

PASSIVE SURVEILLANCE ON OCCURRENCE OF DEADLY INFECTIOUS, NON-INFECTIOUS AND ZONOTIC DISEASES OF LIVESTOCK AND POULTRY IN BANGLADESH AND REMEDIES

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ABSTRACT

Passive surveillance system was designed with the data (102,613 case records) collected from the Government Veterinary Hospitals, Bangladesh and frequency distribution of diseases was calculated during July 2010 to June 2013. Frequently occurring diseases/ disease conditions reported in livestock were fascioliasis (10.66%), diarrhoea (7.92%), mastitis (7.42%), foot and mouth disease (6.42%), parasitic gastroenteritis (6.31%), coccidiosis (5.5%), *Peste des petits ruminants* (PPR, 5.32%), anthrax (4.19%) and black quarter (3.74%). Diarrhoea and coccidiosis were reported to occur throughout the year. The frequency of fascioliasis appeared higher in buffaloes (34%) followed by sheep (22%), goats (13%) and cattle (11%). PPR is a deadly infectious disease of goats and sheep, accounted for 20% and 13% infectivity in respective species. In chicken the most frequently occurring diseases reported were Newcastle disease (28%), fowl cholera (19%) and coccidiosis (11%). In ducks, duck viral enteritis (28%), duck viral hepatitis (17%), diarrhoea (15%), coccidiosis (10%) and intestinal helminthiasis (10%) were the commonest diseases reported in Bangladesh. Few other endemic diseases of livestock and poultry like Tuberculosis, brucellosis, avian influenza, duck anaplasmosis, Marek's disease, Gumboro disease, avian tuberculosis, mycoplasmosis, dermatophilosis etc. were not included in the hospital data sheet. Financial hurdles persist in a country like Bangladesh, imposing difficulties onto the surveillance and early reporting of the disease outbreaks; these diseases are, therefore, stubbornly prevalent. Development of technological and knowledgeable

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man power, in time surveillance and early warning of disease outbreak are the key to protect animal and public health and produce safe food of animal origin.

Keywords: Surveillance, zoonotic, infectious, non-infectious, diseases

INTRODUCTION

Diseases of livestock and poultry are the main hurdles of profitable animal agriculture in Bangladesh. Infectious, non-infectious, emerging, parasitic and zoonotic diseases of livestock and poultry are the leading cause of morbidity and mortality, restricted international trade of meat, milk, eggs, bone, fishes and feed of animal origin, condemnation of carcasses during slaughter and costs of their management. In general, sustainable and profitable livestock and poultry management requires independent state veterinary services and, modern surveillance technologies in order for quick and confirmatory detection of the diseases at early onset and designing control strategy. There are Veterinary Services under the Department of Livestock Services (DLS), Ministry of Livestock and Fisheries, Bangladesh but the surveillance system was not optimized due to conflict between Vet and non-Vet people working under the same ministry. Moreover, the public health services in Bangladesh is yet to organize to its requirement. The State Veterinary Services, Veterinary Faculties and Public Health Department are the wings for designing routine surveillance. Collection of information onto the diseases that are considered reportable by state statute and regulation (OIE 2008) are also ignored. The field veterinarians and public health officers in the third world country including Bangladesh lack innovative ideas/ techniques of diseases surveillance and are not regularly soliciting modern surveillance information.

Most of the local, city, and state veterinary departments require Vets, para vets and animal health care providers as well as town, school, hospital and laboratory officials to report diseases to the local veterinary office. This reporting system in passive surveillance system is yet to develop in Bangladesh. It is interesting to note that the field veterinarians seldom report all cases, sometimes are unaware about the reportable diseases or may consider the report a breach of confidentiality, similar condition also existed in abroad (Wright and Thrusfield, 2016). There are few reports of infectious diseases but the timeliness of reports is often affected by the delay in receiving laboratory test results (active surveillance). In passive surveillance system, there should have coordinator, should provide training to Vets, para-Vets and animal health provider about how to fill in the surveillance forms, and may even send someone to periodically collect forms from animal's health facilities. But little training has given to individual veterinary health provider who reports the information. The Vets, para-Vets and animal health providers require to interview farmers/ owners to filter active case finding in the herd or animal population in passive surveillance (Amaku et al., 2015). This surveillance is required in order to detect sub-clinically infected/ sick animals and birds that may not notify to veterinary health care facilities and this may, therefore, be enabling emergence or epidemicity of a disease.

