The Impact of Emerging Diseases on Livestock

(Dampak dari *Emerging Diseases* pada Peternakan)

John Weaver

Australia Indonesia Partnership for Emerging Infectious Diseases (AIPEID)
john.weaver@aipeid.org

ABSTRAK

Emerging infectious diseases (EIDs) pada peternakan adalah peningkatan bahaya pada kesehatan dan produksi ternak, kesehatan manusia, keamanan pangan dan perkembangan ekonomi. Berbagai penyakit baru muncul dengan sangat cepat yang menyebabkan perubahan ekosistem yang disebabkan oleh besarnya populasi manusia dan ternak, semakin besarnya urbanisasi dan industrialisasi pada produksi ternak, peningkatan konsumsi, perdagangan binatang liar dan meningkatnya perdagangan dan perjalanan internasional. *Transboundary animal diseases (TADs)* yang ada sekarang juga menekan sistem produksi ternak dan dapat dinyatakan sebagai EIDs di peternakan yang masuk ke dalam suatu lingkugan yang baru dan berpengaruh buruk terhadap kesehatan ternak dan kesejahteraan manusia. Resiko ini berlanjut untuk berbagai penyakit yang menyebar ke wilayah baru, tetapi untuk beberapa penyakit lain, resiko ini berkurang sejalan dengan semakin baiknya pemahaman dan meningkatnya pengontrolan. Dampak dari EIDs pada peternakan dan kesejahteraan manusia terutama dapat dibagi menjadi sosial ekonomi atau dampak kesehatan manusia. Dampak sosial ekonomi disebabkan oleh berkurangnya produksi ternak dan biaya untuk pencegahan atau penanganan, terganggunya perdagangan dan berkurangnya pendapatan. Kesehatan manusia yang dipengaruhi oleh penyakit zoonosis dapat menghasilkan kematian. Merujuk pada laporan ekonomi, dapat dilihat bahwa terjadi peningkatan yang drastis pada biaya untuk mengontrol EIDs selama beberapa tahun terakhir. Sedikit negara-negara maju yang mengeluarkan biaya tinggi untuk mengontrol penyakit sebagai deteksi dini. Diperlukan pelaporan awal dan diagnosis dari dugaan EIDs dengan meningkatkan kepedulian dan sistem survei untuk meyakinkan kemungkinan deteksi dini dan juga meminimalkan biaya pengendalian. *Emerging infectious diseases* dapat mengganggu rantai perdagangan dengan hilangnya kepercayaan masyarakat dan hilangnya keseimbangan permintaan dan penyediaan barang. Dampak perubahan pada sistem perdagangan tersebut dapat mempengaruhi pendapatan terutama yang berhubungan dengan rantai penyediaan. Kesehatan masyarakat yang terserang EIDs dengan resiko yang terbesar berasal dari penyakit infeksi dan patogen. Sebagai contoh, terdapat resiko yang sedang dihadapi yaitu penyebaran virus AI yang akan masuk dalam *strain* pendemik penyebab kematian dengan konsekuensi kehancuran dari kesehatan publik. *Emerging infectious diseases* lain yang terdeteksi terpenting adalah peningkatan prevalensi dari berbagai bakteri resisten. Pengurangan efikasi dari antibakteria berdampak pada resiko yang serius pada kesehatan manusia. Sektor peternakan perlu mengambil kepemilikan dari kelebihan penggunaan antibakterial dan mempromosikan peningkatan peternakan untuk mengurangi ketergantungannya. Peningkatan intensifikasi pada produksi ternak berarti memperbesar penekanan pada pengembangan industri peternakan dan rantai pasar dengan *biosecurity* yang tinggi. Peningkatan *biosecurity* pada produksi peternakan akan mengurangi resiko dari EIDs melalui pengurangan pemindahan dan evolusi penyakit. Sebagai resiko tidak pernah musnahnya EIDs yang baru, diperlukan pengembangan dan pemeliharaan sistem yang efektif untuk deteksi dan respon dini. Sistem tersebut harus dikembangkan dengan bersinergi bersama pemerintah dan swasta. Diperlukan inisiatif dunia dan regional untuk mengidentifikasi resiko yang berkembang, deteksi EIDs dan untuk mengurangi penyebaran yang mungkin. Program regional harus memperkuat sistem observasi dan respon dan mengembangkan komunikasi dan koordinasi yang efektif terkait EIDs. Perlu ada peningkatan investasi dalam kesehatan ternak dan masyakarat untuk meperkuat sistem tersebut. Makalah ini menerangkan dampak dari EIDs pada peternakan dengan contoh-contoh untuk menunjukkan dampak nyata yang disebabkan penyakit tersebut.

