort to enter the global marketing so that we could occupy the significant share in world meat export.

6.1.2 Milk and Milk products

6.1.2.1 Milk transportation and public health

The milk production in Bangladesh takes place still not under organized condition and the importance of hygienic milk is not felt by the general public. Supply of milk from widely scattered sources, non-availability of cooling before and during transportation, careless handling, and distribution under improper hygienic condition and willful adulteration with pond or river water are all unsanitary activities under which milk is being sold. Moreover the transportation of milk from villages to urban market centers of towns and cities presents an enormous problem.

Milk after production is kept in buckets or earthenware pails and sold to gowallas and milkmen, who ultimately collect milk in big vessels and transport to towns and cities on shoulder carriage or bicycle or by road transports and rail. During transportation innumerable opportunities are provided for contamination, as in many cases the vessels in
which the milk is delivered usually have no coverings, the utensils are not properly washed and cleaned and made free from possible bacterial contamination. The milkmen to prevent its splashing from the container place banana and date leaves in milk. They do not give attention that the leaves could be abode of pathogens (post-harvest food safety).

6.1.2.2 Effort for Quality Milk production

In all developed countries ‘Milk inspection Act’ erects the maxim “sound and wholesome milk can be obtained from healthy cows” (pre-harvest food safety). The Act proposes the complete exclusion of milk from cows suffering from infectious diseases. It enforces that only milk from registered animal must be sold and the stocks are registered only when the byres meet certain satisfying requirements and the cows are certified to be healthy by veterinary inspection. Bangladesh is still backward in this respect. The country has little or no application of standards relating to hygienic production and distribution of milk. The microbiological standards of quality and the indices of sanitary quality to wipe out the threat of health hazard are not given due importance. It is really surprising and awesome that incompetent and under qualified personnel who have little or no knowledge about food safety are generally employed by the health authorities to work as sanitary inspector and assess the quality of foods. The veterinarians in spite of their adequate knowledge about hygiene of foods of animal origin and food safety functions are not usually employed for these purposes. The limited developments of some dairy enterprises like, Milk Vita, Pran, Arong, Star ship, Danish etc have contributed in the upliftment of quality milk production and processing, but without any effort to adapt them to cultural, socio-economic, climatic and sanitary condition of the country. Some milk processing plants are producing packaged milk products and they get certificates about quality from the BSTI (Bangladesh Standard and Testing Institution) which do not meet standard prescribed by ISO or CAC.

The production of high quality milk is of vital importance to the dairy enterprises all over the world. No other food product is subjected to the close scrutiny and regulatory control, as is milk. The main reason is that the almost universal acceptance of milk and milk products as a food for all age groups mandates a need for establishing and enforcing quality standards by public health agencies to protect consumers. In our country milk inspection should be introduced to safeguard human health. There must be continuous surveillance of the product from the farm through retail sale (per-harvest and post-harvest food safety). Recognition of the safety of milk fosters consumer’s acceptance of this relatively inexpensive nutritious food, whereas distributors benefit economically from increased shelf life resulting from high sanitary standard required for production and processing.

6.1.3 Poultry meat

Two marketing systems or mechanisms dominate the poultry meat sector in Bangladesh — (1) marketing rural scavenging poultry and (2) marketing broilers. In the
former farmers bring birds to a village market where they are either purchased directly by consumers or by middlemen. The middlemen then transport birds to urban areas and sell either in wholesale markets or direct to retailers. The great majority of customers do not have access to refrigerators and therefore they buy birds live based on live weight and undertake slaughter by traditional method. Scalding, plucking and evisceration are done at the household level. During these pre-harvest and post-harvest activities hygienic conditions are not maintained. In the second system the producers of broilers are usually located close to urban centers. If fresh killed birds are required the farmer manually slaughters, plucks and eviscerates near the farm or market premises. The processed birds are packed in polythene bags and places in ice for delivery to customers. The retailer using a chest type freezer unit often then freezes these birds down.

In recent years there has been a rapid expansion in commercial processing of eviscerated ready-to-cook poultry. As with any food product, the sanitation under which these birds are produced is of major concern. In cities live broilers are sold to customers based on live weight. The birds are then slaughtered, scalded and mechanically plucked (using a multi bird drum plucker), eviscerated and packaged while the customer waits. This system allows the customers to select the live birds but avoid the messy process of slaughtering and trouble of preparing the carcass.

Undoubtedly the poultry slaughtered and dressed under Bangladesh conditions carry extremely high initial contamination from the point of slaughtering process to the point at which the customers are offered the product. There occurs bio-magnification at all levels of handling, poor transport and retailing conditions. Improved hygienic measures will minimize the initial microbial load and the proper sanitary applications to the distribution and retailing framework and the arrangement for the inherent cold chain through all the steps up to the customers (pre-harvest and post-harvest food safety) could in fact meet the challenge to deliver a safe good quality product (17). Some research works conducted under my supervision revealed interesting results. Consumers who want to store dressed broilers for prolonged storage should keep them with intact skin, pre-chilled, packaged and subsequently frozen stored for a maximum period of 20 days at -150°C to -200°C. Under these conditions all sensory attributes like color, flavor, juiciness etc are perceived ‘better quality’ and the taste panelists consider the broilers more acceptable for human consumption.

### 6.1.4 Eggs

The poultry population in Bangladesh is still dominated by native chickens, which are used by the production of both eggs and meats. The egg is an excellent example of a safe food product that normally is well protected by the intrinsic parameters. In Bangladesh eggs are sold not on the basis of quality cleanliness, size, and weight but sometimes on the basis of production origin that is native or deshi eggs and farm eggs. Improper handling and bad transportation lead to disturbed architectural arrangements of the egg contents and thus accelerate the condition known as rotting. Considering the
growing importance of poultry farming, farmers are encouraged to produce good quality eggs in order to improve their economic condition. However, the preservation of egg quality and its public health importance are not given due attention. In Bangladesh, many people suffer from gastrointestinal disturbances by taking egg products contaminated with health hazardous organisms. Hens’ eggs are comparatively free from salmonella organisms than those of ducks. Salmonella organisms have been found to be frequently present in dirty and cracked duck eggs. The higher incidence of salmonella in duck eggs calls forth the public health significance (15). Data available indicate the highest prevalence of coliforms that reveal the fact that eggs are contaminated with fecal materials. The egg content samples of soiled and fecal contaminated eggs have been found to be loaded with appreciably high number of microorganisms. The recovery of salmonella organism in clean duck eggs and in dirtied and cracked eggs calls forth its impact on public health and gives indication for its hygienic handling and processing in the preparation of foods for human consumption.

6.1.5 Fish

Fish production in Bangladesh has been increasing as a result of the expansion in freshwater aquaculture activities. Due to the country’s great freshwater potential, fish cannot be regarded only as an excellent source of food, but also as a source of exportation revenue. With the rising costs of meat and cheese protein foods, consumers have become increasingly interested in fish as source of dietary protein. In recent years increased export demand (12 %) for Hilsa fish (*Hilsa hilsa*) together with high economic returns (75 billion taka) has received attention for improved intervention measures in order to reduce the involvement of risks of pathogenic activities of microorganisms associated with fish (18).

The fresh fish trade in Bangladesh has grown from practically nothing to a frozen shrimp industry and fresh water fish production for domestic consumption only a few years back. Due to availability of ice fish caught from remote areas of fisheries are transported to market centers, which receive little or no hygienic care, handling, and management with regard to microbiological quality and safety. Raw fish, if rotten and sold, will not usually be accepted, rather rejected by general customers, but the quality of iced fish at markets in consumer centers varies so widely that there is obviously a need for developing standards for quality and safety. Several outbreaks of food poisoning caused by consumption of fish and fish products reflect attention to microbiological safety of the food. Bacterial contamination of raw processed fish and fish products continue to be of great concern to consumers and Regulatory and Health Officials. Unfortunately in Bangladesh there exists no Public Health Regulatory Mechanism with regard to microbiological safety of raw fish. Emergence or re-emergence of serious diseases such as typhoid, bacillary dysentery, cholera, undulant fever, tuberculosis, listeriosis and hepatitis is a growing concern in this country both in humans and food-animals in the predisposed populations. Research study indicated that fishes from the
departmental shop contained more bacteria than fishes from open market. The possible reason for this variation might be due to the fact that unsold fishes were kept for longer times in the departmental shops. In response to the public health concerns regarding the microbiological safety of raw fish, the contemporary food microbiologists of our country face challenges on the effectiveness of mitigation strategies.

Developed countries have made effort to set some quality control standards for various kinds of fish. In many countries requirements as per recommendation of ISO, CAC and EU standards have already been drawn up for certain kinds of fish products and processing premises. In Bangladesh the frozen fish industry has grown in recent years and shrimp and Hilsa now represent the important export item of food. In Bangladesh there is no Government Regulatory Control for the ‘Establishment of International Code of Practice’ for specifications of quality standard and safety for this product under controlled processing and strict sanitary conditions.

6.1.6 New food items

The extensive development of modern food technology has made possible to offer many kinds of processed foods to consumers in accordance with their needs. The food habits of people all over the world are changing at faster rate and they are increasingly depending on supermarkets. Due to constant changes in technological revolution various processing methods are introduced and new convenient and ready-to-cook types of foods are replacing simple foods. In many supermarkets of developed countries nearly 10,000 food items can be seen. In Bangladesh the following are some of the examples of commonly marketed popular food items of animal origin: Barbecue, Beef patties, Samosa, Patties and Tikka, Seek and Shami kabab Chicken nugget, Corned beef, Meat loaf, Tandoori chicken, Meat or fish pies, Precooked meat rolls, Malaysian Parata, Frozen or cooked peeled shrimp, Dry soup cubes, Meat soups, Salami, Chocolate milk, Trade salad, Butter milk, Vacuum packed meats

As new food items with various ingredients are developed the food hygienists have become more and more concerned in the endeavor to maintain food safe and wholesome. Surveillance as an important tool for intervention activities has now become more and more necessary with the progressive increase in international trade in foods and hazards which cold stem from the introduction of new technique transfer for mass production, rapid and wide spread distribution into commerce. Below are some examples of food items which after ingestion themselves caused outbreaks of disease.

- Many cakes and confectionery products are incorporated with external decoration with shredded coconuts. Such products are decorated after cooking but the coconut receives no heat treatment. It was found that the desiccated coconut was liable to contamination by salmonella and the outbreak occurred.
- While the baking may be expected to have destroyed salmonella in the cake mixture, the imitation cream, an ingredient has been found liable to
contamination with salmonella because in each of the bakeries where the same mixing machine is used.

- Potato chips with spices, fried rice dishes, traditional Borhani drink, Fuchka, Pommes, Kashundi, Tehari, Ghugni and many other popular native pithas or cakes in which food ingredients like meat fragments, dryfish or so called shutki and spices are added that could provide potential food infection.

6.2 Role of Universities and Academic Institutions in Involving VPH Issues to Ensure Food Safety

The reflection that seems to be unique, that universities and academic institutions have clearly defined their roles in ensuring food safety and improving public health. In our position as academician we find that our graduate and post-graduate students of veterinary public health and food hygiene take a proper selection of courses to fit them for a career in aspects of food protection, zoonoses, and environmental hygiene and research experience. It is obvious and well recognized that a university intellectual and research group of Bangladesh can easily and successfully shoulder the responsibilities of public health oriented research, particularly on aforesaid events or aspects, than any other well equipped and adequately staffed laboratory could do. There are some types of investigations that are especially well suited only to an academic environment. Veterinary Public Health personnel of veterinary schools can devote time, facilities, and talents to multidisciplinary problems that may not have immediate importance in practical terms, but could be of great value to generate information for food producers, food processors, and food technologists, food microbiologists and consumers. Food-borne diseases and problems relating to the sanitary and microbiological quality of foods continue to be of major interest and concern in Bangladesh and also all over the world. New problems have been created due to the recent developments of modern technology in the processing, preservation and handling of foods. This resulted in emphasizing the need for establishment of maintaining the safety and quality of foods. The use and efficiency tests and standards for quality and problems related to public health must be worked out from our academic, regulatory and industrial standpoints. The public health service cannot combat alone the complex situation now we are faced, but that the governmental agencies and academic institutions of our country must work together to delineate many of the problems in food safety, hygiene, consumer protection and public health.

7. Adulteration of Foods of Animal Origin in Bangladesh

7.1 Mischievous Skills

Adulteration of foods is a common age-long problem of Bangladesh. Unscrupulous traders of the country willfully and consciously practice this abominable work to debase by mixing inferior spurious ingredients, which is no doubt a social evil. The general public, food traders and food inspectors are all responsible for perpetuating this evil
practice. To undertake the practice of adulteration the major mischievous skills put into habitual action are:

- Mixing with nonfood ingredients
- Substituting with under quality food substances or fabrication
- Texturing to mask the poor quality or under-processing
- Adding decomposed foods to fresh foods and putting up for sale
- Misleading labels of foods
- Misrepresentation of foods
- Using health hazardous agents in foods as preservatives
- Attracting consumers by introducing coloring and flavoring chemical adulterants

7.2 Fraudulent Practices

The concept of adding the above mentioned ‘nonfood substances’ or ingredients to food products as adulterants have posed health hazards among consumers. As a consequence the public are deprived of wholesome foods and are implicated with two major disadvantages:

- Paying more money but getting lower quality
- Highly injurious to health, even causing death. In a number of cases there may be paralysis and long-term carcinogenic effect.

The table 5 below shows the type of common adulteration and malpractices openly seen in Bangladesh. It is evident that the Prevention of Food Adulteration Act in Bangladesh is a very old one. The Rules and Regulations are not framed and revised time to time to conform to the present status of ensuring food safety so that the consumers’ could get their right to get protection from fraudulent / deceptive food trade practices. There exists no monitoring and surveillance of programs for prevention of food adulteration. Occasionally the Health authority, the Magistrate vested with power and the Food inspectors suddenly raid on food shops and their food preparation yards, food workshops, manufacturing plants to catch red-handed the unscrupulous food traders with adulterated foods. Anybody found to do this malpractice is given punishment by the mobile court. It is obvious that the present system of prevention of food adulteration cannot curb the evil activities of unscrupulous food traders and wipe out the growing concern of food safety.
Table 5. **Adulteration of Foods of Animal Origin in Bangladesh**

<table>
<thead>
<tr>
<th>Food items</th>
<th>Unscrupulous malpractice and adulteration with</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Meat</strong></td>
<td></td>
</tr>
<tr>
<td>Fresh raw meat from slaughtered animal</td>
<td>Left over meat, frozen, thawed, hanged and offered for retail sale</td>
</tr>
<tr>
<td>Beef</td>
<td>Buffalo meat</td>
</tr>
<tr>
<td>Goat meat</td>
<td>Sheep meat or mutton</td>
</tr>
<tr>
<td>Emaciated lean carcass</td>
<td>Inflation of carcass</td>
</tr>
<tr>
<td>Meat from small food animal</td>
<td>Dog meat, fox meat, rabbit meat etc</td>
</tr>
<tr>
<td>Regularly slaughtered meat animals</td>
<td>Dead carcass meat not regularly slaughtered</td>
</tr>
<tr>
<td>Slaughtered and dressed poultry meat</td>
<td>Dead poultry meat dressed</td>
</tr>
<tr>
<td>Retail meat cuts from dressed carcass</td>
<td>Retail meat cuts from dressed carcasses soaked or immersed in unhygienic unclean water</td>
</tr>
<tr>
<td>Fresh meat cut in display cabinet</td>
<td>Fresh meat cut in display cabinet with red lighting to impart red color to meat</td>
</tr>
<tr>
<td>Freshly cut raw meat with bones or boneless</td>
<td>Meats mixed with color fixatives</td>
</tr>
<tr>
<td><strong>Milk/ Milk product</strong></td>
<td></td>
</tr>
<tr>
<td>Freshly drawn raw milk</td>
<td>Adding water to increase volume, water of old ditches or ponds having high pH value and bacteriophages to prolong shelf life</td>
</tr>
<tr>
<td>Collected raw milk</td>
<td>Adding treacle to increase attractive color</td>
</tr>
<tr>
<td>Raw milk ready for distribution</td>
<td>Adding salt, starch and sugar etc to increase density</td>
</tr>
<tr>
<td>Raw milk before reaching consumer</td>
<td>Extraction or withdrawal of fat</td>
</tr>
<tr>
<td>Market raw milk</td>
<td>Adding heated milk to increase the keeping quality and shelf life</td>
</tr>
<tr>
<td>Butter/Cream</td>
<td>Adding starch, animal fat, Vanaspati, blended rotten banana, coloring matters flavoring agents to mask undesirable odor</td>
</tr>
<tr>
<td>Ghee</td>
<td>Vanaspati, animal fat, flavoring substance, coloring matters</td>
</tr>
<tr>
<td>Curd (Dahi)</td>
<td>Adding coloring and flavoring ingredients to mask poor quality and adding blended superfine tissue paper in place cream particles to mislead the consumers about enrichment of the product</td>
</tr>
<tr>
<td>Ice cream</td>
<td>Adding in the mix cellulose, starch, harmful coloring and flavoring agents</td>
</tr>
<tr>
<td>Sweetmeats</td>
<td>Adding Flour, suji, non-permitted coloring and flavoring agents</td>
</tr>
</tbody>
</table>
### 8. Zoonoses Information in Bangladesh

Zoonotic diseases represent not only one of the leading causes of illness and death from infectious disease. Worldwide but also that these diseases have a negative impact on commerce, travel and economies (19). The information available on the majority priority zoonotic diseases in Bangladesh is not only meager but also very inaccurate and not reliable. Few zoonotic diseases are reported by Directorate Livestock Services (DLS), National Institute of Preventive and Social medicine (NIPSOM), Rashid et al (20) and a number of research workers and reports (21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31). The major diseases recorded are Rabies, Brucellosis, Japanese B. encephalitis (JE), and Bovine tuberculosis, Anthrax, Psittacosis, Yellow fever.

**8.1 Emerging zoonoses:** (that is newly recognized or newly evolved or previously occurred diseases showing an increase in incidence have potentially serious human health and economic impacts). Examples are *Avian influenza, Bovine Spongiform Encephalitis (BSE)* and the *Nipah virus.*

**8.2 Bacterial zoonoses:** Anthrax, Bovine tuberculosis, *Campylobacteriosis, Brucellosis, E. coli infection, Salmonellosis, Shigellosis, Leptospirosis, Plague*

**8.3 Viral zoonoses:** *Rabies, Avian influenza, and the Nipah virus.*

**8.4 Parasitic Zoonoses:** *Cysticercosis /Taeniasis and Echinococcosis /Hydatidosis*

**8.5 Unconventional zoonoses:** *Bovine Spongiform Encephalopathy*

**8.6 Protozoan zoonoses:** *Toxoplasmosis*

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<table>
<thead>
<tr>
<th>Food items</th>
<th>Unscrupulous malpractice and adulteration with</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eggs</td>
<td></td>
</tr>
<tr>
<td>Fresh shell eggs</td>
<td>Rotten shell eggs</td>
</tr>
<tr>
<td>Fresh shell eggs</td>
<td>Color used in brown shelled eggs</td>
</tr>
<tr>
<td>Hen’s eggs, Duck’s eggs</td>
<td>Duck’s eggs</td>
</tr>
<tr>
<td>Fish</td>
<td></td>
</tr>
<tr>
<td>Raw native</td>
<td>Imported fish with preservatives sold as locally produced fish</td>
</tr>
<tr>
<td>Fresh fish</td>
<td>Mixing of rotten fish to deceive the customers</td>
</tr>
<tr>
<td>Fresh fish</td>
<td>Left over fish frozen, thawed and sold to cheat consumers</td>
</tr>
<tr>
<td>Raw fish</td>
<td>Use of coloring agent in the gill to show evidence of freshness</td>
</tr>
<tr>
<td>Dry fish</td>
<td>Adding fungicides, DDT, formalin etc to increase shelf life and check spoilage</td>
</tr>
<tr>
<td>Salted fish</td>
<td>Use of excessive amount of salt and mycostatic agents to prolong the shelf life and prevent spoilage</td>
</tr>
</tbody>
</table>
9. Impacts of Use of Antimicrobials in Food Animals in Bangladesh

9.1 Anti-microbial Usage

The use of veterinary antimicrobial substances has been consistently considered as a key issue in animal and human health (32, 33). Due to globalization and internationalization of trade the developing country like Bangladesh has experienced to realize that every time when a new antimicrobial is placed in the market by pharmaceuticals there is development of the occurrence that the bacteria quickly respond by becoming resistant. It has been found that the rate of resistance emergence is proportional to the indiscriminate use or overuse or misuse of drugs. Veterinarians in clinical practices are experiencing treatment failures and increased duration of illness and risk of death. The occurrence of this emerging problem is thought to be due to the presence of antimicrobial resistance bacteria that do not respond or show less response to the antimicrobial therapy (34). It is evidenced from the reports of clinicians of this country that the rate of resistance emergence is usually proportional to the extent of usage in man and animals. Recently the use of antimicrobials in food animals has attracted renewed attention, because it has been shown that pathogenic bacteria resistant to antimicrobials are critical for the treatment of infections in human can transmit from animals to humans, and furthermore, that resistances emerge because of indiscriminate antimicrobial use in food animals.

There are three modes of antimicrobial usage in veterinary practices animals:

1. therapeutic use
2. prophylactic use
3. growth promotion use – antibiotics as feed additives

In Bangladesh the antimicrobials are used mostly for the treatment of diseases. Prophylactic use of antibiotics is not practiced. However the use of antimicrobials as feed additives for growth promotions by some farms and feed suppliers has been reported. The use of antibiotics in feeds is thought to be common and a cause of public health concern. The intention is to make animals grow slightly faster and reduce the need of feed marginally. In Bangladesh no registration is required for feed additives such as toxins binder, antibiotics, and vitamin-mineral premixes, animal protein, many of which are potentially detrimental to human health (6).

9.2 Focus on risk

The chief aim of the use of antimicrobials is to protect both animal and human health and it is evidenced that the rational use of antimicrobials is very important as it optimizes its efficacy and safety in animals and therefore complies with ethical obligations and
economic need to keep animals in good health. The violation levels of drug residues can be made from two sources of available information:

1. The random sampling of tissue from apparently healthy food animals, which is called monitoring;
2. The analysis of food products with suspected illegal levels of residues, which is called surveillance.

These two sources of information are not available in Bangladesh, as there is no Regulatory Posture adopted to detect drug residues in foods before it enters consumers’ channels. In developed countries the National Residue Program helps prevent the marketing of foods and food products of animal origin containing illegal residue levels that might pose a health hazard to consumers. Residues can result from the improper use of pesticides, herbicides, animal drugs and medicated feeds as well as from industrial accidents which contaminate animal feeds of the environment where food animals feed or the environment where the food animals are raised. There exists a close and complex relationship between the volume of antimicrobials used in animals and in humans. The Bangladesh Government as well as Veterinary and human health department has no policy recommendation for animal and public health and information for prudent use of antimicrobials to protect human health ensuring the safety of foods of animal origin. Most of the drugs traders and shop keepers in Bangladesh have no formal training on drug handling, transportation, storing and dispensing, and they readily sell drugs such as antibiotics, hormones, and sedatives across the counter without prescription.

The guidelines of WHO and OIE and recommendation concerning antimicrobial resistances, has not yet been adopted in Bangladesh. One major way in which antimicrobial resistance occurs is through direct human medical use that is not well controlled. The Government, health professionals and public are ignorant, indifferent and unaware about the indiscriminate use of antimicrobials that may present important health consequences. In Bangladesh this mismanagement and misuse has led to the potential growing of threat arising from antimicrobial resistance in animals intended for food. The potential of antimicrobial chemotherapy in food animals increase the occurrence of resistant populations of bacteria, which may subsequently be transferred to humans through the food chain, or other means, has been recognized.

There exists no consideration for obligatory prescription for all antimicrobials used for treatment and disease control in Bangladesh. From available clinicians report it is evident that the high percentage of Salmonella, Enterococci, Staphylococci and E. coli organisms have become resistant and in many cases can no longer be used for empiric treatment, particularly for treatment of hospital-acquired infections. The consequences of antimicrobial resistance are severe, leading to an increased risk of therapeutic failure in future cases of infection, where the administration of a drug is indicated. Higher rates of morbidity and mortality associated with antimicrobial resistance are being reported, leading to increased health and economic impacts. In addition, transferable genetic
elements, capable of conferring resistance, may move between commensal bacteria and food-borne pathogens of animal origin, either at the preharvest phase or in human populations (35). Several countries have set up antimicrobial resistance monitoring systems. The European Union banned the use of growth promoters in animals which were related to antimicrobial agents used in human medicine. This ban was subsequently extended to all antimicrobial growth promoters. Ultimately, the ban on antimicrobial agents as growth promoters in these countries led to a reduction in the prevalence of antimicrobial-resistant bacteria in animals, food products and humans, thus justifying the strategy. Such ban is not practiced in Bangladesh. In this country the clinicians are experiencing delay in treatment with an effective antimicrobial agent, thereby increasing the risk of failure and /or leading to the need to prescribe more toxic or more expensive therapeutic agents. The need of strong and appropriate vigilance is therefore advocated to minimize this impact of antimicrobial resistance on animal and public health and food safety.

10. Situation of VPH Activities in Government Organization in Bangladesh

The baseline information and approaches for the efficient and cost-effective delivery of reliable and accurate guideline on the burden of VPH. Zoonoses and other animal-related hazards and Food safety are lacking in Bangladesh with the consequence that the assessment and monitoring of these impacts are poorly developed and handled. Sustainable surveillance and information exchange programs encompass coordination between veterinary and medical surveillance, appropriate information on animal and human populations at risk of disease (e.g. age, location, gender), on animal management (e.g. farm type, feedstuffs) and the environment, as well as the information needed to assess the impact of disease control programs. But these are not necessarily the priorities for Bangladesh because the programs are not technically embedded and economically feasible.

• In Bangladesh deficiency at all levels of infrastructures, general VPH services and surveillance systems and control programs are found. In addition there exists poorly defined epidemiological knowledge of VPH problems and lacking of laboratory-based organized surveillance program.

It is strongly felt that Zoonoses and food-borne diseases could not be efficiently combated or eliminated if prevention, surveillance and control strategies were carried out in isolation by individual country.

• Unfortunately Bangladesh Livestock Directorate is still lagging behind to develop, cultivate and access skills required for disease management, control of animal diseases based on national priorities and organization and management of VPH programs relating to zoonoses, food and water-borne infections and
other environmental problems. There is however poorly managed and implemented Quarantine Act and enacted Legislation on slaughtering of meat animals and some poorly developed VPH programs.

It is obvious that the maintenance of optimum health for optimum production of livestock and poultry at the most efficient level is the pre-condition for getting maximum economic returns to producers and this is absolutely essential for obtaining quality wholesome and safe foods of animal origin in a competitive low price in the current global trade. Management of List A (TADs) and list B diseases in population for quality assurance of animal products and risk analysis assessment and management are requirement of the current international trades (WHO, WTO, OIE and Bio-terrorism Act).

- In Bangladesh Veterinary health service as well as in VPH delivery the Planning and Development of Livestock and Poultry do not depend on appropriate holistic data as well as proactive and reactive population services (i.e., animal health and production service, official veterinary service, VPH service, $Q_A$ and $Q_C$ services (i.e., Quality Assurance and Quality Control Services).

Some of the comments of International and national Consultants on the constraints of Bangladesh Veterinary Services (36, 37, 38, 39, 40 & 41) are presented below:

- There is shortage of skilled manpower in all aspects of Bangladesh livestock sector responsible for quality service delivery, planning and implementation of development programs.
- Improper and inappropriate technical knowledge reflects the inability to technology transfer in a comprehensive and integrated manner.
- The Veterinary Services in Bangladesh are rudimentary and unable on a sustainable basis to supply more than a very ‘basic clinical service’.
- The technical qualifications of personnel are not always matched with the required skills for the right positions. DLS personnel are designated as jack of all trades and master of none
- Very few / none of the DLS senior staff has skills in strategic planning and management, HRD (Human resource development) and preparation of programs and projects
- The employing of veterinarians is oriented almost totally towards clinical services to the animal owners
- There seems to be little appreciation of the requirement of capable of meeting WTO standards
- Livestock service is not well documented and there is no livestock database
- There is lack of comprehensive, integrated approach in extension services
- There is poor health protection and management services
- There is lack of quality assurance and quality control services
- The weak planning process acts as a constraint for VPH development strategy and the associate plan off action.

In fine it can be concluded that International organizations such as FAO, OIE and WHO assistance in harmonizing surveillance systems is least or not shared by this country internationally. Effective VPH and zoonoses surveillance, prevention and control activities and food safety are dependent on various factors, such as exchange of reliable information on disease occurrence, sustained inter-country technical cooperation, harmonization of surveillance and control strategies and legislation, together with SAARC countries intersectoral collaboration and coordination are essential for the success of national programs. In Bangladesh, however these essential features of activities are consistently poor and there is a lack of, or insufficient, inter-country and inter-sectoral collaboration and cooperation among national authorities responsible for VPH programs and activities at all levels. Moreover there is usually lack of public health awareness and education, as well as community involvement in the prevention and control zoonotic and food-borne diseases and pre-harvest and post-harvest food safety. The Director of Livestock Services has not been able to frame any Inspection Program or Service for foods of animal origin like ‘Food safety and Quality’ service that assures consumers that food products sold in Bangladesh markets or intend to ship abroad are safe to eat and truthfully labeled.

11. Scenario of VPH Education in Veterinary Schools of Bangladesh

In Bangladesh just after obtaining DVM degree when a young veterinarian is posted at grassroots level, he shoulders the responsibility of giving treatment against the livestock diseases and look after morbidity and mortality of animal resources of the area under his jurisdiction. Thus his activities are precise to keep vigilance on economics that threaten animal health and animal resources. His pivotal duties are devoted to extension work to create public awareness about measures of prevention and control of diseases of animals and their relation to human health. The knowledge he acquired in Microbiology, Pathology and Parasitology, Population medicine including Epidemiology, and Veterinary public health including Food hygiene are one and almost the same with that of medical profession. His training and academic fitness in Medicine, Surgery and Gynecology will not only give relief to his patient but also give relief to his client from anxiety and economic loss. This veterinarian remains responsible for preventing and controlling of zoonotic diseases by his study of Veterinary Public Health like that of medical profession.

In Bangladesh Veterinary Public Health courses are integrated in veterinary curriculum. Universities and Veterinary Colleges of this country are producing qualified
Veterinary Food Hygienists to deal with matters of health and demands consumers’ food protection. It is therefore the veterinarians to realize that their responsibility for the well being of man and to form an overall view of their profession. It is unfortunate that Bangladesh is still in infancy in this area. The Veterinary Faculty of Bangladesh Agricultural University is although offering advanced courses in Veterinary Public Health and Food Hygiene to obtain MS degree and thus producing experts, but it is sad to say that the recognition of these experts in this field is very limited. Our experience advocates that zoonotic and food-borne diseases can be prevented through changes in behavior and practices in communities. The knowledge acquired by veterinarians from attitudes existing in the community towards these diseases could be the basis for designing and implementing adequate prevention and control strategies.

11.1 Syllabus Theme of Education of Veterinary Public Health Course

Veterinary students should understand the importance of their role in preventing and controlling zoonotic diseases. Traditionally about 25 years ago the VPH course was primarily focused on meat and milk inspection, but now it has been expanded to include:

- Quality assurance of animal-based products to meet consumer expectations,
- Knowledge of the causes, epidemiology and control of food-borne diseases, zoonotic and emerging and reemerging diseases
- Adverse effects of hormone, antibacterial, agricultural and other human activities on health and food quality
- Animal welfare, human health and the environment pollution.

The mode of delivery has shifted to a small number of formal lectures, tutorials, assignments and field visits, which are used to guide the students rather than limitation to instruct them. Moreover specific learning objectives are set for Post-graduate MS students each year and links into other courses that are already providing core material. The portfolios developed and enlarged over the four years during undergraduate study and on graduation over two years provide a dynamic document that can continue to be updated and expanded according to the student’s/ veterinarian’s interests and professional needs at the time.

11.2 Aims of the syllabus theme

1. To show students how veterinary public health generally impacts human health and welfare at local, national and global levels.
2. To recognize the role of the veterinarian in public health and food hygiene.
3. To identify zoonotic diseases (parasitic, viral and bacterial) in animals, especially companion animals and pets, and organize measures to ensure public health safety.
4. To define and identify chemical and antimicrobial residues (existing or potential) in animal products and develop programs to eliminate or avoid them.
5. To create public awareness of the occupational risks and hazards such as radiation or chemical or biological hazards which are associated with animal health care.
6. To confer on students the ability to evaluate the economic value of preventative health programs with regards to cost effectiveness.
7. To create public awareness of the various health hazards in foods of animal origin.
8. To Monitor hygienic handling of food and processing of food products.
9. To make ‘Spearhead investigations’ into outbreaks of food-borne diseases together with foods and agents associated with such outbreaks.
10. To understand about environmental hygiene and waste disposal
11. To know the mechanisms of water purification, storage and water distribution system in a community.

**11.3 Syllabus units for obtaining Academic Degrees**

- Graduate / DVM degree
- Postgraduate / MS degree

**11.4 Number of Veterinarians so far obtained M.S. in VPH**

More than 60

**11.5 University, Colleges and faculty of veterinary medicine in Bangladesh that include a public health or related course as part of the required curriculum**

<table>
<thead>
<tr>
<th>University / College / Faculty</th>
<th>Required course in public health (PH) or related topic (RT)</th>
<th>Source of information</th>
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<tbody>
<tr>
<td>Bangladesh Agricultural University</td>
<td>Offering in DVM and MS degree</td>
<td>website/Registrar/ Dean</td>
</tr>
<tr>
<td>Chittagong Veterinary and Animal Sciences University</td>
<td>Offering in DVM degree</td>
<td>website/Registrar/ Dean</td>
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<tr>
<td>Sylhet Agricultural University</td>
<td>Offering in DVM degree</td>
<td>website/Registrar/ Dean</td>
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<tr>
<td>Haji Danish Science and Technology University</td>
<td>Offering in DVM degree</td>
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<td>Patuakhali Science and Technology University</td>
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<td>Rajshahi University</td>
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<tr>
<td>Bangabandhu Sheikh Mujibar Rahman Agricultural University</td>
<td>Offering in DVM degree</td>
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</table>
12. VPH Activities in Bangladesh Are Rudimentary: Wanting In Strengthening

12.1 The Need for Professional Development in VPH

The need for professional development in VPH cannot be ignored. Time has come for Bangladesh for taking immediate updated structural rationalization and promotion of VPH activities and participation in various strategies. Otherwise the country will suffer a lot and lose prospect of allocation to gain access to global community.

- In our present VPH program we need to pay particular attention to animal-health related problems and issues as they impact the human population. This involves focusing attention to the risks at the level of both production and consumption of foods of animal origin, encompassing the risks stemming from zoonoses and related occupational disease and minimizing environmental population affecting health condition of farm animals.

- The scope of VPH is clearly multidisciplinary, involving not only veterinarians in both governmental and non-governmental sectors, but also other health professionals and scientists as well as paraprofessionals who treat, control or prevent diseases of animal origin. In this context to achieve the maximum benefit from VPH in Bangladesh a team approach to problem solving, research, control programs and communication is very much essential to ensure that veterinary contributions to the improvement of human health would be both significant and sustainable.

- In the Report of the OIE / FAO-APHCA workshop on WTO sanitary and phytosanitary (SPS) agreement of 2000 it was hoped that the VPH section of Directorate of Livestock Services established in 1984 would evolve a guideline so that Bangladesh could combat the maladies of animal origin inflicting public health and draw concrete proposals for action towards a more sustainable veterinary public health and livestock development policy which could meet the needs of consumers as well as of the producers and the farmers. It was emphasized in the workshop that as the process of globalization is continuing with great speed we are therefore committed to derive optimum benefit from our producers through entering into international market. In order to get full benefit we must be abided by the international rules and regulations. At the same time we have to be careful in formulating these rules whether or not these rules are protecting our producers-farmers.

- Since Bangladesh is deficient in VPH infrastructures, lacking in organized surveillance systems and control program, poor in epidemiological knowledge of VPH problems etc we need the help, cooperation, collaboration for the development of VPH issues. To meet the challenges and
get benefit we must build collaborative effort between Bangladesh and International Organizations and regional cooperation with SAARC countries contributing to technical cooperation VPH programs and joint venture activities so that the effective delivery of VPH programs are framed to reach the levels of standards prescribed by FAO, WHO, OIE, CODEX, SPS etc.

- The following recommendations could provide valuable direction to the future VPH program and activities which may be of value for VPH issues, zoonoses and food-borne disease control and food safety thus fostering better health and living conditions.

1) Establishment of Veterinary Public Health Forum

For the VPH professional development it is urgently needed to form and found a ‘Forum’ immediately. This should be a non-political professional society consisting of members who are public health veterinarians having post-graduate degrees and graduate veterinarians of Bangladesh and any other countries of the world, particularly SAARC countries, ASEAN countries, Commonwealth countries, EU countries etc. The important function of the forum would be:

(i) to suggest development of ways and means of public health veterinarians and community participation in VPH activities relating to the prevention of and control of zoonoses, consumers protection,

(ii) to give suggestions for upgrading the capabilities of Public Health veterinarians in surveillance and information systems of emerging and reemerging of diseases of public health importance and

(iii) To instruct development of national strategies in preparing and adapting legislation framework concerning VPH, Zoonoses and Food Safety.

2) Development and Strengthening of VPH for Assisting Inter-country and Region Members of TADs Countries such as SAARC Countries to Organize and Develop their Animal Health and VPH programs, Activities and Services

The main objectives are

- To foster national and interregional programs for the prevention, surveillance and control of zoonoses and food-borne diseases as an integral part of national health programs,
- To strengthen cooperation between national animal health and public health services,
- To improve prevention, surveillance and control of these diseases, and
To strengthen and execution of joint venture targeted plans and collaboration between SAARC Country members, collaborating partners and national participating institutions.

12.2 The major VPH activities need to be implemented or planned should be as follows:

- **Firstly:** the VPH plan should be well targeted and standardized by the member countries and should include contacts with the concerned Ministry of health officials and Ministry of livestock having responsibility in respect of political, legislative and administrative action for the prevention, control and monitoring of animal diseases and zoonoses, and Food safety Inspection Service with national / regional representatives.

- **Secondly:** with respect to Surveillance, information, prevention and control of animal disease, zoonoses and food-borne pathogens VPH priorities should be defined and the recommendations regarding the implementation of methodologies for effective harmonization of VPH activities should be shared with collaborative partners and collaborating centers to make their potential ability to implement thus fostering better health and living conditions of the people of member countries.

- **Thirdly:** to ensure community participation for the involvement of all stakeholders and the coordination of VPH activities. The identification of problems and initial planning activities should include creating awareness of VPH issues within different sectors of society ranging from professionals and policy makers to consumers and producers.

- **Fourthly:** for the success of VPH programs continuous professional development and extension works to control or elimination of zoonoses cannot be overemphasized and as such academic programs and in-service training to deal with the up-and-coming issues, emerging and remerging of zoonotic diseases, food safety, access to regional and global markets for animal and animal products should be developed and promoted.

- **Finally:** establishment and maintenance of a database bank on all activities related to disease occurrence and study of epidemiological surveillance, prevention and control of diseases should be established and maintained. These programs should be coordinated to avoid duplication and effort made cost effective programs and for developing comprehensive pilot programs for smaller geographical areas with subsequent expansion. The database report would encourage livestock producers on the one hand to make them clear that controlling zoonoses and other diseases will lead to lower animal production losses and on the other hand the private industry
who could mobilize resources for the implementation of the mutually beneficial activities.

12.3 Need to Develop Veterinary Professional Skill in Bangladesh in Relation to VPH, Zoonoses and Safety of Foods of Animal Origin

Food safety is a major public health issue in many countries and has been a concern for all government and public health authorities. As foods are obtained from diverse sources all over the world, the present global rules under the World Trade Organization (WTO) has made provisions related to sanitary and phyto-sanitary (SPS) measures and to compliance with food standard and regulation issues. The world is approaching a liberalization of trade involving minimization of trade barriers, so that import control will no longer be present and all partners would agree with a uniform hygienic level in pre-harvest and post-harvest food safety. To ensure implementation of this objective everywhere worldwide this has become the priority task of the food protection authority. World Association of Food Hygienists (WAVHs) is playing the key role in this process and the veterinary public authorities advocate for QSA (Quality, Safety, and Acceptability) concept. It is the conviction of WAVFHs that the veterinarians are well prepared with various duties and tasks destined for food protection programs and there is no doubt that well organized food section of State Veterinary Administration would prove to be very successful in coping with various food hygiene and veterinary public health problems. Universities and veterinary schools of developed countries are producing qualified veterinary food hygienists to deal with matters of health and demands consumers’ food protection. It is therefore the public health veterinarians of Bangladesh to realize that their responsibility for the well being of man and to form an overall view of their profession. It is unfortunate that Bangladesh is still in infancy in this area. The veterinary faculty of Bangladesh Agricultural University is although offering advanced courses in veterinary public health and food hygiene to obtain post-graduation MS degree and thus producing experts, but it is unfortunate and sad to say that the recognition of these experts in this field is very limited.

12.4 National and International Images of VPH and Zoonoses in Bangladesh Context

- The Bangladesh Veterinary Association (BVA), Bangladesh Veterinary Council (BVC), Director General of Livestock Services and other related bodies should develop strategies so that the professional role of public health veterinarians could be clearly defined.
- Veterinary education program must be adapted to new demands of multi-disciplinary approach. Bangladesh Government with rudimentary food hygiene program should take primary initiative in utilizing veterinary food hygienists and public health veterinarians to components of national and international health and food policy programs.
- To keep pace with the complex changes in food trade and commerce, novel
• Standards for ensuring food safety, wholesomeness of foods, and other health risk factors need to be realized. Otherwise our country may lose prospect for food trade in food and agricultural commodities. The hygienic codes of practice of HACCP, GMP (Good Manufacturing Practice), ISO (International Standardization Organization), CAC Codex Alimentarius Commission) should be made mandatory for meat, poultry, egg and fish and their products. Progress in these areas depends on the integration and coordination of concerned authorities of the government and veterinary public health involvement for requisite investment in infrastructure of food protection harmonizing international food trade and directly intervening in the national food safety and surveillance system.

• In most of the developed countries, particularly in Australia public health veterinarians are given opportunity to face the situation of food safety as auditor. We now find a division of veterinary public health under WHO working in various aspects of health and hygiene. FAO/WHO collaborating centers are established in Germany and elsewhere to deal with matters related to food hygiene and zoonoses. Many Asian academic institutions, Chiangmai University in Thailand, few Universities of Malaysia and India have made liaison activities with institutions of developed countries for the mutual benefit in the delivery of veterinary public health education and continuing professional development. In European countries veterinarians act as third party auditor in food safety and HACCP analysis. It is sincerely hoped that in the near future Bangladesh will come forward with veterinary public health responsibilities. The concerned authorities in collaboration with international public health authorities like FAO/WHO/OIE should establish a National or Regional Center for VPH, Food safety, Food quality control and Zoonoses.

13. Conclusion and Recommendations

It is obviously recognized that human health is inextricably linked to animal health and production. This link in both developing and industrialized countries, however can lead to a serious risk to public health with severe economic consequences. A number of communicable diseases (known as zoonoses) are transmitted from animals to humans. About 75% of the new diseases that have affected humans over the past 15 to 20 years have been caused by pathogens originating from an animal or from products of animal origin. Many of these diseases have the potential to spread through various means over long distances and to become global problems.
A number of well known and preventable animal diseases that can be transmitted to humans (i.e. zoonoses) such as rabies, brucellosis, leishmaniasis and echinococcosis continue to occur in many countries especially in the developing world including Bangladesh where they mostly affect the low income poorest segment of the human population. The available reports made us aware that the diseases led to cause a serious amount of deaths and millions of affected people every year. It has been clearly evidenced that all major zoonotic diseases prevent the efficient production of food of animal origin, particularly of much-needed proteins, and create obstacles to international trade in animals and animal products. They are thus an impediment to overall socioeconomic development. In developed countries Veterinary medicine in close collaboration with VPH activities play a major role in the preventing of and interventions against animal diseases including zoonoses.

The following guideline proposal and recommendations would assist in developing participatory approaches and needs of Bangladesh to strengthen VPH issues and key activities of VPH concerns.

1. “VPH Forum” should be formed by the public health veterinarians to deal with the progress of VPH activities

2. In Bangladesh we need to introduce improved method of food handling and processing practices so that our meals could be more wholesome, varied, well balanced and made available all the year round, instead of only seasonally.

3. Since public health problems may arise from pathogens originating from an animal or from products of animal origin and from the production of domestic and commercially processed food products (e.g., fast foods and other varieties of food items, varieties of packaging, wrappers and containers), it will therefore be essential to improve technical intelligence and develop laboratory methods, criteria and operational procedures for the protection of public health. Progress in these areas depends on the integration of microbiological and pathological study and research with investigation and epidemiological surveillance and monitoring that contribute to hazard analysis critical control point.

4. Health authorities alone cannot solve the problems of consumers’ protection and food safety. They will need a national commitment and collaboration of different ministries, organizations, institutions, and agencies concerned with livestock, agriculture, fisheries, finance, planning, commerce, and industry. It is therefore imperative that a national food policy should be adopted as the bases for short and long term planning and continuous support for pre-harvest and post-harvest food safety.

To reach this objective the following points must be kept in view:

- Promotion of increased production and adequate use of raw food materials, products and by products - all having their economic values
• Building up community participation and consumer education in which consumers should be made known of their rights, privileges, and responsibilities under the food law. They should participate in different program organizations and applications relating to food hygiene practices. The consumers can help the inspectors and government officers seeking food safety system. The veterinary food inspectors should not be viewed as policeman, but rather as an adviser. They should be able to give instruction to food producers and handlers in good manufacturing practices.

• Processed quality foods should be made available to the public and as such people need to change their food habits. A food processor must therefore think of utility and likewise of potential hazards.

• Minimization of food losses during production, processing, storage, transportation and marketing stages

• Ensuring satisfactory quality of foods by preventing distribution of unhygienic, contaminated, spoiled and adulterated foods, which are harmful to health or packaged or labeled in such a way as to mislead the consumer.

• Improving and expanding food inspection and compliance program as well as analytical control service in order to ensure that foods sold to the public is free of adulterants, chemical and biological contaminants, that it complies with existing compulsory quality standard, that its composition reflects the statements on the label.

• Fostering adequate development of food industries and thereby protecting the existing local industry as a means of generating significant amounts of foreign exchange from export of foods.

• Strengthening sanitary control of foods through the systematic coordination of all governmental services active in the sector at national, regional and municipal levels. To do so uniform standards should be encouraged for the orderly marketing of food and food products and for the effective application of food laws. Inspectors occupy a key position in the food control service and should therefore be well trained, impartial, and immune to corruption.

• Providing training to professionals (veterinarians, microbiologists, epidemiologists, food technologists, sanitary engineers, food chemists, legal experts and bio-statisticians) and non-professionals (food inspectors, laboratory technicians, administrative staffs) for the governmental and private sectors who are associated with production, marketing and quality control of foods and simultaneously are involved in the dissemination of information useful to the development of these activities.

5. Since the communicable disease outbreak anywhere in developed or developing countries could potentially call for an emergency of national, inter-country
regional and international public health concern, the International organizations FAO/WHO/OIE recognize this phenomenon that threaten the world’s population. As such they developed a common platform named GLEWS (Global early warning system) for the international community and stakeholders to assist in prediction prevention and control of animal diseases including zoonoses. Recently in addition to Zoonoses and food-borne diseases the WHO for animal health (OIE) missions related to the prevention and control of infectious animal diseases have focused on the human and animal health risks related antimicrobial resistance. The concept of the focus is to undertake surveillance study of bacterial resistance, monitor the antimicrobial usage, suggest for prudent use of antimicrobial agents and employ laboratory methodologies for antimicrobial testing.

In context of identified lacking, the VPH activities in Bangladesh should adopt the following measures

(i) A national surveillance system and monitoring program for safety of foods of animal origin (meat, milk, egg and fish etc) and promotion of animal welfare;

(ii) Development of an appropriate risk assessment methodology, for the potential impact on public health and antimicrobial resistance bacteria of animal origin threatening health and hygiene;

(iii) The harmonization of technical guidelines provided by International Organizations would of value for the improvement of the legal framework and development of required resources of Veterinary services

(iv) Technical assistances from international agencies may be sought in the establishment of laboratories to achieve the highest quality isolation, identification, sero-typing of etiological agents and antibacterial susceptibility testing results

(v) Training courses on surveillance, outbreak detection and epidemiological study and response are essential for the success of national VPH programs for the prevention, surveillance and control of zoonoses and food-borne diseases and food safety.

6. Regarding TAD, the SAARC member countries should build coordinated effort and meet the challenges and share each other their existing and future national responsibilities for reporting diseases, and introduce mechanisms to increase the transparency, accuracy and completeness of the data.

In-country and inter-country national organizations should be encouraged to exchange data and develop policies for the SAARC Trans-boundary Surveillance of Zoonotic Diseases. Generally, medical and veterinary surveillance programs should be coordinated at all levels.
7. The following **Theme development for the National Strategic Plan/Approaches of Infrastructure and VPH Program Implementation** would be of value.

**Theme 1: Formation of Veterinary Public Health Forum**

**Theme 2: Establishment of National Communicable Disease Center**

**Theme 3: Foundation of National Institute of VPH Studies**

**Theme 1: Veterinary Public Health Forum**

This is to be created as a nonpolitical society run by the public health veterinarians which would devote activities relating to veterinary public health, contribute to the human and animal welfares, give suggestion to develop policies, guidelines, operational research and strategies for the control of zoonotic and food-borne diseases and disseminating relevant information obtained from experts in public health, veterinary science and other scientific disciplines, to food industrialists, consumer groups and the public.

**Theme 2: National Communicable Disease Center**

This is to be developed constituting four different cells. These cells would be able to address the needed sustainable surveillance system, monitoring VPH issues, prevention, control and eradication of animal and zoonotic diseases, as well as food-borne diseases, assessment of risks and socio-economic impacts of communicable diseases, food safety and food security.

Other functions of the cell would be database risk assessment, disease awareness, cost-benefit analysis of control strategies and improving to build technical capacity, development of standards, policies and plans and management of inter-country VPH programs in close collaboration with **SAARC partner countries**. The four cells to be built up may comprise:

1. **Surveillance and information system cell**
2. **Monitoring cell**
3. **Database cell**
4. **Inter-country coordination and collaboration cell**

**Theme 3: National Institute of VPH Studies**

This is to be founded where promotion of basic and applied research will be undertaken to meet the challenges of VPH. This unit would be designed to have section of information technology and academic and technological facilities for VPH professional development.
Theme development for the National Strategic Plan / Approaches of Infrastructure and VPH Program Implementation

**Theme 1**
Formation of VPH Forum

**Function:**
Devote activities relating to VPH, contribute to the human and animal welfares, give suggestion to develop policies, guidelines, operational research and strategies for the control of zoonotic and food-borne diseases and obtaining relevant informations from experts in public health, veterinary science and other scientific disciplines and disseminating these to food industrialists, consumer groups and the public.

**Theme 2**
Establishment of National Communicable Disease Center

**Function:**
Four cells to be built up:
1. *Surveillance and information system cell*
2. *Monitoring cell*
3. *Database recording cell*
4. *Inter-country coordination and collaboration cell*

To address the needed sustainable surveillance system, monitoring VPH issues, prevention, control and eradication of animal and zoonotic diseases, as well as food-borne diseases, assessment of risks and socio-economic impacts of communicable diseases, food safety and food security.