This research project designed a passive surveillance protocol against a number of deadly infectious, non-infectious, zoonotic and emerging diseases of livestock and poultry in Bangladesh. The passive surveillance data analyzed towards better understanding of the existence of important diseases, formulating necessary control and preventive measures. In developed country passive surveillance is the key epidemiological investigation to predict diseases flow in human and animals. Initially most surveillance for important communicable, trans-boundary, emerging or vector borne diseases is passive (Khan, 2015; OIE, 2008; Ouagal et al., 2010).

Development and implementation of global animal disease surveillance has been limited by the lack of information systems of real-time data capturing, reporting, sharing, analysis, and related decision- and policy-making (Perez et al., 2011). It is global trend to support results of passive surveillance through active surveillance. For active surveillance, samples collected from the field or on farm used in the laboratory for confirmatory detection of diseases. Active surveillance system provides important stimulus to animal health workers, especially Vets and para-Vets in the form of individual feedback or outbreak studies. Active surveillance requires substantially more time and resources in the laboratory and is, therefore, less commonly used in emergencies. But it is often more complete than passive surveillance (OIE, 2008). Active surveillance is often used if an outbreak has begun or is suspected to keep close track of the number of cases. This paper described the results of a passive surveillance with the data collected from Upazilla Veterinary Hospitals, Bangladesh. The output of this finding is assumed to generate suggestions and probable resolutions against a number of deadly infectious, non-infectious, zoonotic and emerging diseases of livestock and poultry in Bangladesh.

MATERIALS AND METHODS

Passive surveillance

Passive surveillance is the most common type of surveillance in human and veterinary medical emergencies. Most surveillance for communicable, trans-boundary, emerging, vector borne diseases are passive. There is diseases investigation and monitoring software for reporting diseases of livestock and poultry attended in the Upazilla Veterinary Hospital, Bangladesh. The Government Vets working in the Upazilla Veterinary Hospitals collect data in the patient register, fill in the surveillance questioner and submit it to the epidemiology unit, DLS by the end of each month. In this study data obtained from the epidemiology wing, DLS, were analyze targeting format (epidemiology, ecology), extend of freedom of the Vets and animal health workers during collection and reporting data etc. We have designed a disease investigation format and analyzed data collected from selected Upazilla Veterinary Hospitals, Bangladesh. A total of 102,613 hospital cases were analyzed through the disease investigation forms during the year 2010-2011, 2011-2012 and 2012-2013. The divisions included were Dhaka, Chittagong, Rangpure, Rajshahi,

Sylhet, Khulna and Barishal. The data were analyzed by statistical analysis software (SAS) at Chittagong Veterinary and Animal Sciences University (CVASU), Chittagong and Bangladesh Agricultural University, Mymensingh. We report herewith the contribution of seasons, age, geography and species of animals and birds onto the distribution of diseases of livestock and poultry and proposing possible remedies, preventive and control strategies.

RESULTS

Out of 102,613 hospital case reports analyzed during 2010 to 2013, cattle (N=49523) appeared to be the most frequently involved animal species attended in the government veterinary hospital followed by goats (N=24526), chickens (N=15936) and ducks (N=4619). Prevalence of all the diseases appeared higher at Dhaka division followed by Chittagong, Rangpur, Rajshahi, Sylhet, Khulna and Barisal division (Figure 1). The top 10 frequently occurring diseases recorded (Figure 2) in the study areas were liver fluke infestation (fascioliasis, 10.66%), diarrhea (7.92%), mastitis (7.42%), FMD (6.42%), parasitic gastroenteritis (6.31%), coccidiosis (5.5%), PPR (5.32%), Newcastle disease (ND, 4.36%), anthrax (4.19%) and black quarter (BQ, 3.74%). While evaluating seasonal influence onto the occurrence of diseases in livestock throughout the country during 2010 to -2013 (Figure 3), liver fluke infestation appeared higher during July and August. During winter, diarrhea appeared as the most commonly occurring malady in livestock. In chicken, ND is the most frequently reported disease during spring, summer and rainy seasons. The burden of common parasitic gastroenteritis appeared higher during rainy (June and July) and winter (November and December) seasons while river bank and bank of other water reservoirs started rising. The farmers allowed their ruminants to graze at the sites of natural water bodies during that time where the encysted cercaria of liver fluke made available to infect ruminants. The warm and humid environment and green grasses on Pasture land by the sites of river, ponds, lakes, and grazing field also favor dissemination of endo-parasites in ruminants.

