

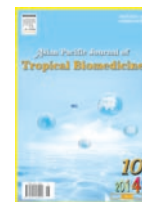
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## Some challenges in progressive control of livestock originated zoonotic diseases in Pakistan—a pilot survey

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## PEER REVIEW

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**Comments**

The manuscript seems fine, as far as the topic and the study area. This is a well-formulated survey. The results of this study will play a contributing role in the epidemiologist and public health concerns for the prevention and control of many zoonotic diseases.

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## ABSTRACT

**Objective:** To document the recent livestock related practices and possible unhygienic ways of pathogen entry. Identification of the potential risk factors for the spread of infection is important to design an evidence-based disease control programme.

**Methods:** Rapid assessment method was adopted and a purposive sample of 60 dairy farmers were interviewed. The following factors were noted for contributing in primary and secondary transmission of zoonotic infections: (i) persons who come in close contact with animals and their secretions, (ii) management strategies of farm animals (sheds and environment), (iii) management practices adopted at farms, (iv) small scale farmers and rural livestock production systems, (v) milk collection systems.

**Results:** This research unveiled the certain routes of zoonotic disease transmission. Certain management practices, precautionary measures and strategies were the pivotal risk factors.

**Conclusions:** The study emphasizes the need to educate the poor livestock keepers.

## KEYWORDS

Zoonosis, Risk assessment, Zoonosis, Livestock, Emerging infections

### 1. Introduction

Zoonotic diseases have always been important for humans because almost 70% of emerging infectious pathogens share the zoonotic status<sup>[1]</sup>. In most developing countries, strategies like public health interventions and mass vaccination of animals are not much successful due to little or no collaboration between veterinary departments and human health authorities. In livestock populations, general efforts are focused on implementation of prevention and eradication measures with little concern related to transmission control strategies<sup>[2]</sup>. According to a report, there are 13 different zoonotic diseases that are most

important to poor livestock owners because they are able to generate harmful consequences on human health, national economics, livestock population *etc*<sup>[3]</sup>. In Pakistan, large part of population, mostly poor people, is running livestock-based business as a primary income source<sup>[4]</sup>. Massive under-reporting, lack of surveillance activities and little field-diagnostic facilities have been the possible causes of hindrance in declaring true status of different pathogens in Pakistan<sup>[3]</sup>. In such situations, a fully functional risk-based approach is usually adopted, which can reduce the impact of zoonotic diseases in their initial stages and their further progression can be understood in a better way<sup>[5]</sup>. Initially, a descriptive analysis of the situation generates different

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hypotheses which should be analysed through classical epidemiological study designs in later stages<sup>[6]</sup>. Therefore, a rapid assessment method was followed by an initial step for the identification of possible risk factors of zoonotic disease transmission prevailing in our livestock system. The objective of this study was to document the recent livestock related practices and possible unhygienic ways of pathogen entry.

## 2. Materials and methods

The study was conducted in Sahiwal—a livestock rich district of Punjab and famous for its notable breed. The data were collected over a 4-month period (From July 2013 to October 2013). This activity included informal individual-level interviews with a purposive sample of 60 commercial dairy farmers. The farmers included on the basis of their history of commercial dairy farming as their sole business. All the respondents were visited at their dairy farms and were informed about the survey in the beginning of interview. An open discussion was initiated on: (i) persons who come in close contact with animals and their secretions, (ii) management strategies of farm animals (sheds and environment), (iii) management practices adopted at farms, (iv) small scale farmers and rural livestock production systems, (v) milk collection systems. During the study, occasional livestock markets and local milk setups were also visited. In the livestock markets, interaction of animal handlers or middlemen and management conditions were observed. In the local milk setups, pasteurization and other handling measures were examined.

## 3. Results

The following were considered as potential risk factors during transmission causing infection that occurred an outbreak.

### 3.1. Management

There are several managerial gaps that can be possible source of zoonotic disease transmission. Lack of proper/separate clothing and shoes is one of the major factors that lead the pathogens to the homes and further unhygienic feeding habits to complete the disease transmission. A number of labourers at farms use improperly washing utensils that are usually placed in store rooms near the shed. In addition, the labourers are lack of hand-washing with soap after touching the animal or feeding the animal. The trend of washing hand only with simple water could cause diseases. Several labourers also use shed as a sleeping place

at nights and feeding trough as their bed. These troughs are usually exposed to nasal secretions of animals while eating. In this way, clothes of the labourers bear the infection and lack of further precautionary measures could also lead to disease.