**Theme 3**
Foundation of National Institute of VPH Studies

**Function:**
Promotion of basic and applied research will be undertaken to meet the challenges of VPH. This unit would be designed to have section of information technology and academic and technological facilities for VPH professional development.
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Veterinary Public Health and Zoonotic Disease Control in INDIA

Dr. Lal Krishna
Assistant Director General (AH)
ICAR, Krishi Bhavan
New Delhi- 110 114
India
Email: lalkrishna1948@hotmail.com
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1. Introduction

1.1 Background

Livestock sector plays an important role in national economy and in the socio-economic development of the country and contributing about 25% of total agricultural sector. This sector also plays a significant role in supplementing family incomes and generating gainful employment in the rural sectors, particularly among the landless labourers, small and marginal farmers and women, besides providing cheap nutritional food to millions of people. India has vast resource of livestock and poultry which play a vital role in improving the socio-economic conditions of rural masses. The Country has 485 million livestock and 489 million poultry population, having the second highest number of cattle (185 million), the highest number of buffaloes (97 million), the third highest number of sheep (61 million), the second highest number of goats (124 million), the sixth highest numbers of camels (6.32 million), the fifth highest numbers of chickens (457 million) and the forth highest number of ducks (33 million) in the world. Animal Husbandry sector provides large self employment opportunities estimated as 11.44 million in principal status and 11.01 million in subsidiary status.

Livestock Sector not only provides essential proteins and nutritious human diet through milk, eggs, meat etc. but also plays an important role in utilization of non-edible agricultural by-products and also provides raw material/by-products such as hides and skins, blood, bone, fat etc. India continues to be the largest producers of milk in the world and the milk production has increased from 53.9 million tones in 1990-91 to 104.8 million tones in 2007-08. Poultry development in the country has shown a steady progress over the years and ranks third in egg production in the World. Egg production has increased from 21 billion in 1990-91 to 53.5 billion numbers in 2007-08 whereas wool production at the end of 2006-07 was 45.1 million kg As compared to 41.2 million kg during 1990-91. According to CSO estimates, gross domestic product from livestock sector at current prices was about Rs. 935 billion during 1999-2000, (about 22.51% of agriculture and allied GDP) which rose to Rs. 1239 billion during 2004-05 with 24.72% share in agriculture and allied GDP. In most cases, animals play an essential role in maintaining the infection in nature and contribute in varying degrees to the distribution and actual transmission of infection in human and animal populations. These diseases have a variety of transmission mechanisms that may be direct such as in rabies and anthrax, or indirect, via vectors, food, water and the environment, as in the case of bovine tuberculosis and cysticercosis while some of the diseases like brucellosis have multiple routes of infection. With the constant and inevitable interaction of man and animals, zoonotic diseases remain a genuine threat to health and survival for people, their livestock, companion animals and wildlife. However, the extent to which the endemic zoonoses on which focus are neglected is evidenced by the fact that global estimates exist for only three of them, i.e. echinococcosis, trypanosomiasis and rabies. Food- borne
diseases mildly or severely affect almost half of the world’s population at any given time. Their public health importance is often ignored because of their true incidence is difficult to be evaluated and the severity of their health and socio-economic impacts is often unclear. Moreover, there is very limited information in most countries on the spread of food borne zoonotic infections among the human population. Brucellosis, bovine tuberculosis, some parasitic diseases and Salmonellosis are among the food borne diseases of greatest importance. The health and socio-economic impacts are increasingly being experienced by many countries, particularly the developing ones. In these countries, the establishment and implementation of adequate measures for livestock and consumer health protection against zoonoses, especially those that are new and emerging, has proven to be very difficult. Thus zoonotic diseases continue to further burden public health systems as well as to undermine efforts to boost livestock production and exports.

Over 30 new pathogens of man have been discovered in the last three decades, 75% of these are shared with lower animals and a number of other diseases previously thought to be limited to man have now been found to be zoonotic. A large proportion of human pathogens – about 60% - are zoonotic and over 800 pathogens have been defined as zoonoses. Recent outbreaks of Swine influenza and avian Influenza have shown once again the potential of microorganism from animal reservoirs to adapt to human hosts. It has been suggested that 75% of emerging pathogens fall within the category of zoonotic diseases. These include SARS, avian influenza, HIV, Ebola, West Nile virus and Nipah virus. More than 300 zoonoses of diverse etiology are now recognized. During the past decade, many previously unknown human diseases have emerged from animal reservoirs. Among these, particularly important ones are anthrax, plague, brucellosis, bovine tuberculosis, leptospirosis, salmonellosis, spotted fever caused by rickettsiae, rabies, several common arthropod borne viral infections (arboviral infection like Japanese encephalitis), certain parasitic diseases, especially cysticercosis, sarcocystosis, hydatid disease, trypanosomiasis, leishmaniasis and toxoplasmosis. Several factors are known to favour emergence and spread of zoonotic diseases which include microbiological adaption, ecological changes environment, and globalization of agriculture, food production, trade and human behavior factors.

The most recent outbreaks especially SARS, WNV, HPAI (H5N1) and Swine Flu (H1N1) have established a strong association and relationship of human and livestock including wild life. This increased human-animals interface has put livestock producers, consumers of livestock products, and traders and processors of livestock products at higher risk of contracting zoonotic diseases while contributing significantly to the total disease burden. Therefore, the importance of collaborative research with effective veterinary and health services has increased for the prevention and control of zoonoses and necessitates an establishment of effective partnerships between human public health and veterinary administration with aim to improve health and well being of the public. This evolving scenario of convergence of human and animal health under “One World-
One health” concept has created new opportunities and challenges for veterinarians whose role is envisioned not only to safeguard the health of animals but also to contribute to the human health. This multidisciplinary approach to combat the threats to human health has thus introduced a relatively new term called “veterinary public health”.

The word ‘zoonoses’ was introduced by Rudolph Virchow in 1880 to collectively include the diseases shared in nature by man and animals. WHO has defined Zoonoses as ‘those diseases and infections which are naturally transmitted between vertebrate animals and man thus it include those diseases where there is proof or a strong circumstantial evidence for transmission between animals and man. Zoonoses occur throughout the world transcending natural boundaries and hence have a serious effect on global economy and also on health.

A compartment of public health activities devoted to the application of professional skills, knowledge and resources to the protection and improvement of human health defined in 1975 has now been re-defined by FAO, WHO, OIE and world experts in 1999 as “the contribution to the complete physical, mental and social well being of human through an understanding and application of veterinary medical science”. In view of the significant role played by the veterinarian in safeguarding the human health and well being, the necessity for the establishment of an independent veterinary public health organization in each member countries to face the challenges of zoonotic disease has been felt by WHO. A global collaborative agenda for prevention and control of emerging and re-emerging diseases of animal origin has also been identified with integrated research with interdisciplinary zoonotic disease research centers; surveillance; animal and human response teams; infrastructure & workforce development and improved coordination.

The core domains of veterinary public health (VPH) include diagnosis, Surveillance, epidemiology, control, prevention and elimination of zoonoses; food safety; management of health aspects of laboratory animal facilities and diagnostic laboratories; biomedical research; health education and extension; production and control of biological products and medical devices; management of domestic and wild animal populations; protection of drinking-water and the environment and management of public health emergencies.

1.2 Justification

The gaps and deficiencies in planning and responding to health emergencies have pointed out in the world during the emergence of epidemic of SARS in 2002, HPAI (H5N1) in 2003 and swine flu in 2008. This has created the need for a prompt and open reporting of infectious events having potential for world wide spread due to globalization and fast traveling means; risk communication; effective multi-sectoral collaboration and to ascertain about the emergence or reemergence of zoonoses and also inter-species transmission animal to human.
It was felt that the current era has some critical and essential factors that are enabling for the emergence, re-emergence and acceleration of zoonoses which in turn, may result in drastic consequences in a very limited time frame across the globe. A wide variety of foods of animal origin like meat, milk, eggs, milk products and fish etc are the good sources of optimal protein, energy and micronutrient but human for various zoonoses are at risk by their consumption. Increasing international trade in livestock and livestock products with enhanced traveling has further increased the risk of spread of such infection globally. Sanitary and Phyto-sanitary (SPS) standards developed by World Trade Organization (WTO) have been undertaken to reduce such risks for implementation which ensures that the foods of animal origin are safe from all pathogens and also are free or within the acceptable limits of antibiotics, hormones and other environmental contaminants.

Since India is maintaining a large animal resource and about 24.3 million personnel both in rural & urban along with about 18.3 million women, 70 million dairy farmers are engaged in the livestock activities and billion of dollars are being earned through export of live animals and their products to various member countries including SAARC members. Therefore, SPS standards are imperative for the producers, consumers, traders and processors to protect them from zoonotic infections but their implementation is mainly depend upon good infrastructure and capacity available with the country to undertake the functions for early detection and their epidemiology.

This report on veterinary public health and zoonoses control in India is attempted for SAARC Member countries with the objectives:

- To share knowledge about safe food of animal origin including fish;
- To share knowledge about zoonotic disease reporting system-linking abattoirs with national and regional coverage;
- To share knowledge about sanitation and meat hygiene (beef, mutton, pork, chicken, ducks etc.) for market access;
- To share knowledge about preventing environmental pollution in SAARC countries.

1.3 Scope of Veterinary Public Health

A novel concept of “One World, One Health” has been coined in view of the rapid emergence/ re-emergence of zoonotic pathogens and their rapid spread by means of foods, trade and international traveling which has created new opportunities and challenges for veterinary services. Thus, the role of veterinarians have been realized in safeguarding the human and animal health and the veterinary public health has therefore re-defined as” the contribution to the complete physical, mental and social well being of human through an understanding and application of veterinary medical science”.

Robert Virchow (A German Physician) in nineteenth century stated that there is no dividing line between animal and human medicine, nor should there be. Thus floated an
idea of one medicine however William Osler (A Canadian Physician) was the first man who used the term “One medicine” and Calvin Schwabe (An Epidemiologist) in 1984 supported the integration of human and veterinary medicine because of increasing interdependence of animals and animal products with human infections. He therefore encouraged both veterinary and medical professions to coordinate each other to prevent such diseases.

The human and animal health problems are closely linked and are not limited to a country or region, as the infectious pathogens are not restricted to the international borders, geographical areas or to a particular ethnic group. The basic issues concerning to the prevention and control are hygiene, quarantine & isolation, bio-security, inexpensive vaccine, surveillance systems, diagnostic capability, treatment options and depopulation capability. These are being undertaken by government & non-governmental sectors, public/private veterinarian, health professionals, policy makers, other health professionals, scientists and para-professionals that treat, control, and prevent diseases of animal origin.

The role of veterinary sciences has been acknowledged due to emergence/ re-emergence of the zoonotic diseases having their impacts on human health and food security. The veterinarians, public health practitioners and medical professionals are required to be involved in the trace back and control & prevention of food borne zoonoses. The role of veterinarians was first acknowledged during 19th and 20th centuries in the area of food hygiene to control the outbreaks of Trichinosis in Germany being the integral part for the development of food hygiene laws & meat inspection system. In USA, the vaccine & disease prevention programs, disease response / assessment, chronic diseases and nutrition aspects, occupational health etc. have been entrusted to the veterinarians. In addition, they are also involved in the disease control, food drugs, water and waste issue; pet facilitated therapy, HIV/AIDS awareness, teaching and management of public health programs and organizations.

2. Endemic Zoonotic Issues and Approach

2.1 Poverty

Zoonoses typically affect isolated rural livestock keeping communities and those living in urban slums. Thus, like other neglected diseases, neglected zoonoses can be characterized as diseases of ‘neglected populations’. The poor in every society, and particularly in developing countries, bear a disproportionately high share of the burden of disease. However, in the case of zoonoses, there are a number of reasons why their burden falls especially heavily on poor people which go beyond the usual reasons of access, affordability and vulnerability. These segments of the population are at higher risk of contracting the infections because some of endemic zoonoses are occupational zoonoses where people live in contact with the animals closely as part of their lively hood (farmers or livestock keepers). They are always at the risk of contracting infections like
brucellosis, tuberculosis, anthrax, leptospirosis; rabies etc. The next important risk factor is through consumption of inferior quality animal food products like meat infected with cystic echinococcosis, pork infected with cysticercus cellulose, eating meat from fallen animals, drinking of unpasteurized raw milk etc. The dogs which are not or never vaccinated or dewormed for any of the parasitic infections are reared by them and act as their best companion animals thereby increasing their risk to rabies and several pet related zoonoses. Livestock contribute to the livelihoods of at least 70% of the world’s rural poor and as zoonoses affect their livestock, which poor households rely on as source of funds in emergencies, they not only make members of the family ill, but at the same time take away the funds that would be used to cope with that sickness. Cysticercosis causes major losses to pig producers through carcass condemnations and cystic echinococcosis through liver condemnations. Anthrax outbreaks are accompanied by high mortality in livestock. Tuberculosis and brucellosis depress livestock productivity and rabies, while mainly affecting carnivores, does cause deaths in livestock – usually cattle. Relative public health burden of selected zoonoses associated with livestock and poor people in different sections of the community is mainly in the occupational groups such as livestock keepers and agricultural labourers for diseases Anthrax, Brucellosis, Cysticercosis and taeniasis, TB are ranked as high risk where as consumers of livestock products and general population it is ranked as low risk. Similarly, the risk from rabies ranked as low in all occupational groups.

2.2 Under Diagnosis

Obtaining a correct diagnosis of the zoonotic infections is the most difficult part of zoonotic diseases for number of reasons. Any diagnosis of the diseases basically requires an epidemiological in put with respect to its prevalence in an area and populations of animals in which agent is circulating or reservoirs of infections where agent is naturally harboured but such information on zoonotic diseases at least in India is lacking. Such information are vital to know the magnitude of the problem and the absence of such baseline data on diseases or under estimations of the actual incidence of diseases owing to the poor diagnosis hampers decision making and proper policy initiatives. The diagnostic facilities and infrastructures are always inadequate. The human population who are affected with the diseases rarely visit health centres for diagnosis as they are unable to bear the cost of diagnosis and treatment and several trips to health centers. The veterinarians who are at the frontline for dealing with the zoonoses also severely handicapped by lack of diagnostic facilities and communication with medical officers which are essential in combating the zoonotic diseases problem from both animal and human health point of view. Veterinarians receive little support even if they wish to be the frontline leaders in control of zoonotic disease problems. It is to the knowledge and experience of the professionals that the crux of the problem is that for many zoonoses, it is the risk to human health that is most important, while the most effective control route is via the animal.
2.3 Health expenditures

The expensive vaccines and drugs are greatest deterrent to invest in health related expenditures and most often becomes prohibitive. The situations in rural area are further complicated by lack of sufficient supply of vaccines and medicines and lack of electric power to maintain the cold chain. Therefore, on most occasions health emergencies are unattended contributing to more morbidity, mortality and rapid spread of diseases. Added to this, the rural women folk keep small-stock tend to be kept by women and provide a modest regular income in the form of egg or milk sales which goes directly to women and children, the latter sometimes benefiting from the extra protein available in the household. Livestock, especially smaller animals, are sold to meet emergency expenditures – such as treatment and hospitalization of family members or food in times of shortage – and thus form a vital component of poor households’ coping strategies. Because poor people keep fewer animals, they are far more vulnerable to an animal’s illness or death. And for animals too, the prognosis is worse if they are kept by a poor household - when an animal does fall ill, the livestock keepers are unlikely to be able to afford to treat it or to have good access to veterinary services and healthcare information.

2.4 Emerging & Re-emerging Zoonotic Issues

Emerging infections are new diseases that have not been previously described and re-emerging are the ones which were seen earlier but have now reappeared in a more virulent form or in a new epidemiological setting after a period of decline or disappearance (e.g. influenza A, tuberculosis, malaria and dengue). The breakdown and complacency of public health measures for previously controlled infections, population movements, socioeconomic disruptions and development of antimicrobial resistance due to overuse of these drugs in humans and animals and microbial adaptability have led to the reemergence of these diseases. Around 61% human microbial pathogens and 73% emerging human pathogens identified during the past two decades are zoonotic. Though poorly documented, zoonoses are a major public health problem in India. Zoonotic diseases assume a great public health importance as approximately 80% population in India lives in close contact with domesticated animals and poultry and there is also an abundance of vectors. Zoological Society of London along with researchers from Georgia and New York analyzed 335 emerging diseases from 1940 to 2004 to study links between emergence of infectious diseases with population density, climate change, latitude and bio-diversity. Modeling was used to identify emerging infectious disease (EID) ‘hot-spots’ on a global map which could be used to predict potential sites for future disease outbreaks. The main ‘hotspots’ were located in low latitude regions like South Asia and South-East Asia, which have not been the focus of global funds to prevent spread of EIDs. EID events were found to be dominated by zoonoses (60.3%); majority of which (71.8%) originated in wildlife (eg. Ebola virus) and had increased significantly over time. EID outbreaks in these regions can be lethal given the current absence of resistance among humans. At least 11 pathogens have emerged or re-emerged in India during 1992-
2009, majority of animal origin. Risk factors for emergence reside in multiple sectors. Emergence and spread of H5N1 has clearly demonstrated the vulnerability of the system. The study reiterates need for urgent, targeted and multi-sectoral preparedness and response to EIDs. The strategy to combat these diseases needs a strong public health structure, effective risk communication, epidemic preparedness and rapid response.

2.4.1. Global warming and Climate/ environmental changes

Despite the great deal of attention that has been focused on emerging infectious zoonotic diseases, including SARS, WNV, monkey pox and avian influenza, there has been less discussion and effort targeted at the environmental drivers of such diseases. One possible reason is that traditional approach of the human health community to zoonotic disease has been an “us versus them” approach. The problem is viewed as an infectious animal reservoir that then poses an infectious risk to humans-either through direct contact with infected animal and their excretion, meat, milk, or other tissues, or via a vector transmission bringing the pathogen from the animal population into human hosts. The control of such diseases has traditionally involved measures such as control of the animal reservoir (through culling, quarantine, or vaccination) or vector control (through pesticides and personal protection). For many zoonotic diseases, however, such approaches are limited because the ultimate causes of infection in the animals may not be addressed sufficiently as the complete natural history of the emerging zoonotic diseases are completely known or understood (example of Nipah virus, Ebola virus, KFD, Lyme disease etc and its emergence). Even the emergence of Asiatic cholera is attributed to rise in the level of sea temperature and bloom in the phytoplanktonic population. This highlights the fact that the “shared risk” approach between medical and veterinary professions shall be able to combat the disease in the population of animals and humans.

2.4.2. Diagnostic problem

Similar to that of endemic zoonosis, the lack of suitable rapid diagnostic techniques hampers the control and spread of epidemics in humans and animals. Moreover, the majority of the emerging zoonotic diseases are acute in nature and spread rapidly with in the susceptible population the rapid diagnostic kits are highly essential.

2.4.3. Epidemiology

As most of the diseases are new, or the old diseases having new dimensions are experienced whenever the epidemics are witnessed, a proper and thorough understanding of the epidemiology of the disease together with ecology and natural history of the diseases becomes the corner stone of control and prevention of emerging diseases. But there are now epidemiological set up in the country to monitor the disease situation which severely affects the planning and control of the diseases at population levels.

2.5. Non-zoonotic or Suspect Category of Zoonoses

Many animal diseases which are currently not believed to pose a zoonotic threat to humans and many human infectious diseases do not appear to infect pets and other
animals they have strong potential to become an established or emerging zoonotic diseases in future. Some of the examples to point out are feline immuno-deficiency virus, canine parvo virus infection, feline leukemia virus infection, chron’s disease etc.

2.6 Immuno Compromised Population and Zoonotic Issues

Advancement in treatment of various diseases has also increased the incidence of zoonotic diseases. Pet ownership has both emotional and health benefits for people with a variety of diseases, however, the immuno compromised conditions in people such as HIV infection and cancer chemotherapy has resulted in the increased infections acquired from pets such as Toxoplasma, Cryptoporidium, Giardia, and dermatophytes etc are just a few examples of zoonotic diseases seen more commonly in immuno-suppressed people.

3. Organizational Set up and Infrastructure in India

Veterinary Public Health is the joint responsibility of Federal & State Government through different Departments of Health & Family Welfare; Environment & Forest; Commerce and Industry and Livestock & Dairy Development Boards and is being performed systemically. As per the schedule under constitution of India, all the activities concerning to agriculture including Veterinary services, human health are the State subjects and all the states are responsible to execute the same in their respective States. Veterinary Services provides health coverage to animals & extension services to improve animal husbandry practices and also supervise processing of livestock products in the country. The disease surveillance and reporting, risk analysis of foods of animal origin, inspection and certification services for import / export of live animals and livestock products are regulated broadly on line with the Codex Alimentarius and Bureau of Indian Standards (BIS). The MoA (DAHDF & DAREICAR) regulates the import and export of livestock and livestock products whereas MoHFW and Municipalities are responsible for the inspection of products of animal origin at market level through their set up of food inspectors and laboratories. MoFPT regulate food production/processing and distribution chain at whole sale and retailer levels, integrating farm for food quality and consumers safety.

3.1 Ministry of Agriculture (MoA)

Ministry is involved in devising the national policies, planning and coordination in respect of animal disease control and upgrading livestock & poultry along with regulation of import and export of livestock, livestock & Fishery products and has a close working links with the State Animal Husbandry and fisheries departments for all the matters concerning to livestock and fisheries. Department of Animal Husbandry, Dairying & Fisheries (DAHDF) came into existence in Feb. 1991 while Fisheries Division was added in October, 1997. Being the nodal department, responsible for all the matters concerning to livestock production, preservation, protection and improvement of infrastructure and regulates all the import and exports of livestock and livestock products. In addition, it
also advises the State Govt./UT’s in formulation of policies and programmes in the field of animal husbandry, dairy development and fisheries. Whereas, Department of Agricultural Research & Education (DARE) was established during 1973 and is responsible for providing technical support to DAHDF for the prevention and control of all types of diseases through well developed largest National Agricultural System (NARS) functional directly under the control of Indian Council of Agricultural Research (ICAR). The system is supported by research institutions in almost all the species of livestock and poultry having well developed infrastructure for conducting research with capable & specialized human resource. One oldest premier national institution in Veterinary science (IVRI) having the predominant role in resolving any issues concerning to any disease situation exists in the country while another national institute in dairy science & technology (NDRI) also functional in the country. In addition, SAU’s/SVU’s having well qualified and specialized personnel involved in teaching and conducting research on regional problems with infrastructure is available.

A network of 27562 Polyclinics/Hospitals/Dispensaries and 25,195 Veterinary aid centers (including stockmen centers/mobile dispensaries) are functional to meet the requirements of the county. More than 86,000 Veterinary Personnel (Veterinary Graduates and Para-vets/Veterinary Field Assistants) looking after the animal health aspect. Every unit has at least one veterinarian/para-veterinarian to provide veterinary services to the farmers at their door step including vaccination against all animal diseases and also reporting the disease outbreaks to the district administration. Veterinary hospital and polyclinics are usually located at town level and all these hospitals and dispensaries are being strengthened in terms of equipments, capacity building and mobility from time to time under various projects/schemes of the Central Govt. Mobile dispensaries have also been established to provide Veterinary health services at farmers’ door steps. These units are well supported by about 250 disease diagnostic laboratories and are functioning in the states and UTs for providing quick and reliable diagnosis. Further, to control major livestock and poultry diseases by way of prophylactic vaccination, the required quantity of vaccines are produced in the country in 26 veterinary vaccine production units. Of these, 19 are in the public sector and 7 are in private sector.

The Centre for Animal Disease Research & Diagnosis (CADRAD) at IVRI, Izatnagar is working as the Central referral apex laboratory. Similarly, five other Regional Referral Disease Diagnostic Laboratories (RRDDL) working at Pune, Kolkata, Bangalore, Guwahati and Jalandhar. In addition, there are about 100-district level diagnostic laboratories in different states of the country. For research on exotic animal diseases High Security Animal Disease Laboratory (HSADL) at Bhopal with BSL-3+ containment facilities is functional and proving all the possible help in the diagnosis of any emerging and exotic diseases. This laboratory has been recognized as one of the referral lab. for the diagnosis of Avian Influenza by OIE. In addition, 23 BSL-2 and 6 BSL-3 laboratories in different states are being developed to meet the challenges of the
future. One specific referral laboratory on FMD has recently been recognized by OIE to support the SAARC countries.

At present Animal Quarantine Certification Stations (AQCS’s) are functioning at Delhi, Mumbai, Chennai and Kolkata and two more are proposed to be establish at Bangalore and Hyderabad. The main objective to prevent the ingress of livestock diseases into India by regulating the import of livestock and livestock related products and providing export certification of international standard for the livestock and related products exported from India. These are being strengthened, in view of increasing load of import and export of livestock and livestock products. The import of Grand Parent (GP) stock of poultry, pets, and laboratory animals and livestock products has already started from these stations. The Animal Quarantine Certification and Enforcement Authority is under consideration for establishment with necessary autonomy, authority to function as an independent body empowered with legislative authority, so that the movement of animals risking infection/disease could be adequately controlled through important airport, seaport, international land routes and movement within the states. Establishing Diseases Free Zones for selected diseases by zoning and buffer zoning keeping international view of OIE and WTO, with strict enforcement of SPS and zoo-sanitary requirements is yet another new initiative has been undertaken.

At present the monitoring the quality of vaccines, biological, drugs etc is being monitored by IVRI, Izatnagar. The National Veterinary Biological Products Quality Control Centre (National Institute of Animal Health) has been established at Baghpat, Uttar Pradesh and would be functional very soon.

National Dairy Development Board (NDDB) located at Anand, Gujarat was set up in 1965 and declared as a statutory corporate in 1965 under the Act of Parliament. This is basically a premier institution to accelerate the pace of dairy development on cooperative lines in the country.

National Fisheries Development Board (NFDB) was set up in 2006 at Hyderabad, Andhra Pradesh to realize the untapped potential of fisheries sector, fish culture, health, processing & marketing, application of modern tools of research & Development for optimizing production and productivity in fisheries. At the same time, the Coastal Aquaculture Authority (CAA) was established under CAA, Act 2005 with the objective to regulate coastal aquaculture activities in coastal areas to ensure sustainable development without damaging coastal environment. There is well organized, effective and efficient system of disease recording, reporting, storage, retrieval, transmission system and is one of the purposeful uses of livestock disease information in disease control strategies. A total of 52757 Animal Disease Reporting Units in the country are available. One disease reporting unit is catering the needs of on an average 12 villages per unit. In the absence of any reliable data on animal disease distribution and population, disease profile, production and marketing patterns, future projections often have an inbuilt draw back of leading strategic plan formulations. Survey and surveillance
programmes for emerging diseases and for the introduced diseases for its early detection and management should be a regular feature and can be taken up on war footing before the introduction of recently emerging diseases spread throughout the country. In order to overcome these difficulties and also to develop reliable active disease surveillance information, the Govt. has taken appropriate measures through schemes which are functional in the country.

**Veterinary Council of India** is a corporate body under the Indian Veterinary Council Act, 1984 and has been adopted by 25 States and all the UT’s. In accordance with the provisions under-graduate veterinary education is regulated in the country by developing syllabus and licensing veterinary institutions to maintain uniform standards.

3.2. Ministry of Health & Welfare (MoHF)

The Ministry is responsible for investigation of outbreaks and control of infectious diseases including zoonosis, water and vector borne infectious diseases in human. It is functioning in collaboration with State/UT’s health departments and also integrating with other departments. It also regulates inspection and certification of all livestock products for its quality and wholesomeness. Food inspectors inspect and certify the food items including meat and other livestock products at different locations and food markets for their quality, shelf life and keeping conditions. They have legislative support to confiscate, destroy the unhygienic or adulterated food items and make punishment as fine or imprisonment or both to accuser through courts. It is technically supported by Department of Health Research through specialized institutions with technically competent human resource under **India Council of Medical Research (ICMR)** and provides diagnostic services for prevention and control of all types of diseases of human. The Directorate General of Health Services, a repository of technical knowledge, is an attached office of this Ministry. The technical advice on all medical and public health the policies and programmes of the Ministry in an effective manner, there are three subordinate offices matters is being addressed for the implementation of various health schemes. In order to implement located at various places in the country which function directly under the Ministry. The Ministry is also administratively concerned with 29 autonomous/statutory bodies. There are also three Public Sector Undertakings under the administrative control of the Ministry.

The **“Central Government Health Scheme” (CGHS)** provides comprehensive health care facilities and started in 1954 and is now operational in the country. The medical facilities are being provided through these dispensaries /polyclinics under 248 Allopathic, 19 polyclinics, 78 Ayush dispensary/ units etc. In addition, medical units also exist in private sector providing health care to human beings.

Allied state health departments emergency Health units have been established with the mandate of providing information about Zoonotic diseases which is headed by Director, **National Institute of Communicable disease (NICD)**. The state disease
surveillance officer along with district health officers is responsible for investigation about the disease outbreaks. The samples so collected from an of such outbreak is being submitted to State Divisional / District Health Laboratories and National Institutes for further investigation and confirmation. These results along with technical advice are being submitted to the state health departments for initiating control measures. These laboratories are adequately equipped in terms of manpower and technical expertise to perform their duties and have BSL-2 to BSL-4 facilities.

Contingency plans for various communicable diseases already exist and are activated in case of emergency. Various committees are in existence under the ministry and have relevant powers to tackle the situation. These committees hold discussions at regular intervals and developing the strategies for their prevention and control. The multidisciplinary approach has been proved very effective in controlling outbreak of avian & Swine influenza and SARS. No case of avian influenza (H5N1) infection was recorded in India till date.

3.3 Ministry of Environment & Forest (MoEF)

The Ministry is the nodal agency for the planning, promotion, co-ordination and overseeing the implementation of India's environmental and forestry policies and programmes. The primary concerns are implementation of policies and programmes relating to conservation of the country's natural resources including forests and wildlife, ensuring the welfare of animals, prevention and cruelty of animals and abatement of pollution. While implementing these policies and programmes, the Ministry is guided by the principle of sustainable development and enhancement of human well-being. The objectives are well supported by a set of legislative and regulatory measures, aimed at the preservation, conservation and protection of the environment. Besides the legislative measures, the National Conservation Strategy and Policy Statement on Environment and Development, 1992; National Forest Policy, 1988; Policy Statement on Abatement of Pollution, 1992; and the National Environment Policy, 2006 also guide the Ministry's work. It also regulates environmental issues in accordance with national laws and international obligations. All Ministries and state departments involved in food safety matters coordinate with each other and hold meetings regularly to exchange information and seek cooperation on matters of common interest.

The Ministry also serves as the nodal agency in the country for the United Nations Environment Programme (UNEP), South Asia Co-operative Environment Programme (SACEP), International Centre for Integrated Mountain Development (ICIMOD) and for the follow-up of the United Nations Conference on Environment and Development (UNCED). The Ministry is also entrusted with issues relating to multilateral bodies such as the Commission on Sustainable Development (CSD), Global Environment Facility (GEF) and of regional bodies like Economic and Social Council for Asia and Pacific (ESCAP) and South Asian Association for Regional Co-operation (SAARC) on matters pertaining to the environment.
Wildlife Institute was established in 1982 and is an internationally acclaimed Institution, which offers training programs, academic courses, and advisory in wildlife research and management and is actively engaged in research across the breadth of the country on biodiversity and health-related issues. In addition, Animal Welfare Board (AFD) through Prevention of Cruelty to Animals Act enacted in 1960 is responsible to prevent the infliction of unnecessary pain or suffering on animals and also to amend the laws relating to the prevention of cruelty to animals and diseases.

3.4 Ministry of Food Processing Industries (MoFPI)

The Ministry is the nodal agency for processed foods and is responsible for developing a strong and vibrant food processing sector with emphasis on stimulating demand for appropriate processed foods, achieving maximum value addition and byproduct utilization, creating increased job opportunities particularly in rural areas, enabling farmers to reap the benefits of modern technology, creating surpluses for exports. Ministry is also helping the industry to provide a proper direction, encouraging exports and creating a conducive environment for the healthy growth of the food processing industry to produce hygienic food. It is concerned with the formulation & implementation of policies and plans for all the industries under its domain within the overall national priorities and objectives. Its main focus is for the development of infrastructure, technological upgradation, development of backward linkages, enforcement of quality standards and expanding domestic as well as export markets for processed food products.

A large segment of the meat production sector is unorganized and production policies in the animal husbandry sector are mainly focused on dairy development. However, due to the increased interest from the meat industry, the government has supported development of the meat sector. Additionally, the Ministry has taken “Grant in Aid” scheme for the modernization of abattoirs. The Govt. has also launched a National Meat and Poultry Processing Board (NMPPB) in February 2009 which will act as a national hub for addressing all key trade issues related to the meat and poultry processing sector. The main objective of the board is to regulate and promote the meat industry and help producers and manufacturers by serving as a single-window service provider. A scheme on “Salvaging and Rearing of Male Buffalo Calves” is also initiated with the purpose of increasing meat production.

3.5 State/Local Governments

The state/local governments also assist in regulation of food inspection services through the food inspectors responsible for food inspections of including milk and milk products, meat and meat products. The licenses for establishment of sites for food manufacturing and or sale are being issued by local administrations. Public veterinarian appointed in the nearest veterinary hospital is being engaged for such purpose of inspections specifically for meat & meat products. The District health officer can also
appoint inspector to undertake inspection to ensure food quality and wholesomeness of the products. The samples so collected by them are being sent for analysis to the neighboring laboratory. Based on the results, the district administration, food inspector and or district health officer may take appropriate action /decision regarding the manufacturer or seller of adulterations and penalties thereof as per the existing laws.

There are about 10 fully integrated meat processing plants conforming to the international standards exist. In addition, a large number of other authorized and non-authorized slaughterhouses are available and operating throughout the country under local Government. Some of the export oriented slaughterhouses have been established in the private sector using latest technologies. The slaughtering animals are being supervised by state veterinarians. The slaughtering practices need improvements to avoid economical losses of meat, hides and skins and other valuable livestock by products.

4. Diagnostic Technologies for Zoonotic Diseases

The diagnosis of all the diseases of public health significance are being diagnosed using latest technologies in the specialized laboratories both in the human and livestock sectors having BSL-2 to BSL-4 bio-containment facilities and are functional in the states and UTs at various levels for providing quick and reliable diagnosis using the diagnostics developed indigenously. In addition, some of the laboratories, having such facilities in various universities and private diagnostic institutions are also providing such services. These laboratories are being strengthened under various programs of the government. These are well equipped for cultural, biochemical and anti-biogram; various conventional serological tests like- Agar gel immunodiffusion test; Haem-agglutination and inhibition tests (HA & HI); Complement fixation CFT) etc. and to advanced diagnostic facilities like- ELISA, PCR, E/M facilities, Histopathology, Histochemistry including, Electrophoresis etc. The international assistance is also being sought from time to time and as per the requirements validation of results from World reference laboratories are also being sought.

In human and livestock sector, diagnostic laboratories are located at various research institutions, state and regional laboratories at divisional and district levels and private sectors. These collaborate with the field veterinary services for diagnosis of livestock diseases and the samples are being collected by them or by the laboratory personnel for investigations. These samples are referred to the reference laboratories for detailed analysis. These veterinary diagnostic laboratories are located mostly at the state capital level and are equipped with advance diagnostic facilities and having a close liaison with the regional diagnostic laboratories.

Indian Veterinary Research Institute (IVRI), Izatnagar is the premier veterinary research institution in the country having the status of Deemed University with specialized laboratories to meet the requirements of the country by providing referral
diagnostic services and developing strategic preventive and control measures. In addition, 45 State Universities under National Agricultural System (NARS) having well developed infrastructure in veterinary colleges are also supporting the diagnostic activities.

Centre for Animal Disease Research & Diagnosis (CADRAD) of IVRI, Izatnagar is discharging the functions as central referral apex laboratory and is supported by five Regional Referral Disease Diagnostic Laboratories (RRDDL) located at Pune, Kolkata, Bangalore, Guwahati and Jalandhar. In addition, there are about 100-district level diagnostic laboratories in different states of the country which are involved in the diagnostic activities. High Security Animal Disease Laboratory (HSADL) at Bhopal with BSL-3+ containment facilities is engaged for specific research on exotic animal diseases including zoonotic ones and is proving all the possible help in the diagnosis of any emerging and exotic diseases using latest technical know-how. This laboratory has already been recognized as one of the referral laboratory for the diagnosis of Avian Influenza by OIE. In addition, 23 BSL-2 and 6 BSL-3 laboratories in different states are being developed to meet the challenges in future.

The samples are processed in these specialized laboratories and analyzed for blood, serum, milk, water and morbid samples for the diagnosis and surveillance of different disease like FMD, PPR, brucellosis, leptospirosis, E.coli, listeriosis, campylobacteriosis, rabies, salmonellosis etc. HSADL, Bhopal has also processed samples for avian influenza. A total of 230 samples for drug residue and heavy metal were processed at the referral laboratory during the last one year. Food borne pathogens were isolated and identified and confirmed by PCR in livestock products. Pasteurollosis, the causative agent Pasteurella multocida from livestock and poultry were identified, sero-typed and characterized using conventional and molecular tools. An immuno-dominant gene of the agent was characterized by cloning and sequencing. Sero-surveillance study for various diseases like brucellosis, PPR, leptospirosis, Blue Tongue, clostridiosis, listeriosis etc in different species of livestock and poultry are being carried out regularly using conventional and modern tools in different laboratories of the county.

5. Diseases Monitoring and Surveillance, Data Processing and Handling

Animal disease prevalence is primarily recorded by the veterinary doctor working in a Government hospital/ dispensary on the basis of clinical diagnosis. This information is passed on to Taluka/ Block level and then to the District and the State veterinary authorities. Disease information is also generated from the disease diagnostic laboratories at the District, State or at the regional level on the basis of laboratory diagnosis. Finally, information from State level is transmitted to the Nodal Government (DADF) in New Delhi and notifies to World Organization for Animal Health (OIE) and other international organizations.
At present due to certain constraints the disease reporting is neither timely nor complete, hence, some times the compiled information does not represent true picture of the disease situation at any given point of time. Therefore, in such prevailing situation, many times animal diseases assume serious proportion before control and containment steps can be initiated, thereby causing avoidable social and economic costs to livestock owners and the country’s economy.

In view to avoid these constraints, a computerized system of animal disease reporting, linking each Taluka/ Block, District and State Headquarters to a Central Disease Reporting and Monitoring Unit at the DADF in New Delhi has been proposed to be introduced. This reporting system will enable the Block, District and State animal health officials to report the disease information and render reports and returns prescribed reports via internet. The system will be so designed as to assure secure data transfer and confidentiality of information. At the apex level, National Animal Disease Reporting System (NADRS) will compile and generate animal disease information country as a whole. The users will have access to the information as per permissions in consonance with their role and responsibilities envisaged under the system. This computerized system will enable fuller and timely reporting of the animal disease situation in the country, enabling its effective management. This information collected / generated are being analyzed and used for disease control, monitoring and research purposes. These laboratories are also imparting training at national and international level through different programs to improve the diseases diagnostic skills of the professionals and technical staff.

The laboratories in human sector at basic health unit conducts only very basic blood and urine tests but at the district levels in addition to above, latest diagnostic techniques are being used for diagnosis of various ailments. Advanced tests including Bioassays, immuno-assays, PCR and DNA sequencing etc are provided in very specialized hospitals/polyclinics. The teaching hospitals have a long range of testing facilities not only to train the students but also for acute and chronic patients in advanced stages of clinical illness. All the information / data about the patient including personal, family, demographic and clinical history and diagnostic history are recorded in epidemiological soft-ware programs, developed for the purpose. Information on zoonotic and food borne infectious diseases are shared with stakeholders to devise control strategy at respective departmental levels.

6. Existing Zoonotic and Food Borne Diseases

Around 61% human microbial pathogens and 73% emerging human pathogens have been identified during the past two decades and are major public health problem in India. Moreover, due to poor record keeping and documentation the problem gets magnified. Zoonotic diseases are assumed to be of great public health importance as approximately
80% population in India lives in close contact with domesticated animals and poultry and there is also an abundance of vectors. In spite of eradication efforts, highly infectious diseases like rabies and anthrax, are still prevalent. Furthermore, new diseases have been surfacing during the past three decades due to the evolution and adaptation of microbes and the re-emergence of old diseases due to the development of antimicrobial resistance and the capacity to spread to new geographic areas. The impact of the emerging and re-emerging diseases in India is felt most at the socio-economic level.

The zoonotic diseases of major public health importance in India are Japanese encephalitis (JE), leptospirosis, plague, rabies, anthrax, Kala azar (Leishmaniasis), Kyasanur Forest Disease, rickettsial diseases, cysticercosis, hydatid disease, trypanosomiasis and toxoplasmosis. Japanese encephalitis and Leptospirosis causes outbreak and have been reported year after year. Recently new diseases such as Chikungunya virus infection, Nipah virus infection and swine influenza have been reported. In addition to the existing zoonoses, exotic zoonotic infection viz. Yellow Fever, Hanta virus infection, Crimean Congo Hemorrhagic fever, Rift Valley fever, Ebola & Marburg disease also pose a serious threat. Important public health zoonoses prevalent in India are detailed below:

6.1. Viral Diseases

6.1.1. Rabies

Rabies is an acute viral disease and responsible for encephalomyelitis and affects all warm blooded animals including humans. Most common host of rabies is dogs, foxes, bats and man. Rabies annually causes 35000-50000 deaths annually and is endemic all over world except Australia and Antarctica. In India, rabies causes high mortality and morbidity and is endemic except for islands of Lakshadweep, Andaman and Nicobar which are rabies free. It is estimated that around 20,000 persons die of this disease and rapidly growing stray dog population (currently almost 25 million) may be attributed to the spread of rabies since most of them are not vaccinated against rabies. Rabies cases are seen throughout the year, almost two thirds of the victims are males and about 40% are children less than 14 years of age. It is estimated that approximately 17.4 million animal bites occur annually in India. Almost 3 million animal bite cases elect to receive post exposure treatment based on vaccine utilization in the country. In case of every potentially suspected animal bite, the treatment is being given immediately. National guidelines on animal bite management have been formulated as per international standards. Antirabies serum and tissue culture vaccines are being produced in the country both in public and private sector. Recently, intradermal inoculation of anti-rabies vaccines has been approved by national authorities to provide wider coverage of post exposure treatment to animal bite victims in the available quantity of cell culture vaccines. The production and use of nervous tissue Vaccine has been stopped since December 2004 and now only killed vaccine is used. Prevention and Control strategy aims at prevention of human deaths due to rabies by giving post exposure treatment to all exposed by a potent tissue culture vaccine and control of dog rabies to interrupt
transmission of the disease. Accordingly the post exposure treatment is being carried out following approaches of wound management, active and passive immunization

6.1.2. Arbovirus infections

Arbovirus infections are found mainly in the tropics and are transmitted mainly through arthropod vectors. More than 350 viruses come under the category of arboviruses and nearly 41 of these are found in India responsible for causing Japanese Encephalitis, West Nile virus, KFD, Dengue. In India, of the mosquito borne infections, JE is one of the prevalent ones causing fatality rate from 6-60 percent. Dengue is found mostly in rural areas whereas KFD is a tick borne infection prevalent in Karnataka state only. Some of the medically important arbo-viruses are as follows.

Family - Togaviridae arboviruses
A. Encephalitis causing virus (Eastern, Western & Venezuelan equine encephalitis)
B. Fever causing virus (Chickungunya, Onyong-nyong, Mayaro, Sindbis & Ross River)

Family – Flaviridae flavivirus
A. Mosquito - borne (Encephalitis, St Louis, West Nile, JE, Murray Valley encephalitis, Yellow fever virus, Dengue virus types 1,2,3,4)
B. Tick- borne (Encephalitis, Russian spring summer encephalitis complex, Louping ill, Haemorrhagic fever, KFD, Omsk Haemorrhagic fever)

Family – Bunyaviridae _ Bunyamwera group, Bwamba group, C group, California group, Simbu group, Turlock group, Crimean Congo Haemorrhagic fever group (CCHF, Hazara), Phlebotomas fever group (Sandfly fever, Karimabad), Nairobi sheep disease group (Nairobi sheep disease, Ganjam), Phlebovirus group (Rift Valley fever)

Family – Reoviridae: Orbivirus, African Horse Sickness, Colorado tick fever, Playam, Vellore)

Family – Rhabdoviridae: Vasiculovirus, Chandipura virus

6.1.3 Japanese Encephalitis

Japanese Encephalitis (JE) is a mosquito borne zoonotic viral disease caused by arbovirus (flavivirus), involving the Central Nervous System. In nature, the virus is maintained in animals and birds (e.g. cattle egrets, pond herons etc.) and in animals in particularly pigs. The virus causes serious neurological affections in humans.

JE was first recorded in Vellore and Pondicherry in mid 1950s. The first major outbreak of JE occurred in 1973 in Bankura & Burdwan districts of West Bengal. Subsequently it spread to many other States. The worst ever recorded outbreak in India was reported from Uttar Pradesh during 1988 when 4485 cases with 1413 deaths were recorded from eight districts with case fatality rate of 31.5%. The highly affected states include Andhra Pradesh, Assam, Bihar, Goa, Karnataka, Manipur, Tamil Nadu, Uttar Pradesh and West Bengal. Outbreaks of JE usually coincide when the vector population
is high i.e. in monsoons and post-monsoon period. In areas which are endemic for the
disease, sporadic cases may occur throughout the year. Case fatality rate in newly
affected areas ranges from 10-70%. However, with early detection and management of
cases it has come down to an average of approximately 20%. Thus case fatality of JE in
general is high ranging from 25-50 percent. The details of the reported cases are as
follows-

6.1.4 Dengue Virus

Dengue fever is the most important vector borne disease spread due to mosquitoes. It
belongs to genus flavivirus and family flaviviridae. It is of major public health concern in
India and abroad. It is a self limiting disease and is found mostly in tropics and sub
tropics. It is prevalent in urban and semiurban areas. In India first major outbreak of
dengue haemmorhagic fever occurred in Kolkata in 1963. The disease is now prevalent in
more than 100 countries including South East Asia, Western Pacific, Eastern
Mediterranean, Africa and Americas. WHO has estimated that there are currently 50
million cases of dengue every year with around 24000 deaths related to its complication.
In 1996 there was outbreak of dengue in India with cases being reported from all over
India with Delhi-10252 cases and 423 deaths; Haryana-1631 deaths and 53 deaths;
Maharashtra-3068 cases and 5 deaths. In 2003, there was a repeat outbreak of dengue
with 12754 cases and 215 deaths. Outbreaks of dengue occur in the post monsoon period
when the vector population of mosquitoes is at highest. Outbreaks usually occur in urban
areas.

6.1.5 Kyasanur Forest Disease

The KFD virus is an arbovirus belonging to Casal’s group B. It belongs to family
Flaviviridae and genus Flavivirus. This disease was first reported in 1957 from Sagar
Sorab area in Karnataka and was noticed due to sudden death of monkeys in the area. The
virus and the disease were named after Kyasanur forest area in Sagar Taluk of Shimoga
district of Karnataka. The case fatality of the disease is estimated to be around 5-10
percent. Serious complications of the disease such as haemmorhages and dehydration are
the cause of death and are generally observed in low socio-economic groups. The disease
is restricted to only few districts in Karnataka such as Shimoga, Chikkamagalore,
Ukannada, Dkannada, Udipi etc. where monkey and human deaths have been reported.In
2004, 568 suspected cases of KFD, 4 human deaths and 86 monkey deaths were reported.
The disease is mainly said to be prevalent from January-June during the dry months.

6.1.6 Chikungunya Virus Infection

This virus belongs to Family Togaviridae and genus alphavirus. The first outbreak of
Chikungunya occurred in Calcutta in 1963. This was followed by an outbreak in 1964 in
Vellore, Madras and Pondicherry. In 1973, a small localized outbreak was reported from
Barsi, Sholapur district, Maharashtra state. No outbreaks were reported from India after
1973 till 2005. An outbreak Chikungunya with sporadic cases of dengue has been
recently reported from different parts of India especially from Maharashtra and Kerala. The outbreak has involved Andhra Pradesh, Maharashtra, Karnataka, Kerala, Tamil Nadu, Madhya Pradesh, Gujarat, Rajasthan and Delhi. Chikungunya infection is transmitted by the bite of infected mosquito (Aedes). Disease is suspected when the patients show symptoms of fever, rash and rheumatic manifestations. Since there is no vaccine or specific medication available against Chikungunya infection hence control of disease becomes difficult. The disease is prevalent during monsoon and post monsoon when vector population is high. Vector control is thus very important in controlling or preventing Chikungunya transmission. Epidemiological and vector surveillance hence play an important role for prevention and control of the disease. The state-wise reported cases of the disease during 2006 are as follows

6.1.7 Nipah Virus

Nipah virus was reported initially in 1999 upon examining samples from an outbreak of encephalitis and respiratory illness among adult men in Malaysia and Singapore. The natural reservoir for Hendra virus is thought to be flying foxes (bats of the genus Pteropus) found in Australia. Nipah virus caused a relatively mild disease in pigs. Nipah virus was transmitted to humans, cats, and dogs through close contact with infected pigs. Infection with Nipah virus was associated with an encephalitis (inflammation of the brain) characterized by fever and drowsiness and more serious central nervous system disease, such as coma, seizures and inability to maintain breathing. Illness with Nipah virus begins with 3-14 days of fever and headache. This is followed by drowsiness and disorientation characterized by mental confusion. These signs and symptoms can progress to coma within 24-48 hours. This disease can be prevented by avoiding animals that are known to be infected and using appropriate personal protective equipment devices when it is necessary to come into contact with potentially infected animals. Case fatality rate is reported to be about 40%. Two outbreaks of Nipah Virus infection have been reported from India. The first outbreak occurred among hospitalized patients, family contacts of patients and medical staff of 4 hospitals in February 2001 in Siliguri. The second outbreak was recently reported in April 2007 in two villages of west Bengal. Five cases and five deaths were recorded in this episode. Human to human transmission was documented in these outbreaks.

6.1.8 Avian Influenza

Avian flu is caused by influenza A viruses. There are 16 H and 9H antigens for influenza A virus which determine the type of strain of the virus. H1N1, H1N2, and H3N2 are circulating in human and H5N1 has potential to infect human but its human to human transmission is limited. The world is concerned because this virus has potential to undergo genetic mutation and become a pandemic strain. In India, the disease due to HPAI was first reported in 2006 from parts of Maharashtra, Gujarat and Madhya Pradesh and was successfully contained and freedom status for the country from the infection was obtained within four months. In 2007-2010 fresh outbreaks was recorded in other parts of
the country, which has been brought under control. This particular infection has the potential to create havoc by inflicting serious damage to our poultry industry and food and nutritional security. It also has the potential to cause a human pandemic with disastrous consequences. These outbreaks had caused serious economic losses to the poultry industry. The massive outbreaks have brought all the stakeholders to pool their energies and expertise to control this menace. Such collaborative efforts proved fruitful and despite the large scale of poultry involvement no case of human infection resulting to the death was reported.