Frequency distribution of commonly occurring and important diseases of cattle across the study period (Figure 4) were liver fluke infestation, FMD, mastitis, black quarter and anthrax. Commonly occurring diseases of buffaloes (Figure 5) were liver fluke infestation followed by parasitic gastroenteritis and nonspecific diarrhoea. Goats were commonly infected with PPR (Figure 6) followed by liver fluke infestation, mastitis and diarrhoea. Frequency distribution of different diseases of poultry across the country during the study period included ND, Fowl cholera, coccidiosis and fowl pox (Figure 7). Ducks were commonly infested with duck viral enteritis followed by duck viral hepatitis, diarrhoea, coccidiosis and intestinal helminthiasis (Figure 8). The zoonotic diseases reported was mostly anthrax, incidence of anthrax was higher in Dhaka and lower in Sylhet divisions.

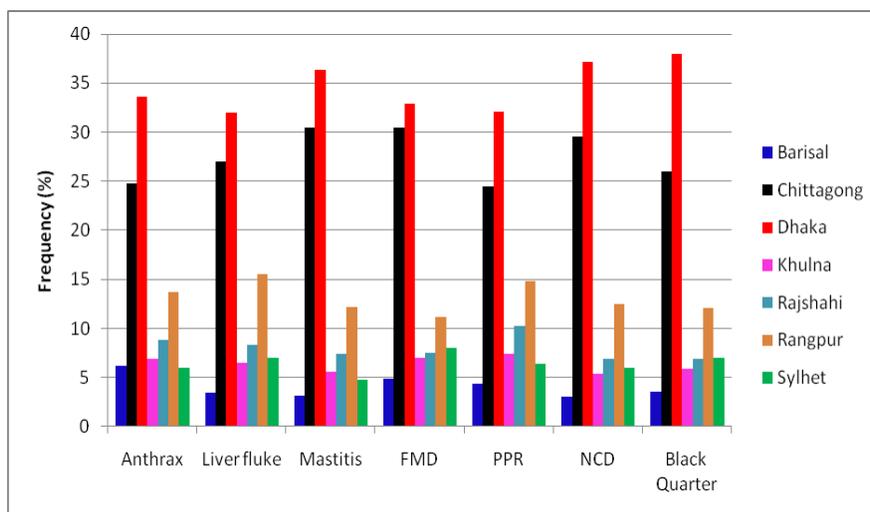


Figure 1. Frequency of commonly occurring diseases of livestock and poultry (2010-2011, 2011-2012 and 2012-2013) is stratified by different geographical areas (Divisions) of Bangladesh. The top most and commonest diseases reported were anthrax, liver fluke, mastitis, FMD, PPR, ND and BQ. Prevalence of all the diseases appeared higher at Dhaka division followed by Chittagong, Rangpur, Rajshahi, Sylhet, Khulna and Barisal division.

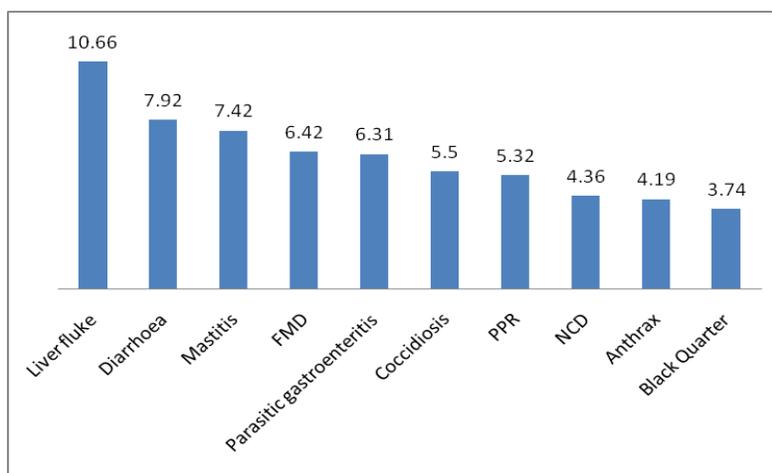


Figure 2. Top 10 frequently occurring (percentages are shown on the top of the bar) diseases of animals and birds in reporting areas of Bangladesh. The geo-climatic condition of Bangladesh favors the growth and dissemination of liver-fluke infestation (10.66%) in cattle, buffaloes, sheep and goats. FMD outbreaks (6.42%) in young calves and PPR outbreaks (5.32%) in yearling goats are the leading causes of death in calves (40-70%) and goats (50-70%) respectively.