Kata Kunci: *Emerging Deseases*, Peternakan, Kesehatan Masyarakat

ABSTRACT

Emerging infectious diseases (EIDs) in livestock are an increasing threat to animal health and production, human health, food security and economic development. New pathogens are emerging at an increasing rate owing to ecosystem changes caused by the larger human and animal populations, the greater urbanization and

industrialization of livestock production, increased consumption and trade in wildlife and increased international trade and travel. Existing Transboundary Animal Diseases (TADs) are also an ongoing threat to livestock production systems and can be considered EIDs as they 'emerge' into new environments adversely affecting livestock health and human wellbeing. This risk is continuing for many diseases with incursions into new areas, however for some other diseases the risk is reducing as diseases are better understood and increasingly controlled. The impact of EIDs on livestock and human wellbeing can be divided primarily into socio-economic or human health impacts. Socio-economic impacts are caused by losses in animal production and the cost of prevention/treatment, market disruption and the loss of livelihoods. Human health can be compromised by zoonotic diseases and food borne illnesses resulting in the morbidity and mortality of people. Reviewing economic reports it can be seen that the cost of controlling EIDs has risen dramatically over recent years. Lesser developed countries may have higher costs of disease control as detection and response systems can be weak. There is a need to promote the early reporting and diagnosis of suspect EIDs by enhancing public awareness and surveillance systems to ensure the earliest detection possible and so to minimise the cost of control. Emerging infectious diseases can severely disrupt market chains with loss of public confidence and loss of the commodity supply/demand equilibrium. The impact of such market change can compromise livelihoods along the supply chain, after a major EIDs event rebuilding public conference can take considerable time. Public health is threatened by EIDs with the greatest risk coming from highly infectious, pathogenic diseases. For example there is an ongoing risk that circulating avian influenza viruses will evolve into a highly transmissible high morbidity/mortality pandemic strain with catastrophic consequences to global public health. Another EIDs being recognised as of major importance is the increasing prevalence of multiple resistant bacteria. The reduced efficacy of anti-bacterials poses a serious risk to human health. The livestock production sector needs to take ownership of its overuse of anti-bacterials and to promote husbandry improvement to reduce this dependence. Increasing intensification of animal production means that even greater emphasis must be placed on developing farm enterprises and market chains with high biosecurity. Improving the biosecurity of livestock production will reduce the risks of EIDs through limiting pathogen transfer and evolution. As the risk of a new EID will never be zero there is also a need to develop and maintain effective systems for early detection and response; such systems must be developed jointly by government and the private sector. There is a need for global and regional initiatives to identify developing risks, detect EIDs and to reduce the threat wherever possible. Regional programs should strengthen surveillance and response systems and develop effective communication and coordination for EIDs. There should be increased investment in animal and veterinary public health to strengthen such systems. This paper explores the impact of EIDs on livestock with examples to demonstrate the significant impact such diseases can cause.

Key Words: Emerging Diseases, Livestock, Public Health

INTRODUCTION

New or emerging infectious diseases (EIDs) entering a naïve animal population or production system tend to have a greater impact than endemic diseases as the population has little or no immunity and detection and response/treatment tends to be delayed with consequently greater morbidity and higher mortality. The net economic, financial, social and cultural impact of EIDs can be very severe. In controlling EIDs there may be a significant political risk with a loss of credibility for failure and environmental degradation in the application of some of the more draconian control strategies.

An EIDs can be defined as: A disease that has appeared in a population for the first time, or that may have existed previously but is rapidly increasing in incidence or geographic range (Fineberg & Wilson 2010). Livestock are considered to be: All domesticated species of animal kept for production and sale (Kellogg 2002). Such a general definition includes the main species kept for meat and milk production (cattle, sheep, goats and pigs), other domesticated species (horses, rabbits), poultry (meat and eggs from ducks, chickens, quail, turkeys), fish and aquatic species, and insects (bees, silkworms). This paper will only consider EIDs of the main species of terrestrial livestock-though the same principles apply to other sectors.