6.1.9 Swine Influenza

Swine Influenza (swine flu) is a respiratory disease of pigs caused by type A influenza virus that regularly causes outbreaks of influenza in pigs. Swine flu viruses cause high levels of illness and low death rates in pigs. Swine influenza viruses usually circulate among swine throughout the year, but most outbreaks occur during the late fall and winter months similar to outbreaks in humans. The classical swine flu virus (an influenza type A H1N1 virus) was first isolated from a pig in 1930. H3N2 influenza viruses began circulating among pigs from 1998. The H3N2 viruses initially were introduced into the pig population from humans. Like all influenza viruses, swine flu viruses change constantly. Pigs can be infected by avian influenza, human influenza viruses as well as swine influenza viruses and hence the pigs are known to be a mixing vessel. When influenza viruses from different species infect pigs, the viruses can re-assort (i.e. swap genes) and new viruses, a mix of swine, human and/or avian influenza viruses - can emerge leading to development of new novel strain for which human beings do not have no immunity. There are four main influenza type A virus subtypes that have been isolated in pigs: H1N1, H1N2, H3N1 and H3N2. However, most of the recently isolated influenza viruses from pigs have been H1N1 viruses. Swine flu virus spreads mostly through close contact among pigs and possibly from contaminated objects moving between infected and uninfected pigs. Symptoms of swine flu in pigs can include sudden onset of fever, depression, coughing (barking), discharge from the nose or eyes, sneezing, breathing difficulties, eye redness or inflammation, and going off feed. Swine flu cases occur in persons having direct exposure to pigs. In addition, there have been sporadic cases of one person spreading swine flu to others. Occasional human swine influenza virus infection occurs every one to two years in the U.S. However but from December 2005 through February 2009, 12 cases of human infection with swine influenza have been reported. Moreover swine flu has assumed importance due to recent outbreak of swine influenza A (H1N1) virus infection having been reported in several countries and especially in India also. This pandemic is thought to have been originated from pig farms in Mexico. The recent recording of the swine flu epidemic has been enlisted in table given below which enumerates state wise cases and deaths due to swine flu in India in year 2009.
6.2 Bacterial Diseases

6.2.1 Anthrax

Anthrax is an acute infectious disease of animals caused by bacillus anthracis, a gram positive spore forming organism. Spores of *B. anthracis* persist in the environment and soil for a long time up to many years also and enter the body through cutaneous abrasions, inhalation, and ingestion and multiply to produce enterotoxins. Anthrax is primarily a disease of herbivores and occasionally affects humans. The cattle, sheep, goats and horses are very susceptible to natural infection and the disease is rapidly fatal due to severe septicemia. This was the first microbial disease whose causative organisms were seen under the microscope, the first pathogen grown in vitro; it was the first disease where the four Koch’s postulates were proven by animal inoculation and the first disease where a bacterial vaccine was developed. Human anthrax is most prevalent when direct human contact with infected animals occurs. Anthrax spores are transmitted by contact with infected carcasses, hides, hairs or bone meal. It is endemic in countries like India, Pakistan, Iran, Russia, Latin America and Central Africa. Anthrax is enzootic in southern and eastern India but is less frequent in the northern Indian states. The disease is endemic in Tamil Nadu, Karnataka and Andhra Pradesh. Live attenuated spore vaccine for domestic animals can successfully control disease and stop transmission to humans. The control of the disease requires coordination between public health, agriculture and animal husbandry departments and the industry. The potential use of anthrax bacillus in bio-terrorism is of genuine concern. Penicillin resistant virulent strains have been produced in vitro and are now seen in clinical practice as well. In Maharashtra state, it is highly prevalent in Konkan region and Thane district. It is more common in agricultural regions where it occurs in animals. In the past years anthrax cases have been reported from Andhra Pradesh, Jammu and Kashmir, Tamil Nadu, Orissa, Karnataka and West Bengal. Outbreaks of Anthrax were also reported in Karnataka (1999 and 2001); West Bengal (2000) and Orissa (2003, 2005 and 2006). Cutaneous anthrax is the most common anthrax infection. The disease mostly affects adults and especially males. It is due to high exposure rate in the group.

6.2.2 Leptospirosis

Leptospirosis is an emerging global public health problem. The disease is caused by Leptospira interrogans naturally seen in rodents. These parasitize kidneys and are excreted in rat urine. Man and cattle are incidental hosts. They get infected by contact with water or soil contaminated with rat urine. The disease was first reported in Andaman Islands, India where 60 cases were reported and confirmed by serology and isolation of the causative agent was achieved in 26 cases. The 1980s witnessed a sudden increase in leptospirosis and sero-epidemiologic and clinical studies show that the disease is endemic in Andaman Islands and southern states of India. The sero-prevalence is reported to be high (52.7%) among high-risk population of these Islands and 19.8% and 9.3% in Madras and Bangalore respectively. A multi-centric study in India showed that leptospirosis accounts for about 12.7% of cases of acute febrile illness attending hospitals.
L. interrogans serovar valbuzzi of serogroup Grippotyphosa is the causative agent in human patients and rodents. Outbreaks were reported from Mysore, Gujarat, Nagpur and Andamans in 1997. There was a severe outbreak in Mumbai in May 2000 and Kerala in August 2000, causing significant mortality. An outbreak of leptospirosis was also reported in 102 cases in Mumbai following prolonged water logging due to heavy rainfall during July, 2002 and subsequently during August, 2005. Leptospirosis is widespread in animals in other regions as well- West Bengal, Bihar, Punjab, Haryana and Andhra Pradesh and has been reported to be a common cause of acute renal failure in south India. State wise cases and deaths due to leptospirosis from 2004 to 2007 is depicted below. The conditions that are below critical for maintenance and transmission of the leptospirosis are the presence of microorganisms in the reservoir & carrier host and their survival in the soil. The survival of leptospires in the soil requires the essential presence of adequate moisture and salinity. These conditions are present in the coastal belt of the country. Hence the disease is prevalent in the coastal region of the country. People of some occupational groups, because of their higher chances of coming into contact with source of infection, are at high risk of acquiring leptospiral infection. This includes farmers and farm labourers, conservancy workers, veterinarians, meat handlers and dairy workers. Risk factor studies conducted in endemic areas and during epidemics show, predictably, association between leptospiral infection and occupational or behavioural factors that are likely to result in exposure to sources of infection. Burden of disease due to leptospirosis at global or national levels has not been estimated as yet, but the WHO has constituted a Leptospira Burden Epidemiology Reference Group (LERG) to conduct global research for providing necessary disease burden data. It is one of the six diseases whose incidence or geographical distribution could change by global warming phenomenon

6.2.3 Brucellosis

Brucellosis is one of the world’s major zoonosis that continues to be of public health and economic concern in many parts of the world. Brucellosis affects primarily the livestock and is transmitted to humans by ingestion, close contact, inhalation or accidental inoculation. The prevalence of brucellosis in different geographical areas varies according to animal husbandry practices, species of the causative agent and local methods of food processing. Most importantly it varies with standards of personal and environmental hygiene. Brucella melitensis is the prevalent species seen in man and causes a more severe form of disease. Dogs are carriers of Brucella canis which can be transmitted to humans. The disease has been repeatedly reported in the animals in India. It is estimated that the true incidence is 25 times higher than the reported cases due to under diagnosis. A seroprevalence of 8.5% among dairy workers and 4.2% in aborted women, 17.39% in field veterinarians and abattoir workers, 7.0% patients of PUO in Varanasi city, 0.8% patients of PUO in Kashmir have been reported by various scientists. An extensive serological and microbiological studies in Karnataka was also carried out to assess the magnitude of infection and reported sero-prevalence of 1.6% by standard
agglutination test (> 1:160) and isolated B.melitensis in 43 pediatric patients during a period of 13 years. During the same period 492 adult patients were also diagnosed. From the same state in another study an incidence of 15.69% was recorded from various professionals at risk. These studies thus indicate a moderate to high prevalence of the disease in various parts of India, however timely vaccination with B. abortus 19BA, and hygienic measures being adopted are able to protect the persons exposed to occupational risk.

6.2.4 Plague

It is a bacterial zoonosis with rodents being the principle reservoir. The black rat (Rattus rattus) and oriental rat flea (Xenopsylla cheopis) are notorious reservoir and transmitting agent for human plague in India. The changes in rodent ecology have been identified as the risk factor for reemergence of plague. Plague is an ancient disease which caused three pandemics since the 6th century. The first records showed that there was an epidemic of plague in 1896 in Bombay. According to an estimate the disease took over 12.5 million lives in that year. The disease trend then showed a decline; it almost disappeared from the entire country in early 1960s. After the last laboratory confirmed case was reported in 1966 in Karnataka, there was a lull for almost three decades till two outbreaks were reported during August-October in 1994, an outbreak of pneumonic plague in Surat, Gujarat and the second outbreak of bubonic plague in Beed, Maharashtra. There were a total of 54 deaths (52 in Surat) and 876 sero-positive cases; 596 in Maharashtra, 151 in Gujarat, 68 in Delhi, 50 in 13 Karnataka, 10 in Uttar Pradesh and 1 in Madhya Pradesh. After a gap of 8 years, a localized outbreak of pneumonic plague occurred in Hatkoti village of Shimla district, Himachal Pradesh in February, 2002. A total of 16 cases with 4 deaths were reported. An outbreak of bubonic plague was reported in Uttarakhand in 2004. A total of 8 cases with 3 deaths were reported. The best plague prevention strategy is an aggressive rodent population control. Prevention and control of plague is primarily based on Surveillance, Vector control, Case management, Chemoprophylaxis, Immuno-prophylaxis. The surveillance of rodents and vectors as well as laboratory and clinico-epidemiological surveillance is not a onetime activity and has to be carried out a continuous basis to be effective in prevention and control of plague.

6.2.5 Tuberculosis

Tuberculosis is one of the chronic wasting diseases of public health significance and caused by Mycobacterium species of organism. Infection due to Mycobacterium bovis typically occurs in cattle but has also been reported in other animals including dogs, cats, swine, rabbits, birds and man. Several investigators from western countries have stressed the possible zoonotic importance of bovine tuberculosis. Very limited data on this aspect are available from Asian countries including India.

The incidence revealed by tuberculin testing was found to vary from herd to herd and much related to the concentration of livestock population, disease status in human beings and management practices followed. In some states it is high whereas in other states it is
low to negligible. In one of the survey conducted through tuberculin testing revealed that the incidence ranges from 5-10% but may be increased depending upon the status of livestock and management. Other study conducted in this direction in 152 animals where tuberculin testing was done and the positive reaction was found to be 4.8% in cows, 18.6% in bulls and bullocks and only 2.7% in calves under two years of age. The reactors in buffalo cows and heifers were about 12.5%. The incidence of TB based on the tuberculin testing of 3765 cattle carried out by CADRAD, IVRI between 2004 and 2009 in different states was found to be 1.088%. In an earlier study carried out at this institute, examination of 98 animal clinical samples, 52 turned out to be positive for mycobacterium including M. bovis (19), M. tuberculosis (8), M. chelonae (7), M. avium complex (7), M. avium (8) and M. fortuitum complex (3). (Verma and Srivastava, 2001).

As per other published reports, the overall national incidence of about 5-25% in cattle and buffaloes has been recorded.

All these studies only suggest but do not provide any clear evidence about the transmission chain including the zoonotic importance. Animals transmit infection to each other through ingestion of urine, faeces and lymph, wound discharge, infected milk along with food and water. In the spread of disease from adults to the young stock of animals, milk as a source has been reported. Some investigation have pointed out the risk of human infection through un-pasteurized, untreated consumption of milk or using raw milk for producing cream, butter or dahi (curd) among cattle owners and herdsmen in community. In India, higher incidence of tuberculosis in buffaloes as compared to cattle has been estimated on the basis of tuberculin testing.

A comparative study in animals and human was made using specific nested-PCR (N-PCR) assay designed based on the hub gene of Mycobacterium tuberculosis (Rv2986c) and Mycobacterium bovis (Mb3010c) as a method to differentiate these closely related species. In one of the study carried out using this technology using extra-pulmonary clinical samples obtained from cattle and humans showed pre-dominance of M. tuberculosis (15.7%) and M. bovis (26.8%) in humans and cattle, respectively. However, more importantly, both mycobacterial pathogens (mixed infection) were identified in a number of samples. In humans 8.7% of the samples and 35.7% in cattle were classified as mixed infection. The detection of mixed infection with the mycobacterial pathogenic duo in humans and bovines denotes the prospect of potential transmission of these pathogens from humans to cattle (zoonosis) and vice versa (reverse zoonosis). The TB bacteria is normally killed during the process of pasteurization of milk, however, consumption of raw milk from TB-infected cows may be definitely a cause TB of the intestine or stomach.

### 6.3 Food-borne Zoonotic Diseases

Food-borne microbial diseases account for 20 million cases annually in the world and their incidence is increasing. Nearly half of all known food-borne pathogens have been discovered during the past 25 years. It is difficult to delineate the emerging food-borne infections and intoxications due to the common symptoms. Safety of street food/fast
foods/other foods and fish hygiene has become important recently. Environmental pollution with agricultural chemicals and mycotoxins adversely affect the immune system of both human beings and meat food animals.

Food safety universally recognized as a public health priority and requires a global approach, from production to consumption. Assessment of health status is must with regard to any infectious or non-infectious agent especially zoonotic agents. There is a possibility of animals having ingested / accumulated chemical (drug residues, pesticides, heavy metals, etc.) or physical contaminants (radioactive elements etc.) during their lifetime may be the source of contaminating animal products (milk, meat, fish, eggs, etc.), as meat and its products are one of the important vehicles for a number of diseases. The biological agents most common and/or dangerous and can be transmitted to humans from animal origin food pathogens are : Salmonella, Campylobacter, verotoxinogenic Escherichia coli, Listeria monocytogenes, Toxoplasma, Leptospira, Coxiella burnetii, Brucella, Mycobacterium tuberculosis, M. bovis, M. paratuberculosis, Yersinia enterocolitica, prions and parasites such as Taenia solium, Taenia saginata and Trichinella spiralis. Pathogens causing diseases from milk and milk products may originate from human beings, milch animals, air, soil and water of the farms and may include : Mycobacterium, staphylococcc, streptococcus, campylobacter, salmonella, corynebacterium, leptospira, listeria, E.coli, clostridia etc.

6.3.1. Escherichia coli

This infection causes no signs of illness in its natural host, cattle and sheep, but has a low infectious dose in humans where it causes haemorrhagic colitis and haemolytic uraemic syndrome. It was first described in 1982 associated with consumption of undercooked beef. Ground beef is the most common vehicle for its transmission but can occur in vegetarian and non-beef eating communities, through exposure to fruits, vegetables or water contaminated by bovine or infected human feces. The manure-contaminated irrigation was the source of the largest recorded outbreak affecting more than 7000 children who had consumed contaminated sprouts in Japan. Isolation of Enterohaemorrhagic Escherichia coli (EHEC) in beef, cattle stools and in human patients of diarrhoea have been reported in India. Non-O157 EHEC were reported in 1.4% of stools from cases of bloody diarrhoea in Kolkata. EHEC O157 sorbitol phenotype have been isolated from the Ganges River. The detection of potentially pathogenic O157:H7 in river water is alarming. Some antibiotics enhance EHEC toxin production and induce verotoxin-phages which enhance environmental stability.

6.3.2 Vibrio Cholera

Cholera is one of the oldest recorded infectious diseases. John Snow first demonstrated the spread of disease by infected water; Pacini in 1854, first described comma shaped bacteria in intestinal contents of cases of cholera. Robert Koch in 1883, showed that cholera was caused by these bacilli, V cholerae. The first recorded six pandemics of cholera originated in Bengal and occurred between 1817 and 1923 and the
seventh pandemic started in 1961 in Indonesia. These spread to south-east Asia, Middle East, East Africa, Europe and Americas. The last decade of the 20th century witnessed a sharp increase in the global re-emergence of cholera. In September 1992, V. cholera O139 Bengal (the first non-O1) appeared in south India. These 14 spread to the rest of India and Bangladesh. Subsequent outbreaks due to this organism were reported in Nepal, Pakistan, South East Asian countries and Japan. Some Cases were also reported on the west coast of the United States, England, Germany and Switzerland. The genome of V. cholerae is in a state of constant flux, resulting in the reemergence and displacement of serotypes Inaba and Ogawa. Diversity of the isolates was reported in Delhi during 1992–2000. Changing patterns of V. cholerae in Sevagram, Maharashtra were seen between 1990–2005.

6.3.3 Listerosis

Listerosis is an emerging zoonotic disease. It is estimated that L. monocytogenes is responsible for 28% deaths due to foodborne illnesses in the United States. The organism is ubiquitous and inherently robust and can thus survive foodprocessing and refrigeration of contaminated meat and dairy products. Carriage of the pathogen has been reported in feces and genital tract of 5-10% humans. There has been a significant decline in the disease in countries where active surveillance and sale of dairy products and meat have been regulated. In India, very few studies have been done. L monocytogenes in cervical secretions of 1.3-3% of cases with bad obstetrical history was reported in 1970s but none of the 125 samples of cerebrospinal fluid obtained from cases of meningitis were found positive to the infection.

6.3.4 Campylobacteriosis

Campylobacter spp. are significant zoonotic poultry pathogens and are the leading cause of bacterial gastroenteritis in the world. Poultry carrying the organism remain healthy carriers and transmit by fecal shedding. Around 2.5 million human infections are reported annually in the United States. The disease is more common in children and there is an emergence of fluoroquinolone resistance. In India it is reported in 5–20% in childhood diarrhoea. C. jejuni was isolated in 13.5% of the diarrhoea patients and this was more frequent than combined Salmonella and Shigella (4.3 %.) infections.

6.4 Rickettsial Infections

Rickettsial diseases have a global distribution and recent reports suggest their continuing presence in India as well. The reported numbers are an underestimate as there are no community-based studies and there is a lack of availability of confirmatory laboratory tests. However a review on its prevalence in Himalayas, Kerala and Tamil Nadu were made and studies in these geographic areas have reported the high magnitude of scrub typhus, spotted fever and Indian tick typhus (R.conorii). The rickettsiae are transmitted by arthropod vectors (lice, ticks, fleas or mites). Man is an accidental host except for louse-borne epidemic typhus caused by R. prowazekii. Since most of the
rickettsial diseases are spread through vectors hence vector control is very important for the control of these diseases.

6.5 Chlamydiosis

Amongst various causes of morbidity and mortality Chlamydiosis has been recognized as one of the important infectious conditions and emerging as threat to the livestock due to various disease manifestations & disease syndromes. It has gained an importance and considered as one of the agent responsible infecting both dams and offsprings, producing production losses due to perinatal mortality, abortions, pneumonia, polyarthritis, conjunctivitis, encephalitis, genital infections etc.

The disease was identified in the country during 1973 from the cases of abortion from sheep and goats in India. Later on various workers also reported various disease manifestations in other animals from the country. The incidence has been recorded ranging from 20-70% in sheep and goats, which became as low as 2-15% in succeeding years. No significant role has been reported in experimentally induced infection in sheep and goats. Higher incidence of abortions in both primapara and multipara sheep and goats has been recorded. The perinatal mortalities due to intra-uterine infection have been described to vary from 5-50% both in lambs and kids. It has also been observed that an overall proportional foetal and neonatal mortality rates in lamb and kids during hebdomadal period (0-1 week) was varied in lambs and kids whereas mortalities in post-hebdomadal period (1-4 weeks) declined both in lambs and kids. Most of the mortalities recorded during 0-1 week were within 72 hours after the birth which was attributed to the intra-uterine infection and also the immunosuppression and/or deficiency of immunoglobulin in milk which might have contributed in interfering with the protection mechanisms during the neonatal period.

The transmission of chlamydia from birds to men is universally recognized. 40-50 human cases of infection are reported annually in USA. The disease in men may vary from in apparent infection to severe pneumonia with septicemia and death. Most frequently transit influenza like syndrome is observed with nausea, fever, vomiting, chills and headache. Trachoma like follicular conjunctive may be the only sign. Infection is acquired by inhalation of contaminated particles. The agent was isolated from cerebrospinal fluid of a febrile child exposed to sheep experiencing abortions. The agent was also isolated from human foetus and placentas of several aborting women who had contact with sheep, goats and cattle suffering from chlamydial pneumonia or abortions.

6.6 Mycoplasmosis

Number of important mycoplasmal diseases such as CCPP, CBPP, chronic respiratory syndrome, contagious agalactia, enzootic pneumonia etc has been recoded in the country in recent past in livestock and poultry. CBPP has now been controlled while CCPP is to responsible for morbidity and mortality in sheep and goats. The disease contagious agalactia of sheep and goat is responsible for mastitis, arthritis, and kerato-
conjunctivitis. CRD in chicken is the common poultry disease being recorded regularly, however, the incidence is at present is negligible due to vaccination of poultry population with specific vaccine. Different species of pathogenic mycoplasma have been isolated from genital tract of bovines associated with infertility or bovine reproductive failure, mastitis, vulvo-vaginitis and infertility.

7. Strategies for the Control of Communicable Disease of Livestock Product Origin

Globalization has led to the rapid movement of people, feed and foods including that from animal sources across the countries. As the world becomes more interconnected, infectious diseases spread more rapidly. The threat of spread of communicable diseases is for both human beings and animals. The spread of most of the communicable diseases is possible through animals and animal products with enormous negative impacts on public health, economic, social, ecological and animal welfare. The animal products like eggs, milk, meat or the skin and hide may be contaminated with infectious agents either from endogenous or exogenous sources. The livestock products, especially foods of animal origin have frequently been implicated as a source of human infections.

The issue of these food-borne infections has now become a matter of great concern because of the rise in incidence of such illnesses and the emergence of new food-borne infections. The changes may be attributed to a combination of factors related to changes in demographics, ecology of the animals, housing environment, increasing stocking density, introduction of exotic animals into a region, changing food habits of consumers and mushrooming growth of related food manufacturing units. Globalization of the food supply has exposed the people to the pathogens native to remote parts of the world through foods purchased locally but manufactured in other country. As a result of international travel, people are exposed to food-borne hazards in foreign countries and import the disease as carrier into their home country.

Systematic and reliable information on the occurrence of diseases caused by infectious agents carried through livestock products is not available in comprehensive manner except fragmentary reports. The proportion of infections that can be attributed to foods of animal origin still remains unclear. A number of organisms like *Listeria monocytogenes*, *Salmonella* sp., *Mycobacterium* sp., *Bacillus anthracis*, *Escherichia coli*, *Campylobacter* sp., *Staphylococcus aureus*, *Bacillus cereus*, *Clostridium perfringens*, *Aeromonas* sp., *Yersinia enterocolitica*, foodborne viruses and *Taenia cysts* etc. are found to be involved. The etiologies in many cases remain obscure. The major problem lies in confirmation of diagnosis, and identification and rectification of week areas during production and processing chain. In the light of opening up of global market and the opportunity of India to trade processed milk, meat and poultry products, it has become important to adopt standard Sanitary and Phyto-sanitary regulations and to develop
protocols for these products that can be implemented in Indian context. A holistic approach is now required, especially in the changed scenario of commercialized mass production, SPS and WTO agreement. Problems of developing countries like ours are diverse and at times carry lot of socio-economic importance. An understanding of these problems will help in modifying the approaches for wholesome production and distributions of livestock products. Animal itself, faecal contamination, infected personnel, environment, ingredients, tools and equipments can be source of infection. We have also got a difficult climate for shelf life of perishable products of animal origin. One of the biggest problems is lack of funds for modernization of organized production units, abattoirs, equipments, buildings, lack of trained personnel, irregular water and electric supplies, lack of awareness about communicable diseases and corrective hygienic and sanitary practices. Obviously, a comprehensive strategy based on improving animal husbandry practices, effective monitoring and control of food production and processing, applying food technology with the potential to reduce or eliminate food-borne pathogens and educating persons is the need of hour. Improved surveillance programmes are essential for early detection of food-borne outbreaks and for limiting their spread before they take an epidemic and pandemic proportions. It requires establishment of efficient inspection services as an integral part of public health administration at all levels – production, wholesale or retail. Tools needed to prevent food-borne diseases are already available in form of Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Total Quality Management (TQM), Hazard Analysis Critical Control Points (HACCP), ISO 22000, etc formulated by various agencies like Bureau of Indian Standards (BIS), APEDA, Directorate of Marketing and Inspection, Ministry of Food Processing, Codex Alimentarius Commission, International Commission of Microbiological Specifications for Foods (ICMSF), ISO, FAO, WHO, WTO and various technical books and bulletins. The main constraints in adoption of quality assurance systems are: lack of awareness; high cost for adoption of quality assurance systems; no legal obligation to adopt the quality assurance system; and lack of time frame for implementation of quality.

The epidemiology of communicable infections transmissible through livestock products needs to be understood in changing pattern of agriculture practices like intensive integrated farming, organic farming, advent of GM (genetically modified) foods, climate change, extensive trade and tourism, evolution of microbial variants, drug resistance, population pressure and changing food habits and social behavior of population. There is also need to develop and adopt rapid and specific techniques for exercising effective monitoring and control of food quality to reduce the food-borne hazards. Institutions/organizations working in this field should evolve such kind of ready to use technologies that could aid and assist the researchers, planners, producers and consumers alike in pre-empting likely and hidden danger for the diseases likely to be transmitted through the medium of food and animals/animal products. Epidemiology of food-borne zoonotic
infections has to be elucidated with special emphasis on source of contamination, the environment in which the egg, meat, milk and their products are produced and processed and standardization of HACCP guidelines for different production systems being adopted presently. Planning should be made to control such diseases with people participation up to village level. Number of animals in the area and increase in human population should be taken into account at the time of planning for both short term and long term. People participation and cooperation is must for proper implementation of any plan. Strategic control of communicable diseases through livestock products requires full cooperation from veterinarians, epidemiologists, statisticians, medicos, farmers, food specialists (persons from food industry), health workers, entomologists and common people. The primary aim should be the production of disease free animals and livestock products. There are three ways by which safe and pathogen free livestock products can be produced:

7.1 Control at the Farm Level

It is the foundation of safe food production and may include use of GMP at the farm level, feeding of pathogen free feed to animals (5-20% of feed contains Salmonella organism), regular cleaning and disposal of excreta, vaccination of the animals against commonly occurring infectious agents and avoidance of rodents and pests in the farms. Certain important aspects of management need due consideration to hold on good bio-security measures. Infected animals should be segregated from the healthy herd and quarantine should be practiced before allowing any new animal into a herd. With regards to milk, hygienic practices need to be adopted to ensure that the animal is in perfect state of health and not having mastitis. A regular screening of the dairy herd should be adopted and the milking parlor should be free of manure and be regularly disinfected. Pre-dipping and fore-stripping should be practiced with proper pasteurization, as improper pasteurization is one of the most important sources of pathogen due to bio-film formation.

7.2 Control at the Processing Level

It helps in preventing contamination of good food by unhygienic practices of the handlers. Implementation of HACCP with sound sanitation and hygienic standards in processing facility reduces the incidence of infectious agents. Creation of 16 infrastructure, for example, modern abattoirs with all facilities for clean and unclean operations, electric and water supplies, facilities for killing, bleeding, skinning bays, offal and condemned meat disposal, blood processing, removal and cleaning of entrails, organs rails, facilities for proper inspections by professionally qualified veterinarians like ante and post mortem inspections and laboratory diagnosis, dressing room, cooling rooms (2 – 40C), freezing rooms (- 100C), sterilization rooms and diagnostic labs, provision for waste disposal and effluent treatment, monitoring of health of abattoir workers and their sense of personal hygiene are needed.
7.3. Control at the Consumer Level

It is the most important point for which large scale mass awareness campaigns are needed. Municipal corporations and village Panchayat should take initiative for cleanliness in society by cleaning street, canal, control of insects, collection of garbage at designated closed place, making availability of clean and palatable drinking water, education regarding hygienic production and use of livestock products, etc.

8. Responsibilities of Public Health Veterinarians in Rural Health in India

India’s economy is based primarily on agriculture and more than 70% of the population is rural based having agricultural occupation. Out of 70%, about 67% small, marginal and landless farmers are having livestock and contributing about 62% of the total milk procurement. As the health and other amenities are not so adequate, therefore the population is more vulnerable to occupational diseases.

Public health veterinarians are contributing significantly in rural areas in looking after the health of this section of population, as they are closely associated with them. Therefore, they are contributing to the welfare of the rural masses. The rural panchayat are taking advice and help from them in resolving these problems in emergency situations. They are involved in imparting awareness and educating the rural masses to preserve the health by the following ways:

- Identification and listing of rural health problems and prioritization.
- Selection of suitable strategy and method of intervention for specific problems.
- Identification of factors responsible for diseases in rural community.
- Implementation and monitoring of effect of intervention.
- Estimation of economic losses due to the disease and its impact.

9. Risk Assessment and Management for Food of Animal and Fish Origin

The microbiological quality and food safety of animal products is influenced by many factors like: animal production methods, use of antibiotics, growth hormones and biological, demand of the end users, and the international trade. These factors are important to be considered while an assessment of risks of health hazards associated with live animals and foods of animal origin is made. Therefore, a well structured surveillance system is required to identify public health priorities, detect, delineate and investigate outbreaks, evaluate intervention and provide a detection service compatible with a modern food industry. Similarly, introduction of methodologies for reducing the entry of pathogenic microbes in the food chain with food safety management system and adequate process control could reduce these health risks to the minimum acceptable levels.
The host, pathogens and environment interactions are difficult and complex to be understood, therefore, there is a need of food safety policies and practices which should be in line with available technologies, production methods and food processing techniques to address the food borne diseases in human. The increased demand of meat in recent past has changed the production methods to more intensive resulting into the contamination to a larger extent. This has lead to more intensive farming practiced by the use of promoters and antibiotics in the feed of animals attributing to the drug resistant human pathogens. It has been reported by WHO that approximately fifty percent of the antibiotics produced today are added to animal feed. Therefore, for the microbiological safety of meat and meat products requires concerted effort from government agencies, livestock producers, and meat processors. Similarly, pathogens may gain entry in to the fresh products while production, harvesting, transport and marketing due to contaminated manure, water, equipments and workers.

The international trade of livestock and livestock products is regulated under OIE animal health guidelines as well as SPS Agreement of WTO, in addition to the national regulations. In order to safeguard consumer health and the zoo technical heritage of the importing country, risk analysis has therefore an important aspect both for protecting public and ensuring national agro food industries access to the international markets. Therefore, it has increased the responsibility of veterinary public health for adopting stringent measures at production and processing levels for quality assurance.

Many of the animal have a potential to adversely affect the food safety, food security and socio economic situation of the country but the infectious diseases especially zoonotic diseases including avian influenza, brucellosis, campylobacteriosis, E.coli (O157:H7), Tuberculosis, Swine flu etc have most serious public health consequences and requires stringent measures for consumer’s safety. The extent of risks of contracting zoonoses by people of Pakistan and ultimately by rest of the world may be determined through analyzing the necessary factors and determinants required for emergence or re-emergence of zoonotic diseases. Those factors or determinants are discussed as under:

9.1 Population and Demographic Changes and Behaviors

A total of about 485.05 millions livestock, 489 million poultry and 7.12 million tones of fish along with 1129.6 million human populations in India contribute an increased interaction between these species and provide favorable environment for cross species infection as well as emergence or re-emergence of resistant microorganisms. At the same, an increased ratio of urbanization and changes in behaviors and lifestyles are added factors exposing them to a variety food borne infections of animal origin to a large scale (Salmonella, Campylobacter, verotoxinogenic Escherichia coli, Listeria monocytogenes, Toxoplasma, Leptospira, Coxiella burnetii, Brucella, Mycobacterium tuberculosis, M. bovis, M. paratuberculosis, Yersinia enterocolitica, prions and parasites such as Taenia solium, Taenia saginata and Trichinella spiralis). Vector- borne zoontic diseases are also more likely to be increased due to high density population of Japanese Encephalitis, West
Nile virus, KFD, Dengue etc. The increasing human population is encroaching upon the wild life habitats thus increasing the close interaction with wild life and the diseases are likely to be increased. Ebola and AIDS have been reported to come from Chimpanzee. Nipah virus disease in human and pigs in 1990 was found to be associated with deforestation in Southeast Asia. Similarly, canine distemper killed lions and other carnivores in Tanzania due to increased contact of domesticated and wild animals.

9.2 Globalization

Globalization has led to the rapid movement of people, feed and foods including that from animal sources across the countries and has increased a close interaction for trade, technological advancement and individual needs as well as for development of pathogenic organisms. As the world becomes more interconnected, infectious diseases spread more rapidly. The threat of spread of communicable diseases is for both human beings and animals. The spread of most of the communicable diseases is possible through animals and animal products with enormous negative impacts on public health, economic, social, ecological and animal welfare. The animal products like eggs, milk, meat or the skin and hide may be contaminated with infectious agents either from endogenous or exogenous sources. The livestock products, especially foods of animal origin have frequently been implicated as a source of human infections. Globalization of food supply has been found to be associated with spread of animal diseases in to previously unaffected geographic regions. E.coli (O157:H7) has been found to be carried with vegetable and ground meat too far of places and caused outbreaks in the susceptible human population.

9.3 Movement of Animal and Animal Products

The globalization and increasing population provide opportunities for the pathogenic agents to move across the species while breaking the natural barriers and causing microbial perfect storm resulting in emergence or re-emergence of zoonotic diseases from unsuspected source. Movement of live animals as well as livestock products for import and export is allowed from and to different countries. The animal products including animal casings and meat are being exported to different member countries. The animals are also moved across the country for sale in the livestock markets held in different cities on weekly or monthly basis. Therefore, such movement of these animals and animal products has great potential for spread of diseases locally; however the chances of transmission through authorized trade and routes seem to be highly unlikely due to presence of animal Quarantine and inspection services in the country. The movement of wild life is equally considerable but difficult to quantify in the current information system.

9.4 Ecological Distortion

Global trade has created a vast opportunities for livestock farmers across the globe to earn huge returns that lead intensive livestock farming. This is also true for India where
people are transforming their livestock business from subsistence farming to more intensive livestock farming. The use of fertilizers, pesticides and insecticides in agriculture and livestock farming has drastically polluted the environment; however, organic farming in the country is being encouraged and is being followed in some parts of the country. The intensive farming complemented by urbanization and deforestation has also disrupted the natural ecology like other Asian countries.

The incidence of some of the diseases of livestock and poultry has been increased due to the change in the climate. Further, the movement of animal diseases across physical and political boundaries threatens food security and creates a global public concern across all countries and all regions. It is evident that climate change is altering the distribution, incidence and intensity of animal diseases such as Bluetongue and other vector-borne diseases. Animal diseases are not evenly distributed over the globe. The increase in movement has accelerated the re-distribution of animal diseases and climate change is able to create a new ecological niches for the establishment and spread of diseases into new geographical areas from one region to another e.g. foot-and-mouth disease, classical swine fever, Rift Valley fever etc. New vectors, selection and recombination of disease genotypes may occur due to mixing of animal species and breeds or the introduction of insects and vectors without their natural hosts. Change in climate would result the changes in species composition and interactions which would augment the emergence of unexpected events, including the emergence of new diseases. Climate change has direct impact on vector-borne animal diseases and macro-parasites of animals due to the free stages of these parasites and may also result in new transmission modalities in different host species. Temperate countries will be particularly vulnerable to invasions by exotic vector or arthropod-borne viral diseases. Diseases caused by arthropod-borne viruses (arboviruses) include a large number of arthropod vector-borne (mosquitoes, midges, ticks, fleas, sand flies, etc.) that are often zoonotic, predominantly RNA viruses, that can cause hemorrhagic fevers or encephalitis. Emerging arbo-virus disease complexes are by far the most important and climate change is only one factor altering disease ecologies. The effects of climate change on internal parasites (gastrointestinal parasites and liver fluke) may include changes in the distribution of the parasites and the intermediate hosts. In wet areas, these will become of greater importance. Apart from the effects on pathogens, hosts, vectors and epidemiology, there may be other indirect effects on the abundance or distribution of the vectors’ competitors, predators and parasites.

9.5 Adaptation of Microorganisms and Unknown Microorganisms

India has good capacity and capability for the identification and diagnosis of all types of emerging, exotic and existing zoonotic pathogens identified by the world. The chances of drug resistant common zoonotic organisms not responding to certain antibiotics are increasing in human due to irrational use of growth promoter in animals and poultry.
9.6 Chronic Diseases

Presence of infectious diseases is sometimes found to be associated with certain chronic disease. For example, it has been noted that toxoplasmosis infection is associated with Schizophrenia. Similarly, many of the unknown zoonotic infections may be present that may be triggered any time by other infectious diseases due to immuno-suppression in the current environmental situation.

9.7 Enhanced Surveillance

The country has a well developed disease monitoring and surveillance system and is capable enough to identify unknown zoonotic disease in the country. Presently, HSADL, Bhopal is involved in surveillance of emerging and exotic diseases while IVRI, Izatnagar & PD-ADMAS, Bangalore are conducting diagnostic and active surveillance studies. Recently, the present reporting and surveillance system in the country has already been modified for better surveillance and monitoring.

9.8 Breakdown in Public Health Measures

Recent emerging infections required public health practitioners, public health workers, veterinarian collaborate continuously to identify and control them. India has successfully controlled the outbreaks of HAPI and other diseases. Veterinary services in the country are reasonably effective and India was declared Rinderpest and Contagious Bovine Pleuro-Pneumonia (CBPP) free country by the OIE in 2006 and 2007 respectively following OIE pathway. However, it is very important to maintain country’s freedom status for which continuous surveillance against these diseases has to be maintained. The disease prevention programs exclusively for zoonotic diseases are initiated from time to time and bio-security measures are being implemented and observed at livestock & poultry farms. The disease surveillance system for zoonotic diseases is in place for influenza A viruses, dengue fever and CCHF. Rabies prevention program is also implemented in collaboration with WHO.

9.9 Bio-Terrorism

The use of biological weapons is another area where the country is taking all types of possible steps to combat the situation through an act to reduce the risk of theft of organisms from the laboratories and also to check the likely risk of biological weapons as well as misuse and pilferage of such organisms. The infrastructure and the competency is being enhanced to tackle any adverse situation through contingency plans. Adulteration of food on a large scale, introduction of new disease to crops and action of similar nature by the terrorists may cause food insecurity and disruption in the food supply chain of as country leading to chaos and Law and order situation or may destabilize the system that can favor their cause.
10. Meat Inspection of Food Animals and Fish

Meat inspection service is an essential component of the veterinary services. Inspection services contribute significantly to consumer’s safety, industry and preventive veterinary medicine and disease control.

10.1 Anti-mortem Examination

The animals for slaughter are being brought usually in the livestock markets and sold by the farmers to the butchers and/or contractors. Local State municipal Committees are authorized to establish, maintain and administer livestock markets where no sick animal is allowed to enter the market. The local governments (Municipal Committee, Town Committee, Zila Council) and Cantonment Boards have also been authorized to establish and maintain slaughterhouses as per Prevention of Cruelty to Animals (Slaughter House) Rules, 2000. The local governments also take measures to alleviate diseases of animals and birds and prevention and control of contagious disease among birds and animals and measures to promote public health.

These animals brought to the slaughterhouses are examined by the public veterinarian to assess their health status and are subjected to physical examination for any abnormalities, skin disease, body temperature, lungs auscultation and close examination of natural openings of the animals. As per the regulation, no person is allowed to slaughter the animal outside the approved slaughterhouse except in exceptional circumstances with the permission of local bodies regulating the slaughter.

Before slaughter all the animals brought for slaughter are required to be confined in the stockyard approved by a local authority for at least six hours before being slaughtered where authorized veterinary officer examine the animals for the suitability of slaughter or otherwise in the context of health state of animal and its usefulness for breeding and or draft purpose. The veterinarian also examine for any evidence of any cruelty to the animal or for its emaciated condition or presence of any disease. The animals rejected for slaughter are marked with a distinguishing mark.

The authorized officer by the district administration and or Cantonment Boards may inspect the premises of slaughterhouses and the activities being undertaken in that premises. The Prevention of Cruelty to Animals Act, 1960 (As amended by Central Act 26 of 1982) also empower the veterinary officers to inspect any site or place where the animals are affected or exposed to any contagious disease and can initiate suitable actions for their segregation, isolation or destruction except cow and its progeny as per the Prevention and Control of Infectious Disease Ac, 2009 and disinfect the premises.

10.2 Post Mortem Examination

- All carcasses are examined for any evidence of bruising, hemorrhage or discoloration, local or general dropsy, swellings or deformities of bones, or joints or swellings or other abnormality in the musculature.
The serous membranes (pleura and peritoneum) are examined in every case and sternum, ribs, vertebrae and spinal cord are examined once the carcass is split.

In order to detect any evidence of cysts, an incision is given on each quarter in the musculature.

All viscera, associated lymph nodes and the other organs of the carcass are examined through palpation and incision for evidence of tuberculosis.

The lower cervical, pre-sternal, pre-scapular, and supra-mammary (or superficial inguinal), iliac, pre-crural, popliteal and sub-lumbar glands are examined after their incision for evidence of infection.

The head including the surface and substance of the tongue, palate or roof of the mouth, and lymph gland including retro-pharyngeal, sub-maxillary, and parotid are examined visually and by palpation.

The outer and inner surfaces of stomach and intestines and substance of the spleen together with gastro-splenic and mesenteric glands and omentum are examined along with the liver surfaces, bile ducts and hepatic lymph glands.

The Kidneys and its lymph glands, urinary bladder, and adrenal lymph nodes, uterus, and the substance of the ovaries are also examined.

The contents of the thoracic cavity including lungs & associated bronchial & mediastinal lymph nodes, heart sac are examined for evidence of any disease.

The udder, or testicles and associated gland are also palpated and incised for any evidence of disease. Based on the post mortem examination following decisions may be made:

In case of generalized tuberculosis, the whole carcass is condemned otherwise the affected part of the organ is condemned.

Similarly the entire carcass and all the parts and organs including blood are condemned and seized, if evidence of any of diseases like Actinomycosis (generalized), pronounced anemia, anthrax, blackleg, general extensive and severe bruising with or without gangrene, generalized cystecercus bovis, general decomposition, general dropsy, general emaciation due to disease, acute fever, acute foot and mouth disease, hemorrhagic septicemia, immaturity, stillborn or un-borne carcasses, pronounced jaundice, john’s disease accompanied by emaciation or anemia, caseous lymphadenitis, malignant catarrhal fever, malignant neoplasm unless localized, acute, septic mammitis, generalized melanosis, acute septic metritis, parturition (within 7days), septic pericarditis, gangrenous pneumonia, pyaemia, rabies, Rickets with malnutrition, rinderpest (eradicated from India), generalized sarcocsysts visible to naked eye, septicemia or septic intoxication, surra, tetanus, multiple tumors in musculature, uremia etc. is found.
Flesh or organs or portion of the carcass affected by disease and the organ or contagious portions are condemned in case other than above mentioned diseases are found. Similarly, the flesh or organ or carcass from animals suffering from bacterial diseases of zoonotic importance or presence of poisonous material or toxins is observed and not fit for human consumption need be condemned.

10.3 Meat Inspection at Meat in Retail Shops

The meat inspection of meat in retail shops is carried out by the staff of health services or food authority in the local government. The Director, health services or food inspector or any person is authorized by the government (Prevention of Food Adulteration Act, 1954) to enter into any premises and inspect any market, go down, shop, stall, or other place used for sale, of any food intended for human consumption or for preparation, manufacture or storage of any such food for the purpose of trade or sale. He is authorized to seize and destroy the product on reasonable grounds if the product appears injurious to health, unwholesome, unfit for human consumption.

10.4 Inspection of Milk and Milk Product

Milk and milk products are regulated under Prevention of Food Adulteration Act, 1954. Milk is defined as “the normal, clean and pure secretion obtained from the udder of a cow, buffalo, sheep or goat or other livestock. The terms of skimmed milk and standardized and homogenized milk are used for the treated or processed milk following certain standards. The milk products under the law include cream, concentrated milk, condensed milk, skimmed milk, separated milk, flavoured milk, milk shake, milk drink, dahi (yogurt), butter milk, khoa (milk dried on fire), barfi (a sweet), pera (a sweet), kalakand (a sweet), cheese, dried milk, ice cream and any other product made by addition of any substance to milk, or to any of the milk products used for similar purposes. The food inspector appointed by Health or Food Authority is authorized to conduct inspection in the area of their respective jurisdictions as per the provisions of the above act.

- No person is allowed to sell, keep or store any food including milk intended for human consumption or prepare or manufacture any such food with intent that the same may be sold, which is unsound, unwholesome, injurious to health or unfit for human consumption.
- No person suffering from infectious or contagious disease is employed to milk animal, handle any vessel used for the reception of milk intended for sale, and assist any business related to dairy farming.
- No person can designate milk or milk products as “pasteurized’ unless treated at a prescribed temperature. The pasteurized milk should be negative for phosphatase test and coliform count which should not be more than 10 per ml at any time after pasteurization and before delivery to the consumer.
- No person can designate milk as “sterilized” unless it is filtered or clarified and homogenized after the treatment at a prescribed temperature.
- No flavoring compounds, which are toxic or contain toxic contaminant is allowed in any food. Classified preservative, stabilizers and flavoring agent are allowed in the foods. Antioxidants are only allowed in edible oils and fats in the prescribe limits.
- Any article of food is considered injurious to health and unfit for human consumption if it is putrified, decayed or emits foul smell, infected with insects, evidence of filth or rodent excretion or hair, contains toxic chemical or food poisoning bacteria and contained metals in excess of the tolerance level as per standards prescribed by BIS.

### 10.5 Fish Inspection

The wholesome fish and quality fish products meant for export or local consumption is the responsibility of Fisheries Department at federal & State level. This is being regulated through Prevention of Food Adulteration Act, 1954. Under this Act, no body is allowed to process and export of fish and fish products unless registered with the department. This law also provided that no person shall process and export or market for export or have in his possession for export or deal in any fish or fish products intended for human consumption which are decomposed, unwholesome or contaminated with pathogenic organisms. Food Inspectors are authorized to inspect any fish processing plant to ensure the quality of fish and fish products and is empowered to or dispose off the detained fish in prescribed manner.

### 11. Slaughter House Waste and Dead Animal Management

#### 11.1 Introduction

India has the world’s largest population of livestock with nearly 185 million cattle, 97 million Buffaloes, 185 million Sheep and Goat, 13 million Pig and over 489 million poultry. About 37.5% of Goat, 32.5% of Sheep, 28% of Pigs, 1.9% of Buffaloes and 0.9% cattle are slaughtered every year. The reported per capita availability of meat in India is about 1.4 kg per annum which is rather low compared to 60-90 kg in European countries. As reported by the Ministry of Food Processing, as of 1989, a total of 3616 recognized slaughter houses slaughter over 2 million cattle and buffaloes, 50 million sheep and goat, 1.5 million pigs and 150 million poultry annually, for domestic consumption as well as for export purposes. While the slaughter houses come under the purview of the DAHDF, Ministry of Agriculture mainly for the purpose of funding.

Livestock sector is one of the most important components of agriculture in India. The value of the output from livestock and fisheries sectors together stood at about Rs. 148,954 crores (US $ 31,000 Million) during 1998-99 (Rs. 123,076 crores, equivalent to US $ 28,000 Million, for Livestock sector and US $ 59, 00 Million for fisheries), which
accounts for 27 per cent of the value of the output of Rs. 553,175 crores (US $ 115,300 Millions) from total Agriculture and the allied fields. (Planning Commission, 2001). Meat production is estimated at 4.9 million tones, standing eighth in rank in the world’s meat production. Buffalo in India contributes about 30% of total meat production. The contribution by cattle, sheep, goats and poultry is 30%, 5%, 10%, 10.2% and 11.5%, respectively.

In spite of big potential because of large livestock population, the meat industry in India has not taken its due share. Although India has acquired number one status in the world contributing 13% of world milk production, the meat production is very low as compared to milk. During the last 25 years, it has only increased from 764,000 tones in 1970-71 to 4.9 million tones valued at Rs. 21,900 crores (US $ 4600 Million), (FAO, 2000, Planning Commission of India, 2001). The compound average growth rate during the last two decades works out to 4.6% as against 21% during the last 5 years which shows it, is now the fastest growing segment of livestock sector. The share of bovine meat in the total meat production in India is about 60% as against small ruminants (15%), pigs (10%) and poultry (12%).

There are many reasons for the slow growth of the meat industry, including the negative attitude of public towards meat on account of misinformation campaign, and socio-political considerations. Most meats are sold in the domestic market without proper sanitary inspection by the veterinarians. Mostly small animals, sheep, goats and pigs are slaughtered in unregistered slaughter houses in small numbers ranging from 2 – 10 by the individual butchers and meat is sold fresh on the same day. However, large numbers are slaughtered in the modern state-of-the-art abattoirs following world class sanitary and phytosanitary measures.

11.2 Components of Meat Industry

There are 11 distinct components of meat and meat by-product related industries, namely:

- Weekly/daily Cattle markets trade of live animals dealing in Buffaloes, Sheep, Goats, Pigs, Bullocks;
- Slaughtering the animals by individual butchers for retail in domestic markets;
- Slaughtering the animals in the mechanized abattoirs in Export Oriented Units (EOU) for export;
- Transportation of fresh frozen meat in refrigerated containers from the point of production to the port for export to various countries;
- Marketing and processing of raw hides and skins;
- Marketing and processing of bones for further processing into gelatin, ossein and Dicalcium Phosphate (DCP);
- Production of casings from the intestines;
Marketing and Processing of hooves and horns in the Cottage Industry;
Marketing and processing of blood for production of pharmaceuticals;
Rendering plants for production of meat-cum-bone meal and bone chips
Production of Meat

The healthy disease-free animals are procured from the livestock markets/farmers/feedlots/farms and are rested for 24 hours to produce quality meat. Veterinarians examined the animals during rest period to ante-mortem examination. After their approval, they are slaughtered either under Halal / Jhatka procedure depending upon consumer’s choice. Thereafter, the Veterinarian inspect the carcass to post-mortem examination. After its approval for safety, it is sold in the retail market as fresh meat. The rejected carcasses on post mortem examination are sent to the rendering plant for production of meat cum bone meal and/or buried depending upon the situation.

The meat meant for export has to pass through ante-mortem and post-mortem examination after 24-hour resting period of the animals, like the meat meant for local market and is chilled for 24 hours to bring down the pH below 6. Thereafter, it is deboned and de-glanded. The meat is then packed into different cuts, and frozen at –40 degree Celsius for 12 hours to bring down the deep bone temperature to -18 degree Celsius. The frozen meat is stored in cold storage for export. There is very little processing of the meat. The meat produced for the domestic market is sold as hot meat. Goat/sheep meat is marketed in villages by slaughtering one or two animals once in a week or as special occasions by a group of people joining together and sharing the cost of the meat so obtained. There is not much overhead cost on meat in villages and realization on the cost of skin, blood etc., is poor. In the small towns sheep/goat meat is directly marketed to the consumers from meat shops. Since the time gap between slaughter and the sale is very short, the deterioration of the quality of the meat is less. In the big towns and cities most of the meat is consumed on the same day or kept in a refrigerator in the households. Large ruminants (buffalo and cattle) are slaughtered in big towns and meat is sold directly to the consumers. Poultry meat is mostly sold by slaughtering the live birds in the presence of the consumers. However, there are a few modern processing plants where poultry is slaughtered; chilled and frozen birds are sold in big cities. The export of poultry meat is insignificant. The reasons are that mortality of birds is high, overhead inventories are abnormal. The greatest disincentive is that exporters find the prices quoted in importing countries are not favorable.

11.3 Meat Quality and Safety Measures

Most of the export-oriented meat processing plants in India follow world class sanitary and phyto-sanitary measures as per notification of OIE (a referral institution of WTO). The plants are certified with HACCP (Hazard Analysis Critical Control Points), ISO-9002 and SGS meeting the OIE norms. These measures are for meat safety which starts right at the primary production level either with the farmers raising 5 – 20 animals
or in the feedlot. The identification and trace ability of the animals from production source to the abattoir is completely maintained. It is ensured that animals have been raised under disease free conditions of the diseases related to List ‘A’ of OIE except for FMD which is endemic in a few pockets of the country and has an insignificant incidence (0.001%). India is free from Rinderpest, CBPP, and BSE etc. and has already launched a massive FMD control programme with Central Government assistance to make the country free from FMD. In the HACCP, the Critical Control Points (CCP) are closely monitored at the reception of the animals (procured from disease free areas), ante-mortem examination, post mortem examination, chilling of carcasses at 0 - 4 degree Celsius for 24 hours to bring pH level below 7, freezing of de-boned meat at –35 to –40 degree Celsius for 10 – 12 hours and storage at –18 degree Celsius. All these measures exclude the possibility of transferring any contagious/infectious/zoonotic disease to the importing countries. The in-house quality laboratories in the plants ensure the absence of Salmonella, Listeria and permissible limits of E-Coli, Coliform bacteria. Almost all the export oriented plants follow the safety specifications given by the Meat and Meat Product Order of 1993 issued by the Directorate of Marketing and Inspection, Government of India. In addition, the measures recommended in Codex Alimentarius are also implemented.