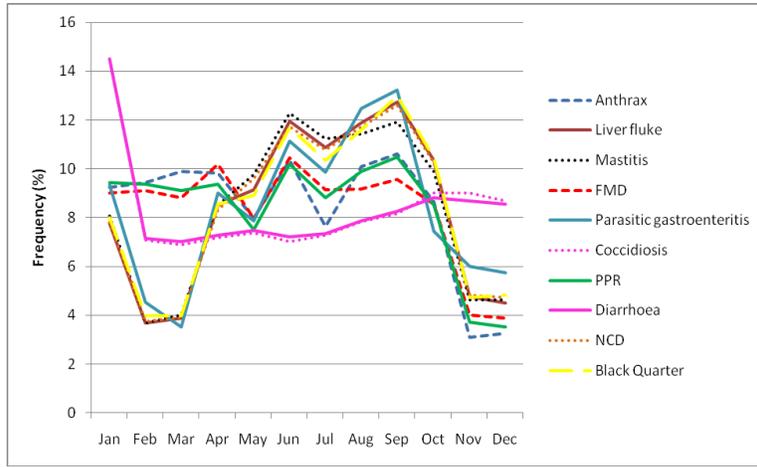


Figure 3. Seasonal occurrence of diseases in livestock throughout the country during 2010 to 2013. The frequency of liver fluke infestation in all ruminants appeared higher during July and August of the year. The burden of parasitic gastroenteritis appeared higher during rainy and winter seasons.

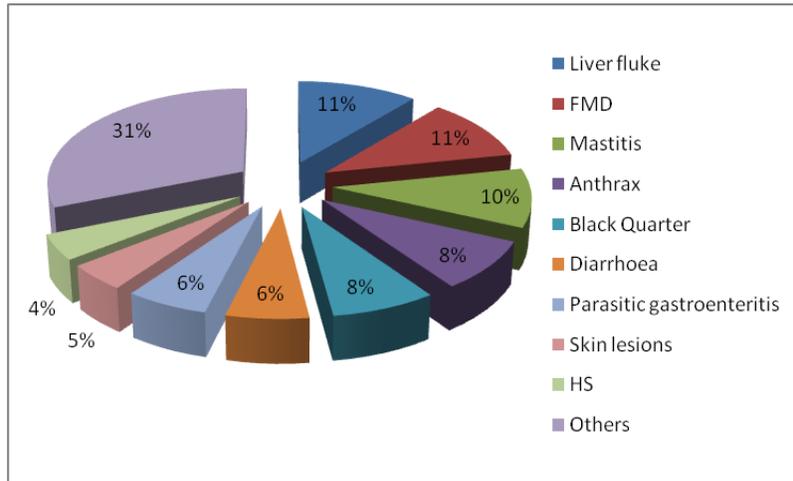


Figure 4. Frequency of commonly occurring and important diseases of cattle across the study period. The highest incidence of disease observed were liver fluke infestation (11%), FMD (11%), mastitis (10%), black quarter (08%) and anthrax (08%). The lowest incidence of diseases recorded were HS (04%), lesions in Skin (05%), diarrhoea (06%) and parasitic gastroenteritis.

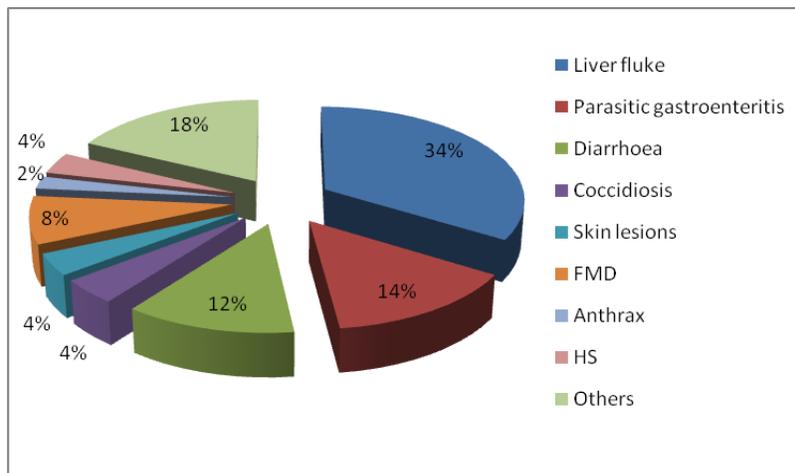


Figure 5. Frequency of commonly occurring and important diseases of buffaloes across the study period. Highest occurrence of diseases reported were liver fluke (34%) infestation followed by parasitic gastroenteritis (14%) and nonspecific diarrhoea (12%). The lowest incidence of diseases in buffaloes seen were anthrax (02%), HS (04%), coccidiosis (04%), dermatitis (04%) and FMD (08%).

