One health approach to curb anthrax in Bangladesh

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Introduction

• The animal anthrax, locally known as ‘Torka’, enzootic for long in Bangladesh
• Since 1986, no reported cutaneous anthrax from Bangladesh until 2009 [10]. Since 2009, collaborative teams from the Institute of Epidemiology, Disease Control and Research (IEDCR) and International Centre for Diarrhoeal Diseases Research, Bangladesh (icddr,b) investigating cutaneous anthrax outbreaks in humans which were associated with anthrax infection in livestock [14, 17].
• This study aimed to identify the gaps in response and the strengths and the challenges for anthrax prevention and propose mechanisms for enhancing anthrax outbreak response in Bangladesh.
Methods

• Review of published reports of recent outbreak investigations from Bangladesh and reports archived in IEDCR.
• Key informant interviews with local livestock officers.
• One group discussion with local human health officials.
• Analysis of all qualitative data using principles of thematic content analysis.
• Triangulation of the data obtained from secondary sources with the qualitative findings.
Result

*Distribution and magnitude of anthrax in Bangladesh*

- Between August 2009 & September 2011, 39 anthrax outbreaks in *humans* reported from 13 districts of Bangladesh.
- Of the 25 outbreaks from 5 districts investigated by the collaborative outbreak investigation team composed of epidemiologists, physicians, veterinarians, and anthropologists from IEDCR, DLS and icddr,b.
- 18 of these 25 outbreaks occurred in 2 northwestern districts, Pabna & Sirajganj, having the highest cattle densities & the ‘*milk shed*’ areas in Bangladesh [18].
Figure 1: Districts with reported anthrax cases and number of outbreaks investigated in Bangladesh during August 2009-September 2011
Result (continued)

Distribution and magnitude of anthrax in Bangladesh

• 414 suspected cases of human anthrax were identified (suspected cutaneous = 378, gastrointestinal = 27, both = 11).

• 93% of the cutaneous anthrax cases participated in butchering of a sick slaughtered animal or present at the slaughtering site within 0 to 22 days prior to their onset of illness \(^{[18]}\).
Result (continued)

Distribution and magnitude of anthrax in Bangladesh

• 190 suspected cases of animal anthrax were identified
• 126 (66%) cattle, 59 (31%) goats, 4 (2%) sheep & 1 (1%) buffalo
• 126 (66%) died of illness, 54 (28%) slaughtered after illness onset & 10 (5%) were sick during illness or were sold alive in the market [18]
Result (Continued)

Distribution and magnitude of anthrax in Bangladesh

• 13 (52%) of the 25 outbreaks were reported first by newspapers, 8 (32%) were reported by local health officials, 3 (12%) were reported through personal communication & 1 (4%) was detected by the outbreak investigation team.

• Thus routine reporting system ineffective. This indicates under-reporting & under-diagnosis of anthrax
Contamination of the livestock leads to economic loss; slaughter and consumption of the infected animal is a common practice in rural Bangladesh.

Also these infected animals are sold off at lower prices (to recover at least part of impending financial loss in case of death of the animal), thus leading to spread of the infection through consumption and handling of contaminated meat. \cite{10, 14, 18, 20}
Factors caused the outbreaks

- Lack of awareness of cattle owners and community members regarding transmission of the disease from animals to humans
- Social norms and poverty
- Among 59 death cases in the 11 outbreaks in 2010, 29 (49%) were thrown into the flood or river water, 10 (17%) were abandoned in open fields & 20 (34%) were buried
CYCLE OF INFECTION IN ANTHRAX

Sporulate on exposure to O₂

Spores

Vegetative forms
(shed at deaths)

Cutaneous

Gastrointestinal

Pulmonary

Multiplication of bacilli
Germination

Toxins
Capsule
S-Layer
Stress factors

Sporulation

soil
• Human gets anthrax both in spore & vegetative form
• Human gets the infection from 3 sources:
  i) Agricultural setting
  ii) Industrial setting
  iii) Deliberate use (bioterrorism) [26]
Factors caused the outbreaks

- Scarcity of livestock vaccine (deficient to annually vaccinate 47 million susceptible animals)
- Low animal vaccination coverage
- Poor quality vaccine production

25% of the suspected animal cases were vaccinated with locally produced Stern vaccine. On the other hand, living spore vaccine reduced the incidence of anthrax 99% in South Africa [26]
Factors caused the outbreaks

- Acute shortage of animal vaccinators
  (e.g. vaccinator : ruminant = 3 : 260,000 in one sub-district where outbreak happened)
- Improper vaccination planning
- Annual single dose of vaccine is practiced by the DLS, which might failed to ensure adequate immunity in the anthrax-prone area
- Lack of institutionalization of one health approach
Decline of natural scavengers