11.4 Processing of Meat

There is very little processing and hardly 1% of the total meat produced in the country is used for processing. Pork and Poultry meat are used for production of ham, sausages, patties etc., for the elite market. The meat processors like Venky, Government Bacon Factories etc, produce these products. Meat from small ruminants, namely, sheep and goat is also used for production of traditional Kebabs (Seekh and Shami Kebab). Buffalo meat is basically used in the household for preparation of curries and Kebabs. It is also mixed with vegetables like potatoes, cabbages, turnips, sugar beet to make delicious dishes, to name a few, besides the irresistible Biryani, which is a mix of meat and rice. Buffalo steak is also a delicious product. Both Seekh and Shami Kebabs are delicacies prepared from buffalo meat only, which is liked by all classes of people in India. The buffalo meat has a great water holding and binding properties, and is, therefore, used for industrial purposes in the production of sausages, patties, nuggets, corn beef, ham etc. A large part of the meat in the Philippines, Thailand, Iran etc., is used for the production of ham and corn beef. India’s international trade in livestock and livestock products is mainly in live animals (17%), meat and meat products (82%), dairy products and eggs (1%). At the global level, India’s exports and imports account for only 0.17% of each. Meat and meat products have dominated the exports from livestock.

11.5 Export of Meat

The major export of meat is of buffaloes whereas the export of sheep and goat meat is less. It has been observed that export of buffalo meat has increased significantly in the recent years. The export of buffalo meat in 1997-98 was 176,328 M.T., which was
increased to 243,356 M.T. in 2001-2002 accounting for an increase of 43%. During 2000-2001, the increase was even greater which stood at 47%. The export of small ruminant meat (sheep and goat) has decreased during the last five years. The export of sheep and goat meat registered in ’997-98 was 7546 M.T., which came down to 3915 M.T. in 2001-2002 thus showing a fall of 35%. This has been due to the reduction in the import by Saudi Arabia. Now this market has been opened for Indian meat and the export of sheep and goat meat is expected to be increased.

11.6 Meat Processing Plants

There are 10 fully integrated meat processing plants conforming to international standards set out by OIE. There are other processing plants also which are partially integrated. Most of the above plants are fully integrated where healthy animals are slaughtered and carcasses are de-boned. The de-boned meat is frozen and exported. These plants also have rendering and effluent treatment plants attached to them. Some of the processing plants in Sahibabad, UP, Kirti Nagar Industrial Area in Delhi and Mumbai in Maharashtra, do not have their own slaughter houses, but receive the carcasses of the slaughtered animals from the Government approved Municipal slaughter houses.

11.7 Challenges and Opportunities for Indian Meat Industry

India has already witnessed “Green”, “White” and the “Blue” Revolutions and now going forward to achieve “Pink Revolution”. The Green Revolution had led to self-sufficiency in food grains while White Revolution made India to occupy the Number One Position in milk production in the world and the Blue Revolution brought about the increase in fish production. This clearly proves that the Indian farmer is progressive but need a proper direction. Contribution of buffalo in bringing about the White Revolution in India is well known. Now India is poised to achieve the Pink Revolution through buffalo. If this could be achieved, India would be acquiring the number one position in meat production which is possible by reducing the mortality rate in male buffalo calves (80%) and rearing the animals scientifically for quality meat production. For example, about ten million buffalo calves, which were otherwise eliminated in their very infancy, would become available for quality meat production. This will raise the standard of living of small and marginal farmers in the long run. Meat production has been neglected and has not been given adequate attention. Meat production is intimately linked to quality leather production in which India has already acquired number two position in the world after Italy. If substantive support is given by the Government, both meat and leather can also achieve number one position in the world, like milk. In order to achieve the Pink Revolution, the following steps have been taken by the Government and the entrepreneurs in India and some have already been initiated by the Government and the Private Sector.

11.7.1 Setting up of the State of Art-Abattoir-cum-Meat Processing Plants

The recent trend in India is to establish latest state-of-the-art abattoirs-cum-meat processing plants. India has already established 10 most modern state-of-art mechanized abattoirs-cum-meat processing plants in various States based on slaughtering buffaloes
and sheep. These plants are environment friendly, where all the slaughterhouse byproducts are utilized in production of meat-cum-bone meal, Tallow, bone chips etc. They are also adopting appropriate technologies to obtain value added products. These plants have effluent treatment devices which treat all the washings of abattoirs, lairage etc. to safe water discharge having 30 PPM of BOD. A few more (eight) are under construction. The plants follow all the SPS) measures required by the International Animal Health code of O.I.E. Having no social taboo, like the cow in India, with buffalo slaughter, these plants mostly produce buffalo meat for export. India is becoming a major buffalo meat producing country and will be a main player in the international market with additional establishment of the state-of-art-abattoirs cum meat processing plants and control of FMD in few years to come. There are also four integrated poultry meat-processing plants, which follow SPS measures of international standards and amongst them the largest plant is of Venkateswara Hatcheries.

11.7.2 Packaging of Technologies to Raise Male Buffalo Calves for Meat Production

In India, every year, about 10 million male calves are removed from the buffalo production system due to intentional killing by the farmers to save dam’s milk due to non-remunerative cost of raising male animals, thus incurring a loss of about US $ 11 million per annum. These calves could be salvaged for meat production, which will not only improve the economic condition of the farmers but also would increase meat production for domestic consumption and export market. In India intensive feeding of male buffalo calves has started for meat production. The male calves at the age of 6 - 8 months purchased from the farmers are quarantined for 15 days during which vaccination and de-worming are provided. Thereafter, they are fed on high protein/high energy diet to put on a weight of 120 kg in 4 months to produce quality meat. (Photograph 8) They are never fed on antibiotics, hormones and growth promoters. They are raised in organic farming. Meat from such animals is tender, lean and juicy and goes to the wet market.

11.7.3 Buffalo Rearing under Contractual Farming as Backward Integration to the Modern Abattoirs for Meat Production

A strong need has been felt to establish a production base around each modern abattoir to produce quality disease-free animals as per the SPS requirements of O.I.E. Hind Livestock Development Foundation has established a model backward integration with 110,000 farmers who are raising more than half a million buffaloes in 2,200 villages under contractual farming system. The Foundation is providing animal health, animal feeding and extension management services to the farmers at their doorsteps. The marketing of the animals to the meat plant is organized by the Foundation to pay them remunerative prices. This has reduced the mortality in the male calves as inputs for animal rearing are provided by the Company in vaccination, de-worming and feeds.
11.7.4 Establishing Disease-free Zones for Rearing Animals

India is now fortunately free from most of the trade related diseases listed as per List ‘A’ of the OIE namely, Rinderpest, CBPP, etc. India has also not reported BSE (Mad Cow Disease), however, FMD is still endemic in some parts of the country with negligible incidence. The Government of India has already launched National FMD control programme covering the most important zones identified for the export purpose and expected that with in next 5 years FMD free zones with vaccination would be established in the country which would further boost the meat export. The Project has started with 100% financial assistance from the Central Government and technical support is being given by PD-FMD—an institution under the control of ICAR/DARE. Training of the scientists and veterinarians has been provided and necessary vaccine is being made available for vaccinating the animals. The mass vaccination has started from October 2003.

11.8 Utilization of Slaughter House By-products

The mechanized slaughter houses produce huge quantities of offal and digesta from the slaughtered animals which could be profitably utilized for production of value added products, like Meat-cum-Bone Meal (MBM), Tallow, Bone Chips, Pet Foods and methane as a source of energy for value addition in most of the modern plants. MBM contains about 50% of good quality protein and is a cheaper source of protein for poultry feeding. It is a good source of lysine and other sulphur containing amino acids. Similarly, tallow is a cheap source of energy for broiler production vis-à-vis the vegetable sources which are expensive. Tallow is also used for soap manufacturing. The rendering plant cooks the byproduct at 133 degree Celsius at Bar 3, which completely sterilizes the MBM and destroys the prion causing BSE in the animals.

11.9 Pet Food Production

India has a large number of dogs and cats, which are kept as pet animals; however, there are only very few companies which have recently come forward for producing pet food. The international market is vast and demand of pet foods runs into billions of dollars. The slaughterhouses produce large quantities of raw material for pet food, which need to be commercially exploited.

11.10 Employment Generation

About 40 million people are engaged in meat sector, namely, trade of live animals, hides, bones, casings, horns and hooves etc. This sector when organized on scientific lines will generate more employment in rearing of animals on scientific lines and processing of slaughter-house by-products for allied industries.

11.11 Globalization of Trade and Removal of Trade Barriers under WTO Agreement

Most of the Asian countries are developing countries and are having a great disadvantage on account of globalization of trade and removal of trade barriers under WTO Agreement. Though, they have plenty of natural resources, but have not developed
technologies to harness them. With the removal of quantitative restrictions on imports, many developed countries are dumping their produce at a very low price compared to indigenous products, as they have the twin advantage of subsidies from their country as well as ultra modern technologies with nil or very little production losses. Take the example of chicken legs that are being produced in developed countries giving lot of subsidies in production as against Asian countries. The developed countries should completely eliminate the subsidies on the raising of the animals for production of food so as to have level playing fields. Similarly, the Governments of the developing Asian countries should, therefore, give at least 10% subsidy to the meat and milk industry, and also establish R&D units so that the benefits should percolate to entrepreneurs. Simultaneously, some agency must be formed which should exercise quality control on imported items in the larger interest of indigenous industry.

11.12 Issues for Buffalo Meat Development

In India due to religious bias, cattle (cow and its progeny) are not slaughtered since the majority of Hindu community does not eat beef. Further, even the non-vegetarian population which consists of about 70% of meat eating population, and its products, eat meat only 2 or 3 times in a week. Therefore, Indians are considered to be vegetarian. Since buffalo meat is not consumed to the extent to which it has the potential, it is surplus for export unlike goat/sheep/poultry meat, which is consumed by all non-vegetarians. In order promote buffalo for meat production following issues deserves serious consideration:

11.12.1 Discrimination Against Buffalo

Buffalo is not a draught animal only but also gives milk and meat to the teeming millions at affordable prices. However, this animal has not been given its due place in the livestock sector. Paradoxically, it is discriminated against merely on account of its dark color. This is clear apartheid against buffalo in relation to its other cousins. On the other hand, it will not be an exaggeration if buffalo is recognized as black gold.

11.12.2 Buffalo as a Tool for Food Security and Rural Employment

Buffalo if reared properly in hygienic environments, would provide food security and rural employment to the small and marginal farmer. This would be possible only if its byproducts are exploited ingenuously for benefit of mankind. Buffalo produces good quality of milk and meat. Its meat is lean, low in cholesterol and has excellent blending quality for production of corn beef, hot dogs and sausages.

11.12.3 Price Parity with Cattle Beef

The international prices of buffalo meat are low as compared to the cattle beef. On the contrary, the prices of buffalo meat should be higher as it is lean, has low cholesterol and there have been no incidence of BSE from any part of Asia in buffalo. When raised in feedlot on high protein/high energy diet, the buffalo meat is tender and juicy as that of beef.
11.12.4 **Organization of Meat Sector – Harmonization of Standards for Buffalo Meat**

There is need for harmonization of national standards for buffalo meat on the lines of beef.

11.12.5 **Proper Organization of Cattle Markets**

The meat animals are raised by the farmers, namely, sheep, goats, pigs etc. The farmers in small hold farming also raise the large animals. There are three stages through which the animal passes as has been shown in the figure below. At each stage, 15 – 25% cost is added till the animal reaches the slaughterhouse which excludes the cost of transportation. The surplus stock is sold to the primary trader in the village itself or it could be taken by the farmers to the weekly animal markets near the village where the secondary traders who are financially better off purchase the animals from the small collector. This trader also purchases the animals from the market to supply them to the main slaughterhouses for export. Usually, this should be the stage at which Municipal/State Government Veterinarian should carry out examination of each animal to ascertain that it is fit for slaughter and also fit for human consumption. The Government ought to modernize the cattle markets where end users should have an access to the farmers’ animals rather than the involvement of the agents in between. There should be a weighbridge and purchase prices should be displayed. This will give proper price to the farmers.

11.13 **Research and Development in Meat Sector**

In India, there are many research Institutions specifically meant for buffalo production e.g. CIRB, Hissar; NDRI,Karnal; NDDB,Anand; Pradeshik Dairy Development Federation etc. Recently, ICAR/DARE has established a NRC on Meat in Hyderabad for meat research, though, IVRI, Izatnagar is also involved in meat research. It is evident that there is a sea change in the meat industry during the last one decade and the state-of-the-art fully integrated slaughter houses with meat processing plants have been established. The trend towards establishing feedlots to raise meat animals has started with launching of FMD Control Programme would be able to witness the “Pink Revolution” in the country in the 21st Century.

11.14 **Production Policy**

Animal slaughter for domestic consumption is mainly carried out either in small corner shops or in slaughterhouses approved by the municipal corporation (a local regulatory body). According to the Animal Husbandry database of the DAHDF, there are a total of 5,520 recognized and 4,707 unrecognized slaughterhouses in the country as of 2006. Livestock trading in India is done in state government regulated livestock markets. Supervision of the markets “direct operations is the responsibility of local authorities such as municipal corporations. Some markets are also privately owned but their regulation falls under the model Agricultural Produce Marketing Act’s (APMC) provision for running private livestock markets.
The processed meat sector, formerly regulated by the Ministry of Food Processing Industries (MOFPI), is now regulated by the Food Safety and Standards Authority of India (FSSAI) through the Meat and Meat Products Order (MFPO), 1973. The MFPO contains standards for the licensing of meat processors and regulates the standards for domestic production and sale of meat products. It also enforces sanitary maintenance of strict controls at all stages of meat (including fish and poultry) products production. The Ministry of Health and Family Welfare regulates both domestic production and importation of meat and meat products, through the standards laid out in the Prevention of Food Adulteration Act and Rules. The export of raw meat (frozen/chilled) is regulated by Raw Meat (Quality Control and Inspection) Rules, 1992. The GOI regulates compliance with animal welfare and animal transportation rules through the Prevention of Cruelty to Animal Act, 1960.

12. Estimation of Residues in Food of Animals and Fishes

In the era of modernization and industrialization man has contributed pollution to the life and ecology of plants, animals and microbes. Increased demand for food and fiber has lead to the chemicalization of agriculture and we have reached on such a stage that modern agriculture is dependent on high yielding varieties, which can only be grown under the influence of fertilizers and pesticides. Pesticides are the man made chemicals which are being used to produce enough cheap food. Greater attention from a public health aspect is needed on the safety of tissue residues as a result of indiscriminate use of pesticides, insecticides, herbicides and the expanding general increase of chemicals and drugs in the food supply.

With the change in the traditional faming system to more intensive farming, there is an increase in the demand for foods of animal origin associated with increase in human population. This has prompted the use of drugs and hormones in food animal for better production which has resulted to the problems of drug residues in the tissues due to their systemic absorption due to improper drug metabolism. These drug residues has not only caused drug resistant human pathogens, toxicity and allergy among susceptible humans but also proved to be a trade barrier.

Chemicals and drugs including antibiotics employed for chemotherapeutic and prophylactic purposes are also used as feed additives to promote growth, improve feed efficiency and synchronize the reproductive cycle and breeding performance which may further lead to residual toxicity. The use of pesticides and insecticides create problems of environmental pollution, resistance and serious health hazard to man and animals. In general, harmful effects of drug and chemical residues may be carcinogenic, teratogenic, reduction in reproductive performance, drug allergy and acute toxicity or poisoning. From a public health point of view, veterinarians have more sincere responsibilities for ensuring the proper use of drugs in food animals. Keeping in view, analytical laboratory
methods should be employed to find out minute quantities of drug residues in animal tissues and to detect the level of residues in meat, milk or eggs or fish used for human consumption.

Joint expert committees of WHO and FAO have mentioned that before a drug product is approved for use in food animals, scientific evidences must be presented to show that the product is safe and efficacious for use in the target animal. Further, these organizations have also established maximum residue limits (MRLs) to safeguard the public health without hampering the international trade. Any food or food product of animal origin exceeding the prescribed limits of drug is forbidden for sale, consumption and export.

Proper use of drug products to protect the public health is one of the chief responsibilities of the veterinarian and livestock producer. Most of the residues found in food products of animal origin, are due to misuse of drug or chemical preparations such as feeding unapproved or unauthorized medicated feed to animals and slaughtering of animals before observing the required period for withholding of drugs or chemicals. In accordance with the prescribed directions of the drug product, the safety levels must be strictly observed so that meat, milk, or egg products or fish may not contain illegal residues when they are sold for human consumption.

In assessment of safety, it is necessary to determine tolerance level and withdrawal time of a drug or chemical residues prior to slaughter of livestock and poultry. This is essential from a public health point of view because levels of residues in edible tissues may produce adverse effects when consumed over a longer time of span.

A tolerance level is the maximum allowable concentration of a drug or chemical in feed or food at a specified time of slaughter, processing, storage and marketing up to the time of consumption by animal or human. The withdrawal time is the time required for the residue of toxicological concern to reach safe concentration as defined by the tolerance. It also refers to the interval from the time an animal is removed from medication until the permitted time of slaughter. The interval is not intended to safeguard the health of the animal but is required to minimize or prevent toxic levels of drug residues in edible tissues for human consumption. Whenever drug or chemical preparations are administered to food-producing animals, the veterinarian must alert the livestock owner to the necessity of withholding animals from market during and following the treatment period as per WHO norms. The addition of antibiotics in meat, milk and eggs must not be permitted. However, if use of antibiotic is necessary (e.g. for the treatment of disease), a withholding period must be followed to avoid residual toxicity. The WHO recommended that an antibiotic exceeding 100 ppm must be given only under the guidance of a Veterinarian and it must be discontinued for sufficient time prior to slaughter. Heavy responsibility is therefore placed on the veterinarian and livestock producer to observe the period for withdrawal of pesticides, insecticides, antibiotics and other drugs prior to slaughter the animals to assure that illegal
concentrations of drug residues in meat, milk, and eggs do not occur.

The public health significance of residues toxicity has been given less importance which needs to be reviewed. It is further observed that no well planned study has been executed on residues toxicity in edible tissues used for human consumption. Therefore, a well planned research programme has been undertaken by DARE/ICAR in the country which will explore valuable aspects of antibiotics, feed additives and pesticides residues in food products to detect their concentration with regards to public health welfare. The data would provide relevant guidelines to employ the safety levels of antibiotics, feed additives and pesticides used in veterinary practice.

Meat and meat products & Milk & Milk products are being exported to various countries and a wide range of antibiotics / antibacterial is used as therapeutic or prophylactic and growth promoting agents in food producing animals (particularly in poultry) which are responsible for tissue residues. In addition, self medication without understanding the sub-lethal about the dosage and withdrawal periods of drugs is some times problematic. The export of animal food products and byproducts is strictly restricted to the testing of these products in accordance with the SPS regulations of WTO and be limited to acceptable levels of any drug/pesticide residue in the product.

The Drugs Controller of India under MoH and FW is only the authorized person to issue permit and license for the use of any drug including hormones, chemicals etc. in human and veterinary practice and such drugs to be used in food producing animal is being viewed seriously.

Regular training and awareness of professionals and farmers is being arranged by State institutions both in human and veterinary fields. The veterinary service is being strengthened in terms of equipment, training and their mobility for early identification of pathogens and rational use of drugs for treatment of animals. The drugs residue testing and quality assurance laboratories are further strengthened and upgraded in terms of trained manpower, equipment and testing facilities all over the country.

Different departments of MoA and MoH and FW are responsible to ensure compliance of SPS standards by the exporters / importer of foods of animal origin and issue health certificates based on laboratory results only and satisfy himself about the consignment of food of animal origin as safe for human consumption. State Fisheries departments are regulating the export of fish and fish products. The quality control laboratories ensure the wholesome of fish and fish products both for local consumption as well for products to be exported. The capability is further being strengthened by equipping the laboratories in terms of equipment, trained manpower and accreditation of laboratories by ISO certified organization.

The milk is grossly regulated in terms of drugs residue and adulteration by bleaching powder and urea fertilizers is being published regularly in the print media. The fresh and frozen processed poultry meat has been infrequently subjected to veterinary inspection
for their suitability for human consumption locally. Limited surveillance system for microbiological contamination and drug residue is present. National veterinary laboratories distributed all over the country are regularly processing and testing meat and fish sample procured from the retail markets for drug residue.

13. Common Regulations for Zoonotic Disease Control of Food of Animal Origin

Every country has its own rules and regulations which regulate the trade, import exports, animal disease control, food safety and animal welfare and veterinary education. Following European Union as Model, SAARC countries are agreed to harmonize rules and standards for food products as well for control of zoonotic diseases.

13.1 Animals and Animal Products Trade

South Asian Free Trade Agreement (SAFTA) requires the countries in the region to have a uniform regulatory framework coinciding with international standards as per WTO, OIE and Codex alimentarius. Under this framework all member states of SAARC are required to establish a National Contingency plan for livestock disease epidemics. Similarly harmonization of standards of products of animal origin is also among the top priorities of the SAARC. India has already developed contingency plan for HPAI and other diseases like FMD, PPR and Hemorrhagic septicemia.

13.2 Animal Disease Control

In order to reduce the risk of spreading infectious diseases including zoonotic diseases continued surveillance, timely information and joint epidemiological measures are warranted at the regional level. Veterinary services across the country have been strengthened in terms of training, equipment and mobility. A network for disease surveillance have already been established for regular reporting of animal diseases including notifiable diseases A state-of-art National & Regional Referral Veterinary Laboratories have already been established and are strengthened. Active surveillance network for HAPI has also been established across the country and are strengthened in terms of staff and equipment. Rapid response teams are on alert in the country for livestock and poultry diseases.

13.3 Food Safety and Animal Welfare

As far as the harmonization of standards for products of animal origin at SAARC level is concerned, standards for meat and meat products have been shared by India through SAARC Secretariat. India has also participated in the Milk Grid initiative of the SAARC. Milk standards are being made in accordance with codex alimentarius.

13.4 Veterinary Education

Harmonization and standardization of veterinary education at region level has been anticipated to ensure competent professionals for the regional services. In India, the veterinary education is being imparted through a National Institute (IVRI, Izatnagar)
supported with 45 SAU’s/SVU’s where under-graduate and post-graduate education is imparted. Indian Veterinary Council Act, 1984 regulate veterinary education and practice in the country while Higher Education is regulated by DARE/ICAR through different institutions under NARS. National Academy of Veterinary Science (NAVS) regulates the professional competency in the country and recognizes the professionals of high quality. Continuing Veterinary education is also being imparted to the field veterinarians.

14. Initiatives Undertaken for Progressive Control of Trans-boundary Animal Diseases (TADs)

Highly Pathogenic Avian Influenza (HPAI), Foot & Mouth Disease (FMD) and Peste des Petits Ruminants (PPR) have been recognized as trans-boundary animal diseases to be contained through regional collaboration. So the thirteen SAARC summit during 2005 had agreed to establish Regional Support Unit (RSU), Regional Epidemiological Center (REC) and three diagnostic laboratories through collaboration with OIE and FAO under Global Framework for containment of trans-boundary animal diseases (GF-TADs). European has now agreed to fund these initiatives under Regional Cooperation Program on Highly Pathogenic and Emerging Diseases (HPED) in South and South East Asia. Moreover, national initiatives have also been taken to control trans-boundary animal diseases in the country by implementing certain Projects/schemes with the internal financial and technical assistance.

14.1 National Project on Rinderpest Eradication (NPRE)

The objective of the scheme is to strengthen the veterinary services and to eradicate Rinderpest and Contagious Bovine Pleuro–pneumonia (CBPP) and to obtain freedom from Rinderpest infection & CBPP as per the pathway prescribed by OIE, Paris followed by the physical surveillance to maintain freedom status. India was declared Rinderpest infection and CBPP free country by the OIE in May, 2006 and May, 2007 respectively. However, it is very important to maintain country’s freedom status for which continuous surveillance against these diseases has to be maintained and annual report confirming the freedom status submitted to the OIE. The physical surveillance through village, stock route and institutional searches is being undertaken throughout the country. Central Project Monitoring Unit (CPMU) with the existing staff is also proposed for strengthening.

It is proposed to control and eradicate the PPR in a time-bound manner similar to the lines of Rinderpest eradication. All the susceptible livestock and the followers (approx. 30%) in the country will be vaccinated in a phased manner over two phases. It is expected that the disease will be fully controlled and subsequently eradicated. The states included in the first phase provide the advantage of natural barriers, adequate availability of infrastructure and their readiness to implement the programme.
14.2 Establishment and Strengthening of Existing Veterinary Hospitals and Dispensaries (ESVHD)

In the present era of globalization, the primary challenges in livestock sector revolve around veterinary practice and disease control not only in animals, but also extend to food safety, human health and environmental concerns. The situation calls for strengthening of veterinary services to meet these challenges while also improving the quality of the services rendered. In order to reduce morbidity and mortality amongst livestock due to various diseases, efforts are being made to provide better health care through polyclinics/ veterinary hospitals/ dispensaries/ first-aid centers, including mobile veterinary dispensaries. In view of low priority accorded to the livestock health, the federal govt. has taken initiative to undertake the programme for improving the veterinary infrastructure in the country. The need is to set up new veterinary hospitals and dispensaries and to equip the existing ones. On the basis of detailed studies, norms for a veterinary hospital and a veterinary dispensary have been worked out.

14.3 National Foot and Mouth Disease Control Programme (FMD-CP)

The FMD Control Programme was initiated in 54 identified districts spread over eight states and five union territories in the country with the objective of creating several FMD-free zones. In these districts, an estimated 30 million cattle and buffaloes are being vaccinated twice a year. The programmes have started showing desired results in terms of reduction in the incidence of disease in these districts compared to other areas. With the initial success observed in the control of FMD in the 54 districts, there is a need to sustain the programme in these districts but also to expand it further to cover larger area. It is now proposed to take up larger, uninterrupted and contiguous areas for FMD Control Programme so as to eventually cover the entire country by expanding to another 167 districts in States/ UTs covering whole of southern peninsula, including Maharashtra, Goa and Gujarat. Most of the disease incidences are reported from the southern states, therefore, the control programme will also benefit from the availability of natural barrier of sea on three sides. In addition, all remaining districts in the State of Haryana and Punjab will be covered which would provide a geographically contiguous area and yield desired results for the creation of FMD-free zones as per OIE guidelines. It is expected that with the implementation of a planned control programme covering the whole country in a phased manner, the vaccination will be gradually stopped and the entire country declared free from the FMD by the year 2025.

14.4 Creating Poultry-free Zone in Identified Areas Bordering Bangladesh

In view of the endemic nature of the Avian Influenza in Bangladesh and absence of adequate measures being implemented in that country to control and contain the disease, it is necessary to check entry of poultry and poultry products from that country. However, porous nature of the border and long-standing social and cultural links between the
people on both sides makes the task difficult. A measure contemplated in this regard is to attempt poultry depopulation in an identified 5 kms bordering area with Bangladesh. It is proposed to be attempted on a pilot scale in one of the most vulnerable districts of States bordering Bangladesh. The poultry-free zone created through preventive culling will be maintained till improvement of Avian Influenza situation in Bangladesh. This will prevent spread of the infection through bird-to-bird contact and also enable strict enforcement of the ban on movement of poultry and poultry products from across the border.

14.5 Creation of Nucleus AI Cells in Vulnerable States

On the basis of the experience gained in tackling various episodes of bird flu, it is felt that there is a strong need to crate a standing mechanism, which should engage itself on an on-going basis to first ensure that all efforts are made to prevent its occurrence, and in case it occurs, to respond to it like a well-oiled machine. For the purpose, there is a need to create dedicated Avian Influenza cells involving deployment of veterinary officers at least in the states, which are considered to be highly vulnerable to the disease. These cells would be manned by Officers/ staff of DADF and fully funded by the Government of India and, inter alia, perform following functions:

- Monitoring of defined parameters associated with potential for occurrence of Avian Influenza.
- Coordinating with the concerned states to ensure their preparedness against the disease and alerting the DADF of any issue that may adversely impact on efforts to prevent, control and contain Avian Influenza.
- To maintain close liaison with state/ district/ block level veterinary officers in order to ensure regular collection of samples and prompt reporting of any unusual mortality.
- Maintaining a reserve stock of PPE kits/ disinfectants/ chemicals etc.
- Coordinating the information, education and communication campaign for Avian Influenza.

14.6 National Animal Disease Reporting System (NADRS)

In the prevailing situation, many times animal diseases assume serious proportion before control and containment steps can be initiated, thereby causing avoidable social and economic costs to livestock owners and the country’s economy. Therefore, it is proposed to introduce a computerized system of animal disease reporting, linking each Taluka/ Block, District and State.

Headquarters to a Central Disease Reporting and Monitoring Unit at the DADF in New Delhi. The reporting system will enable the Block, District and State animal health officials to report the disease information and render reports and returns prescribed reports via internet. The system will be so designed as to assure secure data transfer and confidentiality of information. At the apex level, NADRS will compile and generate
animal disease information for the country as a whole. The users will have access to the information as per permissions in consonance with their role and responsibilities envisaged under the system. This computerized system will enable fuller and timely reporting of the animal disease situation in the country, enabling its effective management.

14.7 Avian Influenza – Preparedness, Control and Containment

The programme has been initiated by the Govt. for the control and containment of HPAI outbreaks as well as to prevent the ingress into the country.

- Culling of the poultry population in the affected zones of 0-3 Kms.
- Continuous strengthening of preparedness to tackle any future eventuality in terms of upgrading of laboratories, training of manpower, stockpiling of materials for control and containments etc.
- Sensitization of general public on Avian Influenza through information, education and communication campaign.

14.8 Up-Gradation and Establishment of Animal Quarantine Stations

In order to fulfill the WTO requirements for import & export of Animal and animal products in the context of SPS agreement, upgrading the infrastructure as well as to build the capacity of animal quarantine station in terms of trained manpower, equipments and mobility is being undertaken with the establishment of new quarantine stations at Bangalore & Hyderabad in addition to the strengthening of existing quarantine stations at Delhi, Kolkata, Chennai and Mumbai.

14.9 Program on Surveillance of Wild Birds and Domestic Animal along Migratory Flyways for Strengthening of HPAI Control in Asia

World Organization for Animal Health (OIE) has organized a Program on Surveillance of Wild Birds and Domestic Animal along Migratory Flyways under OIE/JTF Project for Strengthening HPAI Control in Asia. An OIE Study Mission has visited the High Security animal Disease Laboratory (HSADL), Bhopal to assess its needs for further strengthening its capacity and capability regarding avian influenza (Bird Flu) under OIE Asia Pacific Program of Strengthening of Laboratories for Highly Pathogenic Avian Influenza (HPAI). Based on the capabilities, this laboratory has been designated as referral laboratory for the diagnosis of Avian influenza.

14.10 Programme on Effective Molecular Vaccines Against FMD

Collaborative programme with USDA-ARS has been undertaken under Global FMD Research Alliance (GFRA) with the objectives to assess the vaccine molecular epidemiology in the country.
14.11 Diagnostic laboratory Network coordination for FMD surveillance and vaccine evaluation in South Asia. FMD sero-monitoring and sero-surveillance in the SAARC region has been initiated with the help of FAO.


14.13 Strengthening of Cross – Border Activities among Bangladesh, India and Nepal to Control Possible Cross border Spread of High Pathogenic Avian Influenza (HPAI) (OSRO/RAS/701/USA)

The project was initiated with the help of FAO with the objectives to contribute to the elimination of the threat of HPAI posed by cross-border activities in Gangetic plain sub-region of South Asia and also to strengthen the capacities of continuous sharing on epidemiological environment in the region.

14.14 National Project for Cattle and Buffalo Breeding (NPCBB)

The project was initiated during October 2000 over a period of 10 years in a phased manner. It is now in Phase-II to consolidate the gains made earlier and main focus on the development and conservations of important indigenous breed along with health care. The project is operational in 28 States and one UT. Under the programme a special emphasis is given for the quality semen for breeding purpose, development of Minimum Standard Protocols for semen production (MSP), ISO and HACCP certification of the semen stations, testing of bulls for infectious diseases, quality control and training of professionals.

14.15 National Dairy Plan

It is strategic plan to achieve a target of 180 million tonnes of milk production annually by 2021-22. Milk production is expected to grow at four percent with an annual incremental output of five million tonnes in the next 15 years. The Govt. is now contemplating to enhance the milk production in major milk producing areas, strengthen and expend infrastructure to produce, process and market milk through the existing and new institutional structures. This plan envisages breed improvement through AI and through natural service, setting up of plants to augment cattle feed, by-pass protein and mineral mixtures. World Bank is being approached to assist in the on-going activity.

14.16 Strengthening Infrastructure for Quality and Clean Milk Production

With the increase in milk production, quality standards today in milk production, milk collection and processing need improvement. Due to the microbial contamination the milk is not suitable for human consumption. In order to compete in international market for export of milk and milk products and to meet SPS requirements, it is imperative to produce products of international standards. The scheme is being implemented in the State Govt. and UT’S.
14.17 Dairy Venture Capital Fund

This scheme has been undertaken to bring the structural change in the un-organized sector, measures like milk processing at village level, marketing of pasteurized milk in a cost effective manner, quality and technology up-gradation to handle commercial scale using modern equipments and management skills.

14.18 Buffalo Rearing under Contractual Farming as Backward Integration to the Modern Abattoirs for Meat Production

A strong need has been felt to establish a production base around each modern abattoir to produce quality disease-free animals as per the SPS requirements of O.I.E. Hind Livestock Development Foundation has established a model backward integration with 110,000 farmers who are raising more than half a million buffaloes in 2,200 villages under contractual farming system. The Foundation is providing animal health, animal feeding and extension management services to the farmers at their doorsteps. The marketing of the animals to the meat plant is organized by the Foundation to pay them remunerative prices. This has reduced the mortality in the male calves as inputs for animal rearing are provided by the Company in vaccination, de-worming and feeds.

14.19 Special Livestock Project Suicide Prone Districts

A number of districts in the states of Andhra Pradesh (16), Maharastra (6), Karnataka (6) and Kerala (3) have been identified.

The main components are as follows:-
- Induction of high yielding milch animals.
- Calf rearing programme.
- Providing cattle/buffalo breeding services.
- Provision of health care to dairy animals.
- Establishment of milk chilling plants.
- Feed and fodder supply programme.
- Establishment of fodder blocks making units.
- Fisheries programmes
- Conducting fertility camps.
- Pregnant animal feeding programme.
- Goatry, piggery, poultry and sheep farming.
- Pen and cage culture.

14.20 Future Plans

The future road map has the mile stones in the shape of entering into global Food Trade Market, controlling Trans-boundary Animal Diseases of trade and economic importance and socio-economic uplift of poor small livestock farmers. As per National Agricultural Policy more emphasis is being focused for better animal husbandry practices
and health care with improvement and development of disease resistant breeds against some diseases; feed and fodder availability, food safety and harmonization in processing of products following international standards.

15. Interdisciplinary Collaboration for one World one Health Initiative

One world one health concept formerly known as one medicine advocated the integration of human and veterinary medicine to improve the health and well being of both animals and human. Many Countries have embraced the One Health Initiatives and the foundation of this concept was originated way date back in 19th century when Robert Virchow stated, “that there is no dividing line, nor there should be between animal and human medicine”.

This concept emphasized the need for interdisciplinary collaboration and communication in all aspects of human and animal health care including common educational curricula for medical, veterinary and public health institution; effective communication through publishing respective research and clinical findings in common journals and communication at conferences or seminars and other networks; considering and sharing the possibility of cross species disease transmission while diagnosing, treating and controlling diseases both in animal and human settings; conducting joint research of cross species disease transmission; developing effective tools for prevention and control of diseases in animal and human and developing effective media communication for the public.

The one world one health concept is not well perceived in the country so far. There is very low sensitization on the part of policy makers and little realization on the part of stakeholders including physician, veterinarian, ecologist and other related scientific disciplines or organizations. The major constraints in this regard are the absence of single entity under which professionals belong to different discipline can work together for one health, inadequate legislative cover for collaboration between ministries having their own mandate (e.g. MoH & FW, MoA, MoEF, MoFPI, State Govts.) providing health, veterinary and environment related services and the conventional mindset towards showing reluctance to share information, financial and human resources.

Despite all these constraints, India has developed better collaboration in all aspects for the control of Highly pathogenic avian influenza (HPAI) during 2006-2010 and other contagious diseases where decision makers from all the ministries, scientists and basic health care of both human health and animal health, private organization and international organization including WHO, FAO, USAID, EU and world bank collaborated jointly to control such diseases in India successfully including avian influenza. Similarly following efforts or initiatives are being made directly or indirectly towards achieving the objectives of the one world one health concept:
Professionals participated in the meetings on the One Health initiatives in Bangladesh.

Constituted of National task force for communicable diseases.

Scientists from HSADL have trained in Australia and CDC, Atlanta under Field Epidemiology and Laboratory Training Program (FELTP) and training to the local veterinarian.

Awareness campaign and alertness towards various diseases.

Provisions to ensure safe water and integrated disease surveillance and establishment of public health laboratories network in the vision documents.

Preparation of National public surveillance legislative framework.

16. Legislation in Relation to Veterinary Public Health

There is no legislation exclusively meant for veterinary public health, however, different legislations in piece meal are being followed and is being implemented for various functions of veterinary public health and food safety. Effort was made under some of the schemes/projects to review the existing legislation surrounding livestock marketing, animal health, meat and dairy production and inspection and certification of animal and animal products. As per constitution, agriculture including animal husbandry and human health are the responsibilities of respective State Governments and in these states the veterinary Services are governed by suitable central and state legislations. Most of the States are having their own Animal Disease Control Act for prevention and control of infectious diseases. Veterinary practice and education in the country is regulated through Indian Veterinary Council Act while Livestock importation Act provides modalities of International Animal Health Certification. In order to control animal diseases of public health significance on a national basis and promote import and export of animals and animal products by meeting international obligations, a suitable act was notified on 25th day of August, 2009 for implementation in all the states and UT’s.

Following legislation is in force that regulates the various functions of veterinary public health and food safety:

16.1. Central Legislations

- Glanders and Farcy Act, 1899
- Dourine Act, 1910 (Act No. V of 1910)
- Livestock importation (Amendment) Act, 2001
- Poisons Act, 1919 (Act No. XII of 1919)
- Dangerous Drug Act, 1930.
Indian Panel Code.
Prevention of Food Adulteration Act, 1954.
Indian Veterinary Council Act, 1984.
Bio-diversity Act, 2002
Bio-Terrorism Act, 2008
Milk and Milk Product Order, 1992
Meat And Meat Products Order (MFPO), 1973
Raw Meat (Quality control & Inspection) rules, 1992
Food safety and Standards Act, 2006
Wild Life (Protection) Act 1972
Prevention and Control of Infectious and Contagious Diseases in animals Act, 2009

16.2. State Legislations
- Goa, Daman and Diu Diseases of Animals Act 1974 (Goa, Daman and Diu)
- Gujarat Diseases of Animals (Control) Act 1963 (Gujarat)
- Himachal Pradesh Livestock and Birds Diseases Act 1968 and Himachal Pradesh Livestock and Birds Diseases, Rules 1971 (Himachal Pradesh)
- Madhya Pradesh Cattle Disease Act 1934 and Madhya Bharat Animal Contagious Diseases Act, 1955 (Madhya Pradesh)
- Bombay Diseases of Animal Act, 1948 (Maharashtra)
- Orissa Animal Contagious Diseases Act, 1949 (Orissa)
- Punjab Livestock and Birds Diseases Act, 1948 and Punjab Contagious Diseases of Animals Rules 1953 (Punjab)
- Rajasthan Animal Disease Act, 1959 and Rajasthan Animal Disease Rules 1960 (Rajasthan)
- Bengal Diseases of Animals Act, 1944 (West Bengal)
- Madras Cattle Disease Act 1866; Andhra Pradesh Cattle Disease (Extension and Amendment) Act, 1961; By Laws made under Andhra Pradesh Cattle Disease Act 1866 (Andhra Pradesh)
- Karnataka Animal Diseases Control Act 1961: Karnataka Diseases (Control) Rules 1967 (Karnataka)
The Madras Rinderpest Act, 1940 (Tamilnadu)
The Madras Cattle Diseases Act, 1866 (Tamilnadu)
Kerala Prevention and Control of Animal Disease Act, 1967 (Kerala)
The livestock importation (amendment) act, 2001.
Kerala prevention and control of animal diseases (amendment) rules, 2004
Karnataka poultry and livestock feed (regulation of manufacture and sale) order, 1987
The cattle feed and fodder (standard of quality) order, 2001
Assam cattle diseases Act 1948 (applicable to all seven north eastern states)

17. Conclusion and Recommendations

Conclusion and Recommendations: Based on the foregoing facts following can be concluded:

- The responsibilities of veterinary public health are shared by more than one department/organization along with inadequate legislation for veterinary public health and food safety.
- Efforts are in progress to review veterinary public health and food safety laws both at State and national level.
- There is a need to establish a suitable authority to undertake such issues for better implementation by making a coordinated body both from human and veterinary health under one umbrella which could coordinate and undertake all core functions of veterinary public health in the country with the following objectives:
  - Designing and implementing a uniform health information system across the country.
  - Strengthening of networking of all the units in the field of electronic access and training to strengthen technical expertise of veterinarian and administrative infrastructure.
  - Common disease surveillance system and enhanced communication between all the ministries responsible human and veterinary health.
  - Strengthening of infrastructures of all the national and state diagnostic laboratories/ institutions along with disease reporting system.
  - Reduction in food-borne diseases by adopting strict hygienic measures by implementing different existing legislations.
  - Adoption and implementation of good laboratory practices, good manufacturing practice, HACCP and other codes.
• By undertaking coordinated research projects/schemes for better understanding problems of multiple interfaces of human, animal (livestock and wild life) and environment to assess the impacts of interactions of humans/animal/ environment.

• Uniform veterinary education including public health courses at the graduate and post graduate level with establishment of effective collaboration and linkages between the veterinary and medical institutions and practitioners to ensure health and well being of the public.
Annexure – I

List of Research, Development & Educational Institutions in Veterinary and Fishery Sectors

A. National Agricultural Research System (NARS)
   A.1. Research Institutions
   A.1.1. Animal Science
   A.1.1.1. National Institutes and Deemed Universities
   ➢ Indian Veterinary Research Institute (IVRI), Izatnagar (Health Research) (U. P.)
   ➢ National Dairy Research Institute, Karnal (Dairy Research) (Haryana)

   A.1.1.2. Animal Health Research
   ➢ National Research Institute on Equines, Hissar (Haryana)
   ➢ Project Directorate on Foot & Mouth Disease, Mukteswar (Uttaranchal)
   ➢ Project Directorate on Animal Disease Monitoring & Surveillance, (Bangalore (Karnataka Uttar Pradesh)
   ➢ High Security Animal Disease Laboratory, Bhopal (Madhya Pradesh)

   A.1.1.3. Specific Health Programmes/schemes
   ➢ All India Coordinated Project (AICRP) on Foot & Mouth Diseases (8 Regional Research Units & 22 collaborating units)
   ➢ All India Coordinated Project (AICRP) on Animal Disease Monitoring & Surveillance (18 collaborating units)
   ➢ All India Network Programme on Haemorrhagic Septicaemia (8 collaborating units)
   ➢ All India Network Programme on Blue Tongue (10 collaborating units)
   ➢ All India Network Programme on Gastro-intestinal Parasitism (10 collaborating units)
   ➢ All India Network Programme on Zoonotic Diseases (10 collaborating units)
   ➢ All India Network Programme on Ethno-veterinary Medicine (10 collaborating units)
   ➢ All India Network Programme on Monitoring of Drug Residues, Environmental Pollutants and Toxins (11 collaborating units)
   ➢ All India Network Programme on Type Culture (22 collaborating units)
A.1.1.4. Animal Production Research
- Project Directorate on Cattle, Meerut (Uttar Pradesh)
- National bureau of Animal Genetic Resource, Karnal (Haryana)
- National Institute of Animal Nutrition & Physiology, Bangalore (Karnataka)
- Central Institute for Research on Buffaloes, Hissar (Haryana)
- Central Institute for Research on Goats, Makhdum (Uttar Pradesh)
- Central Sheep & Wool Research Institute, Avikanagar (Rajasthan)
- National Research Centre on Mithun, Jharnapani (Nagaland)
- National Research Centre on Meat, Hyderabad (Andhra Pradesh)
- National Research Centre on Camel, Bikaner (Rajasthan)
- National Research Centre on Pig, Guwahati (Assam)
- National Research Centre on Yak, Dirang (Arunachal Pradesh)
- Central Avian Research Institute, Izatnagar (Uttar Pradesh)
- Project Directorate on Poultry, Hyderabad (Andhra Pradesh)

A.1.1.5. Fisheries Institutions
- Central Inland Fisheries Research Institute, Kolkata (West Bengal)
- Central Institute of Brackishwater Aquaculture, Chennai (Tamil Nadu)
- Central Institute of Fisheries Education, Mumbai (Maharashtra)
- Central Institute of Fisheries Technology, Cochin (Kerala)
- Central Institute of Freshwater Aquaculture, Bhubaneswar (Orissa)
- Central Marine Fisheries Research Institute, Cochin (Kerala)
- Directorate of Coldwater Fisheries Research, Bhimtal (Uttar Pradesh)
- National bureau of Fish Genetic Resource, Lucknow (Uttar Pradesh)

A.1.2. Educational and Teaching Institutions
A.1.2.1. State Veterinary Universities (SVU’s)
- Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana (Punjab)
- Maharashtra Animal and Fishery Sciences University, Nagpur (Maharashtra)
- Anand Veterinary University, Anand (Gujarat)
- Rajasthan Veterinary University, Bikaner (Rajasthan)
- Karnataka Veterinary, Animal and Fisheries Sciences University, Bidar (Karnataka)
- Sri Venkateswara Veterinary University, Tirupati (Andhra Pradesh)
- Tamil Nadu Veterinary and Animal Sciences University, Chennai (Tamil Nadu)
A.1.2.2. State Agricultural Universities (SAU’s) having Faculties of Veterinary and Fisheries Science

- Assam Agricultural University, Jorhat (Assam)
- Birsa Agricultural University, Kanke, Ranchi (Jharkhand)
- Central Agricultural University, Imphal (Manipur)
- Chaudhary Charan Singh Haryana Agricultural University, Hisar (Haryana)
- CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur (Himachal Pradesh)
- Govind Ballabh Pant University of Agriculture and Technology, Pantnagar (Uttarakhand)
- Junagadh Agricultural University, Junagadh (Gujarat)
- Kerala Agricultural University, Thrissur (Kerala)
- Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan)
- Narendra Deva University of Agriculture and Technology, Faizabad (Uttar Pradesh)
- Navsari Agricultural University, Navsari (Gujarat)
- Orissa University of Agriculture and Technology, Bhubaneswar (Orissa)
- Rajendra Agricultural University, Samastipur (Bihar)
- Sardarkrushinagar- Dantiwada Agricultural University, Dantiwada (Gujarat)
- Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, Jammu (J&K)
- Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar (J&K)
- Sardar Ballabh Bhai Patel University of Agriculture and Technology, Meerut (UP)
- Indira Gandhi Krishi Viswa Vidyalaya, Raipur (Chhattisgarh)
- Anand Agricultural University, Anand (Gujarat)

B. Developmental Institutions

B.1. Health Institutions

- National Institute of Animal Health, Baghpat (Uttar Pradesh)
- Animal Quarantine &and Certification Service Station (New Delhi, Chennai, Kolkata, Mumbai, Hyderabad, Bangalore)
B.2. Production Institutions

B.2.1. Animal Husbandry & Poultry

- Central Cattle Breeding Farm, Dhamrod (Gujarat); Lakimpur (Uttar Pradesh); Sonabada (Orissa); Suratgarg (Rajasthan); Chiplima (Orissa); Alamandi (Tamil Nadu); Hessarghatta (Karnataka)
- Central Frozen Semen Production & Training Institute, Hessarghatta, Bangalore.
- Central Herd Registration Unit, Rohtak (Haryana); Ajmer (Rajasthan); Ahmedabad (Gujarat); Prakasam (Andhra Pradesh)
- Regional Station for Forage Production & Demonstration, Kalyani (West Bengal); Srinagar (J&K); Suratgargh (Rajasthan); Hissar (Haryana); Gandhinagar (Gujarat); Alamandhi (Tamil Nadu); Hyderabad (Andhra Pradesh)
- Central Fodder Seed Production Farm, Hassargatha, Bangalore (Karnataka)
- Central Sheep Breeding Farm, Hissar (Haryana)
- Central Poultry Development Organization: Southern Region- Hassargatha, Bangalore (Karnataka); Eastern Region- Bhubneshwar (Orissa); Western region- Mumbai (Maharastra); Northern region- Chandigarh.
- Central Poultry Performance Testing Centre, Gurgaon (Haryana)

B.2.2. Dairy

- National Dairy Development Board, Anand, Gujarat
- Dairy Milk Scheme, New Delhi

B.2.3. Fishery

- Central Institute of Coastal Engineering, Bangalore (Karnataka)
- Central Institute of Fisheries Neutical Engineering Training, Cochin (Kerala)
- National Institute of Fisheries Post Harvest Technology & Training, Cochin (Kerala)
- Fishery Survey of India, Mumbai (Maharastra)
- Fisheries Development Board Hyderabad (Andhra Pradesh)

C. Research and Development institutions related with Food Processing Sector

- Central Food Technological Research Institute, Mysore
- Post Harvest Technology Center, IIT Kharagpur
- Central Institute of Fisheries Technology, Cochin
- National Dairy Research Institute, Karnal
- Indian institute of Packaging, Mumbai
- Indian Veterinary Research Institute, Izatnagar
- Indian Institute of Technology, Mumbai
- Defence Food research Laboratory, Mysore
- Bhabha Atomic Research Centre, Trombay
- Integrated Fisheries Project, Cochin
- National Institute of Nutrition, Hyderabad
- Central Leather Research Institute, Chennai

### D. State Veterinary Institutions (Source: Annual Report, DAHDF, 2009-10)

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<th>Region State/UT’s</th>
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<td><strong>Total</strong></td>
<td><strong>992</strong></td>
<td><strong>5313</strong></td>
<td><strong>6811</strong></td>
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<tr>
<td><strong>Eastern Region</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bihar</td>
<td>39</td>
<td>785</td>
<td>1435</td>
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<tr>
<td>Jharkhand</td>
<td>405</td>
<td>3</td>
<td>-</td>
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<tr>
<td>Orissa</td>
<td>-</td>
<td>540</td>
<td>2939</td>
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<tr>
<td>Chattisgarh</td>
<td>208</td>
<td>708</td>
<td>290</td>
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<tr>
<td>West Bengal</td>
<td>111</td>
<td>612</td>
<td>3248</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>763</strong></td>
<td><strong>2648</strong></td>
<td><strong>7912</strong></td>
</tr>
<tr>
<td><strong>Western Region</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goa</td>
<td>5</td>
<td>21</td>
<td>52</td>
</tr>
<tr>
<td>Gujarat</td>
<td>14</td>
<td>487</td>
<td>587</td>
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<tr>
<td>Region State/UT’s</td>
<td>Veterinary Hospitals/Polyclinics</td>
<td>Veterinary dispensaries</td>
<td>Veterinary Aid Centres/stockman Centres/Mobile Dispensaries</td>
</tr>
<tr>
<td>------------------</td>
<td>----------------------------------</td>
<td>-------------------------</td>
<td>----------------------------------------------------------</td>
</tr>
<tr>
<td>Maharasra</td>
<td>43</td>
<td>1382</td>
<td>2056</td>
</tr>
<tr>
<td>Dadar &amp; Nagar Haveli</td>
<td>1</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Daman &amp; Diu</td>
<td>0</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>63</strong></td>
<td><strong>1892</strong></td>
<td><strong>2708</strong></td>
</tr>
<tr>
<td>NorthEastern Region</td>
<td></td>
<td></td>
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<tr>
<td>Arunachal Pradesh</td>
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<td>93</td>
<td>189</td>
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<tr>
<td>Assam</td>
<td>29</td>
<td>428</td>
<td>1213</td>
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<tr>
<td>Manipur</td>
<td>55</td>
<td>109</td>
<td>34</td>
</tr>
<tr>
<td>Meghalaya</td>
<td>4</td>
<td>70</td>
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</tr>
<tr>
<td>Mizorum</td>
<td>5</td>
<td>35</td>
<td>103</td>
</tr>
<tr>
<td>Nagaland</td>
<td>4</td>
<td>27</td>
<td>127</td>
</tr>
<tr>
<td>Sikkim</td>
<td>12</td>
<td>25</td>
<td>58</td>
</tr>
<tr>
<td>Tripura</td>
<td>15</td>
<td>56</td>
<td>396</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>125</strong></td>
<td><strong>843</strong></td>
<td><strong>2271</strong></td>
</tr>
<tr>
<td>Central Region</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>565</td>
<td>1742</td>
<td>72</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>1439</td>
<td>285</td>
<td>1733</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>1763</td>
<td>268</td>
<td>2313</td>
</tr>
<tr>
<td>Delhi</td>
<td>49</td>
<td>27</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3816</strong></td>
<td><strong>2322</strong></td>
<td><strong>4119</strong></td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td><strong>8732</strong></td>
<td><strong>18830</strong></td>
<td><strong>25195</strong></td>
</tr>
</tbody>
</table>
Annexure- II

Schedule of Health Protocols and Sanitary Requirements for Importation of Livestock into India

A. IMPORTATION OF EQUINES

1. Eligibility
   1.1. The equine should come from a country
      a. Which is free from African Horse Sickness
      b. Where Contagious Equine Metritis (CEM) has not been reported during the last three years. However, animals from CEM infected countries male up to seven years and female up to five years of age which have never been mated are allowed.