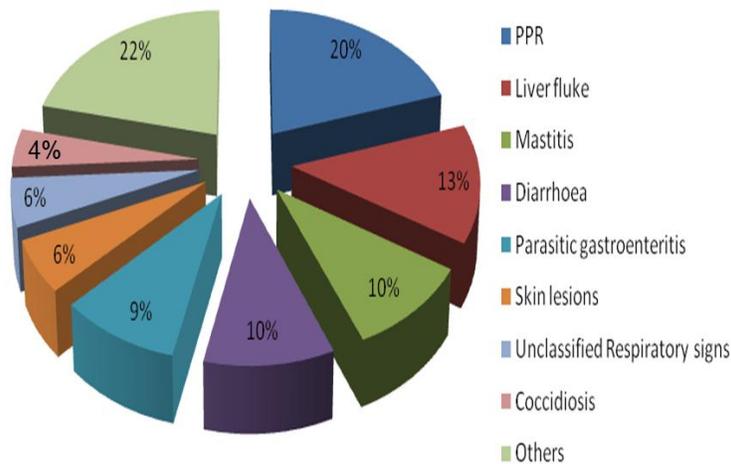


Figure 6. Frequency distribution of different diseases in goats across the study period. The highest incidence of diseases reported were PPR (20%) followed by liver fluke infestation (13%), mastitis (10%) and diarrhoea (10%). The least incidence of diseases reported were coccidiosis (4%), unclassified respiratory signs (6%), dermal lesions (6%) and parasitic gastroenteritis (9%).

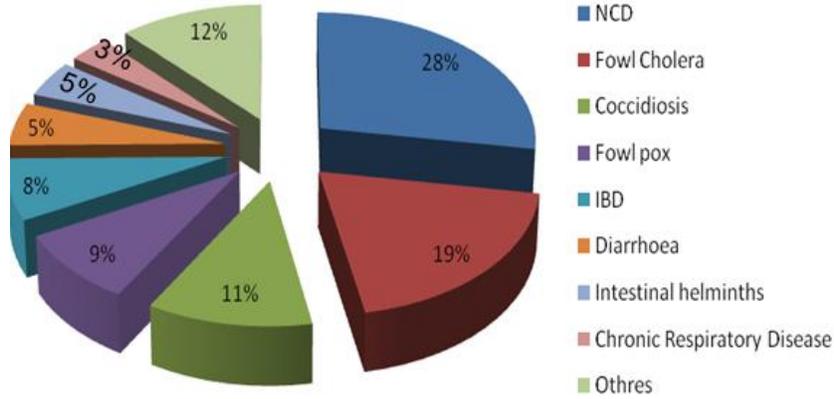


Figure 7. Frequency distribution of different diseases in chicken across the country during July 2010 to June 2013. The highest incidence of NCD (28%) was recorded in the Upazilla Veterinary Hospitals followed by fowl cholera (19%), coccidiosis (11%) and fowl pox (9%). The least commonly occurring diseases were chronic respiratory diseases (3%), intestinal helminthiasis (5%), diarrhoea (5%) and Infectious bursal diseases (8%).

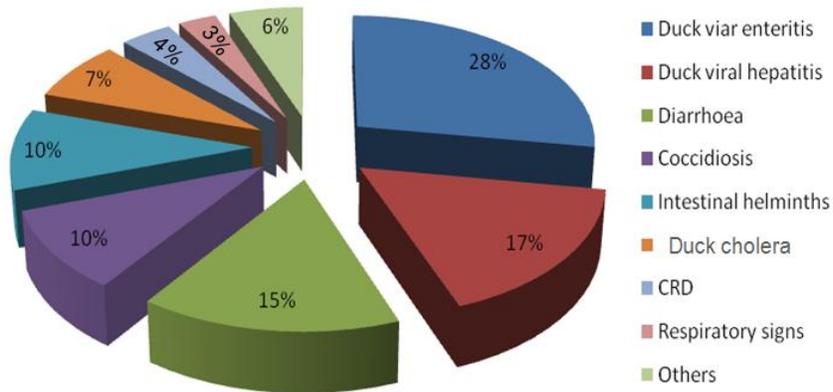


Figure 8. Frequency distribution of different diseases in ducks across the country during 2010 to 2013. In ducks highest incidence of diseases recorded were duck viral enteritis (28%) followed by duck viral hepatitis (17%), diarrhoea (15%), coccidiosis (10%) and intestinal helminthiasis (10%). The least commonly occurring diseases were respiratory distresses (3%), CRD (4%) and duck cholera (7%).