On commercial dairy farms, lack of de-worming, dipping/sprays practices and contact with faeces of such animals will cause intestinal parasitic infections. Farm labourers, owners and animal health workers are at high risk to these infections. Contact with ectoparasites *i.e.* tick, mange *etc.* can transmit some important fatal diseases to humans. Animal handlers and abattoir workers normally come in contact with ectoparasites and the infested tissue. Recent outbreaks of Crimean–Congo Hemorrhagic fever in Pakistan are thought to be associated with exposure of tick infested cattle under bad management.

Another important problem is the improper disposal of wastes either animal excrements or bedding materials. In farms, manure is usually removed at the end of day. Thus manure remains there for a whole day to invite flies and other insects. Farmers do not use fly repellent sprays or any insecticidal chemicals so as to provide the suitable environment for their breeding sites. Farm animals especially cattle act as an important risk factor for providing the site to biting flies *i.e.* sand flies. Introduction of *Leishmania* carrying sand fly to such areas could be disastrous in the future<sup>[7]</sup>. These dried faeces are usually sold to the poor people or different small industrial units. Poor people/nomadic tribes use these faeces for making “oploo” (a building material mixed with wheat straw used for strengthen the house walls) or even sometimes use dry faeces for producing fire so that they can cook.

In livestock production systems, people used to keep their animals in separate houses or “havelis”. The only purpose of a haveli is to provide protecting area for animals during night and in rainy seasons. These houses usually have semi closed shed dimensions. These houses do not provide enough ventilation and could be a source of airborne infections. For airborne infections, generally no preventions are adopted by workers and this condition could be aggravated in outbreaks.

### 3.2. Intermediaries and service providers

In Pakistan, apart from the farm owner and labourers, there are many persons that can come in contact with animals. These persons not only expose themselves to infections but also spread the disease.

#### 3.2.1. Livestock health workers (LHWs)

The category includes veterinarians, veterinary assistants, artificial insemination technicians and cattle attendants. Due to lack of education, neither animals nor LHWs are

usually immunized against potential zoonotic diseases *i.e.* rabies, brucellosis, *etc.* LHWs are usually dressed in common cloths and shoes when approaching animals. Improper restraining often causes minor injuries or scars to them. Among all others, unhygienic contact with excrements and fluids during parturition are main culprits. Similar multiple cases in a day or at same place can cause shortage of gloves and less protective clothing that will further lead them to work in unhealthy way.

### 3.2.2. Animal traders

Animal traders are mostly the middlemen who often trade both healthy and diseased animals. Poor handling and tight conditions in temporary shed-like conditions can be helpful to contract the infection through contact with faeces, urine, saliva and blood of diseased animals. Traders are also involved in meat animals' trade to slaughter houses. Careless postmortem of experienced veterinarians will lead the abattoir workers and market butchers at risk of contacting the disease. In such circumstances, apparently healthy animals/sub-clinically infected animals may prove highly contagion for humans and even lethality[8].

### 3.2.3. Raw milk collectors

The farmers keep selling milk despite outbreak in their herds or flocks. The raw milk is hauled by milk collectors 'Gwallas/Dodhis' who may sell it to milk plants, other collectors, retailers, or even deliver it into cities[9]. These dodhis often sell the milk to local "Halwai/bakers" that make malai or desi ghee or even cheese without boiling the milk apart from the hygienic conditions[4]. It is also a common concept among uneducated farmers that boiling will reduce the energy present in milk when drinking the raw milk in hungry situation. These careless attitudes, practices and subclinical infected animals can transmit serious disease.