   1.2. In case of thoroughbred horses, import will be allowed for breeding purpose only.

   1.3. Prior to export the equines are required to undergo pre-export quarantine for necessary testing.

   1.4. The equine shall only be imported through the International airports of Delhi, Kolkotta, Mumbai and Chennai or any other airport notified by the Government from time to time and the quarantine officers may be informed by the importer in writing at least fifteen days prior to the arrival of the consignment.

   1.5. The animals with more than three hundred days of pregnancy prior to departure is not to be imported at all.

2. Identification

   The equine must accompany with a valid passport OR in case of the horse originate from countries not issuing a passport, the import must be accompanied by complete history sheet with an identification certificate duly authenticated by an official veterinarian of the exporting country.

3. Veterinary Certificate

   3.1. The equine must accompany a valid health certificate issued by an official veterinarian of the exporting country as per the following format:

   Veterinary Certificate for Import of Equines into India*

   Exporting country : ________________________________________________
   Ministry of : ________________________________________________
   Department : ________________________________________________
   Province or District, etc. : ________________________________________________
I. Identification of the animal/s
   a) Details of the animal

<table>
<thead>
<tr>
<th>Species</th>
<th>Breed</th>
<th>Name/Tattoo</th>
<th>Sex</th>
<th>Age/Date/Year of Birth</th>
<th>Color</th>
<th>Passport License No.</th>
<th>Sire</th>
<th>Dam</th>
</tr>
</thead>
</table>

   b) Diagram, marks and description of the animal

Please ensure that the diagram and written description agree

II. Origin of the animal/s

Name and address of the exporter: _______________________________________
Place of origin of the animal/s: _______________________________________

III. Destination of the animal/s

Country of destination: ________________________________________________
Name and address of consignee: _________________________________________
Nature and identification of means of transport: ___________________________

IV. Sanitary information

The undersigned Official Veterinarian certifies that the animal described above and examined on this day

- Shows show no clinical sign or symptom of infectious or contagious diseases on the day of shipment.
- satisfies the following requirements:
  - His country free from African Horse Sickness.
  - During one hundred eighty days immediately prior to export, the equine under export has not visited any country where African Horse Sickness occurred in the past two years immediately preceding the export.
  - Contagious Equine Metritis (CEM) has not been reported during last three years in the country and the animal has not originated/reared in/visited any of the CEM infected countries during the last two years; OR
  - The country has reported CEM but the animal under export is less than seven years (in case of male) / less than five years (in case of female) of age which have never been mated and the equine has not been in contact with breeding stock during the twelve months immediately prior to export swabs collected from prepuce, urethra, vagina and cervix as the case may be of the equines has been found negative for pathogenic micro-organisms specifically Taylorella equigenitalis, by standard culture on three consecutive occasions at seven days interval during the thirty days pre-export quarantine.
The equine was kept in an establishment for three months prior to shipment where no infectious or contagious disease including Epizootic Lymphangitis, Ulcertive Lymphangitis, Trypanosomiasis, Dourine, Equine Piroplasmosis, Equine Rhio pneumonitis, Equine Encephlomyelitis, Equine Influenza, Equine Infectious Anemia, Potomac Horse Fever, West Nile Virus infection and Vesicular Stomatitis was reported and no such diseases reported around such establishment.

The animal prior to export has been vaccinated with Equine Influenza (Killed) bivalent vaccine, and the last vaccination should be within thirty days prior to embarkation but not less than fourteen days.

The equine being exported has been kept in isolations in an approved Government quarantine station and subjected to the following tests with negative results.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Diagnostic Test</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glanders</td>
<td>Mallein/ Complement Fixation Test (CFT)</td>
<td>During Fifteen days before shipment</td>
</tr>
<tr>
<td>Dourine</td>
<td>Complement Fixation Test (CFT)</td>
<td>Fifteen days before shipment</td>
</tr>
<tr>
<td>Equine Infectious Anaemia (EIA)</td>
<td>Coggins (Immunodiffusion Test)</td>
<td>During Thirty days before shipment</td>
</tr>
<tr>
<td>Infectious Equine Abortion (Salmonella Abortus equi)</td>
<td>Serum Agglutination Test ( titre not greater than one/ three hundred)</td>
<td>During Fifteen days before shipment</td>
</tr>
<tr>
<td>Equine Viral Arteritis (EVA)</td>
<td>Virus Neutralization Test</td>
<td>Two occasions at least fourteen days apart with negative result during twenty eight days prior to shipment.</td>
</tr>
<tr>
<td>Vesicular Stomatitis</td>
<td>Complement Fixation Test (CFT)/ Enzyme Linked Immunosorbant assay (ELISA)</td>
<td>During Thirty days before shipment</td>
</tr>
<tr>
<td>Contagious Equine Metritis (CEM)</td>
<td>Culture of Micro-organisms</td>
<td>Three consecutive tests at weekly interval during pre-export quarantine period with negative results</td>
</tr>
<tr>
<td>Equine Piroplasmosis (Babesia equi and Babesia caballi)</td>
<td>Complement Fixation Test (CFT) / Indirect Fluorescent Antibody Test (IFAT)</td>
<td>During Thirty days before shipment</td>
</tr>
<tr>
<td>Venezuelan Equine Encephalomyelitis</td>
<td>Haemagglutination Inhibition (HI) / Complement Fixation Test (CFT) / Plaque Reduction Neutralisation Test (PRNT)</td>
<td>Not less than fourteen days after the commencement of pre-export quarantine.</td>
</tr>
</tbody>
</table>

N.B.: No testing is necessary in respect of such diseases for which freedom status has been certified.

* It is recommended that individuals’ certificates be drawn up for breeding animals.
4. Post import quarantine

After import in India, the animal shall be kept in quarantine for minimum period of thirty days at the Government Quarantine Station. During the quarantine period, the animal shall be subjected to standard culture and serological examination for any disease as deemed necessary by the Government. In the event of any animal found positive for any exotic disease, the same shall be deported back to the country of origin/destroyed at the quarantine station at the cost of the importer.

B. IMPORTTION OF CATTLE

ExportingCountry: _____________________________________________________
Ministry of ___________________________________________________________
Department: __________________________________________________________
Province or District, etc.: ______________________________________________

I. Identification of the animal/s

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Breed</th>
<th>Age</th>
<th>Sex</th>
<th>Official ear mark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

II. Origin of the animal/s

Name and address of the exporter: _______________________________________
Place of origin of the animal/s : ________________________________________

III. Destination of the animal/s Country of

Destination: ___________________________________________________________
Name and Address of consignee: _________________________________________
Nature and identification of means of transport: __________________________

IV. Sanitary information

The undersigned Official Veterinarian certifies that the livestock described above and examined on this day:

- Shows /show no clinical sign of disease;
- Satisfies/ satisfy the following requirements:
- Are born and have been continually resident in exporting country.
- Parent and grandparent of the animal under import also originate from exporting country.
- Have never been fed with feed of ruminant origin.
- Bovine Spongiform Encephalopathy (BSE) and Scrapie are compulsorily
Veterinary Public Health and Zoonotic Disease Control in India

notifiable diseases in exporting country and the country is free from TSE group of diseases.

- The exporting country is free from Foot and Mouth disease (Type C, SAT 1,2,3), Vesicular stomatitis, Rinderpest, Contagious bovine pleuropneumonia, Lumpy Skin disease, and Rift valley fever.

- Originate from herd and establishment that are free from clinical or other confirmation of Bovine Anaplasmosis, Blue Tongue, Leptospirosis, Paratuberculosis (Johnne’s Disease), Bovine Tuberculosis, Bovine Genital Campylobacteriosis, Foot & Mouth Disease (Type O, A, Asia 1), Aujeszky’s disease, Bovine brucellosis, Q. fever, Enzootic Bovine Leucosis, Trichomoniasis, Infectious Bovine Rhinotracheitis/Infectious Pustular Vullovaginitis (IBR/IPV), Malignant Catarrhal Fever (MCF), Bovine Viral Diarrhoea (BVD), Bovine Babesiosis, Bovine Cysticercosis and Dermatophilosis during the last two years and no animal from a herd of inferior health status was introduced in the farm/establishment during that period.

- Have been subjected to examination for the following diseases with negative result in each case within the last 45 days prior to entering the pre-export quarantine and/or within the last 30 days prior to exportation while in the pre-export quarantine:

<table>
<thead>
<tr>
<th>Disease</th>
<th>Within 45 days</th>
<th>Within 30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluetongue (AGID/ELISA/Agent id., PCR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enzootic bovine leukosis(AGID/ELISA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paratuberculosis (DTH/ELISA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malignant catarrhal fever (VN/IFA/PCR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bovine viral diarrhoea (agent id.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bovine anaplasmosis (CFT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infectious bovine rhinotracheitis- -</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infectious pustutar vullovaginitis (VN/ELISA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leptospirosis (MAT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuberculosis (Tuberculin test)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trichomonosis (Agent id.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Campylobacteriosis (Agent id.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Theileriosis (IFA/Agent id.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q fever (CFT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Babesiosis (IFA/ELISA)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Aujeszky’s disease (ELISA/VN)
Bovine brucellosis (CFT/ELISA/BBAT)
- During 45 days prior to entry in the approved pre-export quarantine premises and again while in the quarantine premises but with not less than 14 days interval in between, the animal(s) were treated for:
  - Internal Parasites twice using broad spectrum anthelmintic
  - Liver Fluke using Flukicide
  - External parasites using the parasiticidal dip or spray.
  - While in pre-export quarantine, the animal(s) were treated twice with any broad spectrum antibiotic or dihydro streptomycin (25 mg. per kg. of body weight) with 14 days between treatments.
- Within 48 hours of the cattle entering and leaving the pre-export quarantine premises, the animal(s) were examined and found free from any clinical evidence of infectious and contagious diseases and ectoparasites.
- The vehicle in which the animal(s) were transported from the approved pre-export quarantine premises to the port of departure were cleaned and disinfected with a disinfectant approved by the appropriate veterinary authority.
- Has/have been kept for 30 days under pre-export quarantine in quarantine premises which have been approved by the Government of Exporting Country for the purpose of quarantining cattle for export into India.
- Has/have not been vaccinated against Brucellosis and IBR/IPV.
- Are examined clinically as the day of departure and found properly grown for age, are below five months of pregnancy and are found suitable for transport.

Post Import Requirements
On arrival in India, the consignment and the documents will be examined by the Regional Officer/Quarantine Officer.
- The cattle shall be kept under quarantine in Government Quarantine premises for a period of 30 days. They shall be subjected to clinical examination and other tests by Quarantine Officer for evidence of any contagious and infectious diseases and ectoparasites.
- In case of positive findings, appropriate action shall be taken by the Department of Animal Husbandry, Dairying and Fisheries, Government of India at the cost of importing agency.
- The hay, straw and feed accompanying the cattle must be destroyed by incineration on arrival in India.
C. IMPORTATION OF GOATS

Exporting country: _____________________________________________________

Ministry of: __________________________________________________________

Department: __________________________________________________________

Province or District, etc.: ______________________________________________

I. Identification of the animal/s

<table>
<thead>
<tr>
<th>Species</th>
<th>Breed</th>
<th>Age</th>
<th>Sex</th>
<th>Official ear mark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

II. Origin of the animal/s

Name and address of the exporter: ________________________________________

Place of origin of the animal/s: __________________________________________

III. Destination of the animal/s

Country of destination: _________________________________________________

Name and address of consignee: __________________________________________

Nature and identification of means of transport: ____________________________

IV Sanitary information

The undersigned Official Veterinarian certifies that the livestock described above and
examined on this day:

➤ shows /show no clinical sign of disease;

➤ satisfies/ satisfy the following requirements:

- Are born and have been continually resident in exporting country.
- Parent and grandparent of the animal under import also originate from
  exporting country.
- Have never been fed with feed of ruminant origin.
- Are more than one year of age at the time of export.
- Female goats are not more than 3 months pregnant at the scheduled date
  export and found suitable for transport.
- Bovine Spongiform Encephalopathy (BSE) and Scrapie are compulsorily
  notifiable diseases in exporting country and the country is free from TSE
  group of diseases
- The exporting country is free from Foot and Mouth disease (Type C, SAT
  1, 2, 2), Vesicular stomatitis, Rinderpest, Peste des petits ruminants,
  Contagious agalactia and Rift valley fever.
- Originate from flocks and establishment that are free from clinical or other
cnfirmation of Caprine Brucellosis, Bluetongue, Q fever, Enzootic abortion, Leptospirosis, Salmonellosis (S. abortus ovis), Contagious Caprine Pleuropneumonia, Aujeszky’s disease, Sheep & Goat Pox, Pulmonary Adenomatosi, Foot & Mouth Disease (Type O, A, Asia I), Paratuberculosis (Johnie’s disease) and these diseases have not been reported during the last two years and no animal from a herd of inferior health status was introduced in the flock / establishment during that period.

- Caprine arthritis/encephalitis was neither clinically nor serologically diagnosed in the goats present in the flocks of origin during the past five years, and that no goats from a flock of inferior health status was introduced into these flock during this period.

Has/Have been subjected to examination for the following diseases with negative result in each case within the last 45 days prior to entering the pre-export quarantine and/or within the last 30 days prior to exportation while in the pre-export quarantine:

<table>
<thead>
<tr>
<th>Disease/Condition</th>
<th>Within 45 days</th>
<th>Within 30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluetongue (AGID/ELISA/Agent id., PCR)</td>
<td></td>
<td>(retest)</td>
</tr>
<tr>
<td>Paratuberculosis (DTH/ELISA)</td>
<td></td>
<td>(retest)</td>
</tr>
<tr>
<td>Leptospirosis (MAT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q fever (CFT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aujeszky’s disease (ELISA/VN)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caprine Brucellosis (CFT/BBAT)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caprine arthritis/encephalitis (AGID/ELISA)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enzootic abortion (CF)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contagious Caprine Pleuropneumonia (CF)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salmonellosis (S. Abortus) (Agent id.)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- During 45 days prior to entry in the approved pre-export quarantine premises and again while in the quarantine premises but with not less than 14 days interval in between, the animal(s) were treated for:

- Internal Parasites twice using broad spectrum anthelmintic
- Liver Fluke using Flukicide
- External parasites using the parasiticidal dip or spray.
While in pre-export quarantine, the animal(s) were treated for leptospirosis twice with dihydrostreptomycin (25mg per Kg of live body weight) at an interval of 14 days. The second injection being given within 24 hours of the intended date of export.

Within 48 hours of the goats entering and leaving the pre-export quarantine premises, the animal(s) were examined and found free from any clinical evidence of infectious and contagious diseases and ectoparasites.

The vehicle in which the animal(s) were transported from the approved pre-export quarantine premises to the port or airport of departure were cleaned and disinfected with a disinfectant approved by the appropriate veterinary authority.

The animals were transported directly to the place of embarkation from the preexport quarantine premises and have not come into contact with any other animals of a lesser health status.

Were protected from insect vectors during quarantine and transportation to the place of shipment.

The animal(s) were transported in pens/containers from the approved quarantine premises to the place of embarkation as well as pens in the aircraft have been cleaned and disinfected before loading to government approved standards.

Has/have not been vaccinated against Brucellosis.

Post Import Requirements

On arrival in India the consignment and the documents will be examined by the Regional Officer/Quarantine Officer.

The goat shall be kept under quarantine in Government Quarantine premises for a period of 30 days. They shall be subjected to clinical examination and other tests by Quarantine Officer for evidence of any contagious and infectious diseases and ectoparasites.

In case of positive findings, appropriate action shall be taken by the Department of Animal Husbandry, Dairying and Fisheries, Government of India at the cost of importing agency.

The hay, straw and feed accompanying the goat must be destroyed by incineration on arrival in India.
# References

The present report has been prepared from the information available on the Web-Sites of following Ministries/Department/Organizations.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Reference</th>
<th>Web-site</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Department of Animal Husbandry, Dairying &amp; Fisheries (DADHF)</td>
<td><a href="http://www.dahd.nic.in">www.dahd.nic.in</a></td>
</tr>
<tr>
<td>2</td>
<td>Department of Health &amp; Family Welfare (DoHF)</td>
<td>mohfw.nic.in</td>
</tr>
<tr>
<td>3</td>
<td>Central Government Health Scheme (CGHS)</td>
<td><a href="http://www.cghs.nic.in">www.cghs.nic.in</a></td>
</tr>
<tr>
<td>4</td>
<td>Department of Agricultural Research &amp; Education (DARE).</td>
<td><a href="http://www.dare.nic.in">www.dare.nic.in</a></td>
</tr>
<tr>
<td>5</td>
<td>Indian Council of Agricultural Research (ICAR)</td>
<td><a href="http://www.icar.org.in">www.icar.org.in</a></td>
</tr>
<tr>
<td>6</td>
<td>Department of Health Services (DMHR)</td>
<td>en.wikipedia.org</td>
</tr>
<tr>
<td>7</td>
<td>Indian Council of Medical Research (ICMR)</td>
<td><a href="http://www.icmr.nic.in">www.icmr.nic.in</a></td>
</tr>
<tr>
<td>8</td>
<td>Ministry of Environment &amp; Forest (MoEF)</td>
<td><a href="http://www.envfor.nic.in">www.envfor.nic.in</a></td>
</tr>
<tr>
<td>9</td>
<td>Animal Welfare Board (AFB)</td>
<td><a href="http://www.awbi.org">www.awbi.org</a></td>
</tr>
<tr>
<td>10</td>
<td>Veterinary Council of India (VCI)</td>
<td><a href="http://www.vci-india.in">www.vci-india.in</a></td>
</tr>
<tr>
<td>11</td>
<td>Medical Council of India (MCI)</td>
<td><a href="http://www.mci-india.org">www.mci-india.org</a></td>
</tr>
<tr>
<td>12</td>
<td>Agricultural &amp; Processed Food Products Export Development Authority (APEDA)</td>
<td><a href="http://www.apeda.gov.in">www.apeda.gov.in</a></td>
</tr>
<tr>
<td>13</td>
<td>Directorate of Marketing &amp; Inspection</td>
<td>agmarknet.nic.in</td>
</tr>
<tr>
<td>14</td>
<td>Export Inspection Council of India (EICI)</td>
<td><a href="http://www.eicindia.gov.in">www.eicindia.gov.in</a></td>
</tr>
<tr>
<td>15</td>
<td>National Institute of Communicable Diseases (NICD)</td>
<td><a href="http://www.nicd.nic.in">www.nicd.nic.in</a></td>
</tr>
<tr>
<td>16</td>
<td>National Dairy Development Board (NDBB)</td>
<td><a href="http://www.nddb.org">www.nddb.org</a></td>
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<td>17</td>
<td>Bureau of Indian Standards (BIS)</td>
<td><a href="http://www.bis.org.in">www.bis.org.in</a></td>
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<td>Codex Alimentarius</td>
<td><a href="http://www.codexalimentarius.net">www.codexalimentarius.net</a></td>
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<td>Ministry of Food Processing Industries (MoFPI)</td>
<td><a href="http://www.mofpi.nic.in">www.mofpi.nic.in</a></td>
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<td>National Meat and Poultry Processing Board (NMPPB)</td>
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<td>22</td>
<td>Planning Commission, Government of India</td>
<td><a href="http://www.planningcommission.nic.in">www.planningcommission.nic.in</a></td>
</tr>
<tr>
<td>23</td>
<td>National Academy of Agricultural Science (NAAS)</td>
<td><a href="http://www.naasindia.org">www.naasindia.org</a></td>
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<tr>
<td>24</td>
<td>World Health Organization (WHO)</td>
<td><a href="http://www.who.int">www.who.int</a></td>
</tr>
<tr>
<td>25</td>
<td>Project Directorate on Foot &amp; Mouth Disease (PD-FMD)</td>
<td><a href="http://www.icar.org.in/files/pdfmd">www.icar.org.in/files/pdfmd</a></td>
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<tr>
<td>26</td>
<td>Project Directorate on Animal Disease Monitoring &amp; Surveillance (PD-ADMAS)</td>
<td><a href="http://www.pdadmas.ernet.in">www.pdadmas.ernet.in</a></td>
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<td>27</td>
<td>Indian Veterinary Research Institute (IVRI)</td>
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<tr>
<td>28</td>
<td>Ministry of Commerce &amp; Industry (MoCI)</td>
<td><a href="http://www.commerce.nic.in">www.commerce.nic.in</a></td>
</tr>
<tr>
<td>29</td>
<td>Dr. A. Paturkar- Prof. &amp; Head, Department of Veterinary Public Health, College of Veterinary Science, Mumbai.</td>
<td>Personal Communications</td>
</tr>
<tr>
<td>30</td>
<td>Publications of Dr. Lal Krishna</td>
<td>Personal Communications</td>
</tr>
<tr>
<td>31</td>
<td>Reports of different State Animal Husbandry Departments/ Agriculture/ Veterinary Universities</td>
<td>Personal Communications</td>
</tr>
</tbody>
</table>
Dr. Bala Ram Thapa
Senior Veterinary Officer
Department of Livestock Services
Ministry of Agriculture and Cooperatives
Government of Nepal
Email: balaramthapa@gmail.com
1. Introduction

Nepal, officially the Federal Democratic Republic of Nepal, is a Himalayan country in South Asia and, as of 2010, the world's most recent nation to become a republic. It is a landlocked country bordered to the north by the People's Republic of China, and to the south, east, and west by the Republic of India. Geographically, it can be divided into three distinct belts - the mountains in the north, the hills in the middle and the plain of the terrain to the south. It lies between 80° -88° E and 26° -31° N. With an area of 147,181 square kilometres (56,827 sq mi) and a population of approximately 30 million, Nepal is the world's 93rd largest country by land mass and the 41st most populous country. Kathmandu is the nation's capital and the country's largest metropolitan city.

Nepal is a land of diversity with marked multi-ethnic characteristics. Approximately 55% of the population comprises indigenous Nepali speakers. Nepal is a secular state with a social system characterized by the centrality of the family with factors such as caste and religion having significant impact on the lives of the people.

Administratively, Nepal is divided into 5 development regions, 14 zones, 75 districts, 58 municipalities, 3915 Village Development Committees (VDC), and nearly 36,000 wards.

Nepal's economic development has been severely constrained by geographic, topological and socio-cultural factors including: its landlocked position, limited natural resources, rapid population growth, heavy dependence on traditional agriculture and an increasing reliance on foreign assistance.

1.1 Geography

Nepal is commonly divided into three physiographic areas: the Mountain, Hill and Terai Regions. These ecological belts run east-west and are vertically intersected by Nepal's major, north to south flowing river systems.

1.1.1 Terai Region: The southern lowland plains or Terai bordering India are part of the northern rim of the Indo-Gangetic plains. They were formed and are fed by three major Himalayan rivers: the Koshi, the Narayani, and the Karnali as well as smaller
rivers rising below the permanent snowline. This region has a subtropical to tropical climate. The outermost range of foothills called Shiwalik or Churia Range cresting at 700 to 1,000 metres (2,297 to 3,281 ft) marks the limit of the Gangetic Plain, however broad, low valleys called Inner Tarai (Bhitri Tarai Uptyaka) lie north of these foothills in several places.

**1.1.2 Hill Region:** The Hill Region (Pahad) abuts the mountains and varies from 800 to 4,000 metres (2,625 to 13,123 ft) in altitude with progression from subtropical climates below 1,200 metres (3,937 ft) to alpine climates above 3,600 metres (11,811 ft). The Mahabharat Lekh reaching 1,500 to 3,000 metres (4,921 to 9,843 ft) is the southern limit of this region, with subtropical river valleys and "hills" alternating to the north of this range. Population density is high in valleys but notably less above 2,000 metres (6,562 ft) and very low above 2,500 metres (8,202 ft) where snow occasionally falls in winter.

**1.1.3 Mountain Region:** The Mountain Region (Parbat), situated in the Great Himalayan Range, makes up the northern part of Nepal. It contains the highest elevations in the world including 8,848 metres (29,029 ft) height Mount Everest (Sagarmatha in Nepali) on the border with China. Seven other of the world's eight thousand metre peaks are in Nepal or on its border with China: Lhotse, Makalu, Cho Oyu, Kanchenjunga, Dhaulagiri, Annapurna and Manaslu.

Nepal has five climatic zones, broadly corresponding to the altitudes. The tropical and subtropical zones lie below 1,200 metres (3,937 ft), the temperate zone 1,200 to 2,400 metres (3,937 to 7,874 ft), the cold zone 2,400 to 3,600 metres (7,874 to 11,811 ft), the subarctic zone 3,600 to 4,400 metres (11,811 to 14,436 ft), and the Arctic zone above 4,400 metres (14,436 ft).

Nepal experiences five seasons: summer, monsoon, autumn, winter and spring. The Himalaya blocks cold winds from Central Asia in the winter and forms the northern limit of the monsoon wind patterns. In a land once thickly forested, deforestation is a major problem in all regions, with resulting erosion and degradation of ecosystems.
2. Veterinary Public Health Structure as Well as Set Up

2.1. Ministry of Agriculture and Co-operatives

A. Department of Livestock Services

There are nineteen border quarantine check post with India. Only one with China. One at international Air port, Kathmandu and two internal quarantine check point
Human Resources in Veterinary Public Health Office

Senior Veterinary officer (Gaz.II)

Veterinary officer (Gaz.III)

Account

Technical

Junior Technician-2

Junior Technical Assistant-1

Administration

Typist-1

Office Assistant-2

B. Department of Food Technology and Quality Control (DFTQC)

Coming to the present context of time, the food regulating department, these days, is working as Department of Food Technology and Quality Control(DFTQC)under the ministry of Agriculture and Cooperatives(MOAC). At present the structure for food control system has been extended up to the district level as given below(in brief):

As a Central Body:
Department of Food Tech and Quality Control which Comprises with

- Quality Control Division
- Food Technology development and training division
- Central Food Laboratory
- SPS Enquiry point
- National Nutrition Program

As Regional Wings:
Regional Food Technology and Quality Control Offices (RFTQCO) at

- Biratnagar
- Hetauda
- Bhairahawa
- Nepalgang
- Dhangari
As District Level Extentions: 20 District Inspection Units (DIU) mainly at Terai and inner terai districts

**As Custom Check Points:**
- Food Quarantine Labs: At
- Tatopani (Nepal-China Boarder)
- Kakarvitta (Nepal-India Boarder)
- Birganj (Nepal-India Boarder)
- Gaddachauki, Mahendranagar (Nepal-India Boarder)
- TIA Inspection Unit (At Tribhuvan International Airport)
- As technology transfer Unit Apple Processing Unit Jumla

Altogether there are 231 positions at different tires as entire Human resource working throughout the structure within DFTQC as outlined above.

**2.2 Ministry of Health and Population**

```
Ministry of Health and Population
    ↓
Department of Health Services
    ↓
Epidemiology and Disease Control Division
    ↓
Zoonotic Disease Section
```

There is provision of 1 veterinarian and 1 veterinary technician to look after the zoonotic diseases within the Zoonotic section of Epidemiology and Disease Control Division under Department of Health Services.
3. **Veterinary Public Health Laboratory Activities for Inspection, Surveillance of Zoonotic Diseases and Data Processing and Handling**

There is no separate public health laboratory in Nepal but some of the activities related to Public health is carried out by the Veterinary Drug Standards and Administration Office under Department of Livestock Services and laboratory under Department of Food Technology and Quality Control (DFTQC). These labs basically perform the test to determine the residue level of antibiotics in foods of animal origin. The laboratory in Nepal related to public health by one or other way can be summarized as below:

**Central Veterinary Laboratory (CVL):** This laboratory located at Tripureshwor, Kathmandu is the national reference laboratory for the diagnosis and investigation of livestock diseases. This is the only laboratory of Nepal where rabies is diagnosed. Other zoonotic diseases like Highly Pathogenic Avian Influenza, Japanese encephalitis are also diagnosed in this lab.

**Regional Veterinary Laboratory (RVL):** There are five regional level laboratories, one at each developmental region. These laboratories mainly act to diagnose and investigate livestock diseases prevalent in that particular region and other major livestock diseases. Preliminary diagnosis of HPAI is done in these labs.

**National Avian Laboratory (NAL):** This laboratory located at Bharatpur, Chitwan. This is the national laboratory for the diagnosis and investigation of poultry diseases. Preliminary diagnosis of HPAI is also done in this lab.

**Rabies Vaccine Production Laboratory:** This laboratory produces vaccine against rabies for animals. This lab is also producing vaccine for human which is under trial.

**Lab under DFTQC / RFTQC:** These labs basically perform the test to determine the residue level of drugs and toxins in foods of animal origin. Also this lab is responsible for the detection of all the food contaminants and hazards. There is one central lab and other 6 regional laboratories under DFTQC.

**Lab of Epidemiology and Disease Control Section under MoHP:** This laboratory diagnoses the various human diseases.

**Surveillance**

Surveillance of zoonotic diseases in human side is primarily done by Epidemiology and Disease Control Section under Department of Health Services whereas the situation of such diseases in animals is compiled by Veterinary Epidemiology Center (VEC) under Department of Livestock Services and reported to Veterinary Public Health Office. Such reporting in animal population is compiled by the VEC from the reports obtained from all the 75 district livestock services offices, which is done based on passive surveillance.
Veterinary Epidemiology Center receives monthly epidemiological reports from all
the 75 DLSOs in a prescribed format. Such report is entered in the access based software
and data can be retrieved as when needed. The reporting system from field level to OIE is
shown in the flow diagram below:

4. Functions and Responsibilities of Veterinary Public Health Services

Objectives
- To contribute in safeguarding the public health by controlling zoonotic
diseases.
- To safeguard the public health by surveying zoonotic diseases and
controlling it.
- To safeguard the public health by minimizing the frauds in foods of
animal origin.
- To safeguard the environment by reducing the environmental pollution
caused by non-edible products of animal origin.

Functions
- To survey, identify and record zoonotic diseases prevalent in Nepal.
- To prepare contingency plans for the control, prevention and eradication
of zoonotic diseases and implement it.
• To conduct public awareness programs and trainings to entrepreneurs and persons working in abattoirs about clean meat production.
• To organize public health awareness campaigns for livestock farmers, entrepreneurs and consumers.
• To initiate monitoring of antibiotic residue in the meat and food of animal origin.
• To coordinate for the establishment of slaughter house/slaughter slabs in all municipalities and VDCs gradually in the public private partnership approach and technically help them.
• To assist in the implementation of public health related Animal Health and Livestock Services Act and Meat Inspection and Slaughterhouse Act and their regulation.

5. Existing Zoonotic and Food Borne Diseases According To OIE Categories

Zoonotic diseases are those in which human beings are infected with pathogens carried by livestock. They can be transmitted directly through animal-to-person contact, or indirectly through consumption of contaminated food. Livestock carry potential health hazards, so food animals are an integral part of public health protocols. Zoonotic diseases here in Nepal are classified as 


**Risk factors Associated to Zoonoses Occurrence are**

- Epidemiological factors;
- Environmental factors;
- Animal reservoir factors;
- Socio-economic factors;
- Community economical development factors.

Zoonoses seem to always catch us by surprise! However, so far scientists have made some achievement in identifying, diagnosing, controlling and preventing diseases in Nepal like:

- Rabies
- Japanese Encephalitis
• Leishmaniasis (Visceral and Cutaneous)
• Echinococcosis/Hydatidosis
• Taeniasis/Cysticercosis
• Brucellosis
• Anthrax
• Foot and Mouth Diseases

Challenges
There are number of emerging and re-emerging zoonotic diseases coming up in both human and animal population in domestic as well as wild living pattern like:

• Avian influenza (Bird flu)
• Rabies
• Swine Influenza
• Dengue Fever
• Salmonellosis
• Leptospirosis
• Monkeypox
• Tuberculosis
• Japanese Incephalitis
• Snake bites etc

In coming Challenges to prevent and control Zoonotic diseases here in Nepal

• Global climatic change
• War – internal and international
• Flood
• Drought
• Urbanization (by deforestation), migration (temporary or permanent)
• Hunting, pets and globalize trade in wildlife
• Demand and supply of consumption pattern of livestock product, cereal product, fruit and vegetable product, milk and milk product, meat and meat product, eggs production and consumption
• Arthropod vector borne population may affect zoonotic disease distribution
• International health regulations
• These above mentioned points support in emerging, re-emerging zoonotic diseases to catch us by surprise
Changing farm Management and Consumer habit

- With respect to the prevalence and socio-economic consequences of zoonotic diseases in Nepal the conditions have actually deteriorated in recent year which is due to:
- Farm management, changing land-use patterns, and animal industries have led to ecological developments without appropriate controls of their respective public health hazards.
- Changing consumer habits rapidly developing food industries by inadequate services of diseases surveillance and control.

5.1. Zoonotic and food borne diseases surveillance, data processing and reporting linking the SAARC countries with Nepal

5.1.1. Bacterial Zoonotic Diseases in Nepal

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Type of zoonotic diseases</th>
<th>Reported/Studied in Nepal</th>
<th>Reporting Year</th>
<th>Control Plan Envisaged</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Anthrax</td>
<td>√</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>2.</td>
<td>Brucellosis</td>
<td>√</td>
<td>1972</td>
<td>√</td>
</tr>
<tr>
<td>3.</td>
<td>Tuberculosis</td>
<td>√</td>
<td>1985</td>
<td>√</td>
</tr>
<tr>
<td>4.</td>
<td>Salmonellosis</td>
<td>√</td>
<td>1986</td>
<td>√</td>
</tr>
<tr>
<td>5.</td>
<td>Escheria coli</td>
<td>√</td>
<td>1983</td>
<td>√</td>
</tr>
<tr>
<td>6.</td>
<td>Streptococciosis</td>
<td>√</td>
<td>1983</td>
<td>√</td>
</tr>
<tr>
<td>7.</td>
<td>Staphylococciosis</td>
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<td>1983</td>
<td>√</td>
</tr>
<tr>
<td>8.</td>
<td>Complybacteriosis</td>
<td>√</td>
<td>1983</td>
<td>√</td>
</tr>
<tr>
<td>9.</td>
<td>Glanders</td>
<td>√</td>
<td>1987</td>
<td>√</td>
</tr>
<tr>
<td>10.</td>
<td>Leptospirosis</td>
<td>√</td>
<td>1987</td>
<td>√</td>
</tr>
<tr>
<td>11.</td>
<td>Plague</td>
<td>√</td>
<td>1964/65</td>
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</tr>
<tr>
<td>12.</td>
<td>Tetanus</td>
<td>√</td>
<td>1984/65</td>
<td>√</td>
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### 5.1.2. Viral Zoonotic Diseases in Nepal

<table>
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<tr>
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<th>Reported/Study in Nepal</th>
<th>Reporting Year</th>
<th>Control Plan Envisaged</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Rabies</td>
<td>√</td>
<td>1960</td>
<td>√</td>
</tr>
<tr>
<td>2.</td>
<td>Cowpox</td>
<td>√</td>
<td>1973</td>
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<tr>
<td>3.</td>
<td>Foot and Mouth Disease</td>
<td>√</td>
<td>1962</td>
<td>√</td>
</tr>
<tr>
<td>4.</td>
<td>Goat Pox</td>
<td>√</td>
<td>1973</td>
<td>√</td>
</tr>
<tr>
<td>5.</td>
<td>Monkey Pox</td>
<td>√</td>
<td>1987</td>
<td>√</td>
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<tr>
<td>6.</td>
<td>Avian Influenza/Bird Flu</td>
<td>√</td>
<td>2006</td>
<td>√</td>
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<tr>
<td>7.</td>
<td>Swine Influenza/Swine flu</td>
<td>√</td>
<td>2008</td>
<td>√</td>
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### 5.1.3 Parasitic Zoonotic Diseases in Nepal

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Type of Zoonotic Diseases</th>
<th>Reported/Study in Nepal</th>
<th>Reporting Year</th>
<th>Control Plan Envisaged</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cutaneous Leishmaniasis</td>
<td>√</td>
<td>1983</td>
<td>√</td>
</tr>
<tr>
<td>2.</td>
<td>Visceral Leishmaniasis</td>
<td>√</td>
<td>1983</td>
<td>√</td>
</tr>
<tr>
<td>3.</td>
<td>Toxoplasmosis</td>
<td>√</td>
<td>1986</td>
<td>√</td>
</tr>
<tr>
<td>4.</td>
<td>Cryptosporidiosis</td>
<td>√</td>
<td>1988</td>
<td>√</td>
</tr>
<tr>
<td>5.</td>
<td>Echinococcosis/Hydatidosis</td>
<td>√</td>
<td>1971/72</td>
<td>√</td>
</tr>
<tr>
<td>6.</td>
<td>Fascioliasis/Liverfluke</td>
<td>√</td>
<td>1971/72</td>
<td>√</td>
</tr>
<tr>
<td>7.</td>
<td>Schistosomiasis</td>
<td>√</td>
<td>1992</td>
<td>√</td>
</tr>
<tr>
<td>8.</td>
<td>Taeniasis/Cysticercosis</td>
<td>√</td>
<td>1982/83</td>
<td>√</td>
</tr>
<tr>
<td>9.</td>
<td>Ascariasis</td>
<td>√</td>
<td>1982/83</td>
<td>√</td>
</tr>
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<td>10.</td>
<td>Cutaneous Larva Migrans</td>
<td>√</td>
<td>1990</td>
<td>√</td>
</tr>
<tr>
<td>11.</td>
<td>Trichinosis</td>
<td>√</td>
<td>2003/04</td>
<td>√</td>
</tr>
<tr>
<td>12.</td>
<td>Zoonotic Filariases</td>
<td>√</td>
<td>2008/09</td>
<td>√</td>
</tr>
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<td>13.</td>
<td>Zoonoses scabies/mange</td>
<td>√</td>
<td>2001/02</td>
<td>√</td>
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</table>
5.1.4. Prevalence of Zoonotic Diseases of livestock in Nepal

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of disease</th>
<th>Number of Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2004/05</td>
<td>2005/06</td>
</tr>
<tr>
<td>1.</td>
<td>Rabies</td>
<td>31</td>
</tr>
<tr>
<td>2.</td>
<td>Anthrax</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>Brucellosis</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Salmonellosis</td>
<td>485</td>
</tr>
<tr>
<td>5.</td>
<td>Mange/mite infection</td>
<td>0</td>
</tr>
<tr>
<td>6.</td>
<td>Colobacillosis</td>
<td>353</td>
</tr>
<tr>
<td>7.</td>
<td>Taeniasis</td>
<td>2</td>
</tr>
<tr>
<td>8.</td>
<td>Fascioliasis</td>
<td>271</td>
</tr>
<tr>
<td>9.</td>
<td>Ascariasis</td>
<td>6</td>
</tr>
<tr>
<td>10.</td>
<td>New Castle Disease</td>
<td>32</td>
</tr>
<tr>
<td>11.</td>
<td>FMD</td>
<td>0</td>
</tr>
</tbody>
</table>

(Source: Veterinary Public Health Office)

5.1.5 Situation of Bird flu in Nepal

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>02 March 2010</td>
<td>Tikapur, Kailali</td>
<td>(6)</td>
</tr>
<tr>
<td>25 Feb, 2010</td>
<td>Ghorahi, Dang</td>
<td>(5)</td>
</tr>
<tr>
<td>19 Feb, 2010</td>
<td>Dhudharakshya, Rupendehi</td>
<td>(4)</td>
</tr>
<tr>
<td>16 Feb, 2010</td>
<td>Chainpur, Chitwan</td>
<td>(3)</td>
</tr>
<tr>
<td>08 March, 2010</td>
<td>Jhyalbas, Nawalparasi</td>
<td>(7)</td>
</tr>
<tr>
<td>26 Jan, 2010</td>
<td>Gharipatan, Kaski</td>
<td>(1)</td>
</tr>
<tr>
<td>04 Feb, 2010</td>
<td>Chatakpur, Banke</td>
<td>(2)</td>
</tr>
</tbody>
</table>

There were 14 Hot spots detected outside the infected area in Pokhara outbreak
5.1.12 Cases, Deaths and Quantity of Anti Snake Venom supply situation in Nepal

![Graph showing Cases, Deaths and quantity of ASV (Anti Snake Venom) Supplied 2061/62 to 065/66](image)

Source: ECDC


Foods of animal origin like milk and milk products, meat and meat products are the vehicle for food borne disease as well as the major source of zoonotic disease. Hence, to prevent the public health from such communicable and zoonotic disease these foods should be properly handled carefully to avoid contamination at every step of processing, from pathogens and organisms responsible for spoilage of milk and meat products. The condition of animal handling for both milk and meat production and marketing in Nepal is primitive. The milking and slaughtering condition is far from satisfactory with unhygienic transportation and marketing. Compliance with HACCP requirements will safeguard the safety of foods of animal origin and. The new approach to supervise food hygiene is the HACCP (Hazard Analysis, Critical Control Points) system. The HACCP system is a scientific and systematic approach to the identification, assessment and control of hazards. The system seeks to identify the hazards associated with any stages of food production, processing or preparation, assess the related risks and determine the operation where control procedures will be effective.

The hazard analysis and critical control point is globally accepted food safety management tools. Nepal’s food control system has not yet incorporated the essential
provision of HACCP certification in the regulatory framework. The so far executed system is mainly based on end product testing modality. On the contrary the is demand of well established system of food safety management in the world for the assurance of safety and quality of the products in international markets. Furthermore, the SPS agreement under WTO has insisted to the member countries to adopt system of harmonization, equivalence in SPS regime so as to minimize trade related disputes on SPS matters. In this connection, WTO has recognized CODEX, OIE and IPPC guidelines and standard for food safety, animal health and plant health respectively. Our neighboring country India is consolidating and updating the food safety and quality regulations. EU has established modern systems for SPS related regulations in place and updated the facilities accordingly. These all national and international requirements have created the urging environments for Nepal to move towards preparing for HACCP certification.

The HACCP system is a preventive management tool for food safety assurance that can be applied to all sections of the food chain, from primary production to processing, manufacturing, distribution and retail to the point of consumption. It is now recognized as an essential tool for use by the food industry in the control of food contamination and enhancing food safety. Besides enhancing food safety, other benefits in applying HACCP include more effective use of resources and more timely response to food safety problems. In addition, the application of the HACCP system can aid inspection by food control regulatory authorities and promote international trade by increasing buyer confidence in food safety.

Although, HACCP is considered a universal tool of safe food production, particularly in highly sensitive foods of animal origin like milk and meat, but it has yet to establish in Nepalese food value chain. So far less than half dozen of food manufacturing units have certified for implementation of HACCP. Recent studies have clearly indicated the needs of adoption of HACCP to improve the safety of foods of animal origin.

Dhital et al. (2007) briefly reviewed the current slaughtering practices and HACCP approaches for safe pig meat production. Their finding indicated that slaughtering condition is far from satisfactory with unhygienic transportation and marketing of pig meat in Nepal. Sources and causes of bacterial load in raw milk were studied (Khanal, 2007). The studied result reveled that the reason for high bacterial load on Nepalese milk chain is due to health and hygiene of animal, environment in which the animal is housed and milked sanitation of handling equipments and utensils and storage environment.

Joshi (2004) had conducted a very comprehensive study on hazard analysis of traditional Nepalese meat based street foods - "Kachila", "Chhoyala", "Wo of black gram with meat", "Wo of green gram with meat", "Sekuwa" of Nepal. Study had investigated the total viable count, coliform count, staphylococcal count, yeast count and mold count of raw minced meat used for preparation of these traditional meat based foods using HACCP a module and results are shown in Table 6. The reports reveled that the presence
of *Escherichia coli*, *Salmonella species*, coliform pattern and, mold pattern of finished products, depended on the types of contaminants in the raw meat and other raw materials. It was concluded that improper handling during preparation adds more contaminants and adoption of the HACCP principles could dramatically reduce the microbial load in these preparation. The author recommends – minimizing the hazards associated, CCPs were found as quality of raw materials, cleaning of raw materials, hands of the handler, storage condition of prepared meat products.

Researches are also piling up to investigate the microbial risk from milk and milk products in Nepal, and reports have indicated Nepalese milk chain are endanger of microbial contamination. Adhikari and Shrestha (2007) reported the very poor microbiological quality of milk received by all dairies in kathmandu valley (Table 7). The report was very critical on observing the pathogenic bacteria (Coliform) in the processed milk and urged for immediate improvement for such worse situation by adoption of HACCP in milk chain.

### 6.2 Coliform load in raw and packaged milk of different dairies

<table>
<thead>
<tr>
<th>Dairy Code</th>
<th>Raw milk at Different dairies</th>
<th>Processed packaged milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5.84 (5.55-6.74)</td>
<td>1.75 (1.25-2.12)</td>
</tr>
<tr>
<td>B</td>
<td>6.95 (6.63-7.83)</td>
<td>0.00</td>
</tr>
<tr>
<td>C</td>
<td>6.5 (5.87-6.99)</td>
<td>1.42 (0.95-1.9)</td>
</tr>
<tr>
<td>D</td>
<td>6.41 (5.65-6.99)</td>
<td>2.07 (1.31-3.04)</td>
</tr>
</tbody>
</table>

Adopted from Adhikari and Shrestha (2007)

Bhatta *et al.* (2007) comprehensively studied the HACCP module in milk chain. They had reported Microbial counts were found increasing from farm level to just before pasteurization (Table 8). The total plate count, Gram negative bacteria, coliform and yeast mold count at farm level ranged from 5.6x10⁶ to 2.8x10⁷ cfu/ml, 4.4x10³ to 1.3x10⁵ cfu/ml, 8.7x10³ to 1.6x10⁴ cfu/ml, 2.1x10² to 4.1x10⁵ CFU /ml and 1.7x10³ to 5.7x10⁵ cfu/ml, respectively. This much microbial count had been gradually increased in each subsequent steps of raw milk and finally attained a maximum level of 3.5x10⁸ cfu to 1.5x10⁹ cfu/ml 2.5x10⁵ to 5.4x10⁷ cfu/ml, 5.0 x10⁵ to 5.5 x10⁶ cfu/ml, 4.1 x10⁴ to 1.8x10⁵ cfu/ml and 3.8 x10⁴ to 1.3x10⁵ cfu/ml, respectively for total plate count, Gram negative bacterial count, coliform, faecal coliform and yeast mold in the step just before pasteurization. Higher microflora in farm level revealed the contamination from milch animal, equipment used, milking method applied and from handlers. Incensement in count of raw milk after farm level might concern with the use of unsanitized and uncleaned cans/ equipments, polluted water supply, unhygienic handlers, microbial growth
and inadequate chilling pasteurization. Study finding concluded that these poor situations could be improved by the adoption of HACCP in milk chain.

7. **Pre-slaughter Examination of Food Animals (cattle, goats, sheep, pigs and buffaloes, etc.)**

   Here in Nepal, farm animals are being examined by village animal health worker in first hand at the farm level, then further they are examined by junior and senior veterinary technician followed by Qualified veterinary Doctor on case basis. Some co-operatives have self employed Veterinary JTA who helps to manage herd health.

8. **Inspection of Abattoir Sanitation, Food Processing Industries, and Foods of Animal Origin (meat, egg, milk, fish) and/or animal origin processed food (ice cream, card, cheese, yoghurts etc.)**

   The food inspection activity which has been practiced within DFTQC can be grouped into the following categories:
   1. Market Inspection
   2. Industry inspection
   3. Hotel, restaurant and street food inspection

   **8.1. Market Inspection**

   It is a routine type of inspection which is mainly focused to the urban areas. Visits of the inspectors are confined to the retail shops and groceries where the inspector observes the food products packed and unpacked (that are sold open). During the visit inspectors keenly looks to the labels of packed food products and general looks for the openly sold products. In case of any reasons ground appears to suspect that the practice followed by the owner is not healthy to the quality of products inspectors insist him to follow the proper way. He has the right to take the sample of the product which he has suspected.

   **8.2. Industry Inspection**

   Industry inspection can be divided in 3 categories;
   a. Industry inspection for licensing
   b. Industry inspection as surprise check
   c. Industry inspection focused for perishable products

   **a. Industry inspection for licensing:** The person who wish to establish food industry in the country should apply with all the detail to department of industry, incase of small
and cottage scale of industry the application is submitted to district office of small and cottage industry. Upon scrutinizing the documents the department or office what so ever will notify the matter to DFTQC or its regional offices. Then DFTQC forward letter of recommendation to proceed forward to establish the industry. The responsible authority of the industry at the final stage of establishment inform DFTQC for inspection. Then the quality control division depute inspection mission to inspect the overall aspects of the industry which include the technology, the machinery selected and installed, the general hygiene and sanitation, the surroundings and other safety and quality aspects of products. After thorough observing all of the safety and quality related aspects the inspection mission gives necessary suggestion if any to the responsible personnel of the industry. There could be re-inspection as the case may be to ensure that the industry has corrected the identified gaps of the previous inspection. Upon completion of all the essential requirements then the sample from the first batch is analyzed. Based on the inspection finding and laboratory report submitted by the inspector the industry concerned is permitted to launch the products in the market.

b. Industry inspection as surprise check: This is also a part of routine inspection. The only question is how to set priority to select a particular industry to visit. For that reason the factors considers are: whether there is any complaints about any particular product in the market, if there is any frequently raised issue in newspaper, fm or radio. It also depends on the nature of the product or how susceptible is the product for contaminants.

c. Industry inspection focused for perishable products:

Special priority is always given for the inspection of perishable products because of their hazard prone nature. From the public health point of view their monitoring is essential.

i. Inspection of milk processing industries (premises):

Milk processing ventures are emerging in various capacity ranges in Nepal, ranging from large to small. Being highly susceptible to contamination, the monitoring of safety and quality has to be implemented throughout the chain. The business operators in each value chain are to be responsible for the operations and treatments followed in place. This is the area where strong intervention is needed with due participation of relevant stake holders. This is the sector where affective adoption of Good Hygienic Practice (GHP) is required. In this connection, there should be the thorough inspection in order to assure that GHP is followed effectively in the entire chain that is from farm to the fork.