IMPACT ON PRODUCERS

The most obvious impact of EIDs on livestock is the direct loss of animal production.

The cost to producers of EIDs can be attributed to the loss of animal productivity. Production will be limited variously,

depending on the disease, by the death of animals, reduced growth rates, reduced production of animal by-products (such as milk and eggs), reduced reproductive rates and loss of premium products (delayed time to slaughter, requirement to process, etc), in addition producers will incur the cost of prevention and treatment. For example following recognition of the association between BSE and variant CJD in 1996, the domestic sales of beef in the UK dropped by 40%, export markets were closed and market prices fell by 25%-the loss to the UK economy in the following 12 months was estimated to be some 1.2 billion USD (Atkinson 1999).

SUPPLY CHAIN IMPACT

Emerging infectious diseases will have an impact along the supply chain-from producer through traders/middlemen to processors and retailers. Picture 1 shows some of the players in a supply chain-all of which may be affected by an EID. In addition the suppliers of services and products to the supply chain will be affected; such suppliers include feed and pharmaceutical companies, farm service men and veterinarians, users of farm by products such as fibre and feathers, manure and litter.

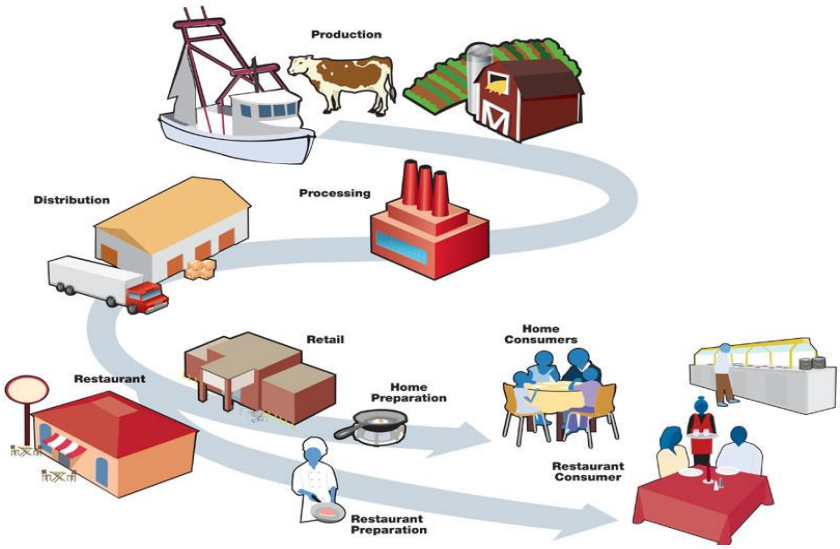
The scale of the impact of the EID on the supply chain will depend on a number of factors including the severity of the animal disease (production losses, prevention/ treatment costs), the policy for disease control (stamping out, vaccination, treatment costs, improved biosecurity, restricted movement and trading), the impact on public health and market confidence.

Emerging infectious diseases can halt livestock production completely or make animal products more costly, trading practices may be prevented or severely restricted, as can processing. There may be market shocks with a loss of balance in product supply and demand and resulting price collapse or instability. Consumers may lose confidence in the product and turn to alternative products.

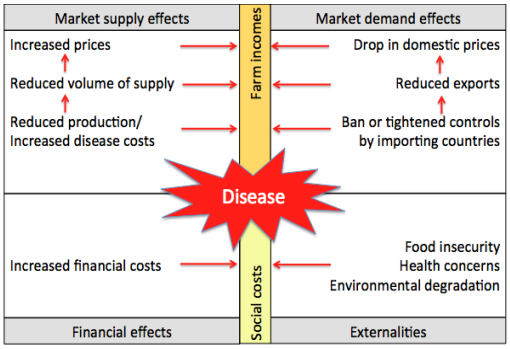
ECONOMIC IMPACT

The impact of livestock EIDs can also impact the wider economy. The diagram below depicts the economic impacts that an EID can cause.

Emerging infectious diseases may result in reduced production/reduced supply and increased prices; alternatively EIDs may result in reduced market access with reduce demand and so a drop in prices. The balance in reduced supply/reduced demand will determine the actual market price and so is dependent on the disease, the public health consequences or perception and how public confidence and disease control is managed.



Picture 1. The food production chain



Picture 2. The economic impacts

In the longer term further impacts may be encountered such as loss of employment in the production sector and reduced viability of the associated service industries and industry change in order to supply alternative products.