It is customarily accepted that the existing and suspicious new cases or clinical signs should be reported to local (Upazilla), regional (city or division) and state Veterinary department (Department of Livestock Services) by the animal health care providers, institutional, research laboratories or market sources (Figure 9). Surveillance case definitions enable animal health officials to classify and count cases consistently across reporting jurisdictions. Surveillance case definitions are not intended to be used by healthcare providers for making a clinical diagnosis or determining how to meet an individual patient’s health needs. Not all the diseases has to be reported to Center for Disease Control and Prevention (CDC). The list of reportable conditions varies by state. The Council of State and Territorial Epidemiologists (CSTE) has to define and recommend the state health departments report cases of selected diseases to CDC’s National Notifiable Diseases Surveillance System (NNDSS). Every year, case definitions are updated using CSTE’s Position Statements and they provide uniform criteria of national notifiable infectious and non-infectious conditions for reporting purposes.

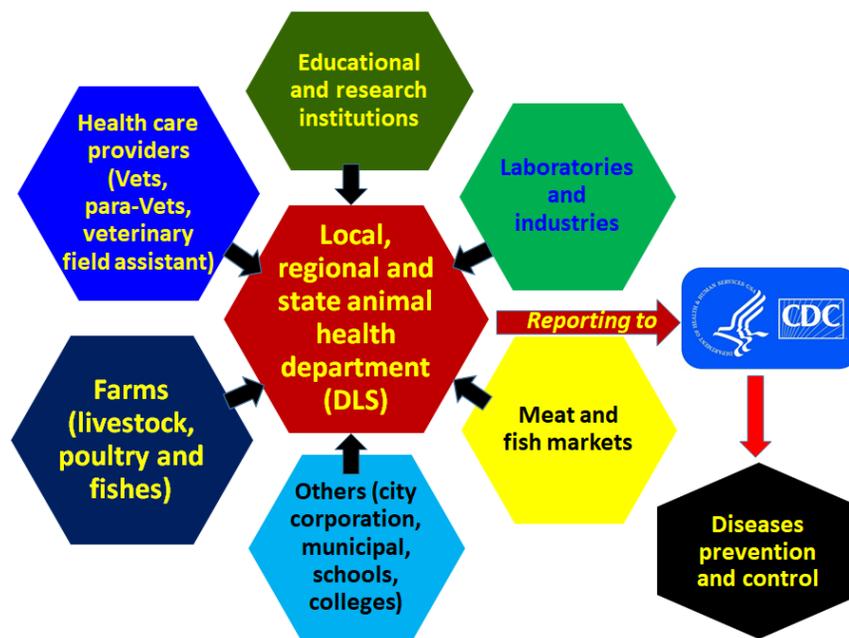


Figure 9. A flow chart of national diseases surveillance system. Only the notifiable diseases or disease conditions (<https://wwwn.cdc.gov/nndss/conditions/notifiable/> 2018) have to be reported to CDC. The main goal of such reporting is to protect public and animal health and safety through the prevention and control of disease, injury, and disability in the regional and international level.

DISCUSSION

The top 10 frequently occurring diseases of livestock and poultry in Bangladesh were liver fluke infestation, diarrhoea, mastitis, FMD, parasitic gastroenteritis, coccidiosis, PPR, ND, anthrax and BQ. Less than 2% of total livestock and poultry population were attended in the Upazilla Veterinary Hospitals and the prevalence of diseases reported does not truly reflect the real pictures. There is little opportunity in the Government veterinary health care facilities at Upazilla level to measure the effect of these diseases on weight gain, meat and milk yield, morbidity and mortality of animals and birds. The important zoonotic diseases only noted in the hospital data sheet during passive surveillance was anthrax. Brucellosis (Dey et al., 2013) and Tuberculosis in dairy cattle (Hossain et al., 2015), Leishmaniasis in goats (Labony et al., 2014) and canids (Khan et al., 2012) and avian influenza in chickens (Bari et al., 2009) and ducks (Ruba et al., 2015) were endemic in Bangladesh and extremely zoonotic, these diseases were not included in the hospital data sheet. The passive surveillance protocols were, therefore, unable to analyze frequency distribution of the existing zoonotic diseases of livestock and poultry in Bangladesh.

The hospital record proposed diarrhoea as second most commonly occurring condition in livestock but the actual cause(s) left unreported. The gastrointestinal round worm infestation, coccidiosis, balantidiasis, immature amphistomiasis, schistosomiasis, nitrate poisoning etc. may contribute diarrhea in livestock but these are underreporting. Babesiosis, anaplasmosis and thileriosis are commonly occurring tick borne diseases of livestock in Bangladesh (Karim et al., 2012) but have got little information in the data sheet. The higher rate of morbidity and mortality of goats due to PPR as we observed during our active surveillance (Dhar et al., 2015) was literally absent in the hospital data recording.