However DFTQC has prioritized for the inspection of milk processing chain. Because of inadequate logistic facilities including inspection van the effectiveness has yet to be attained as mentioned above. In addition to that there is need to prepare GHP guidelines applicable for each stake holders in milk value chain. And also the regulatory
frame work has to be updated with the requirements of milk chain in Nepal giving due emphasis to cold chain operation requirements.

ii. Inspection of Slaughter house and meat processing centers /Inspection of abattoir sanitation:

- Slaughtering of meat animals is less organized sector in Nepal which needs to be strengthened by giving utmost priority in national context. The veterinary aspects of imported meat animals are to be traceable.
- The slaughtering spots should be equipped with essential hoarding, inspecting, vaccinating, stunning, washing, bleeding, cleaning, dressing, draining and cold storage facilities.
- These all requirements are to be managed with the due participation from both the private and public sectors
- Comparatively slaughtering of poultry birds has appeared quite organized specially in Kathmandu valley but there is lot to do to attain acceptable system from GHP standpoint
- There is need of strong regulatory frame work in order to define the responsibility of each business operators of meat value chain and equally there is need of regulation with mentioning clear demarcation of responsibility of DLS, DFTQC, and DoA. In this connection the veterinary and animal health aspect is taken care by DLS where as the processing aspects is taken care by DFTQC. In case of GHP implementation there need to be joint efforts from both the depts. DoA and DFTQC. There are areas like fodder production and others where the role of DOA could come.

All these requirements mentioned for the meat chain have always been important prerequisites for establishing a system of hygienic meat supply in the country.

The so far established industries in the meat sector are those producing sausage and sukuti and mainly marketing their products within town and peripheral locations inside Nepal. The inspections carried out in the meat processing sector, though limited in number, are mainly confined to those units which produce sausage and sukuti.

Recently two modern slaughterhouses were established in Biratnagar industrial area and a substantial quantity of their manufacture is being exported outside Nepal. For such industries, maintaining the hygienic quality of their products and ensuring sanitation of their premises and surroundings is crucial and it is also the responsibility of governmental authorities to facilitate such industries by providing them technical know-how for the maintenance of the safety of their products.
8.3 Hotel, Restaurant and Street Food Inspection

Hotel, restaurant, and street food inspection is a relatively newer activity under the DFTQC.

As the expansion of urbanization has happened at a rapid pace in Nepal and the earning of the people diversified from that of the traditional agriculture practices, their eating habits of people changed rapidly, people ate out more and more. Because of this, the country as a whole saw the establishment and emergence of new hotels, restaurants, and street food businesses (especially in most of the cities). From the food safety perspective, the DFTQC felt the need to create awareness amongst the business operators in these sectors and to monitor the hygiene and sanitation of the products. With this objective, the central structure of the department and its regional wings conduct inspections of hotels, restaurants, and street food outlets. During the course of inspection, the business operators are advised to improve the hygienic and sanitary situation of their eateries.

9. Determination and Reporting of Residues (drugs, hormones, toxin, pesticides) in Food of Animals Including Fish

Previously laid down standards under the Food Act focused on composition and were more generic. Later when the threats of contaminants increased because of the introduction of agrochemicals, pesticides, and veterinary drugs and these issues started to be raised at various international forums including CODEX, most of the nations felt the urge to address these issues keeping in mind the seriousness of the health impact of contaminants. Realizing the need of addressing these issues effectively, Nepal also gave due emphasis to this issue. In this connection, there was need to update the prevailing standards and incorporate the limits of contaminants in food standards.

With the advent of time, the importation, distribution, and uses of various pesticides, veterinary drugs, and hormones increased in the country. Consumer activists and media persons also raised this issue on their own which made the consumer even more conscious. The rapid pace of globalization and the formation of the WTO compelled the system of food safety and quality internally and internationally to address this challenging issue more scientifically so as not just to restrict trade by the name of protecting the health of food, plant, and animal of the country concerned. The SPS agreements under the WTO gave rights to the member countries to implement restrictive measures on their borders.

Nepal began to review its food standards so as to incorporate the limit of residues in various food products. However the so far fixed limits for MRLs are only for pesticide residues. There is an urgent need to investigate the situation regarding residues of veterinary drugs in animal products. Again the issue of the use of hormones in agricultural and livestock products is raised frequently in relevant forums. This certainly
needs to be investigated and monitored. If the findings appear to be alarming, the setting of MRLS in the products concerned and other measures need to be implemented.

The problem of environmental pollutants and heavy metals, an important area of concern from the food safety point of view, also has been raised. There are other toxins originating from moulds (generally termed as mycotoxins) which have been a matter of important public health concern.

All these concerns have been pressurizing the food control system authorities of Nepal for a timely review of necessary measures including standards updating. In this connection, the health related standards needed to be given with due priorities and food products are to be covered under horizontal standards.

### 9.1 List of pesticides with MRLs in food standards (Food research Bulletin, by DFTQC, 2009/2010)

<table>
<thead>
<tr>
<th>Pesticide type</th>
<th>Food commodity</th>
<th>Maximum residue limit (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Aldrin, Dieldrin</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Skimmed Milk Powder and</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.03</td>
</tr>
<tr>
<td>2. Benomyl</td>
<td>Skimmed Milk Powder</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>3. Carbaryl</td>
<td>Food Grains, legumes, and pulses</td>
<td>1.5</td>
</tr>
<tr>
<td>4. Carbendazim</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.50</td>
</tr>
<tr>
<td></td>
<td>Skimmed Milk Powder</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>5. Carbofuran</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>Skimmed Milk Powder</td>
<td>0.1</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.1</td>
</tr>
<tr>
<td>6. Chlordane</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Skimmed Milk Powder</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Mineral Water</td>
<td>0.03</td>
</tr>
<tr>
<td>7. Chlorfenvinphos</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.025</td>
</tr>
<tr>
<td></td>
<td>Skimmed Milk Powder</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.2</td>
</tr>
<tr>
<td>8. Chlorpyrifos</td>
<td>Food Grains, legumes, and pulses</td>
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</tr>
<tr>
<td></td>
<td>Skimmed Milk Powder</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.01</td>
</tr>
<tr>
<td>9. Cypermethrin</td>
<td>Skimmed Milk Powder</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.05</td>
</tr>
<tr>
<td>Pesticide type</td>
<td>Food commodity</td>
<td>Maximum residue limit (mg/kg)</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>10. DDT</td>
<td>Food Grains, legumes, and pulses</td>
<td>Absent</td>
</tr>
<tr>
<td></td>
<td>Skimmed Milk Powder</td>
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</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Mineral Water</td>
<td>1</td>
</tr>
<tr>
<td>11. 2,4D</td>
<td>Food Grains, legumes, and pulses</td>
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</tr>
<tr>
<td></td>
<td>Skimmed Milk Powder</td>
<td>0.05</td>
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<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Mineral Water</td>
<td>100</td>
</tr>
<tr>
<td>12. Diazinon</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.05</td>
</tr>
<tr>
<td>13. Dicamethrin/Deltamethrin</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.50</td>
</tr>
<tr>
<td>14. Dichlorvos</td>
<td>Food Grains, legumes, and pulses</td>
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</tr>
<tr>
<td>15. Dithiocarbamates</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.2</td>
</tr>
<tr>
<td>16. Edifenphos</td>
<td>Skimmed Milk Powder</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.05</td>
</tr>
<tr>
<td>17. Ethion</td>
<td>Skimmed Milk Powder</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.5</td>
</tr>
<tr>
<td>18. Fenthion</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.10</td>
</tr>
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<td>Skimmed Milk Powder</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.01</td>
</tr>
<tr>
<td>19. Fenitrothion</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Skimmed Milk Powder</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.05</td>
</tr>
<tr>
<td>20. Fenvalerate</td>
<td>Skimmed Milk Powder</td>
<td>0.05</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.05</td>
</tr>
<tr>
<td>21. Heptachlor</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.01</td>
</tr>
<tr>
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<td>Skimmed Milk Powder</td>
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</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Mineral Water</td>
<td>0.1</td>
</tr>
<tr>
<td>22. Hexachlorobenzene</td>
<td>Mineral Water</td>
<td>0.01</td>
</tr>
<tr>
<td>23. Hydrogen Cyanide</td>
<td>Food Grains, legumes, and pulses</td>
<td>37.05</td>
</tr>
<tr>
<td>24. Hydrogen Phosphide</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.02</td>
</tr>
<tr>
<td>25. Inorganic Bromide</td>
<td>Food Grains, legumes, and pulses</td>
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</tr>
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<td>26. Lindane</td>
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<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Mineral Water</td>
<td>3.0</td>
</tr>
<tr>
<td>27. Malathion</td>
<td>Food Grains, legumes, and pulses</td>
<td>4.0</td>
</tr>
</tbody>
</table>
### Pesticide Residue Limits for Selected Food Commodities

<table>
<thead>
<tr>
<th>Pesticide type</th>
<th>Food commodity</th>
<th>Maximum residue limit (mg/kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>28. Monocrotophos</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.025</td>
</tr>
<tr>
<td></td>
<td>Skimmed Milk Powder</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.02</td>
</tr>
<tr>
<td>29. Oxydemeton methyl</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.02</td>
</tr>
<tr>
<td>30. Paraquat dichloride</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.025</td>
</tr>
<tr>
<td>31. Phenthoate</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.05</td>
</tr>
<tr>
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<td>Skimmed Milk Powder</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.01</td>
</tr>
<tr>
<td>32. Phorate</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.05</td>
</tr>
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<td>Skimmed Milk Powder</td>
<td>0.01</td>
</tr>
<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.01</td>
</tr>
<tr>
<td>33. Phosphamindon</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.05</td>
</tr>
<tr>
<td>34. Pirimiphos methyl</td>
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<tr>
<td></td>
<td>Whole Milk Powder</td>
<td>0.05</td>
</tr>
<tr>
<td>35. Pyrethrins</td>
<td>Food Grains, legumes, and pulses</td>
<td>Absence</td>
</tr>
<tr>
<td>36. Trichlorfon</td>
<td>Food Grains, legumes, and pulses</td>
<td>0.05</td>
</tr>
</tbody>
</table>

### 10. Framing Common Rules and Standards for Zoonotic Disease Control and Safe Food of Animal Origin

Developing countries, including Nepal, are becoming more involved in international food trade. There is a shift from the traditional production of milk and meat raw materials to producing processed or semi-processed food products. This shift has brought in new challenges in order to cope with international trends in food regulations and standards.

Such challenging demands include upgrading legislation, together with the integration of laws and regulations in comprehensive and user-friendly documents, the harmonization of the responsibilities of multiple institutions dealing with food safety issues, the reorganization of inconsistent and selective enforcement, the non-use of risk assessment to develop standards, the non-existence or insufficient number of efficient accredited control laboratories, the confusion between quality and safety, and the lack of a framework of collaboration between governmental institutions and the entrepreneurs.

As SAARC countries face increasing problems of common zoonotic diseases, a coherent approach is necessary to control this menace. It is almost impossible to contain these insidious diseases without a coordinated approach. So, it is the need of the hour to frame common rules and standards for zoonotic diseases and safe food of animal origin for SAARC countries.
11. National/ regional Initiatives that have been Undertaken for the Progressive Control of Priority Trans-boundary Animal Diseases (TADs)

Nepal has listed 22 livestock diseases as notifiable diseases and published them in its gazette. Among them, the following diseases have been identified as the priority trans-boundary animal diseases:

1. Foot and Mouth Disease (FMD)
2. Peste des petits ruminants (PPR)
3. Highly pathogenic avian influenza (HPAI)
4. Classical swine fever (CSF)
5. Rinderpest (Eradicated from 2002)
6. Blue tongue (Emerging TADs)

11.1 National PPR Control Program: This is the national control program for PPR which includes the mass vaccination of the sheep and goat population. However, due to resource constraints, the coverage of vaccination is yet to be increased.

11.2 Avian Influenza Control Project: For the control of HPAI in Nepal, there is a World Bank funded project named Avian Influenza Control Project (AICP) which terminates in 2011. Both human health and animal health components are working jointly to contain this disease.

For FMD and CSF, there is no such control program. However, when outbreaks are reported in any area, ring vaccination is done to contain the disease/s.

Some regional measures have also been undertaken for the progressive control of priority TADs. These include regular meetings of chief veterinary officers and different seminars or workshops at the regional level coordinated by the SAARC, or FAO. Apart from this, there are also certain bilateral agreements. However, such coordination needs to be strengthened further and extended to the implementation level to achieve positive results.

12. Interdisciplinary Collaboration that has been under taken in one World one Health Initiatives

Interdisciplinary collaboration that has been undertaken in one world one health initiatives is still at a primitive level. Only very few things has been done according to the concept of one world one health. Zoonotic diseases can only be effectively controlled by applying this unique concept of health and building up regional cooperation.

In Nepal, the human component is primarily focused on treatment only caring less, to little, for prevention. Take the example of rabies: Annually, more than 30,000 people take post-exposure treatment in Nepal. Rabies cannot be controlled unless the rabies in
animals itself is minimized. However, there is no national rabies control program for animals in Nepal. The same is the case for many other zoonotic diseases.

So, the interdisciplinary collaboration between related stakeholders needs to be greatly strengthened.

13. Legislation of Veterinary Public Health and their Implementation


Few controls are currently exercised over the food of animal origin including quality control, zoonotic and food borne diseases surveillance, pre- and post-slaughter examination of food animals, inspection of abattoir sanitation, food processing industries, or foods of animal origin, and monitoring the importation, exportation, and handling of animal food products in the country. While there is existing legislation on food from animal origin in Nepal, most of it is very old and not all its principles and definitions are in harmony with the current international belief, as reflected in the CODEX and OIE. Nor are the duties of the various governmental units involved in the control of food of animal origin well defined in the existing legislation. This leads to overlaps and gaps in the controls exercised on the animal food production and handling in the country.

The legislative framework for animal food products in Nepal is composed of a variety of legal provisions found in many acts and regulations. Some specific laws and regulations in relation to the control of foods of animal origin are discussed hereafter:

1. Food Act (1966) and Food Rules (1979): The Food Act and Rules were enacted in 1966 and 1979, respectively, and are administered by the Department of Food Technology and Quality Control within the ministry of Agriculture and Cooperatives, Government of Nepal. The main purpose of this act is to prevent the adulteration of foodstuffs, to prevent activities that reduce the quality and utility of foodstuffs, and to maintain the quality of foodstuffs. Food laws clearly state the quality requirement of animal products to safeguard consumer health and to avoid likely threats from diseased animals or contaminated animal foods. Section 2 (a) of Food Act 1966 deals with, “Foodstuffs prepared wholly or partially from any diseased or disease-carrying birds or animals or harmful vegetable materials, in such a manner as to be unfit for human consumption”. Similarly, Section 3 of Food acts 1966 prohibit the production, sale, distribution, export, and import of contaminated and substandard foodstuffs, which also includes all types of meat and meat products.

2. Consumer Protection Act (1998) and Consumer Protection Rules (2000): The Consumer Protection Act and Regulation is administered by the Department of Commerce, and was enacted to protect consumers from the sale, supply, import, export,
and storage of unsafe and substandard consumer goods. Among the various rights granted by the Consumer acts, the right to life, including protection of health from harmful consumer good, is applicable to control the quality of animal products including poultry, meat, and meat products. Section 2 (i) of Consumer Protection Act has a special provision in relation to the control of the quality and safety of animal products. It says that consumer goods which are fully or partly made of any diseased or disease-generating animals or birds are considered as sub-standard consumer goods and the Act prohibits the sale, supply, import, export, and storage of such foods of animal origin.

3. Slaughterhouse and Meat Inspection Act (1998) and Rules (2001): The Slaughterhouse and Meat Inspection Act 1998 were enacted with a view to protect public health from adulteration of meat and from other activities that affect meat quality. The Act also provides for the establishment of slaughterhouses. This Act is administered by the Department of Livestock within the Ministry of Agriculture and Cooperatives, Government of Nepal. The Act has made provision for licenses to be obtained from concerned agencies before any person can operate a slaughterhouse. Further, the Act provides that livestock shall be inspected before it is sent to the slaughterhouse; it also requires that a stamp be affixed to meat after its inspection and before its sale to consumers.

4. Animal Health and livestock Services Act (1998) and Rules (2000): This Act was enacted with a view to developing animal husbandry including the healthy production, sale, distribution, export, and import of animals, animal products, or animal production inputs. Section 3 of the Act provides for the establishment of quarantine checkpoints. Section 6 requires the quarantine of imported animals and animal products for a specified period of time in order for them to be inspected.

5. Local Self-Governance Act (1999) and Rules (2000): The Local Self-Governance provisions having to do with animal products include section 96 (g) and 96 (i), which authorize Municipalities to ban the public use, sale, distribution, and consumption of such things and objects in the Municipality area that are harmful to public health or even to remove these things/objects.

In a nutshell, Acts, policies, rules and regulations having relation to zoonoses and livestock services are given below:

13.2 Agricultural Policies

5. Long-Term Agriculture Projects Development Policy, 2067 B.S. (2010 A.D.)
13.3 Agricultural Acts


14. Conclusions and Recommendations

In conclusion Nepal government should engage in the following activities urgently to control zoonotic diseases in Nepal:

- Legislation/Acts to control zoonoses in Nepal
- Prevention and control of zoonoses through surveillance and research
- Strengthen inter-institutional global frameworks for early detection and containment
- Refine existing and develop new tools for control strategy selection
- Promote new concepts for zoonose prevention
- Regional co-operation for the control of zoonotic and priority trans-boundary diseases
- Global one world one health policy should be implemented

References


ABBREVIATIONS and ACRONYMS

CCP  Critical Control Points
CSF  Classical Swine Fever
CVL  Central Veterinary Laboratory
DDT  Dichloro Diphenyl Trichloroethane
DLSO  District Livestock Service Office
DFTQC  Department of Food Technology and Quality Control
DIU  District Inspection Unit
DOA  Department of Agriculture
DLS  Department of Livestock Services
ECDC  Epidemiology Centre for Disease Control
EU  European Union
FAO  Food and Agricultural Organization of the United Nations
FMD  Foot and Mouth Disease
Ft  Feet
Gaz  Gazetted
GDP  Gross Domestic product
GHP  Good Hygienic Practices
HACCP  Hazard Analysis and Critical Control Points
HPAI  Highly Pathogenic Avian Influenza
IPPC  International Plant Protection Convention
JTA  Junior Technical Assistants
MOAC  Ministry of Agriculture and Cooperatives
MOHP  Ministry of Health and Population
MPA  Milk Producer’s Association
MRLs  Maximum Residual Level
NAL  National Avian Laboratory
NG  Non-gazetted
NZFHRC  National Zonoses and food Hygiene Research Center
OIE  Office International Epizooties (World Organization for Animal Health)
RFTQCO  Regional Food Technology and Quality Control Offices
RVL  Regional Veterinary Laboratory
SAARC  South Asian Association for Regional Cooperation
SPS  Sanitary and Phyto-sanitary Measures
Sq. mi  Square miles
TADs  Trans-boundary Animal Diseases
TIA  Tribhuvan International Airport
WTO  World Trade Organization
VDC  Village Development Committee
VEC  Veterinary Epidemiology Center
Veterinary Public Health and Zoonotic Disease Control in PAKISTAN

Dr. Muhammad Akram
Assistant Animal Husbandry Commissioner
Ministry of Livestock and Dairy Development
Government of Pakistan
Email: muhammadakram422@yahoo.com
1. Introduction

2. Veterinary Public Health (VPH) Structure and Set up in Pakistan

3. Veterinary Public Health Laboratory Activities for Inspection, Surveillance of Zoonotic Diseases and Data Processing and Handling

4. Existing Zoonotic and Food Borne Diseases According to OIE Categories

5. Risk Assessment and Development of Hazard Analysis and Critical Control Program for Food of Animal and Fish Origin

6. Procedures of Pre-slaughters Examination of Food Animals (cattle, goats, sheep, pigs, camels and buffaloes, etc.)

7. Inspection of Abattoir Sanitation, Food Processing Industries, and Foods of Animal Origin (meat, egg, milk, fish) and/or Animal Origin Processed Food (ice cream, card, cheese, yoghurts etc.)

8. Determination and Reporting of Residues (drugs, Hormones, Toxin Pesticides, etc.) In Food of Animals-including Fishes

9. Framing Common Rules and Standards for Zoonotic Disease Control and Safe Food of Animal Origin for SAARC Countries

10. National/regional Initiatives that have been under taken for Progressive Control of Priority Trans-boundary Animal Diseases (TADs)

11. Interdisciplinary Collaboration that has been Undertaken in one World one Health Initiative

12. Legislation of Veterinary Public Health and Their Implementation

13. Conclusion and Recommendations

Veterinary Services of Pakistan

Abbreviations

References

Acknowledgement
1. Introduction

1.1 Background

The human and infectious diseases have extremely close relationship since their creation and the world will continue to witness epidemics till the life exists on earth. This proposition can be proved while studying the history of spread of infections which can be divided into three different periods. The first period is associated with the agricultural revolution when early human ancestors gave up nomadic life to establish agrarian society about 10,000 years ago. This change of lifestyle favored the spread and emergence of infectious pathogens because of the clustering of humans at one place and increased contact between human-human and the human-animals. The second period of disease spread is linked to the industrial revolution when discovery of antibiotics and vaccines and other scientific progress in medicine caused misperception that the infectious diseases were overcome for ever. This misperception resulted in poor attention to public health measures and infrastructure development which gave rise to the resurgence of diseases like TB and emergence of new disease like HIV which spread worldwide. The third period in the spread of infectious diseases is of course the current era where livestock and wild life are explicitly associated with spread and or emergence of pathogens especially the zoonoses.

About one infectious disease has been experienced every year during recent past and the scientists has reported that out of total 1415 known infectious diseases of human 868 (61%) are of zoonotic importance. Following are few important zoonotic infections, the world has seen during last twenty years:

- Huntaviruses from rodents;
- Nipah virus from bats through swine;
- Influenza viruses from poultry and water fowls;
- West Nile Virus from birds through mosquitoes;
- Lyme disease from deer via ticks;
- Prion agent causing BSE and CJD from cattle;
- SARS from captive wild mammals;
- Monkeypox from pet rodents; and
- Swine flu from pigs.

The most recent outbreaks especially Severe Acute Respiratory Syndrome (SARS), West Nile Virus (WNV), Highly Pathogenic Avian Influenza (H5N1) and Swine Flu have proved a strong association of human and livestock including wild life. This increased human-animals interface has put livestock producers, consumers of livestock products, and traders and processors of livestock products at higher risk of contracting zoonotic diseases while contributing significantly to the total disease burden. So the importance of collaborative research and effective veterinary and health services has
increased manifold for the prevention and control of zoonoses. This situation necessitates the establishment of effective partnerships between human public health and veterinary administration and services aiming to improve health and well being of the public. This evolving scenario of convergence of human and animal health under “One World-One health” concept has created new opportunities and challenges for veterinarians whose role is envisioned not only to safeguard the health of animals but also to contribute to the human health. This multidisciplinary approach to combat the threats to human health has thus introduced a relatively new term called “veterinary public health”

Veterinary Public Health initially defined in 1975 as “A compartment of public health activities devoted to the application of professional skills, knowledge and resources to the protection and improvement of human health” has now been re-defined in 1999 by FAO, WHO, OIE and world experts as” the contribution to the complete physical, mental and social well being of human through an understanding and application of veterinary medical science”.

Keeping in view the significant role of veterinarian in safeguarding the human health and well being World Health Organization (WHO) has emphasized the member countries to establish an independent veterinary public health organization to face the challenges of zoonotic disease. A global collaborative agenda for prevention and control of emerging and re-emerging diseases of animal origin has also been identified by WHO with following components:

- Integrated research;
- Interdisciplinary zoonotic disease research centers;
- Surveillance of domestic animals, wild life and humans;
- Animal and human response teams;
- Infrastructure development;
- Workforce development;
- Improved coordination and strengthened focus.

The core domains of veterinary public health (VPH) include:

- Diagnosis, Surveillance, epidemiology, control, prevention and elimination of zoonoses;
- Food safety;
- Management of health aspects of laboratory animal facilities and diagnostic laboratories;
- Biomedical research;
- Health education and extension;
- Production and control of biological products and medical devices;
- Management of domestic and wild animal populations;
- Protection of drinking-water and the environment; and
- Management of public health emergencies.
1.2 Justification

The SARS epidemic in 2002, highly pathogenic avian influenza (H5N1) in 2003 and swine flu in 2008 have pointed out the gaps and deficiencies in planning and responding to health emergencies even in most advanced health care systems in the world. This situation over and above created the need for (a) prompt and open reporting of infectious events having potential for world wide spread due to globalization and fast traveling means; (b) risk communication; (c) effective multi-sectoral collaboration and partnerships to know the answers of unknown questions about the emergence or reemergence of zoonoses and about the crossing of species barrier from animal to human.

The scientist and the experts have the considered view point that the current era has all the critical forces and essential factors that provide enabling environment for the emergence, re-emergence and acceleration of zoonoses which in turn, may result in drastic consequences in a very limited time frame across the globe. Those forces and factors may include:

- Human/livestock and wild life are on the same interface;
- Increasing stress on the world food system and intensive animal production systems;
- Development of new and or resistant strains of human and animal pathogens;
- Unprecedented increase in world trade and traveling;
- Use of modern technology in medical and food industries;
- Uncontrolled global climatic and environmental changes;
- Rapidly growing human and animal populations;
- Urbanization ;
- Poor socioeconomic conditions especially in developing countries;
- Advances in medicines and industry leading to growing number of microbes resistant to antimicrobials;
- Growing number of elderly and immune-compromised individuals;
- Ability of the pathogens to cross the species barrier from animal to human and their spread via vectors.

There is no doubt that a wide variety of foods of animal origin including meat, milk, eggs, ice cream, butter cheese, yogurt and fish etc are important for optimal protein, energy and micronutrient nutrition but the consumption of these foods may risk the human for various zoonoses as well. Burgeoning international trade in animal and animal products and increased traveling has further increased the risk of spread of such infection globally.

In order to reduce such risks, the international community has agreed to follow Sanitary and Phyto-sanitary (SPS) standards developed by World Trade Organization
The SPS standards ensure that the foods of animal origin are safe from all pathogens affecting human and are free or within the acceptable limits of antibiotics, hormones and other environmental contaminants.

Since Pakistan is maintaining a large animal resource base while employing 30 to 35 million families in the livestock business and is earning billion of dollars through export of live animals, meat, animal casings etc to Middle East and EU member countries as well as is a responsible member of SAARC. Therefore, in order to protect the producers, consumers, traders and processors from zoonotic infections locally, regionally and abroad, the implementation of SPS standards is imperative. The implementation of SPS standards is possible only if infrastructure and capacity are available with the country to undertake the functions outlined under the core domains of veterinary public health which would enable them for early detection and trace back of pathogen and quick response to the emerging or re-emerging pathogens.

This report on veterinary public health and zoonoses control in Pakistan is compiled for South Asian Association for Regional Cooperation (SAARC) with the following objectives:

- To share knowledge about safe food of animal origin including fish;
- To share knowledge about zoonotic disease reporting system-linking abattoirs with national and regional coverage;
- To share knowledge about sanitation and meat hygiene (beef, mutton, pork, chicken, ducks etc.) for market access;
- To share knowledge about preventing environmental pollution in SAARC countries.

1.3 Scope of Veterinary Public Health

The rapid emergence or re-emergence of zoonotic pathogens and their rapid spread by means of foods, trade and international traveling have compelled the experts and policy makers to converge their human and animal health to a novel concept of “One World, One Health”. This concept has created new opportunities as well as has posed significant challenges for veterinary services. The role of veterinarians has ever first been realized in safeguarding the human and animal health and the veterinary public health has therefore re-defined as” the contribution to the complete physical, mental and social well being of human through an understanding and application of veterinary medical science”.

Robert Virchow (A German Physician) in nineteenth century stated that there is no dividing line between animal and human medicine, nor should there be. Thus floated an idea of one medicine however William Osler (A Canadian Physician) was the first man who used the term “One medicine” and Calvin Schwabe (An Epidemiologist) in 1984 supported the integration of human and veterinary medicine because of increasing interdependence of animals and animal products with human infections. He therefore
encouraged both veterinary and medical professions to coordinate each other to prevent diseases from occurring.

The human and the animal health problems are inextricably linked and the health is not an issue of a country or region but the whole world as the infectious pathogens cannot be restricted with in international borders, geographical areas or to a particular ethnic group. Therefore, the basic principle of VPH according to Allard et al (2004) is to deliver fundamentals of public health programs as close to the individual, small groups or community as possible which in turn necessitate the multi-disciplinary approach. Those fundamentals may include basic hygiene principles, quarantine and isolation, bio-security, inexpensive vaccine, surveillance systems, diagnostic capability, treatment options and depopulation capability. The actors for delivery of fundamentals may include but not limited to government & non-governmental sectors, public / private veterinarian, health professionals, policy makers, other health professionals, scientists and para-professionals that treat, control, and prevent diseases of animal origin.

In reality, the role of veterinary science can better be understood while considering the relationship of food production and animal health as well as the likely impacts of animal diseases on food supplies, transportation and draft power. Similarly the role of veterinary sciences has also been acknowledged due to emergence or re-emergence of the zoontonic diseases having their direct impacts on human and indirect impact on food security. The veterinarians, public health practitioners and medical professionals are required to be involved in the trace back and control & prevention of food borne zoonoses.

The veterinary science has contributed a lot to the human mankind. Veterinarians are the first line of defense for zoonotic diseases and number of toxicants. The role of veterinarians however, was first acknowledged during 19th and 20th centuries in the area of food hygiene to curb the large outbreaks of Trichinosis in Germany where veterinarian were the integral part to the development of food hygiene laws, meat inspection system. The veterinarians in USA are now involved in environment health, vaccine preventable disease programs, disease response / assessment, chronic diseases and nutrition aspects, occupational health, in jury control, food drugs, water and waste issue, pet facilitated therapy, HIV/AIDS awareness, teaching and management of public health programs and organizations.

Last but not least, the knowledge of animal sciences in the ecological, economic and cultural contexts helps us in planning sustainable public health which is ecologically grounded, culturally feasible and economically realistic and all these facts point towards the expanding scope of veterinary public health across the globe including Pakistan.
2. Veterinary Public Health (VPH) Structure and Set up in Pakistan

Veterinary Public Health is the shared responsibility of Federal & Provincial Livestock & Dairy Development, Health, Environment and Local Govt. Departments. These departments perform public health activities in their defined jurisdictions. Veterinary Services takes care of things at production and processing levels. It provides health coverage to animals; supervises processing of livestock products and provide extension services to improve animal husbandry practices in the country. The disease surveillance & reporting, risk analysis of foods of animal origin, inspection and certification services for import / export of live animals and livestock products, forward & backward tracing systems and mechanisms are broadly in line with the international standards and requirements. The M/O Health and Municipalities takes care of products of animal origin at market level through their set up of Food inspectors and laboratories. These departments regulate food production/processing and distribution chain at whole sale and retailer levels, integrating farm to fork approach for food quality and consumers safety.

2.1 Role of M/O Health

M/O Health operates through their provincial health departments, integrating other line departments. It is responsible for investigation of outbreaks and control of infectious diseases including zoonosis, water and vector borne infectious diseases. M/O health and local governments regulate inspection and certification of milk and dairy products for its quality and wholesomeness. Food inspectors inspect and certify the food items including meat and other livestock products at whole / retail shops, and food markets for their quality, shelf life and keeping conditions. They have legislative support to call back, confiscate, destroy the unhygienic or adulterated food items and may fine, give imprisonment or both to accuser through courts.

A Public Health Cell has been established in M/O Health and their allied provincial health departments with the sole mandate of checking Zoonotic diseases. It is headed by Director, Communicable disease control. The Provincial disease surveillance officer, District health officer (Preventive), Executive district officer (Health) are responsible for investigation and response to the disease outbreaks. They collect samples from the outbreak and submit to Provincial Divisional / District Health Laboratories and National Institutes of Health for further investigation. These laboratories in turn furnish results and technical advice to the provincial health departments for action / response. These laboratories are adequately equipped in terms of manpower and technical expertise to perform their duties. These laboratories fall under the category of BSL-1 & 2, depending upon their location. Divisional level labs generally have better facilities of diagnosis. A laboratory of bio-security level-3 (BSL-3) has recently been constructed in Islamabad for avian influenza.
Contingency plans exist for communicable diseases. They are activated in case of need. A National steering committee (Annex-I) and a Joint Steering Committee (Annex-II) have also been constituted for communicable diseases. It has all relevant departments on board. This committee meets every now and then to review zoonotic disease situation in the country. This multidisciplinary approach was proved very effective in controlling outbreak of avian influenza in poultry. No case avian influenza virus (H5N1) was recorded in Pakistan since June, 2008. The flow of information and organogram of Health department are as under:

Human Disease Reporting Mechanism

2.2 M/O Livestock and Dairy Development

M/O Livestock and Dairy Development was created in November 03, 2008. The ministry has been mandated to devise national policies, planning and economic coordination in respect of animal disease control and national grading for livestock, poultry and animal products including fish. This ministry has close working links with the provincial livestock and fisheries departments for livestock and fisheries matters. The veterinary services infrastructure in Pakistan is at Annex. III. Every union council has at least one veterinary assistant to provide veterinary services to the farmers at their door step including vaccination against trans-boundary animal diseases and reporting the outbreaks to the veterinary officer based in veterinary hospital and or veterinary dispensary. This civil veterinary hospital or dispensary is usually located at town level covering six to ten union councils. These hospitals and dispensaries have been
strengthened from time to time under various projects. It is strengthened in terms of equipments, capacity building and mobility. Mobile dispensaries have been established to provide Veterinary health services at farmers’ door steps.

There are approximately 295 slaughterhouses operating throughout the country under local Government. About a dozen export oriented slaughterhouses have been established in the private sector (Annex-IV). The slaughtering is supervised by state veterinarians. They observe Halal method of slaughtering. The slaughtering practices need improvements in order to avoid economical losses of meat, hides and skins and other valuable livestock by products.

Department of Livestock and Dairy Development Government of Punjab is in process of creation of a meat and milk safety agency with in their jurisdiction. M/O Livestock and Dairy Development however, is planning to set up a “Veterinary Public Health and Food Safety Authority” in order to supervise the public health issues under one authority in the entire country with the following objectives:

- Design and implementation of health information system.
- Electronic access and networking and training to information to strengthen technical expertise of veterinary and administrative infrastructure.
- Effective disease surveillance system and enhanced communication between ministries of health, agriculture, wildlife, environment and livestock.
- Research in the impacts of interactions of humans/animal/environment and the better understanding of multiple interfaces of human, animal (livestock and wild life) and environment.
- Develop programs aiming to improve the safety of food and water in the context of zoonotic pathogens,
- Develop and implement codes of good manufacturing practice, HACCP and other similar auditing systems.

### 2.3 M/O Local Governments

The local government also assists in regulation of food inspection services. It has food inspectors who conduct food inspections including milk and milk products. They issue licenses for establishment of sites for food manufacturing and or sale there of. For meat inspection, they contract with public veterinarian appointed in the nearest veterinary hospital. The District health officer, who is ex-officio inspector, can also appoint inspector to undertake inspection to ensure food quality and wholesomeness including animal products. The food inspectors or health officer conducts inspection and collects food samples and submit them to public analyst. The public analyst (at Provincial level) reports the results to the concerned food inspector as well as testifies before the court, in case of need, for the results of food samples. Based on the results, the district administration, food inspector and or district health officer may take appropriate action/decision regarding the manufacturer or seller of adulteries.
2.4 M/O Environment

M/O Environment regulates environmental issues in accordance with national laws and international obligations. All Ministries and provincial departments involved in food safety matters coordinate with each other. They hold regular meetings to exchange information and seek each other's cooperation on matters of common interest.

3. Veterinary Public Health Laboratory Activities for Inspection, Surveillance of Zoonotic Diseases and Data Processing and Handling

A large number of laboratories both in the human and livestock sectors are providing clinical & diagnostic services at various levels. These laboratories are moderately equipped and fall generally in category of BSL-I or BSL-2 depending upon their location. Certain universities and private sector’s accredited laboratories are also providing diagnostic services. These laboratories are strengthened under various programs. They are equipped from moderate (Culture, biochemical and drug sensitivity test; Agar gel immuno diffusion test; Haemagglutination and inhibition tests; Complement fixation etc.) to advance livestock diseases diagnostic facilities (ELISA, PCR and SDS-PAGE, drug sensitivity, Histopathology, Histopathology, Electrophoresis etc.). The international assistance has also been sought from time to time and specimen samples have been sent to World reference laboratories for validation of results of the national laboratories.

In livestock sector, diagnostic laboratories are located at Division and District levels. It collaborates with the field veterinary services for diagnosis of livestock diseases. The samples are sent or collected by the laboratory for investigations and also sent to Veterinary Research Institutes (VRI’s) and national reference laboratories for detailed analysis. Veterinary Research Institutes are situated at the provincial capital level. These are equipped with advance diagnostic facilities and closely liaison with the field diagnostic laboratories.

National Veterinary Laboratory (NVL), Islamabad serves as Reference Laboratory for the diagnosis / research of livestock diseases. The NVL has processed and analyzed approximately 16000 blood, serum, milk and water samples for disease diagnosis and surveillance of foot and mouth disease (FMD), peste des petits ruminants (PPR) during 2009 - 2010. This laboratory has also processed 54 batches of avian influenza vaccine for their quality, titer and safety etc prior to their marketing in Pakistan. This laboratory processed 437 samples for drug residue and heavy metal during one year. The research and development is the continued activity at NVL. During the last year the scientists in this laboratory worked on protein profiling of subunit of Pasteurella multocida (a bacterium that cause hemorrhagic septicemia in large animals) using SD-PAGE and purification of this bacterium using biological assay in mice. The scientist in this laboratory also worked on sero-surveillance of brucellosis in bovine species in the
country. They are still working on preparation of RBPT from S-19 strain of Brucella abortus. NVL is in process of being accredited by Pakistan National Accreditation Council (PNAC) and UNIDO is providing technical assistance in this regards. A DNA sequencing laboratory has recently been established in this laboratory and a scientist from this laboratory has been trained abroad under a Project titled, “Special Program for strengthening SPS facilities and Quality inspection services in compliance with WTO- Establishment of National Animal and Plant Health inspection Services (NAPHIS)”.

National Reference Laboratory for Poultry Disease, National Agricultural Research Centre is serving as Reference Laboratory for Avian Influenza (AI). This is also recognized / declared as Regional Reference laboratory for avian influenza (H5N1) for the regional countries i.e Afghanistan and central Asian states by FAO and OIE. The laboratory is being upgraded to Bio-security level-III (BSL-III) and accredited by Pakistan National Accreditation Council (PNAC). UNIDO is providing technical assistance in this regards. The laboratory has analyzed 627146 poultry samples for identification and surveillance of avian influenza during the July 2007 to April 2010.

Animal Disease Reporting Mechanism

Farmers / Field / Abattoir

Fortnightly / monthly

Veterinary Officer, Stock Assistants, Dispensers, Compounder, Private Vet. etc.

Assistant Director

Deputy Director

Director (Animal Health)

Livestock Disease information System

Director General

Secretary (Livestock)

Animal Husbandry Commissioner, M/O Livestock

Veterinary Research Institute

District Laboratory

Flash Reporting for TAD

(24 to 48 Hrs)

Veterinary Officer, Stock Assistants, Dispensers, Compounder, Private Vet. etc.

Assistant Director

Deputy Director

Director (Animal Health)

Livestock Disease information System

Director General

Secretary (Livestock)

Animal Husbandry Commissioner, M/O Livestock

Veterinary Research Institute

District Laboratory

Flash Reporting for TAD as soon as Possible Otherwise quarterly / annually

OIE
This information collected/generated are being analyzed and used for disease control, monitoring and research purposes. These laboratories also conduct national and international training programs to improve the diseases diagnostic skills of the professionals and technical staff.

The laboratories in human sector at basic health unit conducts only very basic blood and urine tests if at all and a relatively large number of blood, urine diagnostic tests in addition to ultrasonography and X-Rays are done at district levels. Advanced tests including Bioassays, immuno-assays, PCR and DNA sequencing etc are provided in very specialized hospitals. The teaching hospitals have a long range of testing facilities not only to train the students but also for acute and chronic patients in advanced stages of clinical illness. All the information/data about the patient including personal, family, demographic and clinical history and diagnostic history are recorded in epidemiological software programs, developed for the purpose. Information on zoonotic and food borne infectious diseases are shared with stakeholders to devise control strategy at respective departmental levels.

4. Existing Zoonotic and Food Borne Diseases According to OIE Categories

The world is now interconnected where more than one million people cross the international borders daily for their social, political and economic reasons and the foods are produced and manufactured in one part of the earth and consumed in the other part of the earth due to quick and efficient means of transportation. The negative aspect of this globalization phenomenon is the easy, rapid and effective transmission of infectious pathogens from one part of the world to the other with the movement of people, animals and animal products. Inadequate cargo inspection and quarantine services has permitted the infected animals, insect vectors and agricultural products to move to other regions which are otherwise free from such pathogens and the host of such parasite have inadequate immunity against them. For instance, it has been reported that Aedes albopictus (a mosquito found in Asia), a vector of dengue fever virus has been exported to North America with the trade of used tires. It has also been noted that poor budgetary position of the countries at large including Pakistan has triggered the emergence or re-emergence of zoonotic diseases during last twenty years.

The disease reporting is a regular activity of the provincial livestock and health department departments to the federal government. The knowledge of epidemiology of vector and food borne zoonotic agents is critical for their early detection and developing programs for control and their prevention. Pakistan has established influenza surveillance program under NPCPAI project and animal disease surveillance and epidemiology network under SLSP project in livestock sector in Pakistan. A participatory disease surveillance program was also established aiming to surveillance of Rinderpest, Foot &
Mouth Disease (FMD) and Peste Des Petits Ruminants (PPR) under trans-boundary animal disease project funded by FAO. The surveillance teams in their respective provinces searched the animal diseases including zoonotic diseases and reported accordingly.

Similarly disease early warning system (DEWS) for surveillance of various infectious diseases has been put in place by M/O Health in collaboration with World Health Organization in the human sector. The rapid health response teams in each province including AJK and federally administered areas attend the outbreak, collects sample and submit to NIH for analysis. Public health laboratories at provincial level also conduct special surveillance for dengue fever and CCHF. Based on these disease surveillance programs following important zoonotic diseases have been reported in Pakistan:

- Avian influenza
- Dengue Fever
- Crimean Congo Hemorrhagic Fever (CCHF)
- Brucellosis
- Tuberculosis
- Johne’s disease
- Anthrax
- Rabies
- Tetanus
- Goat Pox
- Fowl pox
- Leishmaniasis
- Salmonellosis
- Campylobacterosis
- E.Coli
- Leptospirosis.

4.1 Brief Description of Selected Zoonotic Diseases in Pakistan

4.1.1 Avian influenza

Avian flu is caused by influenza A viruses. There are 16 H and 9H antigens for influenza A virus which determine the type of strain of the virus. H1N1, H1N2, and H3N2 are circulating in human and H5N1 has potential to infect human but its human to human transmission is limited. The world in concerned because this virus has potential to undergo genetic mutation and become a pandemic strain.
Pakistan has seen H5N1 outbreaks in 2006 that caused economical losses to the poultry industry. The massive outbreaks has brought the all the stakeholders to pool their energies and expertise to control this menace. Such collaborative efforts proved fruitful and despite the large scale of poultry involvement only one case of human infection resulting to his death occurred. It was reported to be due to ignorance and deviation from safety procedures by the victim. Since June 2008, no case even in poultry has been reported.

4.1.2 Dengue Fever

Dengue is a mosquito borne viral infection of zoonotic importance. There are four subtypes of the virus. The infection with one serotype confer life long immunity against that serotype however, increases the susceptibility for hemorrhagic complication when exposed to another serotype of this virus. Most of the dengue cases have been reported in Karachi due to un-hygienic living. The control measures include the control of mosquito and behavioral changes at individual, household and community levels.

4.1.3 Crimean Congo Hemorrhagic Fever (CCHF)

Crimean Congo Hemorrhagic Fever (CCHF) is a tick borne viral infection (Nairovirus) usually found in sheep and cattle. The bite of tick to human and butchering of infected animal may spread the infection to susceptible human. The crushing of gravid tick while butchering may even infect the butcher handling the meat via direct contact with virus. Control measures include tick control and occupational safety measures to avoid contact of virus and susceptible individual. All sheep crossing border between Pakistan and Afghanistan are required to be dipped in acaricide at the check post to reduce the risk of infection to be imported from abroad. Its incidence has been reported mostly in Balochistan province which is a major sheep/goat raising area.

4.1.4 Brucellosis

Brucellosis is highly contagious disease infecting both human and animals. WHO has recorded about 500,000 new cases every year in the world. Many species of Brucella (including Br.abortus, Br.melitensis, Br.canis and Br.suis) are involved in causing this disease. It is one of the routinely reported diseases in large and small animals in Pakistan by disease surveillance network. The disease burden is piling up over time and recent epidemiological studies have shown prevalence of brucellosis up to 26.1% in dairy animals in Pakistan. Other animals susceptible to having brucellosis include sheep, goats, camel, zoo and wild animals in Pakistan. A limited study by Amra, 1991 has reported 19.4% brucellosis among those who have close contact animals.

The disease can be transmitted through direct contact with infected animals, aborted fetuses, afterbirth and uterine discharges of diseased animals, infected carcasses at slaughterhouses and or by the consumption of contaminated milk and dairy products.

Due to the socioeconomic impact of this disease and the associated control costs CDC has declared this as one of the three important bioterrorist agents. Its control in
human lies in the control of this disease in animals as every case of brucellosis in human is usually linked with animal. The control of brucellosis in animals in Pakistan is through vaccination of reactors and culling of male infected animals.

4.1.5 Tuberculosis

Bovine tuberculosis is a bacterial zoonotic. It has been reported among a wide range of animals including almost all domesticated animals, and certain wildlife populations. The genome of Mycobacterium bovis is 99.95% identical to that of M. tuberculosis and is a part of the Mycobacterium tuberculosis complex. The bovine TB organism is found to be a highly virulent, easily transmissible and stable at ambient temperature.

Mycobacterium bovis is transmitted horizontally among animals and human by aerosol and ingestion of contaminated food or water. Raw/ unpasteurized milk consumption may be a source of bovine tuberculosis among humans in Pakistan. About 280,000 individuals in Pakistan are contracting TB each year.

TB prevalence in Pakistan has been reported to be in the range of 0.53 to 8.64% among cattle and buffaloes. Mycobacterium bovis has been isolated from a quarter of raw milk samples obtained from animals positive for bovine TB which indicate the risk of using raw and un-pasteurized milk. The stringent measures including thorough inspections of meat, fish and milk are underway.

TB control program in the ministry of Health is under implementation. Animals are required to be investigated as one of the major risk factors for human TB to implement an effective and appropriate TB control in Pakistan. So the existing situation calls for a comprehensive program to address this problem in order to improve the health of livestock and to safeguard the human population from this menace.

4.1.6 Johnes’ disease

Johnes’ disease also known as paratuberculosis is production disease of cattle caused by Mycobacterium avium. This is a production disease of cattle however thought to be associated with Crohn’s disease in human.

4.1.7 Campylobacteriosis

Campylobacteriosis caused by C. jejuni and coli are of major public health concerns. They are normally found in the intestinal tract of the domestic animals and pet animals. Both organisms do not cause disease in animals under normal conditions but they may become carrier and pose significant risks for human health. These organisms have also been isolated from wild birds, pet animals, rodents, flies and other insects and can infect human in low doses. Similarly these organisms like other micro organisms may colonize the alimentary tract of poultry birds and become lifelong excreters of campylobacter organisms.

Campylobacter infection has not been reported in Pakistan so far. However, an epidemiological study is required to be undertaken to prove this claim. The control calls for appropriate risk management at all stages of production, processing and distribution of products from infected farms.
4.1.8 Rabies

Rabies is a significant public health issue as well as of economic importance due to the associated awareness cost in the world including Pakistan. According to WHO, 58% of the total deaths occurred due to rabies are recorded from Asia each year. Around 40,000 children bitten by rabid dogs die annually and 45% of these cases are children below 15 years of age. The disease is mainly associated with stray dog. Cases of animal and human bites have been reported. Rabies control in Pakistan is mainly through killing of stray dogs and creation of awareness about rabies control by the municipal committees.

5. Risk Assessment and Development of Hazard Analysis and Critical Control Program for Food of Animal and Fish Origin

A wide array of factors influences the microbiological quality and food safety of animal products. The animal production methods, use of antibiotics, growth hormones and biological, demand of the end users, and the international trade are important factors to be considered while assessing the risks of health hazards associated with live animals and foods of animal origin. Enhanced surveillance system is required to establish public health priorities, detect, delineate and investigate outbreaks, evaluate intervention and provide a detection service compatible with a modern food industry. Similarly by reducing the entry of pathogenic microbes in the food chain by implementing robust food safety management system with adequate process control these health risks may be reduced to the minimum acceptable levels.

Since the relationship among pathogens, the host, and the environment is complex therefore food safety policies and practices are required to be in line with available technologies, production methods and food processing techniques to address the food borne illnesses in human. For instance, like other food commodities, the increased demand for meat over the last three decades has changed the production methods to more intensive which in turn facilitated the spread of pathogens among animals. The increased disease burden in animals and more intensive farming techniques thus lead to more use of antibiotics and growth promoting feed ingredients which contributed to the drug resistant human pathogens. It has been reported by WHO that approximately fifty percent of the antibiotics produced today are added to animal feed. So the microbiological safety of meat and meat products requires concerted effort from government agencies, livestock producers, and meat processors. Similarly, pathogens may gain entry in to the fresh products while production, harvesting, transport and marketing due to contaminated manure, water, equipments and workers.

The international trade of livestock and livestock products is regulated under OIE animal health guidelines as well as SPS Agreement of WTO, in addition to the national regulations. This has placed food safety at the forefront in order to safeguard consumer
health and the zoo technical heritage of the importing country. Risk analysis has therefore become an indispensable instrument, both for protecting public and ensuring national agro food industries access to the international markets. New ways of producing, distributing, preparing and eating food present new challenges for ensuring its safety. This has therefore, increased the responsibility of veterinary public health for adopting stringent measures at production and processing levels for quality assurance.

Pakistan hosts about 173.51 million individuals with 110.46 million in rural areas. About 30 to 35 million people are involved in the livestock farming for their livelihoods. The statistics revealed that 93% households maintain at least one buffalo, 64% owned at least one cow and 58% villagers keep one goat while 20% people have at least one sheep at home (Heur,1996). Similarly there are about 18000 poultry farm where 1.5 million workers are deriving their livelihood income. Approximately 20 million poultry birds are maintained at any time of the year and approximately three million birds are slaughtered every day.

All the diseases of animals have a potential to adversely affect the food safety, food security and socio economic situation of the country. But the infectious diseases especially zoonotic diseases including avian influenza, brucellosis, campylobacteriosis, E.coli (O157:H7), Tuberculosis, Swine flu etc have most serious public health consequences. Thus require stringent measures for consumer’s safety.

The extent of risks of contracting zoonoses by people of Pakistan and ultimately by rest of the world may be determined through analyzing the necessary factors and determinants required for emergence or re-emergence of zoonotic diseases. Those factors or determinants are discussed as under:

5.1 Population and Demographic Changes and Behaviors

Human Population in Pakistan is over 173.5 million and total population of domesticated animals is over 160 million plus over 500million of poultry birds. Such a large number of animal and human populations and increased interaction between these species has provided favorable environment for cross species infection as well as emergence or re-emergence of resistant microorganisms. Similarly increased urbanization and changes in behaviors and lifestyles of the people are added factors which exposed them to a variety of foods of animal origin that may result in food borne infections at a large scale. Example of such infection may include salmonellosis, campylobacteriosis, E.coli, Brucellosis and tuberculosis etc. Similarly, Vector borne zoonitic diseases are more likely to spread due to high density population. Example may include dengue fever. The increasing human population is encroaching upon the wild life habitats thus increasing their contacts with wild life and the diseases they carry. Ebola and AIDS have been reported to come from Chimpanzee. Nipah virus disease in human and pigs in 1990 was found to be associated with deforestation in Southeast Asia. Similarly, canine distemper (a disease of dogs) killed lions and other carnivores in Tanzania due to increased contact of domesticated and wild animals.
5.2 Globalization

Globalization phenomenon has brought the different cultures, societies, enterprises, and industries as well as disease agents more close than ever before, which allowed various species to mix together for trade, technological advancement and individual needs as well as for development of pathogenic organisms. This globalization and increasing population provide opportunities for the pathogenic agents to move across the species while breaking the natural barriers and causing microbial perfect storm resulting in emergence or re-emergence of zoonotic diseases from unsuspected source. Globalization of food supply has been found to be associated with spread of animal diseases in to previously unaffected geographic regions. *E.coli* (O157:H7) has been found to be carried with vegetable and ground meat to far of places and caused outbreaks in the susceptible human population.