### 3.2.4. Persons who remove skin of dead animals

Shearing of wool or hair is an important task in small animal farming. In local farms, shearing is commonly done in summer. For meat and dairy oriented farms, this sheared wool gives no profit to owner as this is given to shearer in terms of his labour. The shearing persons usually belong to poor class and they do not take care of certain hygienic measures to stop inhalation of infected air. Similar conditions are also faced by the people who remove skin or are responsible for disposing the dead animals. Minor scratches and wounds during skin removing are often neglected or remain as open wound[5].

### 3.3. Rural/rangeland livestock production system

In rural systems, people with poor or middle status

usually keep animals in their houses that sometimes come in contact with utensils of domestic use. Goat kids and calves are usually not tied in the day so they can freely move in the house. Children in houses with less cared are usually at more risk than others. These freely roaming children and their unhygienic conditions can lead them to contact with parasite eggs or shedded bacteria. Grazing livestock farming is usually practiced in nomadic and poor areas. This is economical but often leads to contamination of the environment through faeces and urine that could be a source of soilborne infections.

## 4. Discussion

This study has stressed on the importance of a system that can rapidly assess the risk factors for zoonotic disease transmission present in Pakistani livestock system or dairy farms. Potential risk factors were chosen keeping in view structure of livestock population, milk selling systems, veterinary health personal approach, field observations and review of literature.

The study area is rich in livestock animals and represents almost all types of farming systems. This district is also considered as highly profitable for milk related businesses. The farmers with history of dairy farming as long term family business were purposively included as respondents because of their high experience and awareness of livestock systems and other inter-linked businesses. The selected informal open discussion method proved much helpful in evoking the farmer's point view about other possible routes for disease transmission in local conditions[5]. This method increased the participation and confidence of the farmers that made them eager to contribute their reflections or observations and to point out what could be the possible reasons of disease spread. This is a cross-sectional and descriptive study which describes contacts between humans and animals and can act as primary or secondary source of zoonotic diseases. The findings of this study can act as hypotheses that may be tested through classical epidemiological studies or need further risk assessment. The study could further be meaningful by increasing the sample size, stratifying the participants, including respondents from all farming categories across the nation, ranking the risk factors according to their impact. This study should be considered as a pilot survey when the proposed idea could not be performed at mass level because of logistic constrains. This study will be much useful for responsible local people with more logistic resources and man-power. The important risk factors for zoonotic diseases as mentioned in this article strongly indicate the need of zoo-sanitary education of the poor livestock keepers and quantitative

research for policy making. Economic measure is also an option but it should be in indirect ways *i.e.* as a reward on milk/meat production. Massive under-reporting is a major constrain in understanding the disease transmission and disease prevention that can be overcome by establishing proper detailed surveillance system with spatial distribution.

### Conflict of interest statement

We declare that we have no conflict of interest.

### Acknowledgements

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### Comments

#### Background

This report will play a pivotal role in the prevention and control of many zoonotic diseases. In Pakistan, most of poor people run livestock-based business as a primary income source. Lack of surveillance activities and little field-diagnostic facilities have been the possible causes of hindrance in declaring true status of different pathogens in Pakistan. According to a report, there are 13 different zoonotic diseases that are most important to poor livestock owners because they are able to generate harmful consequences on human health, national economics and livestock population.

#### Research frontiers

Outbreak of any dangerous zoonotic disease can occur at any time and especially in those areas where there is lack of documented data on the ways of the spread of these diseases. So current research is a contributing report in finding the ways of the spread of many zoonotic pathogenic organism.

#### Related reports

No such documented evidence have been found from the current study area. One report by Abbas *et al.* 2012, only highlights the spread of foot-and-mouth disease, but this report points out many current challenges in progressive control of livestock originated zoonotic diseases in Pakistan.

### Innovations and breakthroughs

Many neglected aspects are highlighted in this paper, which is commonly practised in the area of current study. This seems the first report in the current study area.

### Applications

By knowing the route causes of zoonotic diseases, the spread of pathogenic organism can be minimized. A common awareness campaign can be carried out based upon the results of this study. This study will not only be beneficial for the community of the current study area but also be useful for those countries where the same challenges exist in the prevention and control of these diseases.

### Peer review

The manuscript seems fine, as far as the topic and the study area. This is a well-formulated survey. The results of this study will play a contributing role in the epidemiologist and public health concerns for the prevention and control of many zoonotic diseases.

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