Anthrax (Zohora et al., 2012), FMD, PPR and BQ are preventable disease of livestock and require regular immunization. The farmers have restricted opportunity to vaccinate their animals against these diseases. Cattle in Bangladesh were commonly infected with FMD viral serotype O, A and Asia 1 (Islam et al., 2016; Pervin et al., 2011). Routine biannual vaccination of ruminant by using polyvalent vaccine containing FMD viral serotype O, A and Asia 1 is recommended. Following primary immunization of livestock with trivalent FMD vaccine a boost 15-21 days lateris recommended. Young sheep and goats were commonly infected with PPR with higher rate of mortality. Infected goats died following PPR mostly due to secondary infection caused by *Pasteurella multocida* (data was not shown). Goats over one year of age were commonly infested with *Fasciola gigantica* and may contribute higher rate of morbidity and mortality. Moreover, 25-30% goats found to carry anti PPR antibodies in their sera, they may neutralize vaccine virus following immunization and may be the leading cause of vaccine failure and death following PPR. Regular deworming of small ruminants and analyzing anti PPR antibodies before immunization with PPR vaccine is recommended.

A recent threat of dairy industry in Bangladesh is the occurrence of Tuberculosis (TB, Hossain et al., 2016), which is not addressed in hospital data sheet. Recent evidence suggested that there is emergence of drug resistance TB (multi drug and extensive drug resistance, about 8-10%) in man and animals (Cohen et al., 2015; Corbett et al., 2003; Espinal et al., 2001); this information in Bangladesh is virtually absent. Vets are routinely involved with the management of diseases of livestock including TB but unknowingly many vets of Bangladesh may have had TB from farm, zoo and slaughtered animals. Routine intra dermal tuberculin test in the elderly dairy cattle is recommended to prevent future zoonosis and possible emergence of multi drug and extensively drug resistance TB. Avian TB is also endemic in few elderly commercial poultry farms in Bangladesh (Haque et al., 2016) but was not included in the hospital data sheet. The bovine TB (*M. bovis*), human TB (*M. tuberculosis*), Para TB (*M. avium sub spvarpara tuberculosis*) and avian TB (*M. a. avium*) are endemic in Bangladesh and extremely zoonotic. State Veterinary Services or Public Health Department require empowering to test all the dairy, zoo and slaughtered animals and dispose the test positive animals immediate after testing. Test and slaughter of infected/ test positive animals and birds are needed to make a safe environment for the farmers, owners, veterinarians and human being getting close proximity to farms.

The ecosystem and availability of vectors or intermediate hosts of parasites made Bangladesh a heaven for parasitism (Alam et al., 2014; Hossain et al., 2015; Hossain et al., 2011; Khan, 2015; Samad et al., 2004); all animals require regular examination for the existence of specific nematode, trematode, cestode and ecto-parasites. It is not difficult to test and diagnose parasitism of livestock but little technical facilities were provided from the diagnostic shelf of Government and private veterinary health care services. The government Vets, para-Vets and animal health providers require training on certain ecological and epidemiological approaches of parasitic life cycle and to learn basics of parasitic disease diagnostics and management. Accurate reporting and management of parasitic diseases of livestock and poultry were, therefore, obtained. Buffaloes and sheep appeared resistant animals species to a number of infectious and parasitic disease compared to cattle and goats; their feeding, breeding and management practices are mostly neglected. Very few buffaloes and sheep were attended in the Upazilla veterinary hospitals and the diseases they carry were not either reported.

Farm animals living in and around forest areas are at increased risk of vector borne disease like trypanosomiasis (Surra), babesiosis, anaplasmosis, thileriosis, stephanofilariosis etc. but the disease information is lacking in the hospital data sheet; these may be due to lack of detection protocol or reporting system. There are diseases of cattle, buffaloes, sheep and goats transmitted through domestic and wild mammals and vectors like heart worm infestation (Yousuf et al., 2014) rabies, toxoplasmosis, hydatidosis, coenurosis etc., these information is also lacking in the hospital recording. A similar study was carried out in Van Gujjars, India (Wright and

Thrusfield, 2016) with the perceptions that these diseases should be present, but were under-reported. The animal diseases in Bangladesh and India have much greater concern to the community like surra (trypanosomiasis), kala-ajar, bovine viral diarrhoea, salmonellosis, brucellosis, leptospirosis, endocrine disorders like anestrus, hypoplastic ovary, cystic ovarian syndrome etc. but were neglected or the field veterinarians were not much aware of these diseases.