5.3 Movement of Animal and Animal Products

Movement of live animals as well as animal products to and from Pakistan is allowed. Pakistan is exporting live animals to Afghanistan and Gulf states. The animal products including animal casings and meat are being exported to EU member countries and Middle East. Similarly pets and live dairy animals are being imported by Pakistan from Australia and western countries. Meat and live animals are moved from India and China to Pakistan for onward movement to Central Asian States. The sacrificial meat from Saudi Arabia on the eve of Eid-uz-Zaha is transported to Afghanistan through Pakistan. The animals are also moved across the country for sale in the livestock markets which are held in different cities on weekly or monthly basis. The movement of these animals and animal products has great potential for spread of diseases locally. However the chances of transmission through authorized trade and routes seem to be highly unlikely due to presence of animal Quarantine and inspection services in the country. The movement of wild life is equally considerable but difficult to quantify in the current information system.

5.4 Ecological Distortion

Global trade has created a vast opportunities for livestock farmers across the globe to earn huge returns that lead intensive livestock farming. This is also true for Pakistan where people are transforming their livestock business from subsistence farming to more intensive livestock farming. The use of fertilizers, pesticides and insecticides in agriculture and livestock farming has drastically disrupted the environment. Their use however in Pakistan is limited and there is generally organic farming in the country. This intensive farming complemented by urbanization and deforestation has disrupted the natural ecology, thus considered as one of the major factors for the emergence of new zoonotic diseases in the world.

Global warming and shorter winters are also providing enabling environment for spread of certain vector borne zoonotic agents across the geographic regions. For example, Yellow fever and dengue fever have surfaced in more temperate areas during the last 30 to 40 years.
5.5 Adaptation of Microorganisms and Unknown Microorganisms

Pakistan has very limited capacity and capability of identification and diagnosis of new zoonotic pathogens identified by the world. Thus it may pose huge risk for spreading the new zoonotic agent across the country as well as across the borders before it is identified as new zoonotic disease. Similarly irrational use of growth promoter in animals and poultry may lead to drug resistant common zoonotic organisms which don’t respond to certain antibiotics when used in human. Many pathogens including salmonella, mycobacterium etc has been recognized as resistant to quonolone group of antibacterial drugs.

5.6 Chronic Diseases

Presence of infectious diseases is sometimes found to be associated with certain chronic disease. For example, it has been noted that toxoplasma infection is associated with Schizophrenia. Similar type of unknown zoonotic infections may be present that may be triggered any time by another infectious disease in the current environmental situation.

5.7 Enhanced Surveillance

Pakistan has developed a reasonably good disease surveillance system which may identify unknown zoonotic disease in the country.

5.8 Breakdown in Public Health Measures

Recent emerging infections required public health practitioners, public health workers, veterinarian collaborate continuously to identify and control them. Pakistan has successfully controlled the outbreaks of HAPI since 2003. Veterinary services are reasonably effective and eradicated rinderpest in 2007, following OIE pathway; however there is always room for improvement. The disease prevention programs exclusively for zoonotic diseases are initiated from time to time. Bio-security measures are moderately observed at livestock farms. Its observance in poultry establishment, however are at a reasonable level. The disease surveillance system for zoonotic diseases is in place for influenza ‘A’ viruses, dengue fever and CCHF. Rabies prevention program is in place and is being implemented by WHO. The poor containment measures and inadequate sanitation and bio-security at livestock farms may cause emergence or re-emergence of zoonotic diseases in the country.

5.9 Bio-Terrorism

Pakistan is fighting a war on terror as front line country. The use of biological weapons and limited capacity to preempt and response to such attacks can not be rules out. International community especially USA is negotiating with Pakistan to enhance the capacity of the professional and the scientists to reduce the risk of theft of organisms from the laboratories in order to reduce the likely risk of biological weapons as well as misuse and pilferage of such organisms.
Adulteration of food on a large scale, introduction of new disease to crops and action of similar nature by the terrorists may cause food insecurity and disruption in the food supply chain of a country leading to chaos and law and order situation or may destabilize the system that can favor their cause. Since the capacity to detect Melamine in Pakistan is limited, therefore the risk of adulteration of foods is likely.

6. Procedures of Pre-slaughters Examination of Food Animals (cattle, goats, sheep, pigs, camels and buffaloes, etc.)

According to the Punjab Agricultural Produce Market Ordinance 1978 livestock is an agricultural produce. It includes male, female, (milch or draft), sheep, goats, buffalos, cows, camel, horse, and poultry including turkeys (dressed or otherwise), fish and livestock products viz. beef, mutton, hides, and skins (dry and wet), bones, bone meals, feeds, wool, hair, eggs, cheese, butter, desi ghee, milk and curd. The Agricultural Produce market Act and Rule 1939 (continued in force by virtue of West Pakistan Act VI 1956) regulate purchase and sale of agricultural produce (livestock) and establishment of markets for agricultural produce (Livestock) in all the provinces except Punjab where Ordinance, 1978 has been enforced in 1981.

The animals for slaughter are sold by the farmers usually in the livestock markets to the butchers and or contractors. The West Pakistan Municipal Committee (Cattle Market) Rules, 1969 authorize municipal Committee to establish, maintain and administer livestock markets where no sick animal is allowed to enter the market.

The local governments (Municipal Committee, Town Committee, Zila Council) and Cantonment Boards have been authorized to establish and maintain slaughterhouses duly approved by competent authority. The local governments also take measures to alleviate diseases of animals and birds and prevention and control of contagious disease among birds and animals and measures to promote public health.

These animals are then brought to the slaughterhouses for slaughtering where these animals are examined by the public veterinarian to assess their health status. These animals are subject to physical examination for any skin disease, body temperature, lungs auscultation and close examination of natural openings of the animals.

Under the law, No person is allowed to slaughter the animal outside the approved slaughterhouse except during the days of Eid-uz-zuha (religious ritual once in a year). Any person intending to slaughter an animal in a slaughterhouse is required to produce and confine the animal in the stockyard approved by a local authority for at least six hours before being slaughtered where authorized veterinary officer examine the animals to determine its suitability for slaughtering or otherwise in the context of health state of animal and its usefulness for breeding and or draft purpose. The veterinarian examine for the evidence of any cruelty to the animal by over trucking, over driving or by any other act. He also examines the animal for its emaciated condition and presence of any disease.
The animals rejected for slaughter at the slaughterhouse are marked with a distinguishing mark.

The authorized officer by the district administration and or Cantonment Boards may inspect the premises of slaughterhouses and the activities being undertaken in that premises.

The Sindh Cattle (Contagious Diseases) Act, 1948 and its Rules 1949 empower the veterinary officer enter and search any building, field or other place in which any cattle (cows, bulls, bullocks, buffaloes, sheep, and goats and young one of both sexes) is affected by or exposed to any contagious disease (Rinderpest, hemorrhagic septicemia, Anthrax, Black Quarter, Contagious abortion, Tuberculosis or notified in the official gazette). The veterinary officer may carry out test (e.g. Tuberculin test), seize the affected animals, segregate and destroy under a prescribed manner. He may order the owner to disinfect the premises, if animals in the particular found positive to tuberculin test.

7. Inspection of Abattoir Sanitation, Food Processing Industries, and Foods of Animal Origin (meat, egg, milk, fish) and/or Animal Origin Processed Food (ice cream, card, cheese, yoghurts etc.)

7.1 Inspection of Abattoir

Abattoirs / slaughterhouses are regulated under the West Pakistan Animal Slaughter Control Act, 1963 and Rule, 1965. “Slaughterhouse” is any building or premises approved by the local council constituted under the local Government Ordinance 1979 or a Cantonment Board established under the cantonment Act, 1924 to be used for slaughtering of animals.

The site, structure and sanitary requirement of slaughterhouse under the provisions of said law are described below:

7.1.1 Site and Structure

i. No slaughterhouse should be situated within 300 feet of any dwelling house or building frequented by the public and he site should be such as to admit of free ventilation from open spaces on at least two sides of it;

ii. A signboard marked “approved municipal slaughterhouse” should be placed in front of every slaughterhouse;

iii. No part of the slaughterhouse should be below the level of the adjoining ground;

iv. The approach to the slaughterhouse should not be on an incline with a slope steeper than one in four, and should not be through any dwelling house or shop;

v. No door of the slaughter-hall or cooling room should open directly in to any street or lane or other public place;
vi. The slaughtering of animals should not be visible from any public place, public street or from any adjacent dwelling-house, or occupied place outside the slaughterhouse.

vii. Every slaughter-hall or cooling room should be covered with proper roof and no room or loft should be constructed or used for the purpose of habitation or for use as lairs or pens over the slaughterhouse;

viii. Lairs or pens should be provided for cattle awaiting slaughter in the slaughterhouse. Such lairs or pens should not be within 100 feet of any dwelling place or building frequented by public and should be properly paved, drained, ventilated and lighted and provided with a convenient and adequate water supply;

ix. No such lair or pen should be so situated or constructed that cattle within it may step in to any slaughter-hall or cooling room;

x. The slaughterhouse should be provided with thorough ventilation and abundant light, both natural and artificial.

xi. All doors and windows should be provided with fly proof shutters. Adequate number of hangers or pulleys for hanging the carcasses and facilities for dressing of carcasses should be provided;

xii. The slaughterhouse should be well paved with rough cement concrete or other non-slippery impervious materials and laid with a proper slope and channels running towards one or more gullies (which should be properly trapped and covered with grating, the bars of which should not be more than three-eighth of an inch apart) placed immediately outside the slaughter hall or cooling room to allow of the floor being flushed and drained.

xiii. The corners of the walls and floors should be rounded off to prevent the collection of dirt and dust. Where there is no sewer, a cesspool or pit, constructed of non-absorbent material, should be provided outside the building for collection of slaughterhouse refuse;

xiv. The surface of the walls in the interior of the slaughterhouse should be covered with hard, smooth and impervious material to a height of at least 6 feet. The walls should be white washed at least once in six months;

xv. The open area in the slaughterhouse should be covered by wire-netting to keep out carrion birds.

7.1.2 Sanitation

i. The water supply should be ample, clean and wholesome with adequate facilities for its distribution in the slaughterhouse;

ii. The slaughterhouse should be provided with an adequate tank or other suitable receptacle for water having a water tap to which a hose can be readily attached, so placed that bottom of the tank or receptacle should not be less than 6 feet above the level of the floor of the slaughterhouse;
iii. No water closet, privy or cesspool should be constructed with in the slaughterhouse.

iv. There should be no direct communication between the slaughter hall and any part of the premises where meat is kept, stored or handled and any stable, water closet, privy or cesspool except that which is provided for the collection of the slaughterhouse refuse;

v. Every practicable precaution should be taken to keep the slaughterhouse free from flies, rats, mice and other vermin.

vi. The use of poisons and rat-viruses for any purpose in rooms or compartment within the slaughterhouse premises where meat or meat products are stored or handled is forbidden;

vii. Every slaughterhouse should be provided with properly located facilities for personal disinfection and cleanliness and for disinfecting and cleaning the utensils, and instruments used in handling any meat or meat products.

viii. The slaughterhouse should have water system in proper order at all times as a well as sufficient supply of clean water for the purpose of thoroughly washing and cleaning the floor or pavement every part of internal surface of every wall of the slaughterhouse and every utensils, vessel or receptacle which may be used for the collection and removal from such slaughterhouse of any blood, manure, garbage, filth or other refuse products of slaughtering or dressing of any carcass on the premises.

ix. All blood, manure, garbage, filth or other refuse from any animal slaughtered and the hide, viscera and offal there from should be removed from slaughterhouse to avoid any nuisance at the premises or in the public street or elsewhere.

x. Every receptacle or vessel should be thoroughly cleaned immediately after it had been used for such collection and removal and kept thoroughly clean when not in actual use.

xi. No dog, pig or bird is allowed to enter the slaughterhouse at any time;

xii. No person affected with tuberculosis and any other infectious or contagious disease or having leprosy sores or any other skin disease is allowed to enter the slaughterhouse;

xiii. Butchers should undergo medical inspection on every three months;

xiv. No person is allowed to rub or drag the inner side of the skin / hides upon the ground within the slaughterhouse;

xv. No gut scrapping, tripe cleaning, manufacture or preparation of articles of food for man or for animals, household washing or work of any nature, other than that necessary for the purpose of the slaughterhouses are allowed except in the adjunct to the slaughterhouse intended for such purposes.
7.2 Inspection of Food Processing Industries, and Foods of Animal Origin

7.2.1 Inspection of Meat

7.2.1.1 At the slaughterhouse

The veterinary officer appointed at the slaughterhouses conducts both ante and post mortem inspection of animals brought to the slaughterhouses intended for slaughtering.

7.2.1.1.1 Ante-mortem Examination

Animals to be slaughtered in a slaughterhouse are required to be produced and confined in the stockyard of approved slaughterhouse for at least six hours before being slaughtered where authorized veterinary officer examine the animals to determine its suitability for slaughtering or otherwise in the context of physical health state of animal. The veterinary officer examine for the evidence of any cruelty to the animal by over trucking, over driving or by any other act. He also examines the animal for its emaciated condition and presence of any disease. The animals rejected for slaughter at the slaughterhouse are marked with a distinguishing mark.

7.2.1.1.2 Post Mortem Examination

a) All carcases are required to be examined for evidence of bruising, hemorrhage or discoloration, local or general dropsy, swellings or deformities of bones, or joints or swellings or other abnormality in the musculature;

b) The serous membranes (pleura and peritoneum) are examined in every case;

c) The sternum, ribs, vertebrae and spinal cord are examined once the carcass is split;

d) An incision is given on each quarter in the musculature to detect the cyst (Cysticercus bovis);

e) All viscera, associated lymph nodes and the other organs of the carcass are examined through palpation and incision for evidence of tuberculosis;

f) The lower cervical, pre-sternal, pre-scapular, and supra-mammary (or superficial inguinal), iliac, pre-crus, popliteal and sub-lumbar glands are examined after their incision for evidence of infection;

g) The head including the surface and substance of the tongue, palate or roof of the mouth, and lymph gland including retro-pharyngeal, sub-maxillary, and parotid are examined visually and by palpation;

h) The outer and inner surfaces of stomach and intestines and substance of the spleen together with gastroplenic and mesenteric glands and omentum are examined;

i) The liver surfaces, bile ducts and hepatic lymph glands are examined;

j) The Kidneys and its lymph glands, urinary bladder, and adrenal lymph nodes, uterus, and the substance of the ovaries are also examined;
k) The contents of the thoracic cavity including lungs & associated bronchial and mediastinal lymph nodes, heart sac are examined for evidence of any disease;

l) The udder, or testicles and associated gland are also palpated and incised for any evidence of disease;

Based on the post mortem examination following decisions may be made:

i. In case of generalized tuberculosis, the whole carcass is condemned otherwise the affected part of the organ is condemned.

ii. Similarly the entire carcass and all the parts and organs including blood are condemned and seized if evidence of any of the following conditions is found:

Actinomycosis (generalized), pronounced anemia, anthrax, blackleg, general extensive and severe bruising with or without gangrene, generalized cystecercus bovis, general decomposition, general dropsy, general emaciation due to disease, acute fever, acute foot and mouth disease, hemorrhagic septicemia, immaturity, stillborn or un-borne carcasses, pronounced jaundice, johne’s disease accompanied by emaciation or anemia, caseous lymphadenitis, malignant catarhral fever, malignant neoplasm unless localized, acute, septic mammitis, generalized melanosis, acute septic metritis, parturition (within 7 days), septic pericarditis, gangrenous pneumonia, pyaemia, rabies, Rickets with malnutrition, rinderpest (eradicated from Pakistan), generalized sarcocysts visible to naked eye, septicemia or septic intoxication, surra, tetanus, multiple tumors in musculature, uremia.

iii. Flesh or organs or portion of the carcass affected by disease and the organ or contagious portions are condemned in case other than above mentioned diseases are found.

iv. The flesh or organ or carcass from animals suffering from bacterial diseases of zoonotic importance or presence of poisonous material or toxins are deemed unwholesome and not fit for human consumption therefore condemned.

7.2.1.2 Meat inspection at meat in retail shops

The meat inspection of meat in retail shops is the responsibility of the staff of health services or food authority in the local government. The Director, health services or food inspector or any person authorized by the government are authorized to enter into and inspect any market, godown, shop, stall, or other place (and vehicle except belonging to Railways) used for sale, of any food intended for human consumption or for preparation, manufacture or storage of any such food for the purpose of trade or sale. He is authorized
to seize and destroy the product on reasonable grounds if the product appears injurious to health, unwholesome, unfit for human consumption, not of the same nature, substance or quality which it purports to be or not fulfilling the prescribed conditions subject to which such food is to be manufactured, sold, kept, or stored or if any such apparatus, utensils or vessel is of such kind or in such state as to render any food prepared, manufactured or contained therein unwholesome or unfit for human consumption or injurious to health.

7.3 Inspection of Milk and Milk Products

Milk and milk products are regulated under West Pakistan Pure Food Ordinance, 1960 and Rules, 1965 made there under. Milk is defined as “the normal, clean and pure secretion obtained from the udder of a cow, buffalo, sheep or goat from which cream has not been extracted and include boiled, pasteurized and sterilized milk. The terms of skimmed milk and standardized and homogenized milk are used for the treated or processed milk following certain standards. The milk products under the law include cream, concentrated milk, condensed milk, skimmed milk, separated milk, flavoured milk, milk shake, milk drink, dahi (yogurt), butter milk, khoa (milk dried on fire), barfi (A sweet), pera (a sweet), kalakand (A sweet), cheese, dried milk, ice cream and any other product made by addition of any substance to milk, or to any of the milk products used for similar purposes.

The food inspector appointed by Director, Health Service and or Food Authority in the area of their respective jurisdictions may conduct inspection to ensure the observance of following provisions of the said law:

a. No person is allowed to sell, keep or store any food including milk intended for human consumption or prepare or manufacture any such food with intent that the same may be sold, which is unsound, unwholesome, injurious to health or unfit for human consumption.

b. No person is allowed to offer, keep in possession for sale or deliver for sale or supply to any person:

   i) Impure or unwholesome milk or milk drawn from animals affected with any disease of livestock whether contagious, infectious or otherwise capable of causing the milk to become unwholesome.

   ii) Milk drawn from animals with in thirty days before or ten days after pasteurization or for butter, curd or cheese making.

c. No person suffering from infectious or contagious disease is employed to milk animal, handle any vessel used for the reception of milk intended for sale, and assist any business related to dairy farming.

d. No person can designate milk or milk products as “pasteurized” unless treated at temperature of not less than 143F for at least 15 seconds continuously and has been cooled immediately to a temperature of not more than 40F in a plant approved for the purpose. The milk should show efficient
pasteurization as evidenced by satisfactory negative phosphatase test and the coliform count should not be more than 10 per milliliter at any time after pasteurization and before delivery to the consumer.

e. No person can designate milk as “sterilized” unless it is filtered or clarified and homogenized after the treatment at a temperature not less than 212°F for such a period as to ensure that it will comply with prescribed turbidity test. After the treatment the receptacles were sealed with an air tight seal. The process can only be done at approved plant in the licensed premises.

f. No flavoring compounds which are by themselves toxic or contain toxic contaminant is allowed in any food. Classified preservative, stabilizers and flavoring agent are allowed in the foods. Antioxidants are only allowed in edible oils and fats in the prescribed limits.

g. Any article of food is considered injurious to health and unfit for human consumption if it is putrefied, decayed or emits bad smell, infected with insects, has evidence of filth or of rodent excretion or hair, contains toxic chemical or food poisoning bacteria and contains metals in excess of the tolerance. Residual limits of few are as under:

- Alluminium (max. 250 PPM)
- Antimony (max.2PPM)
- Arsenic liquid Max.0.1ppm
- Arsenic solid (max.2PPM)
- Boron (max.80ppm)
- Cadmium (max.6ppm)
- Zinc (max.100ppm)
- Copper (max.10ppm)
- Tin (max.100ppm)
- Fluorine (max.1.5ppm)
- Silver (max.1ppm)
- Lead liquid (max.2ppm)
- Lead solid (max.20ppm)

h. No person is allowed to sell by retail or display for sale by retail, any pre-packed food unless there appears on a label marked on or securely attached to the wrapper or container a true statement except for fruit, vegetable, liquid milk, shell eggs, fish and any food served by caterer as a meal. Labeling requirement in English or Urdu for various products including milk and milk products have been covered under the law.
7.4 Inspection of Eggs

The hens and ducks eggs are graded and marked under the Egg Grading and Marking Rule, 1937 made under the agricultural produce (Grading and Marking) Act, 1937. According to these rules, the grade designations are marked legibly on each egg in indelible ink on the shell by means of a rubber stamp. The grade designation mark label is attached by means of a lead seal bearing the word “Pakmark” to each package of eggs and it clearly show the following particulars:

- Grade designation of eggs
- Number of eggs;
- Net weight of eggs;
- Name of grading station;
- Date of dispatch.

The provisions of the said law required the following:

- All packages are closed in sealed cover and packed in a material which is clean, dry and sweet free of any taint liable to impart an objectionable flavor to the eggs.
- Hen and duck eggs are packed separately.
- Eggs of different are packed separately as far as possible. If eggs of more than one grade are packed in one container, a layer of clean paper or clean straw is placed between different grades.

The food inspectors may cause inspection of eggs being food product under pure food laws 1960 and Rules 1965 to ensure their wholesome and fitness for human consumption.

7.5 Fish Inspection

The wholesome fish and quality fish products meant for export or local consumption is the responsibility of Marine Fisheries Department (MFD) at federal level and fishery department in the respective provinces. MFD administer the Pakistan fish Inspection and Quality Control Act, 1997.

Under this Act, no body is allowed to process and export of fish and fish products unless registered with MFD. This law also provided that no person shall process and export or market for export or have in his possession for export or deal in any fish or fish products intended for human consumption which are decomposed, unwholesome or contaminated with pathogenic organisms. Under this law people suffering from leprosy, tuberculosis, polio, or such other contagious disease notified from time to time are not allowed to handle, carry or process fish. He is not even allowed to work in the fish processing and packing plants or establishments.
Fishery officer is authorized to inspect any fish processing plant to ensure the quality of fish and fish products and he is empowered to detain and or dispose off the detained fish in prescribed manner.

A penalty of Rs.50,000 for first conviction, Rs.100,000 for second conviction and Rs.200,000 for third time conviction and imprisonment up to one year or a fine of 300,000 for subsequent conviction may be imposed in case of violation of any provision of this Act.

An authorized inspection committee represented by a member each from Export Promotion Bureau (EPB) and MFD and a broad based trade association of fish processing plants in Pakistan is also provided in this Act. This committee is responsible to conduct a survey or surveys of fish processing plants with a view to determine their fitness for registration. This committee also hears appeals against orders, decision, actions, or omissions of the fishery officers. The said committee can make recommendations to the federal government for the efficient functioning of the industry, the removal of malpractices there in and the enhancement of exports.

The provincial departments are mainly dealing with the inland fresh water fisheries. The provinces have no or dormant legislation therefore limited inspection services are available. The government of Punjab is in process of tabling a bill before the provincial assembly to empower the fishery department of Punjab to conduct inspection of fish and fish products to ensure the quality and wholesome of fish and fish products.

8. Determination and Reporting of Residues (drugs, Hormones, Toxin Pesticides, etc.) in Food of Animals-including Fishes

With the increasing demand for foods of animal origin associated with unprecedented increase in human population, the traditional farming system has changed to more intensive farming which resulted in much more reliance in the use of drugs and hormones in food animal production. The widespread use of drugs and hormones appeared in the problem of drug residues in the tissues due to their systemic absorption and non-metabolization to biologically inactive derivatives. These drug residues has not only caused drug resistant human pathogens, toxicity and allergy among susceptible humans but also proved to be a trade barrier. Veterinary drugs including but not limited to β-Lactum, Sulphonamides, Tylosin, Tilmicosin, streptomycin, Carbadox, Chloramphenicol, tetracyclines, clenbuterol and Fluoroquinolone are matter of concerns of the international community because they have been reported to cause cancer, aplastic anemia, skin rashes and other allergic reactions in addition to infection of thousands of people with drugs resistant organisms. WHO/FAO and EU have therefore, established maximum residue limits (MRLs) to safeguard the public health with out hampering the international trade. Any food or food product of animal origin exceeding the prescribed limits of drug is forbidden for sale, consumption and export. Nitrofurans, β-antagonists and Chloraphenicol are banned for their use in food producing animals.
Pakistan is exporting meat and meat products to Gulf States and animal casings to European Countries. A wide range of antibiotics / antibacterial is used as therapeutic or prophylactic and growth promoting agents in food producing animals (particularly in poultry) in Pakistan. Self medication by animal owners having no understanding about the dosage and withdrawal periods of drugs is some times problematic. Since the implementation of SPS agreement of WTO, the export of animal food products and byproducts is strictly restricted to the testing of these products in accordance with the international standards and acceptable levels of any drug/pesticide residue in the product.

The Drugs Registration and Licensing Board in Pakistan has adopted a policy not to register Chloramphenicol for use in food producing animal and is seriously considering such policy for Nitrofurans and β-antagonists.

In addition to the above measures, training and awareness of professionals and farmers have been arranged under development project titled “Livestock Production and development for meat production”. The veterinary services have been strengthened in terms of equipment, training and their mobility for early identification of pathogens and rational use of drugs for treatment of animals. The drugs residue testing and quality assurance laboratories are further strengthened and upgraded in terms of trained manpower, equipment and testing facilities all over the country.

The quarantine department is responsible to ensure compliance of SPS standards by the exporters / importer of foods of animal origin and issue health certificates only if satisfied that the consignment of food of animal origin is safe for human consumption duly supported by authorized animal quarantine and or national veterinary laboratories in Pakistan.

The Marine Fisheries Department is regulating the export of fish and fish products. The quality control laboratories of MFD ensure the wholesome of fish and fish products both for local consumption as well for products to be exported. The capability of MFD is further being strengthened by equipping the laboratories in terms of equipment, trained manpower and accreditation of laboratories by ISO certified organization.

The milk is grossly regulated in terms of drugs residue and time and again the stories on milk adulteration by bleaching powder and urea fertilizers have been published in the print media. Similarly poultry meat is usually consumed in the local market with exception of exporting to Gulf States and Afghanistan. The fresh and frozen processed poultry meat has been infrequently subjected to veterinary inspection for their suitability for human consumption locally.

Limited surveillance system is in place for microbiological contamination and drug residue. National veterinary laboratories Islamabad is regularly processing meat and fish sample procured from the retail markets for drug residue. During 2008-09 about two thousand tissue samples including tissue samples submitted by Animal Quarantine Department (AQD) were analyzed for drugs residue and reported accordingly to take
corrective measures by the concerned authorities. Generally export /import consignments of livestock products having over and above the prescribed microbial count and drug residue limits are rejected/ confiscated and destroyed.

9. Framing Common Rules and Standards for Zoonotic Disease Control and Safe Food of Animal Origin for SAARC Countries

Every country has its own rules and regulations which regulate the trade, import exports, animal disease control, food safety and animal welfare and veterinary education. Following European Union as Model, SAARC countries are agreed to harmonize rules and standards for food products as well for control of zoonotic diseases. Following attempt in these regard are pertinent to mentioning here:

9.1 Trade in Animals and Animal Products

South Asian Free Trade Agreement (SAFTA) requires the countries in the region to have developed a uniform regulatory framework coinciding with international standards put forward by WTO, OIE and Codex alimentarius. Under this framework all member states of SAARC are required to have established a National Contingency plan for livestock disease epidemics. Similarly harmonization of standards of products of animal origin is also among the top priorities of the SAARC.

Pakistan has developed contingency plan for HPAI and is on the way developing contingency plans for FMD, PPR and Hemorrhagic septicemia.

9.2 Animal Disease Control

In order to reduce the risk of spreading infectious diseases including zoonotic diseases continued surveillance, timely information and joint epidemiological measures are warranted at the regional level.

In Pakistan, veterinary services across the country have been strengthened in terms of training; equipment and mobility. A network for disease surveillance in 93 districts have already been established from where regular reporting of animal diseases as well as flash reporting of notifiable diseases is being done for prompt response as appropriate. A state of art National Veterinary Laboratories were established at Islamabad. Another surveillance network for HAPI has also been established where by laboratories across the country was strengthened in terms of staff and equipment. Rapid response teams are on alert in the country for poultry diseases.

9.3 Food Safety and Animal Welfare

As far as the harmonization of standards for products of animal origin at SAARC level is concerned, standards for meat and meat products have been shared by Pakistan through SAARC Secretariat. Pakistan has participated in the Milk Grid initiative of the SAARC. Milk standards are being made in accordance with codex alimentarius and the standards for the rest of the products are regulated under Pure Food Ordinance, 1969 and
its Rules, 1965. An independent authority in Pakistan has been established with the mandate to develop food standards for implementation in the country in the international context including SAARC region.

### 9.4 Veterinary Education

Harmonization and standardization of veterinary education at region level has been anticipated to ensure competent professionals for the regional services.

In Pakistan, University of Veterinary & Animal Sciences, Lahore and University of Agriculture, Faisalabad are the leading institutions for veterinary education. A few other universities are also in the run of producing veterinary graduates across Pakistan. In order to ensure a uniform standard of veterinary education, Pakistan has enacted Pakistan Veterinary Medical Council (PVMC) Act, 1996 to regulate veterinary education and practice in Pakistan. Higher Education Commission regulates the syllabus and quality of education in the country.

### 10. National/regional Initiatives that have been under taken for Progressive Control of Priority Trans-boundary Animal Diseases (TADs)

Highly Pathogenic Avian Influenza (HPAI), Foot & Mouth Disease (FMD) and Peste des Petits Ruminants (PPR) have been recognized as trans-boundary animal diseases to be contained through regional collaboration. So the thirteen SAARC summit during 2005 had agreed to establish Regional Support Unit (RSU), Regional Epidemiological Center (REC) and three diagnostic laboratories through collaboration with OIE and FAO under Global Framework for containment of trans-boundary animal diseases (GF-TADs). European has now agreed to fund these initiatives under Regional Cooperation Program on Highly Pathogenic and Emerging Diseases (HPED) in South and South East Asia. Moreover, national initiatives have also been taken to control trans-boundary animal diseases in the country. Certain Projects are under implementation with the international financial and technical assistance. Brief description of few projects is as under:

#### 10.1 Livestock Production and Development for Meat Production

This project was started by Federal Government in 2007 for five years to undertake following activities:

- The key Project activity is to motivate the livestock farming community to participate in feedlot fattening to double the quality meat production through establishment of lead, small and feeder farms for veal, beef and mutton production.
- About 728 farmers have been trained in feedlot fattening farming;
- About 8 individuals were trained in meat cutting and processing in Malaysia
• Technical feasibilities for both slaughterhouse and butchery were prepared and widely disseminated.

10.2 Milk Collection/Processing and Dairy Production and Development Program

This project was started by Federal Government in 2007 for five years to undertake following activities:

• To move from subsistence dairy farming to market oriented farming (more than 10,000 rural subsistence dairy farmers are likely to enter in the milk marketing chain due to project interventions)
• To produce 20,000 breeding animals of better genetic potential for milk production.
• To improve milk collection and marketing from small and landless dairy farmers through farmers organization in order to improve livelihood of dairy farmers (Production and marketing of milk is expected to increase by 30-40% in project areas.
• Installation of milk chillers to be operated by Milk Producers Groups (MPG) on cooperative basis.
• Training of village livestock workers and selected farmers in handling of milk and milk chillers to ensure quality of milk while transportation.

10.3 Strengthening of Livestock Services Project (SLSP)

This project was started by Federal Government in 2005 with the financial assistance of European Union for five years under which Pakistan achieved the following:

• Federal Disease Surveillance network was established and currently functioning in 93 districts. The government of Punjab has created a directorate for disease surveillance to ensure its sustainability.
• All the Epidemiological Units, District Disease Reporting Centers and the Model Veterinary Hospitals are now functional with installed software and have started to generate disease reports.
• The necessary sero-surveillance material, books and IT equipment in the form of computers, software (TADinfo) and printers, have been provided to these disease reporting offices and Model Veterinary Hospitals and they have started submitting disease reports. PTC L.V. wireless connection has also been provided to the Target District Epidemiological Units in Pishin, Mastung and Kalat.
• PPR ELISA kits for the detection of PPR were procured to support the development of a control strategy for PPR disease in Pakistan.
• Fodder Model, Poultry Model, Dairy Model and Wool Model were
implemented: Expansion of the basic models to include practical training in animal health, nutrition, feeding management, fodder production, storage and housing.

- A short documentary on Milk Collection Center to disseminate information about the benefits of farmer’s community for milk collection was prepared and widely disseminated.
- Advertisement on Pakistan Radio Mag “Aahang” on provision of clean water to Animals for their good health.
- Pakistan got freedom from infection of Rinderpest following OIE pathways.
- Strengthened livestock services in term of equipment, training and mobility.
- The project website (http://www.slsp.org.pk/) is continuously updated with all the relevant information made available to the masses.

10.4 National Program for the Control and Prevention of Avian Influenza (NPCPAI)

The project was launched during 2006-07 with the overall objective of developing national capacity to combat any future outbreak of bird flu through effective surveillance and disease response mechanism. The specific objectives of the proposed project are:

1. Improve and scale up avian influenza surveillance, reporting and diagnostics at federal, provincial and district levels.
2. Strengthen disease control, outbreak containment, and eradication of highly pathogenic avian influenza (HPAI).
3. Increase awareness among the farmers, consumers, veterinary professionals and other stakeholders regarding AI epidemics.
4. Undertake research in the area of AI virus ecology, pathogenesis, diagnostic and vaccine development.
5. Strengthen AI vaccine evaluation and quality assurance system.
6. Develop legal and regulatory framework for providing veterinary services with the power to enforce national animal disease control measures.

Followings have been achieved so far.

- A total of 10 Provincial / Areas/ Institutional Units established.
- 10 labs established (equipment supplies, trained manpower).
- 40 Regional Surveillance Units have been established and are functional.
- 60 Rapid Response Units (RRU’s) have been established across the country.
- 08 Training workshops conducted with the assistance of USAID & UNICEF where by more than 200 Veterinarians and Medical professionals were trained as Master trainers.
• 44 seminars and 164 training workshops were held where by over 8000 participants representing general public, poultry farmers, veterinarians and medical health personnel were trained on different aspects of AI surveillance and control.

• Approximately Rs.25 million were disbursed among the farmers as compensation to their losses due to H5N1 outbreak.

10.5 **Up-Gradation and Establishment of Animal Quarantine Stations in Pakistan**

In order to fulfill the WTO requirements for import & export of Animal and animal products in the context of SPS agreement this project was launched to upgrade the infrastructure as well as to build the capacity of animal quarantine station in Pakistan in terms of trained manpower, equipments and mobility.

Offices and Laboratory at Khokharapar and Khunjrab have been constructed to facilitate the exporters or importer. Animal Quarantine stations at Peshawar, Lahore and Sialkot are being moved from rented buildings to their own shortly.

10.6 **Prime Minister’s Special Initiative for Livestock Project**

The project was initiated in December 2006 with a cost of Rs.1, 696.40 million for five years to create a trained cadre of 7,250 Community Livestock Extension Workers (CLEWs) to provide veterinary and extension services at the grassroots level.

The project is aimed at livestock productivity enhancement through provision of livestock production and extension and veterinary services at farmer’s doorsteps targeting 13 million rural poor in 1963 Union Councils in 80 districts.

10.7 **Aquaculture and Shrimp Farming Project**

The project has been started in September 2007 for five years.

The Project envisaged the establishment of 11 model shrimp farms, 9 fish and shrimp hatcheries, 5 cage culture farms and 6 fish markets in addition to training of master trainers and community workers, provision of Business Development Support to fish farmers, development of master plan for Coastal Aquaculture and applied Research and Development in fisheries sector.

10.8 **Fisheries Training Centre at Gawader**

The project was started in July 2006 for next six years. Following strategy has been adopted to expose the fish industry of Baluchistan to the improved methods in fish preservation and to train the fishermen, fish processors and the fish traders in preservation of fish:

• Engaging Foreign Expertise for the transfer of Fishing and Fish processing technology to the fish industry of Baluchistan by training.

• Pilot fish processing technology by installing processing equipments.

• Training Extension staff of the Fisheries Directorate intensively in Fishing and fish processing methods for continuance of extension activities.
10.9 Controlling Trans-boundary Animal Diseases in Central Asian Countries (GTFS/INT/907/ITA)

The project has been funded by Italy and implemented by FAO. The cost of the project is US$ 2842125.

Following Research Projects have been completed under this project:

1. Molecular and Field epidemiological studies of FMDV at Landhi Cattle Colony Karachi, Pakistan completed with following salient findings:
   - Swab sampling followed by Real-time PCR analysis is an easy and practical way to estimate FMDV prevalence.
   - New subtypes of serotype O are present in Pakistan
   - FMDV serotype A subtype Iran/2005 isolated which is not covered by any vaccine in circulation

2. A study on efficacy and cross protection of live intranasal Haemorrhagic Septaemia vaccine in buffalo calves completed with following findings:
   - The vaccine provided year long protection
   - No untoward reactions was observed in vaccinated animals
   - Easy to administer and is the most economical available options

3. A study on duration of immunity and protective efficacy of PPR vaccine completed and found that vaccine provides protection for at least three years.

4. Isolation and identification of PPR Virus from field cases undertaken and sequencing of virus collected from six different outbreaks.

5. More than 3000 samples (Swabs, serum and tissues) have been collected and sent to world reference laboratories for characterization of FMD virus.

6. 32 training and awareness workshops on TAD were arranged whereby 1870 participants were trained.

7. Five laboratory specialists completed their advance training in Italy and Denmark.

10.10 Highly Pathogenic Avian Influenza: Strengthening Cross-border Surveillance and Containment Activities between Afghanistan and Pakistan

FAO has approved a Project titled “Highly Pathogenic Avian Influenza: strengthening cross border surveillances and containment activities between Afghanistan and Pakistan” at a total cost of US$ 1,300,000 (US$ 65,000 for each country). These funds have been provided by the Government of USA as a donation to FAO. The project is of 18 month (April 2008-09). The M/O Food, Agriculture & Livestock and Ministry for Agriculture irrigation and livestock, Afghanistan will execute the project. The project is aimed at improving laboratory and field services capacity of Afghanistan (Jalalabad, Khandahar) and Pakistan (Peshawar and Quetta); standardization of procedures for
border control inspection, strengthening surveillance activities for Avian Influenza (AI); developing common methodological approach to surveillance in live bird markets, improving Avian Influenza surveillance systems and enhances the local capacity for AI detection and control.

10.11 Program on Surveillance of Wild Birds and Domestic Animal along Migratory Flyways under OIE/JTF Project for Strengthening HPAI Control in Asia

World Organization for Animal Health (OIE) has organized a Program on Surveillance of Wild Birds and Domestic Animal along Migratory Flyways under OIE/JTF Project for Strengthening HPAI Control in Asia. An OIE Study Mission has visited the National reference laboratory for poultry disease, NARC in July 2008 to assess its needs for further strengthening its capacity and capability regarding Avian influenza (Bird Flu) under OIE Asia Pacific Program of Strengthening of Laboratories for Highly Pathogenic Avian Influenza (HPAI) in order to upgrade it as Regional Training Center for Highly Pathogenic Avian Influenza to impart training to national and international nominees. The proficiency of serology and molecular testing has been tested by World reference laboratory at random bases and was found to be 97%.

10.12 Australia – Pakistan Agriculture Sector Linkages Program

Australia has funded a program titled “Improving Dairy Production in Pakistan through Improved Extension Services” which is a collaborative program with Australian Centre for International Research (ACIAR) under Agriculture Sector Linkages Program (ASLP). The original Program (ASLP) has a budgetary allocation of 6.6 million Australian Dollars over four years period. The extended project started in August 2007 and was due to be completed in March 2010 however extended for another four years. The project is aimed at increasing the dairy production of small holder dairy farms in Pakistan by improving current extension services. Charles Stuart University (CSU, Wagga, Australia) is working with the Livestock and Dairy Development Board (LDDB) for the implementation of this project.

The project has two components involving distinct but related research activities. The first component will focus on the economic and regulatory issues affecting the dairy supply chain for semi-subsistence farming systems. The second component of the project will focus on industry competitiveness and the policies that will shape the development of a globally cost competitive industry. This component of the project will focus on the macro level industry policy arrangements.

The overall objective of the project is to provide policy recommendations that address the economic and policy constraints affecting industry growth and improvements in farm performance focusing on the small scale, semi-subsistence farm sector and more generally, reductions in rural poverty.

Farmer discussion groups and extension training were carried out covering basic nutrition and Animal Health and Disease Prevention etc and developed key messages for farmers’ awareness.
A vaccine review has been completed in Pakistan with the aim to review and help the small holder farms for better vaccines.

Linkages between Pakistani and Australian institutes have been promoted and strengthened through workshops.

One of the great achievements of the project has been involving students in the project work. In early 2009, four students from CSU Wagga Wagga traveled to Pakistan to work at University of Agriculture, Faisalabad, Pakistan.

10.13 Future Plans

The future road map has the milestones in the shape of entering into global Halal Food Trade Market, controlling Trans-boundary Animal Diseases of trade and economic importance and socio-economic uplift of poor small livestock farmers. Feasibility Studies of the following new mega development projects are underway:

1. Establishment of Halal Food Certification System in Pakistan (Cost = Rs. 1000 million) (Allocation for 2009-10 = Rs. 10.0 million)
2. Progressive Control of Foot and Mouth Disease (FMD) in Pakistan (Cost = Rs. 3000 million) (Allocation for 2009-10 = Rs. 9.390 million)
3. Accreditation of Animal Quarantine Laboratory, Karachi.
4. Strengthening of Fisheries Infrastructure along Sindh and Baluchistan Coast (Cost = Rs. 1000 million) (Allocation for 2009-10 = Rs. 25.0 million)
5. Reactivation and Improvement of Fisheries Training Centre of the Marine Fisheries Department (Cost = Rs. 278.0 million) (Allocation for 2009-10 = Rs. 50.0 million)
6. Strengthening Through Provision of Fishing Equipments and Support Programme (Cost = Rs. 1000 million) (Allocation for 2009-10 = Rs. 25.0 million)
7. Negotiations are underway with the united States for financing project for disease surveillance and animal trace back and registration data base.

11. Interdisciplinary Collaboration that has been Undertaken in one World one Health Initiative

One world one health concept formerly known as one medicine advocated the integration of human and veterinary medicine to improve the health and well being of both animals and human. Many Countries have embraced the One Health Initiatives. The foundation of this concept may date back in 19th century when Robert Virchow stated, “Between animal and human medicine there is no dividing line, nor there should be”. This idea later on supported by Calvin Schwabe in 1984.

This concept emphasized the need for interdisciplinary collaboration and communication in all aspects of human and animal health care including but not limited to common educational curricula for medical, veterinary and public health schools;
effective communication through publishing respective research and clinical findings in common journals and communication at conferences or seminars and other networks; considering and sharing the possibility of cross species disease transmission while diagnosing, treating and controlling diseases both in animal and human settings; conducting joint research in the context of cross species disease transmission; developing effective tools for prevention and control of diseases in animal and human; and developing effective media communication for the public as well to guide the influential political forces.

The one world one health concept is not well perceived in Pakistan so far. There is very low sensitization on the part of policy makers and little realization on the part of stakeholders including physician, veterinarian, ecologist and other related scientific disciplines or organizations. The major constraints in this regard are the absence of single entity under which professionals belong to different discipline can work together for one health, inadequate legislative cover for collaboration between ministries having their own mandate (eg. M/O Health, M/O Livestock & Dairy Development, M/O Food & Agriculture, M/O Environment and Wildlife, M/O Local Governments) providing health, veterinary and environment related services and the conventional mindset that the people employed in one ministry or organization think others alienated and show sometimes reluctance to share information and limited financial and human resources.

Despite all these constraints, Pakistan has observed an exemplary collaboration in all aspects of control of Highly pathogenic avian influenza (HPAI) during 2003:2008 where decision makers from both ministry of health, ministry of livestock and dairy development and ministry of environment, scientists and basic health care settings of both human health and animal health, private organization and international organization including WHO, FAO, USAID, EU and world bank joined their hands to control the avian influenza in Pakistan successfully. It was all due this extensive collaborative efforts and resultant effective HAPI surveillance system and rapid response system that only one confirmed casualty resulted despite the wide spread of infection of HPAI in poultry population. Similarly following efforts or initiatives are in place that aims directly or indirectly towards achieving the objectives of the one world one health concept:

- Professionals from Pakistan participated in a meeting on the One Health initiatives in Bangladesh.
- National task force for communicable diseases has been constituted;
- Under Field Epidemiology and Laboratory Training Program (FELTP) sponsored by CDC two veterinarians have been trained and are planning to train local veterinarian in the upcoming training courses. This program is working following a new idea that individual training of the professionals will bring the change itself because of their own realization to change the traditional trend or mindset once they are trained in particular field.
• Seasonal Awareness and alert letter by M/O Health is being issued quarterly basis. The dissemination of this letter is widespread including the M/O Livestock and dairy Development and M/O Environment;

• People development Plan 2011-15 and Vision 2030 of Planning Commission of Pakistan have provisions to ensure safe water and integrated disease surveillance and establishment of public health laboratories network.

• Dipping of sheep in acaricide solution to protect them against CCH fever when they cross the border between Afghanistan and Pakistan in Baluchistan.

• National public surveillance legislative framework is prepared and circulated to the provinces for their concurrence.

12. Legislation of Veterinary Public Health and Their Implementation

No legislation exclusively for veterinary public health existed however legislation in pieces and bits is available and is being implemented for various functions of veterinary public health and food safety. Effort was made under SLSP and NAPHIS projects to review the existing legislation surrounding livestock marketing, animal health, dairy production and inspection and certification of animal and animal products. The consultants submitted their reports and the same was consolidated and shared with standing committee of parliament on livestock. The bill is ready for submission to the parliament for promulgation. This new legislation will address veterinary public health and food safety issues. Following pieces of legislation are in force that regulates the various functions of veterinary public health and food safety:

• Dourine Act, 1910;
• Punjab Dourine Rules, 1952;
• Glanders and farcy Act, 1899;
• Sindh Glanders and Farcy rules, 1921;
• South African Horse Sickness rules, 1959;
• Sindh cattle (Contagious Disease) Act, 1948;
• Sindh cattle (Contagious Disease) rules, 1949;
• NWFP Animal Contagious Diseases Act, 1948;
• Bye Laws for Registration and Control of Dogs and Prevention of Rabies with the Texila Cantonment;
• Pure Food Ordinance, 1960;
• Pure Food Rules, 1965.
• Cantonments Pure Food Act, 1966;
• Cantonments Pure Food Rules, 1967;
• Milk Boards Ordinance, 1963;
• Agricultural Produce (Grading and Marking) Act, 1937;
• Agricultural Produce (Grading and Marking) Amendment Act, 1972;
• Animal Hair (Grading and marketing) Rules, 1961;
• Egg Grading and Marking Rules, 1937;
• Ghee Grading and Marking Rules
• Creamery Butter Grading and Marking Rules, 1941.

13. Conclusion and Recommendations

Based on the foregoing facts following can be concluded:

- Inadequate legislation for veterinary public health and food safety existed and the functions of veterinary public health are shared by more than one department / organization. Efforts are underway to review veterinary public health and food safety laws both at provincial and national level. For instance, Government of Punjab is in process of creation of milk and meat safety agency and is updating the laws on food inspection and disease surveillance system with their jurisdiction.

- M/O Livestock & dairy development is in process of creation of a “Veterinary Public Health and Food Safety Authority”. Once it is created, it will take over and or coordinate all core functions of veterinary public health with the following objectives:
  a. Health information system will be designed and implemented across the country.
  b. Electronic access and networking and training to information to strengthen technical expertise of veterinarian and administrative infrastructure.
  c. Common disease surveillance system and enhanced communication between ministries of health, agriculture, wildlife, environment and livestock will be developed.
  d. Impacts of interactions of humans/animal/environment and the better understanding of multiple interfaces of human, animal (livestock and wild life) and environment will be researched through coordinated projects.
  e. Food and water safety programs will be developed aiming to control zoonoses,
  f. Codes of good manufacturing practice, HACCP and other similar auditing systems will be developed and implemented.
g. Uniform veterinary education while including the public health courses at the graduate and post graduate level will be ensured and effective collaboration between the veterinary and medical institutions and practitioners will be established to ensure health and well being of the public.

Veterinary Services of Pakistan

The animal health services in the country were developed to cater the need of veterinary services at gross root level. It provided prophylaxis, treatment and diseases monitoring services. It assisted the livestock owners by identifying the prevalent livestock diseases, carrying out treatment and routine vaccination during normal and epidemic conditions thus restricted mortalities to minimum. Resultantly, livestock population grew with a good pace, realizing the need to extend the sphere of the activities towards production side as well. The cross breeding of local non-descript animals with the exotic breeds have improved the production potentials of the local breeds but at the same time introduced exotic diseases in the country and next generation proved to become more vulnerable to diseases. This situation created more pressing demand of improved veterinary and allied services through better diagnostic facilities, increased vaccine production and better health coverage to protect the local livestock population.

1. Organization

The animal health organization is bifurcated into Federal and Provincial departments in the country. The Federal department formulates national policies, plan, coordinate/liaison with the Provincial / International agencies, animal quarantine and inspection, collection and compilation of livestock statistics for sectoral activities. Provincial livestock departments are the executing agencies and focal points for all the livestock activities in the provinces. The livestock department is divided into Extension Directorate, Artificial Insemination Directorate, Animal health Directorate, Livestock farm Directorate, Planning and Research Directorates. These directorates function in their defined spheres through a net work of field offices at gross root level. The Federal and Provincial veterinary authorities interact with each other periodically.

2. Field Services

Directors of each veterinary service aided by deputies/assistants are responsible for the field veterinary services. They are posted at divisional / district levels respectively. Services within the district are further sub-divided to Tehsil and Union Council levels. Veterinary hospitals are generally situated at Provincial Capital, Division, and District levels while Dispensaries, Veterinary centers are located at Tehsil and Union Council levels respectively. There are also numbers of mobile units working in various parts of the country.
The staffing varies with the requirement. Generally Provincial headquarters have up to 20 or more veterinarians, Division has up to 8 and each District has several veterinary officers (V.O), stock assistants (S.A) and Compounders. The number of veterinary establishments in the country and existing strength of these departments are as follows:

### Veterinary Establishments

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Punjab</td>
<td>511</td>
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<td>2757</td>
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<tr>
<td>Sindh</td>
<td>116</td>
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<tr>
<td>AJK</td>
<td>17</td>
<td>108</td>
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</tr>
<tr>
<td>Northern Areas</td>
<td>11</td>
<td>150</td>
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<tr>
<td>Pakistan</td>
<td>805</td>
<td>2093</td>
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### Technical Staff of Livestock Departments in each Province

<table>
<thead>
<tr>
<th>Post</th>
<th>NWFP</th>
<th>Punjab</th>
<th>Sindh</th>
<th>Baluchistan</th>
<th>AJK</th>
<th>Northern Areas</th>
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<tr>
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<td>-</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Director</td>
<td>1</td>
<td>11</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Project Director/</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Senior Staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deputy Director</td>
<td>6</td>
<td>42</td>
<td>8</td>
<td>20</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Asst. Director/SVO</td>
<td>30</td>
<td>62</td>
<td>37</td>
<td>17</td>
<td>21</td>
<td>5</td>
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<tr>
<td>Veterinary Officer</td>
<td>124</td>
<td>816</td>
<td>106</td>
<td>108</td>
<td>70</td>
<td>8</td>
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<tr>
<td><strong>Other Technical Staff</strong></td>
<td>1375</td>
<td>2400</td>
<td>681</td>
<td>462</td>
<td>400</td>
<td>83</td>
</tr>
</tbody>
</table>

* SVO = Senior Veterinary Officer

** Includes Stock Assistants, Veterinary Compounders, Cattle Development Assistant, Sheep Development Assistants, Poultry Assistants, Inseminators.