- Vultures in Bangladesh are on the verge of extinction
- Residues of diclofenac (a NSAID) consumed by the cattle also declines the vultures to feed on carcasses
- Carcasses disposed of in the fields/water remain exposed for longer, contaminating the soil & water [19]
**Strengths in anthrax prevention and control**

- The epidemiological investigations had defined anthrax epidemiology in Bangladesh to a large extent \([10, 14, 17, 18, 20]\).
- Bangladesh Livestock Research Institute (BLRI) embarked on the prevention task by increasing the availability of anthrax vaccine in the market, either through increasing domestic production or through importation.
- Increases the demand of vaccine through raising awareness among the cattle owners,
- Both the Department of Livestock Services and the Health Education Bureau of the Ministry of Health and Family Welfare have developed many health education materials to increase anthrax awareness in the country.
Anthrax awareness pamphlets

By Directorate General of Health Services (DGHS)

By Department of Livestock Services (DLS)
Impact of anthrax
Cattle market in Eid-ul-Azha
(1 of the 2 great festivals of Muslims)
• The **leather** (US$69 m) and **beef industry** (US$392) lost a total of about **US$461 million** following the outbreak of cutaneous animal anthrax (mid August-October 2010)

• Due to the anthrax scare, there was a daily loss of 70% to 80% in the overall US$968,880 beef market in Dhaka

• Leather industry traders and beef-sellers in Bangladesh are looking to Eid-ul Azha festival to pull them out of a desperate slump caused by an anthrax outbreak that hit just as they were trying to recover exports lost during the global recession.

• The largest number of animals are sacrificed at this festival, leading to a huge collection of raw but quality hides from cows, goats, buffaloes and other animals.

• About **7.5 million cows and goats were sacrificed** *(slaughtered)* in Bangladesh during 2009 Eid-ul Azha
Discussion

• The One Health Movement calls for professionals of different disciplines namely human health, animal health and environment in the realms to communicate and collaborate as colleagues in order to utilize the synergism achieved to advance healthcare for the 21st century and beyond by accelerating biomedical research discoveries, enhancing public health efficacy, expeditiously expanding the scientific knowledge base, and improving medical education and clinical care.

• In recognition of the association of the complex interplay of social, behavioural, cultural, economic, human, animal and environmental health factors in the causation and transmission of anthrax in Bangladesh, the One Health Approach may be the most effective approach to curb anthrax & other zoonotic diseases in
Ecological triad

The agent, the host, and the environment interact dynamically to produce disease

Agent
- Biological agents
- Physical agents
- Chemical agents
- Nutrient agents
- Mechanical agents
- Social agents

Host
- Biological characteristics
- Socioeconomic characteristics
- Demographic characteristics

Environment
- Physical environment
- Biological environment
- Social environment

Disease
All three of these are constantly changing

- **Disease agent**: Microorganisms adapt to changing conditions, including human control efforts such as antibiotics.

- **Host**: Human populations are constantly growing and moving as people age, travel, and migrate into new environments.

- **Environment**: Changes occur locally and globally, both naturally and through human intervention.
Infectious/Zoonotic Disease Model

Host

Disease

Pathogen

Environment
Human health can only be protected if we also secure animal health and a healthy environment.
Conclusions

• For Bangladesh to benefit from one health approach, it needs some degree of institutionalization within the government.

• Collaborative investigations & response to disease outbreaks government functions that would be a particularly effective area to develop broader multi-disciplinary coordination.

EPI success story

• Expanded Program on Immunization (EPI) officially kicked-off in 1979 in Bangladesh
• Functionally it was started with proper strategy (micro-planning) in 1985
• In 1985 EPI coverage was only 2%
• At present EPI coverage is 87%
• As a result, NMR, IMR, U-5 MR, MMR reduced significantly & all are in the right track to meet MDG goals in time
• Bangladesh achieved UN MDG-4 Award (2010), UN South-South Award 2011, GAVI Award (2009 & 2012)
Story behind the EPI success

• Micro-planning of EPI:
  Chain of command active from top (DGHS under MOH&FW) to bottom (primary health care facilities at the grass root level)

• Observance of NID (National Immunization Day) annually in a festive mood

• Strong political commitment:
  Prime Minister herself inaugurates the NID by vaccinating children (live telecast by electronic media)

• Proper utilization of human resources (community participation)

• Adequate supply of logistics & vaccines

• Social mobilization

• Surveillance

• GO-NGO collaboration
One health to give
Many lives to live
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