In chicken the most frequently occurring diseases reported were ND, FC and coccidiosis. In ducks the diseases reported were duck viral enteritis, duck viral hepatitis, and intestinal helminthiasis. The ND, FC in chickens and duck viral enteritis and duck cholera in ducks were preventable by using appropriate vaccines but the preventive measures rarely practiced in most of the farm operation. The free range chickens and ducks (more than 60% of total poultry and duck population) rarely brought to the Government veterinary health care facilities and rarely vaccinate against these diseases. The ecosystem of Bangladesh also provides ample opportunity for the development and dissemination of parasitic disease of poultry and ducks (Alam et al., 2014; Musa et al., 2012). Using passive surveillance system the loads of parasitic diseases cannot be identified but information like progressive weight loss, reduce eggs and meat production may be indicative. The active surveillance system to identify specific adult parasites and their load is helpful. It is simple to test fecal samples of livestock and poultry by direct microscopy (available in veterinary health care facilities) but little is practiced in the Upazilla Veterinary Hospital. Intestinal nematodes, cestodes and flukes are common in ducks rearing in open water bodies. All of the free range ducks and chicken requiring anthelmintic application at regular basis.

CONCLUSIONS

Before considering how best animal disease surveillance can be implemented, the veterinarians or data collector should first have a clear understanding of why they need to do surveillance. The important reasons why veterinary authorities undertake surveillance activities can be summarized into four general purposes; 1. Finding cases of new disease, 2. Early detection of disease, 3. Measuring the level of disease, and 4. Demonstrating freedom from disease (diseases are not truly present). These purposes can further be divided into two groups: 1). surveillance for diseases that are currently or usually not present and 2). surveillance of diseases that are endemic. The data we analyzed showed that a number of important diseases of livestock and poultry were neglected or under reported. Diseases that were not reported can be categorized into six subtypes for better reporting and management of diseases includes;

1. **Exotic diseases** (known diseases that are not present in a country, but exist in other countries) like Bovine spongiform encephalopathy (BSE), visna, scrapie, bluetongue disease, chikungunya etc.

2. **Endemic diseases** (diseases existed in a geographic location under certain levels) like dermatophilosis, amphistomiasis due to *Gigantocotyle explanatum*, contagious bovine pleuro-pneumonia (CBPP), schistosomiasis, Linguatulaserrata infestation (Islam et al., 2018) etc.
3. **Emerging diseases** (recently identified diseases that have got much attention due to increased host range, enhance pathogenicity or spread) like Avian influenza, ND, Marek's disease etc.
4. **New diseases** (diseases which have not previously been recognized): need to find out
5. **Epidemic diseases** (diseases which is present in a country or location where sudden outbreak occurs, and then do not occur for a certain period): goat pox and often confused with PPR in goats
6. **Zoonotic diseases** (diseases transmissible between man and animals) like Tuberculosis, Avian influenza, Malaria, toxoplasmosis, Brucellosis, mites infestation, heartworm infestation in dogs, etc.

When the diseases is not present in a country (or a zone or compartment within a country) there may have a number of benefits, including the ability to export animals/ animal product or to cease disease control measures (such as a vaccination program). However, in order to get these benefits, the veterinary authorities must first be confident that the disease is truly absent. Demonstrating freedom from disease is difficult. However, if there is a tendency of the Vets, para-Vets or animal health providers to hide information about the occurrence of a disease or diseases in passive surveillance, that may cause serious havoc on national economy in the long run by sudden outburst which in turn costs a lot for their prevention, control and eradication and finally restricting global trade of animals and animal product. Early recognition of a disease incursion may be important for early response and prevention of epidemicity.

Our study showed that all of the diseases now endemic in livestock and poultry in Bangladesh was not recorded by the Vets or animal health providers in the hospital data sheet. There is lacking of routine active surveillance of animal diseases as well. Rarely the results of passive surveillance were supported by the observation of active surveillance. There is huge shortage of effective vaccines (less than 10% of requirement) against all of the endemic infectious diseases of livestock and poultry in Bangladesh. The free animal movement across the country may disseminate avian influenza in poultry and FMD and PPR in livestock. Lab based survey of filed samples revealed that avian influenza in ducks and chickens is now endemic in Bangladesh. There is crying need to develop FMD, PPR and Avian influenza institutes in Bangladesh to combat devastation on livestock and poultry sector each year. The Government and non-government research organizations have to enrich their surveillance system and have to report all the diseases to prevent future havoc.

Timely collection and analysis of the data of passive and active surveillance systems may enable us to detect most of the infectious, emerging, zoonotic and endemic diseases at early onset and provide warning and precautions accordingly. This may boost biosecurity and health care facilities of millions of buffaloes, cattle, goats, sheep, chickens and ducks across the country. A successful adaptation of passive surveillance system onto the occurrence of diseases of livestock and poultry may enable us to provide safe food of animal origin and may boostup economic power of the country.

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