### 3. Vaccination/Treatment

The vaccinations program of livestock is based on regional/sub-regional seasonal disease pattern, which is carefully monitored round the year. Prophylactic vaccinations are carried out against the endemic diseases like Foot and Mouth, Haemorraghic Septicemia, Enterotoxaemia, sheep/ goat pox etc. Dipping/spraying/drenching against Endo/Ecto parasites is also a routine. The vaccination services are provided by public and private sector. Previously medicines were provided by the state free of cost but for the last two years, it has been provided on partial cost recovery basis. Similarly govt. is planning to gradually phase out the public services thus encouraging private sector to increase its share in the provision of veterinary services. Full privatization of veterinary hospitals/services is also on the agenda.
4. Diagnostic Services

Diagnostic laboratories are located at Division and District levels and equipped with moderate facilities. An assistant disease investigation officer (ADIO) being in charge and provided with supporting staffs. It collaborates with the field veterinary services for diagnosis of livestock diseases. The samples are sent or collected by the laboratory for investigations. The informations collected are analyzed and used for disease monitoring.

Veterinary Research Institutes are situated at the provincial capital level. These are equipped with advice diagnostic facilities and closely liaison with the field diagnostic laboratories. Veterinary biologicals are also produced to meet the local requirements of vaccines. They also interact with the agriculture universities. They carry out reseat on field oriented problems in different disciplines of livestock.

5. Federal Livestock Services

The Federal department formulates national policies, plan, coordinate/liaison with the Provincial / International organizations such as O.I.E Head / Regional Offices and WHO, Geneva, regulates animal quarantine and inspection, veterinary drugs administration; collection and compilation of livestock statistics for sectoral activities. Livestock Wing is also administering Pakistan Animal Quarantine (Import and Export of Animals and animals Products) Ordinance, 1979, Animal Quarantine (Import and Export of Animal Products) rules, 1980. Exclusive Fisheries Zone (Regulation of Fishing ) Ordinance, 1983; Exclusive Fishery Zone (Regulation of fishing ) Rules 1990 and Korangi Fisheries Harbor Authority (KFHA) Ordinance 1982 through its attached departments Animal Quarantine Department Karachi, Marine fisheries Department, Karachi and autonomous body Korangi Fisheries Harbor Authority (KFHA).

Animal Quarantine Department (AQD) under M/O Food, Agriculture & Livestock, regulates the import / export of livestock and livestock products through Pakistan Animal Quarantine (Import & Export of Animals and Animal Products) Ordinance, 1979 and Rules 1980 (copy enclosed). It observes WTO, European Union and trading partners Conditionalities during export of products of animal origin. AQD offices are located at Entry and Exit points of airports and Seaports. It has offices at Islamabad, Karachi, Lahore, Peshawar, Quetta, Multan and Sialkot. The quarantine department provides Central Certification Services to importers / exporters of livestock and livestock products. It registers export oriented slaughterhouses, animals’ casings units, gelatin processing units.

Private practice in veterinary is authorized to practitioners registered with Pakistan Veterinary Medical Council (PVMC) while import, export, manufacture, sale, storage and distribution of veterinary pharmaceutical biologics is regulated under the Drugs Act, 1976. It is regulated by M/O Health as per laid down procedures and formalities. Livestock disease reporting is being regulated through national laws and OIE guide lines. The livestock diseases and pests believed to pose risk on account of their ability to spread
and trade implications are immediately reported as per OIE policy and procedure. The health situation is regularly reported to OIE on quarterly basis. Pakistan has properly planned and organized programs for the control and eradication of Trans-boundary diseases and pests of trade and economic importance.

6. National Veterinary Laboratories (NVL) Islamabad

National Veterinary Laboratory (NVL) Islamabad, Project was launched to meet the sanitary conditionalities of WTO and European Union. The project envisages to establish a National Veterinary Laboratory for providing modern diagnostic facilities, train provincial staff, provide vaccine Quality Assurance Services, test livestock products against drug residues, evaluate veterinary drugs and suggest measures for control of animal disease and diagnosis of fisheries diseases.

7. Veterinary Institutions

- University of Veterinary & Animal Sciences, Lahore
- Veterinary Faculties at Agricultural Universities
  - University of Agriculture, Faisalabad
  - University of Arid Agriculture, Rawalpindi
  - Agriculture University, Peshawar
  - Sindh Agriculture University, Tandojam
  - Gomal University-DI Khan
  - Lasbela University.
- Colleges of Veterinary Sciences, Jhang
- Colleges of Veterinary Sciences, T.T.Singh.
- Baqai College of Veterinary Sciences, Karachi (Baqai University in Private Sector)

8. Research Institutions

- Animal Health Research
  - Animal Sciences Institute, NARC
  - Veterinary Research Institute, Lahore
  - FMD Research Center, Lahore
  - Centre for Adv.Studies on Vaccinology and Biotech (CASVAB), Quetta
  - Veterinary Research Institute, Peshawar
  - Veterinary Research Institute, Karachi
- **Animal Production Research**
  - Animal Sciences Institute, NARC
  - LPRI, Bahadarnagar Okara
  - Barani LPRI, Kherimurat Attock
  - Buffalo Research Institute, Pattoki
  - Poultry Research Institute, Rawalpindi
  - Res. Center for Conservation of Sahiwal Breed (RCCS) Jhang
  - Poultry Research Institute, Karachi
Abbreviations
AGPT  Agar Gel Precipitation Test
AHC   Animal Husbandry Commissioner
AJK   Azad Jammu and Kashmir
AQD   Animal Quarantine Department
BSE   Bovine Spongiform Encephalopathy
BSL-III  Bio-security level-III
CCHF  Crimean Congo Hemorrhagic Fever
CDC   Centre for Disease Control
CJD   Creutzfeldt-Jakob Disease
CMH   Combined Military Hospitals
DAHC  Deputy Animal Husbandry Commissioner
DCO   District Coordination Officer
DEWS  Disease Early Warning System
DNA   Deoxyribose Nucleic Acid
E.coli Escherichia coli
EDO   Executive District Officer
ELISA Enzyme Linked Immunosorbant Assay
EPB   Export Promotion Bureau
EU    European Union
FAO   Food and Agriculture Organization of United Nations
FELTP Field Epidemiology and Laboratory Training Program
FMD   Foot & Mouth Disease
GF-TADs  Global Framework for containment of Trans-boundary Animal Diseases
HACCP Hazard Analysis Critical Control Point
HI    Hemeagglutination Inhibition Test
HIV/AIDS Human immunodeficiency Virus / Acquired immunodeficiency syndrome
HPAI  Highly Pathogenic Avian Influenza
HPED  Regional Cooperation Program on Highly Pathogenic and Emerging Diseases
IT    Information Technology
M/O L&DD Ministry of Livestock and Dairy Development
M/O   Ministry of
ME    Middle East
MFD   Marine Fisheries Department
MOH   Ministry of Health
MPH   Master of Public Health
MRLs  Maximum Residue Limits
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS</td>
<td>Medical Superintendent</td>
</tr>
<tr>
<td>NAPHIS</td>
<td>National Animal and Plant Health Inspection Services</td>
</tr>
<tr>
<td>NARC</td>
<td>National Agricultural research centre</td>
</tr>
<tr>
<td>NIH</td>
<td>National Institute of Health</td>
</tr>
<tr>
<td>NPCPAI</td>
<td>National Program for the Control &amp; Prevention of Avian Influenza</td>
</tr>
<tr>
<td>NVL</td>
<td>National Veterinary Laboratories</td>
</tr>
<tr>
<td>NWFP</td>
<td>North West Frontier Province (now Khyber Pakhtoonkhwa)</td>
</tr>
<tr>
<td>OIE</td>
<td>Office International Des epizooties (World Animal Assembly for Animal Health)</td>
</tr>
<tr>
<td>PARC</td>
<td>Pakistan Agricultural Research Council</td>
</tr>
<tr>
<td>PCR</td>
<td>Polymerase Chain Reaction</td>
</tr>
<tr>
<td>PNAC</td>
<td>Pakistan National Accreditation Council</td>
</tr>
<tr>
<td>PPM</td>
<td>Parts per million</td>
</tr>
<tr>
<td>PPR</td>
<td>Peste Des Petits Ruminants</td>
</tr>
<tr>
<td>PTCL</td>
<td>Pakistan Telecommunication Company</td>
</tr>
<tr>
<td>PVMC</td>
<td>Pakistan Veterinary Medical Council</td>
</tr>
<tr>
<td>RBPT</td>
<td>Rose Bengal Agglutination Test</td>
</tr>
<tr>
<td>REC</td>
<td>Regional Epidemiological Center</td>
</tr>
<tr>
<td>RSU</td>
<td>Regional Support Unit</td>
</tr>
<tr>
<td>RT-PCR</td>
<td>Real Times Polymerase Chain Reaction</td>
</tr>
<tr>
<td>SAARC</td>
<td>South Asian Association for Regional Cooperation</td>
</tr>
<tr>
<td>SAFTA</td>
<td>South Asian Free Trade Agreement</td>
</tr>
<tr>
<td>SARS</td>
<td>Severe Acute Respiratory Syndrome</td>
</tr>
<tr>
<td>SDS-Page</td>
<td>Sodium Dodecyl Sulfate- Poly Acrylamide Gel Electrophoresis</td>
</tr>
<tr>
<td>SLSP</td>
<td>Strengthening of Livestock Services Project</td>
</tr>
<tr>
<td>SPS</td>
<td>Sanitary and Phyto-sanitary</td>
</tr>
<tr>
<td>TADinfo</td>
<td>Trans Boundary Animal Disease Information software.</td>
</tr>
<tr>
<td>TB</td>
<td>Tuberculosis</td>
</tr>
<tr>
<td>UNIDO</td>
<td>United Nations Industrial Development Organization</td>
</tr>
<tr>
<td>USAID</td>
<td>United State Agency for International Development</td>
</tr>
<tr>
<td>VH</td>
<td>Veterinary Hospital</td>
</tr>
<tr>
<td>VPH</td>
<td>Veterinary Public Health</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
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<tr>
<td>WNV</td>
<td>West Nile Virus</td>
</tr>
<tr>
<td>WTO</td>
<td>World Trade Organization</td>
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References

Ministry of livestock and Dairy development, Pakistan
Provincial department of livestock, Pakistan
Ministry of Health, Pakistan
National Institute of Health and Provincial Departments of Health, Pakistan
Animal science Institute, NARC, Pakistan
Ministry of local government and rural development and provincial departments of local governments, Pakistan

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I wish to thanks to all those who helped me completing this report without appearing before scene.

Last but not least, I express my deep appreciation and love to my family especially my wife who devoted much of her time in looking after my health and accessories during the period of gathering and compiling information for this report.
Veterinary Public Health and Zoonotic Disease Control in SRI LANKA

Dr. H. M. A. Chandrasoma
Director (Animal Health)
Department of Animal Production & Health
Peradeniya, Sri Lanka
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1. Introduction to Veterinary Public Health

Veterinary Public Health (VPH) was defined by the WHO consultation on "future trends in veterinary public health" held in Teramo, Italy in 1999 as "the sum of all contributions to the physical, mental and social well-being of humans through an understanding and application of veterinary science" (1). Veterinary medicine has a long and distinguished history of contributing to the maintenance and promotion of public health.

Human health is inextricably linked to animal health and production. This link between human and animal populations, and with the surrounding environment, is particularly close in developing regions where animals provide foods as proteins (meat, eggs and milk) transportation, draught power, fuel, fertilizer and clothing as well in both developing and industrialized countries.

A number of communicable diseases (known as zoonoses) are transmitted from animals to humans (1). About 75% of the new diseases that have affected humans over the past 10 years have been caused by pathogens originating from an animal or from products of animal origin. Many of these diseases have the potential to spread through various means over long distances and to become global problems.

In addition a number of well known and preventable animal diseases that can be transmitted to human (i.e. zoonoses such as rabies, brucellosis, leishmaniasis and echinococcosis) continue to occur in many countries especially in the developing world where they mostly affect the poorest segment of the human population. They cause a serious amount of deaths in millions of affected people every year.

All major zoonotic diseases prevent the efficient production of food of animal origin, particularly of much-needed proteins, and create obstacles to international trade in animals and animal products. They are thus an impediment to overall socioeconomic development. From way back veterinary medicine played a major role in the preventing of and interventions against animal diseases including zoonoses (1).

The core domains of VPH include diagnosis, surveillance, epidemiology, prevention and control, elimination of zoonoses; food protection; management of health aspects of laboratory animal facilities and diagnostic laboratories; biomedical research; health education and extension; and production and control of biological products and medical devices etc. Other VPH core domains may include management of domestic and wild animal populations, protection of drinking-water and the environment, and management of Public Health Emergencies (1). Main activity fields in veterinary Public health are Zoonoses, Food Hygiene & Safety, Environmental hygiene, Livestock husbandry & transport of animals, and Animal welfare.
1.1 Zoonoses and Veterinary Public Health (VPH)

"Zoonoses are all diseases and/or all infections naturally transmissible between animal and man. Zoonoses present a constant risk for people. Cleveland at al has presented ‘Surprisingly of the 1,415 known pathogens of human 61.6% 6 have an animal origin. A total of 616 pathogens were documented for domestic livestock with 77.3% considered as multiple species. For domestic carnivores the total was 374 pathogens with 90% being classified as multiple Species (11).

Beyond living animals, especially food can carry zoonotic pathogens. This way of pathogen transmission plays an important role, because most people do not have any direct contact with farm animals. Zoonotic pathogens that were fought and erased successfully can be re-introduced at any time. Similarly it is possible that new zoonoses emerge or zoonotic pathogens that were originally restricted to specific regions can get spread globally (2).

According to the PAHO publication any disease or infection that is naturally transmissible from vertebrate animals to humans and vice-versa is classified as zoonoses. Over 200 zoonoses have been described and they have been known for many centuries. They are caused by all types of agents: bacteria, parasites, fungi, viruses and unconventional agents.

1.1.1 Bacteria

Every year millions of people get sick because of food borne zoonoses such as Salmonellosis and Campylobacteriosis which cause fever, diarrhoea, abdominal pain, malaise and nausea. Other bacterial zoonoses are anthrax, brucellosis, infection by verotoxigenic Escherichia coli, leptospirosis, plague, Q fever, shigellosis and tularaemia.

1.1.2 Parasites

Cysticercosis/Taeniasis is caused by a parasite which infects swine and can cause seizures, headache and many other symptoms in humans. In Latin America for example, 100 out of 100 000 inhabitants suffer from this disease (estimation). Other parasitic zoonoses are trematodosis, echinococcosis/hydatidosis, toxoplasmosis and trichinellosis.

1.1.3 Fungi

Dermatophytoz are superficial mycoses that may be acquired from infected animals and affect the skin, hair and nails of humans, causing itching, redness, and scaling and hair loss. Another mycotic infection that can be zoonotic is sporotrichosis.

Viruses

Rabies is a deadly disease of carnivores and bats mainly transmissible to humans by bites. An estimated number of 55 000 persons, mainly children, die of this disease in the world every year. Dogs are responsible for most human deaths. Other viral zoonoses are avian influenza, Crimean-Congo hemorrhagic fever, Ebola, Rift Valley fever and Nipah virus. Latest are avian influenza and H1N1 infection of poultry and Pigs.
1.1.4 Unconventional agents

The agent of Bovine Spongiform Encephalopathy is thought to be the cause of Variant Creutzfeldt-Jakob Disease (VCJD) which is a degenerative neurological disease different from CJD, at present inevitably lethal in humans.

1.1.5 Emerging zoonoses

Contrary to "lingering" zoonoses, public awareness of "emerging" zoonoses is very high. The WHO/FAO/OIE joint consultation on emerging zoonotic diseases held in Geneva, 3-5 May 2004, defined emerging zoonoses as "a zoonose that is newly recognized or newly evolved, or that has occurred previously but shows an increase in incidence or expansion in geographical, host or vector range".

Emerging zoonotic diseases are previously unknown infections or known infections in new locations or in unsusceptible species. They are potentially with serious human health and economic impacts and their current upwards trends are likely to continue. Examples are avian influenza, Bovine Spongiform Encephalitis (BSE) and the Nipah virus. Some of the "lingering" zoonoses are re-emerging in some regions, although they seem to attract less public awareness. Brucellosis, dog rabies and parasitic diseases such as Cysticercosis/Taeniasis and echinococcosis/hydatidosis are examples.

Many factors lead to the emergence of zoonotic diseases. Environmental changes, human and animal demography, pathogen changes and changes in farming practice are a few of them. Effects of globalization with economic advancement leads to in crease animal movement livestock and poultry, wild life pet animals and livestock product , hunting for bush meat and buying at live animal markets as delicacies/hot favorites, also play as important factors affecting the emerging of zoonoses. Scientific interferences like improved surveillance, attempts to diagnose uncultivatable microorganisms and chronic diseases, some times the possible bioterrorism also play significant role in emerging of new zoonoses.

1.2 Food Safety Issues and Food Borne Infections

Food borne infections are human infections from food of animal origin. On this note, such infections belong to the zoonoses. The pathogens are located in the living animals. Those infections proceed mostly in apparently, and the emission of pathogens occurs intermittently. When in apparently infected animals are slaughtered, a contamination of meat of originally healthy animals is inevitable. Therefore, the second contamination is the more usual mode of bacterial contamination and can be controlled, but not completely stopped by keeping the instructions of hygiene. The huge reproduction of existing bacteria can be prevented by maintenance of the cold chain from the slaughterhouse to the consumer's refrigerator. Diarrhoea caused by Campylobacter sp. or salmonella in poultry or eggs, or caused by E. coli such as enterohaemorrhagic E. coli (EHEC) in beef or veal, Rotavirus-infections, Listeria monocytogenes or Yersinia enterocolitica are other relevant bacteria are common food borne pathogens.
The parasite Toxoplasma gondii can be transmitted to man by meat of small ruminants and pigs, too, and can damage the baby, if the first infection takes place during pregnancy. Furthermore, *Taenia saginata* and *Trichinella spiralis* are parasites which can be transmitted by meat. The importance of these diseases often is underestimated.

Residues of food and animal feed not naturally or not in natural concentration that contain undesirable physiologic effects in human. These are mostly substances used for the control of biological processes or for production safety in food or animal feed production, f. ex. herbicides, insecticides. However, toxic substances originating from animal feed like f. ex. pesticides or dioxin or else contaminating are still found in food. Mycotoxins come in human food via animal feed and are toxic Substances like poly-chlorinated biphenyls (PCB), DDT and different heavy metals concentrate in meat. Disinfectants can contaminate food during the production process. The clearance of cadavers and abattoir waste is not only a problem of the hygiene of infectious diseases. The conventional processing to carcass meal is getting more and more criticized because of the BSE problem.

The increasing industrialization of the animal and food production results in environmental pollution, because large-scale livestock farming causes huge amounts of liquid manure and emissions of dust. Solutions for those problems (f. ex. slatted floors and extraction of biogas) are strongly associated with animal hygiene, and the demands of animal housing must be included. Mostly the consequences on ecology and human health still cannot be estimated.

Wild animals which are, in contrary to the domestic animals, permanently exposed to environmental influences and which collect their feed directly from their habitat play an important role as bio-indicators for pollution in the region. For this purpose, investigations give important advices on human health threats (3).

Especially the herd surveillance belongs to the responsibility of veterinary public health. Herd management comprises several aspects which mean the whole flock but not the individual animal: type of husbandry, feeding, stable climate, animal hygiene surveillance and advancement of the herd's health (prophylaxis), promotion of fertility and growth etc. Therefore, mainly subsidiary items of veterinary medicine, apart from the classic veterinary tasks (examination, sampling, treatment), play a role in veterinary public health.

The US public health services corps has identified the veterinarian’s a officer in the Commissioned Corps, who have many roles of routine, who can serve as a clinician responding to animal and human disease outbreaks, or manage disease prevention and control programs. Other challenges include conducting medical and biological research Investigations, regulating drugs, monitoring vaccine development, ensure public safety as a public health compliance and quarantine. So the Veterinary public health is an essential part of public health and includes various types of cooperation between the disciplines that link the health triad, people-animals-environment, and all of its interactions (1).
2. Country Profile

2.1 Background Information

Sri Lanka is an island situated in the Indian ocean between 5.34 and 9.52 northern latitudes, and between 79.39° and 81.53° of eastern longitude. The total extent is 65610 square kilometers of which 1.7 million hectare of forests and 2,905 square kilometers of inland waters. Maximum length is 432 km and width is 224 km. Mean annual temperature is 27 degree centigrade in low land and 15 degree Centigrade in up hills. (Highest peak 2524 meters) Relative humidity varies from 70% during the day and 90% at night. Annual rain fall is 2500mm to 5000mm in south west of the island and less than 1250mm in the North West and south east of the island. Biannual rain fall pattern is prevails with south west monsoon in May to August and north east monsoon in November to February.

Administratively Sri Lanka is a unitary state, a socialist republic, which has 9 provinces governed by separate councils with devolved power on certain disciplines. In addition to these political divisions of 160 electorates, there are 25 administrative districts and 326 administrative Divisions and 14013 GN divisions for 35,425 villages. (16) The human population is 20.1 million with highest density in Colombo district and lowest in Wanni district. Most of Public health functions are devolved to, 330 Local government authorities, which are consist of Municipal Councils (18) and Urban councils (42) and Pradesiya Saba (270).

Animal population is 1.2 million cattle 0.3 million buffaloes 0.4 million of sheep and goats 94,000 pigs and 13.7 million of poultry, producing 202,009,000 liters of milk and 915 million of eggs and (6) per annum.

The Per capita availability of protein is 18.2 gram and energy is 156.5 calories per day from animal origin with total per capita availability of 2,357.1 calories, and 59.1 grams proteins and 48.9 grams of fats(6).

International animal trade of Sri Lanka is s minimal when compared to other countries except an average of 500,000 numbers of day old layer /Broiler parent chicks imported per annum.

Major commodities of livestock origin imported are milk, (65,944 Metric tons) beef, (34,000kg) mutton, (5,940kg) chicken meat (1,199 metric tons). Live Animal imports are mainly of pets, aviary, and zoo animals.

The import value of Veterinary biological and pharmaceuticals was Rs 6,427 million in year 2007, which is six fold of that of previous year, indicating a highly increasing demand for animal health /welfare issues or irrational use of veterinary drugs.(8).
2.2 Veterinary Public Health structure in Sri Lanka

Major institutions empowered to involve in public health activities in Sri Lanka are Department of Health Services, and Local government Authorities. They operate under the provision of specific acts and ordinance published on food safety and control of zoonoses. The Department of Animal Production Health, Department of wildlife conservation, National Aquatic Research Authority, and Fisheries Department are playing a sedated support role in implementation of some of those acts and regulations.
2.3 Department of Health Services

This Department is mainly responsible in coordinating, surveillance & information shearing, risk reduction and research in all zoonotic diseases and issues relevant to food safety. They use the provision of Food Act No 26 of 1980 and Cosmetic Devices and Drugs Act No 27 of 1980, to discharge their duties.

Department has representation in national level, (Director, epidemiology,) in District level (Regional Epidemiologists), Divisional level (Medical officers of Health,) in rural level (Public Health Nursing Sister, Public Health Inspectors & Public Health Midwife) who work under the command of DGHS.

Human health sector is the one which is well organized with ample resources both in Man power and physical, compared to the Animal health sector. Curative and preventive entities could be clearly identified in the human health sector having a well qualified and trained man power. Main categories of health staff are 16234 Medical officers, 47517 Nursing Officers, 2872 Public Health Inspectors in order to look after the health system of the country.

In addition, the Health Department comprises of a well organized public health network of Medical Officers of Health (MOH) providing the services through 301 regional centers. Preventive sectors is organized well with a fully functional central Epidemiology Unit, directed by Consultant Epidemiologists and a group of medical officers and a network of Regional Epidemiologists who provides their services through regional Centers located on district basis, with 40 working epidemiologists.

2.4 Department of Animal Production and Health

This Department is made responsible in surveillance & information shearing, risk reduction and research in all animal diseases including zoonoses and animal diseases relevant to food safety.

These functions are carried out by the Animal Health Division of the Department of Animal Production and Health. They do disease surveillance, disease investigation, diagnostic support, and collection and dissemination of Animal Health information nationally and internationally. They also involve in food safety and animal welfare issues with in a limited scope. Main areas are Salmonellosis control in poultry breeder farms and Brucellosis control in cattle herds.

Central Animal quarantine station which is functioning directly under Director General of the Department is involve in import risk reduction, surveillance of exotic animal diseases, and control of import and export of animals and animal products.

State animal health and veterinary public health service is made of Director General Animal Production and health, Director Animal Health,9 Provincial Directors, 17 Veterinary Investigation officers and 280 Range veterinary surgeons and other government veterinarians employed by other Government departments and statutory boards. They uses the provisions given in Animal act No 29 of 1958, Animal disease Act
No 59 of 1992 and Animal feed Act No 15 of 1986, to discharge their duties relevant to veterinary public health, with major emphasis on Animal Health perspectives.

Country animal disease situation is reported to DG, APH, on monthly basis, through Disease occurrence report by all range veterinary surgeons in the island. This Information’s are handled by animal Health Division of DAPH. Information are analyzed using to TAD info soft were and feedback quarterly to all Provincial Directors and make available to sector participants through Veterinary Epidemiological Bulletin Biannually.

Improvement are on going to increase the efficiency of this service as a web based Animal Health Information System and date base (SLAHIS). Country animal disease situation is reported to OIE on biannual basis by the focal point of DAPH.

When a contagious animal disease broke out the range veterinary surgeon send the Preliminary Investigation Report to Director General Animal Production and Health immediately to enable him to declare the situation through an extra ordinary government gazette notification. This empowered the government Veterinary surgeon of the area to take action to arrest the spread by restriction of animal movements and transport of animal products within and out of the infected area, and do ring or border vaccination to arrest the spread. This is a joint operation where the vaccine and cost of vaccination is provided by the central government, while implementation is done by the Provincial Departments.

Main zoonoses that they are combating at farm level are Salmonellosis in poultry farms, Brucellosis in dairy herds and establish preparedness for highly pathogenic Avian Influenza.

2.5 Department of Wild Life Conservation

Even though wild life has direct exposure to natural pathogens the incidences of transmitting wild life diseases to feral or domestic populations were not reported and investigated in scientific manner within the recent past. The country has segmented to five zones, and each zone is given a veterinarian, who is in charge of wild life diseases, and reports to the Deputy Director (Veterinary) about wild life disease situation, who compile these information and report to OIE as the focal Point. The linkages of DWL in disease reporting with DAPH which is mandated for national animal health information collection and dissemination had been very poor up to date but in the process of Development.

They use the provision in Fauna and Flora Protection ordinance to implement specially the protection and welfare of wild animals. Special attention is given to resolve human elephant’s conflicts and treating injured animals rather than controlling outbreaks in wild beasts, birds and other animals. Bird disease surveillance has been recently introduced specially in hot spots (breeding and nestling places) for early detection of HPAI infection, by DAPH veterinary Investigation officers.
2.6 National Aquatic Research Agency and Fisheries Department

This agency is identified as the focal point for fish disease reporting to OIE by DG AP&H. The diseases control of fishes is governed by the Animal disease Act No 59 of 1992, where veterinarians are identified as authorized officers, but most of the actions regarding fish diseases are done by fisheries officers, who have no veterinary background. Main disease identified as contagious in the 1st schedule of Animal Disease Act is Infectious Pancreatic necrosis.

2.7 Local Governmental Institutions

There are 18 municipalities, 42 urban councils, and 270 Pradesiya Saba operating in the country. The biggest municipality (Colombo) and (Kandy), the second largest are involved in veterinary Public Health functions. They address the three main public health functions which are Meat inspection, Zoonoses control, and Market controls. Dehiwela, Kotte, and Mount Lavonia, and Kalmune are the other Municipalities which are deployed veterinarians to handle public health Functions. Very few municipalities and urban councils get the services of Provincial council veterinarians to handle Meat inspection on part time basis. Others and almost all Pradesiya Saba depend on the services of Public Health Inspectors of Provincial Department of Health to get their meat inspected.

They use the provision made under Butcher ordinance and Rabies ordinance, and Food Act to execute these functions. Main Municipalities have their own by laws to govern these functions in addition to said acts and ordinances.

2.8 Environmental Authorities

There are two main authorities functioning to protect environment in Sri Lanka. One is Central environmental Authority which covers Entire Island except north western province which is covered by Provincial Environmental Authority of (Wayamba). They enforce the respective environmental act and statute to protect the public from injurious public health hazards, in the area of environment pollution.

3. Veterinary Public Health Laboratory Activities for Inspection, Surveillance of Zoonotic Diseases, and Data Processing and Handling

3.1 Department of Health Services

Disease surveillance and establish public food safety is the primary duty of the Medical Officer of Health. They collect the suspected samples, and send to laboratories belong to Government Analyst Department. In addition Health Department has their own central laboratory, at Colombo, (Medical Research Institute,) and regional laboratories at Kalutara, and Anuradapura. They provide facilities for diagnosis of (rabies, brucellosis,) for zoonoses, and checks food samples sent by public health Inspectors for adulteration, additives, residues and for bacteriology. All findings relevant to zoonoses, food safety
and other infectious diseases are communicated through the official website and weekly epidemiological bulletin by the epidemiology unit of the Health Department.

3.2 Government Analyst Department

This department has their own laboratories and check samples sent for legal interventions, especially those for adulteration, additives etc in foods. Their reports are considered as professional evidence in court proceedings.

3.3 Department of Animal Production and Health Services

Animal disease passive surveillance is mainly done by field level veterinarians employed by provincial Departments of Animal Production and Health, who are serving at Divisional level and those work in NLDB farms. They send a Monthly disease occurrence report to DAPH head quarters. These are basically syndromic type of surveillances based purely on clinical findings. Central Department of Animal Production and Health is playing major role in providing diagnostic support for all animal disease surveillance and control programs. Preliminary diagnostic activities are done at the District Veterinary Investigation centers (VICC) located at the districts level. The confirmatory diagnosis is done at the central VIC attached to Veterinary Research Institute. Veterinary Research institute play the role of reference laboratory in animal disease diagnosis using advanced diagnostic Techniques. Viral infection are diagnosed at Animal Virus Laboratory, Polgolla, which is a branch of VRI, while all other diagnostic activities are done at Veterinary research Institute itself.

3.4 Department of Wild Life Conservation

In relation to the wildlife health sector, the Department of Wildlife Conservation is only staffed with 7 veterinarians placed in strategic locations in the country in order to look after the wildlife parks and sanctuaries. Their most visible output is to manage the curative health of affected wild animals, and involve in management of elephant-human conflicts. They don’t have their own investigation or disease surveillance system, or laboratory set up of their own but depends mainly on the services of Department of Animal Production and Health with satisfactory level of coordination.

3.5 National Aquatic Research Agency (NARA) and Fisheries Department

The Ministry of Fisheries and Aquatic Resources has not employed any veterinarians to diagnose aquatic health problems. But the disease diagnostic support is obtained from local veterinary Investigation centers of DAPH. A senior scientist of National Aquatic Research Agency (NARA) has been identified and served as OIE fish disease focal point by DG DAPH.
3.6 The Centre for Aquatic Animal Disease Diagnostic and Research laboratory (CAADDR)

This has been established at the faculty of veterinary medicine and animal sciences, University of Peradeniya under foreign funded project which serve as the National reference laboratory for fish disease diagnosis, and research work.

4. Function and Responsibilities of Veterinary Public Health Services

There is no well coordinated island wide single network or mechanism established to handle veterinary public health work in Sri Lanka. But activities are handled by various institutes in deferent magnitudes with deferent levels of degrees in success. Main functions they handle are as fallows:

<table>
<thead>
<tr>
<th>Functions</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rabies control</td>
<td>DHS</td>
</tr>
<tr>
<td>Control of salmonellosis</td>
<td>DHS, DAPH</td>
</tr>
<tr>
<td>Control of Brucellosis</td>
<td>DAPH</td>
</tr>
<tr>
<td>Control of HPAI</td>
<td>DAPH, DHS, DWLC</td>
</tr>
<tr>
<td>Import risk reduction of zoonoses</td>
<td>DAPH, DHS</td>
</tr>
<tr>
<td>Food processing of Animal origin</td>
<td>DHS, DAPH, SLRI</td>
</tr>
<tr>
<td>Meat Inspection</td>
<td>LG, DHS, DAPH</td>
</tr>
<tr>
<td>Markets fruits and vegetables</td>
<td>LG, DHS</td>
</tr>
</tbody>
</table>

In Health department most of above functions are done by Public health Inspectors and MOHH, while in Major local Government authorities and Animal Production and Health Departments above functions are done by qualified Veterinarians.

Guidelines provided jointly by FAO, WHO, OIE to establish collaboration between animal and human health sectors at country level (ISBN 97892-90613992)and the specific guide lines in the areas of coordinating mechanisms, surveillance and information shearing, coordinated response, risk reduction is not in place in Sri Lanka. But a little coordination is done to certain level on HPAI under world bank funded HPAI preparedness and response project is an indication for possible coordination.
5. Existing Zoonotic and Food Born Diseases According to OIE Categories (zoonoses- human cases/ 2004)

<table>
<thead>
<tr>
<th>OIE code</th>
<th>Disease</th>
<th>Number of human cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>A080</td>
<td>Rift Valley Fever</td>
<td>0</td>
</tr>
<tr>
<td>B051</td>
<td>Anthrax</td>
<td>0</td>
</tr>
<tr>
<td>B053</td>
<td>Echinococcus/ Hydatidosis</td>
<td>...</td>
</tr>
<tr>
<td>B056</td>
<td>Leptospirosis</td>
<td>+..</td>
</tr>
<tr>
<td>B057</td>
<td>Q Fever</td>
<td>0</td>
</tr>
<tr>
<td>B058</td>
<td>Rabies</td>
<td>...</td>
</tr>
<tr>
<td>B060</td>
<td>New world screw worm (Cochliomyia hominivorax)</td>
<td>0</td>
</tr>
<tr>
<td>B061</td>
<td>Old world screwworm (Chrysomya bezziana)</td>
<td>0</td>
</tr>
<tr>
<td>B062</td>
<td>Trichinellosis</td>
<td>...</td>
</tr>
<tr>
<td>B105</td>
<td>Bovine tuberculosis</td>
<td>...</td>
</tr>
<tr>
<td>B106</td>
<td>Bovine cysticercosis</td>
<td>+..</td>
</tr>
<tr>
<td>B209</td>
<td>Glanders</td>
<td>0</td>
</tr>
<tr>
<td>B212</td>
<td>Japanese encephalitis</td>
<td>+..</td>
</tr>
<tr>
<td>B216</td>
<td>Venezuelan equine encephalomyelitis</td>
<td>0</td>
</tr>
<tr>
<td>B252</td>
<td>Porcine cysticercosis</td>
<td>...</td>
</tr>
<tr>
<td>B312</td>
<td>Avian encephalitis</td>
<td>...</td>
</tr>
<tr>
<td>B352</td>
<td>Tularemia</td>
<td>0</td>
</tr>
<tr>
<td>B501</td>
<td>Leishmaniosis</td>
<td>...</td>
</tr>
<tr>
<td>C611</td>
<td>Listeriosis</td>
<td>...</td>
</tr>
<tr>
<td>C612</td>
<td>Toxoplasmosis</td>
<td>+..</td>
</tr>
<tr>
<td>C801</td>
<td>Swine erysipelas</td>
<td>0</td>
</tr>
<tr>
<td>E001</td>
<td>Brucellosis</td>
<td>...</td>
</tr>
<tr>
<td>E002</td>
<td>Salmonellosis</td>
<td>...</td>
</tr>
</tbody>
</table>

Main zoonoses are Rabies, and Brucellosis, while main Food born diseases are viral hepatitis, Typhoid, Dysentery, Food poisoning, and cholera. Cholera, Plague, and yellow fewer are considered as group (A)diseases, which are internationally notifiable diseases, while others like polio considered as group (B) diseases.

If outbreaks occur in serious manner like in suspected acute flaccid paralysis, Ring vaccination is done in 11/2 km radius. And examination of stool is done of neighbors specially children. In case of rabies, Tetanus, Leptospirosis, MOH personally attend to do investigation and find the route of the cause and educate the affected public and take any other remedial actions as needed. Mean time reports to Director, Epidemiology and regional epidemiologist.

Rabies is given high priority as zoonoses by establishing special unit operated under a director whose primary focus is on population control of dogs, through sterilization, followed with vaccination.
The policy instruments that they used are the provisions of the Butcher ordinance, Food act No 26 of 1980, for food safety issues and Cosmetics, Devices, and Drugs Act No 27 of 1980, for residues in foods and Rabies ordinance to address zoonoses.

6. Zoonotic and Food Borne Disease Surveillance Data Processing, and Reporting Linking the SAARC Countries

Surveillance of zoonotic diseases is a primary duty of the Medical officers of the Department of Health services. Main zoonoses that they handle are Rabies, and Brucellosis, while main Food born diseases are viral hepatitis, Typhoid, Dysentery, Food poisoning, and cholera. Cholera, Plague, and yellow fewer are considered as group (A) diseases, which are internationally notifiable diseases, while others like polio considered as group B diseases.

When affected patient admitted to the Government hospital with a notifiable disease, once detected clinically and confirmed at the in hospitals laboratory, the House officer of the Ward reports it directly to MOH of the respective area, Who gets it investigated through respective PHII and send preliminary report to Director Epidemiology through Regional Epidemiologists, within 7 days. This report contains details on the index case and measures of control implemented with his staff. All information connected to outbreak is reported weekly in the special format, called Weekly disease return.

Department of Animal production and Health is involved in more active disease surveillance on HPAI and Salmonellosis in poultry and pigs, and brucellosis on cattle. They involve in active and passive surveillances on these diseases. Once the case is reported by the government veterinary Surgeon through preliminary disease investigation report VIO of the District visit the area with the range veterinary surgeon and collect the samples and do the diagnosis at VICC and send the sample to VRI for confirmatory diagnosis. Same time they try to find out the index case and support to establish control measures. For confirmatory diagnosis of zoonoses like rabies Samples are sent to MRI for diagnosis by the veterinarians. Fish disease Diagnosis is done only at Welisara VIC and CAADDR, at university Peradeniya.

The linkages of Department of Animal Production and Health and Department of Health Services were very weak but recently started in developing with the implementation of World Bank funded Avian influenza preparedness and response project activities.


OIE and FAO have set guide line for good Farming practices for animal production and food safety in 2009. Even though these have not been implemented fully, Sri Lanka has set of procedures to do the risk assessment and HACCP for poultry breeder farms,
Hatcheries, and processing plants (B/145). Clearly laid out code of procedure is available for importation and exportation of livestock and related products.

Normally Pre import Risk analysis and adoption of HACCP for animal product is done by the animal quarantine and inspection service of the Department of animal Production and Health based on Codex Alimentarius.

Processing companies who export their products it is a must to practice HACCP. When go for HACCP they have to prepare a manual with the assistance of professional Quality experts and forward to Sri Lanka Institute of Standards for certification. They get the technical assistance of the DAPH for verification of such industries based on the said manuals when livestock matters are involved.

For fish and fish product export Ministry of Fisheries has introduced a protocol to guarantee the quality, but no sufficient veterinary inspection is involved in this process.

8. Procedures of Pre Slaughter Examination of Food Animals

   cattle, sheep, goats, pigs, camels and buffaloes

The slaughter of cattle, buffaloes, sheep and goat, except pigs is governed by the Butchers Ordinance, No 09 of 1893 where the local Authority is vested with all powers of registering butchers and issue of permits for slaughter of animals and set regulations for the slaughter procedure.

In most of local bodies have their own slaughter houses. In all most all other places no proper slaughter facilities are established. Facilities provided are of very primitive nature with limited facilities for retention, ante mortem and post mortem inspection of animals and meat. Veterinary Inspection is done at few places. When compared to the modern world none of them can be named as abattoirs. No pregnant cow is permitted to be slaughtered. Since the slaughter of female cattle and buffaloes are controlled most of slaughtering is done at illicit places.

All cattle, buffaloes, sheep and goats brought for slaughter should bear a ownership voucher in prescribed form, and to be retained 24 hours in the premises, provided only with water but no food. Ante mortem inspection is done by a person authorized by the local authority may be a veterinarian or Public health inspector 24 hours before slaughter and only a healthy animals are allowed to be slaughtered by the registered butchers. Post mortem inspection is done after slaughter by a veterinarian or public health inspector and the affected parts or the entire carcass if affected with any pathological changes are seized and the Good parts of the carcasses are allowed to be sold. In special occasions temporary permits are issued to slaughter of cattle in home premises by the local authorities. The hygienic practices at the meat stalls are done by market inspectors and public Health Inspectors.

Pig meat is allowed to sell in registered meat stalls but no ante mortem or post mortem inspection is done by veterinary authorities.

Inspection of abattoir sanitation and food processing industries is directly under the supervision of Department of Health services is done with different degrees of satisfaction.

Laboratory Service Division of Sri Lanka Standard Institute which comprises of six specialized laboratories in the fields of Chemical, Electrical, Food, Materials, Microbiology and Textiles are equipped with modern instruments and manned by experienced and qualified staff.

They conduct certification services with Department of Animal Production and health and Department of Health services based on set manuals of the industrialists.

These services are open to both public and private sectors. The tests are carried out in accordance with Company, National or International standards, these laboratories, Chemical and Microbiology Laboratories have been accredited by the Swedish board for Accreditation & Conformity Assessment (SWEDAC).

All abattoirs and processing factories involved in export of animal products are checked and audited periodically by a team comprising DAPH, SLSI and DHS and provide certification.

The export of fish products is governed by the Fish Products (Export) Regulations 1998 framed under the Fisheries and Aquatic Resources Act No.2 of 1996.

Fish products mean any aquatic organism whether piscine or not, and includes any shell fish, crustacean, pearl oyster, mollusks, holothurians and its young fry, egg or spawn.

A processor who wishes to export his products shall be registered with the Department of Fisheries and Aquatic Resources, the Competent Authority. A basic requirement to be met to get registration is that the establishment shall establish and maintain a Hazard Analysis and Critical Control Point System (HACCP system) to cover the products and processes concerned.

The registered establishments are monitored for continual maintenance of the system. These inspections are carried out by the Sri Lanka Standards Institution under the powers delegated by the Competent Authority in accordance with section 17 (1) of the Regulation through signing a MOU. The results of the inspections are notified to the Competent Authority to take necessary actions. The Competent Authority also carries out certain inspections and official sampling.

The frequency of inspections will for the first year be once in 02 months. The frequency of inspections will later be based on the rating of the nonconformities reported in the previous inspection.
Veterinarians are empowered to do meat inspection by food Acts, but authority for other livestock products like dairy, egg, or fish in origin is not clearly mentioned in any law in Sri Lanka.

10. Determination and Reporting of Residues in Foods of Animal Origin Drugs, Hormones, Toxins, Pesticides

Adulteration, or inclusion of deleterious substances in food, putrid, repugnant, decayed, decomposed, or pathological lesions bearing parts and portions any other injurious parts are prohibited by food Act No of 26 1980 and Food amendment Act No 20 of 1991.

The detection of, putrid, repugnant, decayed, decomposed, or pathological lesions bearing parts and portions in any food of Animal origin are to be done by qualified Veterinarians but as previously motioned, except in very few main municipalities, other local authorities have not employed veterinarians instead they use the services of Public Health Inspectors of the Health department.

The collection of samples for drugs, hormones, Toxins, and pesticide residues and any other injurious parts in foods of animal origin in major markets is done by Municipal veterinarians and in other places it is left to Public health Inspectors, who take samples and send to government analyst for detection, identification and reporting. This function is done by animal quarantine officers on imported and export products at all harbors.

Industrial technology Institute (ITI), Sri Lanka standard Institute (SLSI) Medical research institute (MRI), Government Analyst, and Veterinary public health division of faculty of Veterinary Medicine and Animal Sciences, University of Peradeniya has facilities to detect Drugs, Hormones, Toxins, Pesticides in foods.

11. Framing Common Rules and Standards for Zoonotic Disease Control and Safe Food of Animal Origin

Animal Act No 15 of 1986 is the legal document, which govern the registration of farms, Identification of animals, rearing, breeding, transport of cattle and buffaloes and other animals in within the country. Recent threats of outbreak of HPAI in neighboring countries Department of Animal production and Health of Sri Lanka, was compelled to register all poultry operation as a measure of preparedness in controlling this disease, which subsequently implemented as a routine practice. All poultry breeder farms are given a special attention under the Animal disease Act No 59 of 1992, where a code of Good animal husbandry Practices has been introduced and use them as guide line for primary registration and annual renewal of registration.

When Zoonoses are considered Rabies is specially addressed by two ordinances enforced by colonial rule and still in force, the Rabies ordinance and ordinance of dog registration ordinance, which has provision of destruction of stray dogs, and compulsory
vaccination of pet dogs. In today's context destruction is discouraged due to rising interests on animal welfare by animal lovers and welfare organizations. Hence rabies control activities are limited to spaying and vaccination only.

Brucellosis is supposed to control by screening and culling of reactors, when the disease was in epidemic proportions, with limited geographical distribution, but since now is reported from other areas of the country, compulsory vaccination for heifer with S19 vaccine is practiced in affected areas.

Bovine tuberculosis and Leptospirosis are the other zoonoses identified with very little incidence rate which were not given much attention in controlling through, set rules or regulations.

12. Legislation on Veterinary Public Health and their Implementation

There is no specific single legislation on veterinary public health is in operation in Sri Lanka, Instead several acts and ordinances are in operation to cover the discipline.

1. The provision given in Food Act 26 of 1980, and Butchers ordinance to regulate and control the food safety of foods of animal origin.

2. The provision of Animal Disease Act, No 59 of 1992 and amendment made to the Import and Export Act No 01 of 1969, to arrest entry of bovine spongiform encephalopathy, and joint circular issued by Director Generals of Health Services and Director General of Animal Health on Highly Pathogenic Avian Influenza, and Rabies ordinance which can be used in controlling entry and, spread of zoonotic disease.

3. The Sri Lanka Institute of Standards, which is a member of the nineteen member forum of food advisory committee under the food act, has set standards for most of meat, milk and their products.

In implementation of most of these acts and ordinance Local authorities are empowered to take the lead roles, (Butcher Ordinance, Food Act, Rabies Ordinance). These powers are not used properly to appoint qualified veterinarians to handle veterinary Public Health functions. Even though Powers are vested to veterinary surgeons to inspect meat by food Act, except in few major Municipalities this function is done by non veterinarians. No veterinary representation is found in the powerful food committee formed under Food Act.

Since the discipline is handled by different agencies at deferent localities in different powers in different manner the quality of the service is badly affected and left with poor status of recognition.
13. Conclusion

Even though multi sectoral and multi disciplinary approach exists, there is no overall cohesive strategy and collaborative mechanism to execute prevention project and programmes to control emergence of food borne diseases, zoonoses and their surveillance in Sri Lanka. Existing health and Animal health management polices do not address the quick detection and control and response to the emerging and reemerging zoonoses and food safety issues.

The rise of emerging and remerging infectious zoonotic diseases and food born infections are becoming a big threat to human life world wide. To win this situation stern strategies are to be implemented while ensuring the biological integrity of the Earth. This requires interdisciplinary and multi-sectoral approaches to disease surveillance, monitoring, prevention, control and mitigation by establishing food security and food safety while concentrating on environmental conservation more broadly. It is clear that no single discipline or sector has enough knowledge and resources to prevent the emergence or resurgence of diseases in today’s globalizing world. So broader understanding of health and Disease demands a unity of approach which is achievable only through a consensus of human, domestic animal and wildlife health sectors which is in other word expressed as One Health.

Under such circumstances, it is necessary to recognize and establish the essential link between human, domestic animal and wildlife health and environmental sectors within each local authority jurisdiction with sound policy and implementation of programs and projects, jointly. In order to break the barriers among agencies, individuals, specialties in all these sectors, to launch sound veterinary public health practices in Sri Lanka.

14. Recommendations

- The guidelines prepared jointly by WHO, and FAO, OIE (15) for establishing collaboration between Animal and Human sectors at the country level, to be followed and implemented early to enhance coordination in between human, animal and environment sectors with their participation with Local authorities, in surveillance, information sharing, early response, risk reduction, and collaborative research.
- Sufficient legal framework and organizational structure to be developed and implemented to enable veterinarians and medical officers, to involve in public health activities jointly within the local government jurisdictions.
- Present legislations (Animal disease Act, Veterinary Practitioners Act) are to be updated to accommodate zoonoses and food safety issues as recommended in OIE PVS country report and OIE Guidelines on veterinary legislation (19).
• The veterinary and medical laboratories and professionals in those institutes should be made responsible to work together towards a common goal by sharing the knowledge and skills and information and other resources by developing good understanding and cohesive working culture towards zoonoses and food safety issues.

• Diagnostic Facilities for newly and reemerging Trans boundary diseases are to be developed and specific reference laboratories are to established for each important zoonoses by twinning with relevant world reference laboratories. An exchanging of scientists among such laboratories is to be encouraged and supported.

• Farm to Folk approach to be adopted in public health risk analysis procedures in all foods of animal origin. Guide lines prepared by OIE for good farm management practices are to be implemented, for general farm management, Animal health management, veterinary drugs and biological, animal feeding and Watering, Environment and infrastructure, animal and product handling.

• Animal health sector should have a special emphasis on the surveillance of zoonoses and reporting in their Animal Health Information system and Database which to be shared with medical counterparts and to be open for the general public locally and globally.

• The veterinary epidemiology unit to be strengthens and strong link to be developed with medical epidemiology unit, and collaborative research to be encouraged.

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## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AÑO</td>
<td>Animal Quarantine Officer</td>
</tr>
<tr>
<td>DAPH</td>
<td>Department of Animal Production and Health</td>
</tr>
<tr>
<td>DGHS</td>
<td>Director General Health Services</td>
</tr>
<tr>
<td>DGAPH</td>
<td>Director General Animal Production &amp; Health</td>
</tr>
<tr>
<td>DHS</td>
<td>Department of Health Services</td>
</tr>
<tr>
<td>DWLC</td>
<td>Department of Wild Life Conservation</td>
</tr>
<tr>
<td>ITI</td>
<td>Industrial Technology Institute</td>
</tr>
<tr>
<td>FVMAS</td>
<td>Faculty of Veterinary Medicine and Animal Sciences</td>
</tr>
<tr>
<td>LG</td>
<td>Local Governments</td>
</tr>
<tr>
<td>MRI</td>
<td>Medical Research Institute</td>
</tr>
<tr>
<td>MC</td>
<td>Municipal Councils</td>
</tr>
<tr>
<td>NARA</td>
<td>National Aquatic Research Agency</td>
</tr>
<tr>
<td>OIE</td>
<td>World Animal Health Organization</td>
</tr>
<tr>
<td>PS</td>
<td>Pradesiya Saba</td>
</tr>
<tr>
<td>PHI</td>
<td>Public Health Inspector</td>
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<tr>
<td>SSI</td>
<td>Sri Lanka Standard Institute</td>
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<tr>
<td>VRI</td>
<td>Veterinary Research Institute</td>
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<tr>
<td>VIC</td>
<td>Veterinary Investigation Centers</td>
</tr>
<tr>
<td>VPH</td>
<td>Veterinary Public Health</td>
</tr>
<tr>
<td>UC</td>
<td>Urban Councils</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organization</td>
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