In a broader context EIDs may result in increased financial costs owing to loss of confidence in the livestock sector. Externalities of EIDS include a reduction in food security, public health impact and environmental costs of control or reduced production efficiency.

There may also be opportunity costs as the government focus on prevention or control of the EID limits investment in other areas of the economy.

FINANCIAL COSTS

Overall the financial cost of the prevention and control of EIDs can be very high and can require changes to policy priorities with political consequences.

The financial impact of EIDs can be considered at two stages-the cost of prevention and the cost of control.

Prevention of incursions of EIDs internationally will be based on effective border security (quarantine) operating at all possible ports of entry with strong public awareness of the need for compliance. The responsible government authority will also need to undertake scanning and risk assessments of potential EID threats as they emerge internationally in order to target their mitigation activities most efficiently and effectively.

Domestically a similar approach to international risk assessment and management is required to identify the risks of within country disease spread and how best to mitigate the risk. The national quarantine agency will need to be supported in these activities by the Directorate of Animal Health and the provincial and district dinas authorities.

Once an EID occurs the cost of preventing further spread and controlling the disease can be extremely high. Picture 3 shows the financial costs of major animal disease outbreaks globally since 1994. It can be seen that a number of infectious diseases have caused these losses with highly variable epidemiology ranging from:

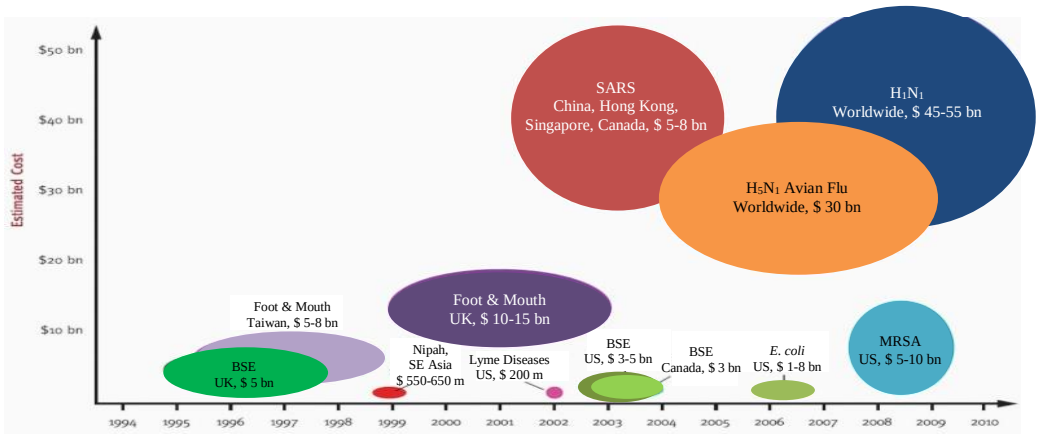
1. BSE: Zoonosis, infectious, but non-contagious, long incubation period, 100% mortality, mainly cattle
2. FMD: Non-zoonosis, highly infectious, short incubation period, high morbidity/low mortality, multiple species, not an unknown disease but one that ‘re-emerges’
3. H5N1 HPAI: Zoonosis, highly infectious in poultry, short incubation period, multiple species affected with varying epidemiology and varying morbidity/mortality, new virus types are EIDs
4. SARS: Zoonosis (bats and civets) but mainly with human health impact, short incubation period, high mortality
5. MRSA: Zoonosis, high morbidity and mortality, multiple species.

In the outbreaks depicted it must be recognised that the impact of EIDs is not merely in the financial cost of control or the loss of production but also from broader wide-reaching affects. Such impacts include:

1. Loss of food security as livestock production and marketing is disrupted in control programs
2. Loss of draught animals and an inability to till land/grow crops or to earn an income from haulage
3. Loss of opportunity to address other priority issues as disease control is being funded at the exclusion of other activities

PUBLIC HEALTH

It has been recognised in human health that the rate of EIDs is increasing with a new diseases being identified approximately every 8 months (Daszak et al. 2000). Of these diseases it is estimated that more than 70% are



Figures are estimates and are presented as relative size

Picture 3. Economic impact of selected infectious disease outbreaks

Source: Bio-era (2011)

zoonotic with an origin in animals-from both domestic livestock and wildlife.

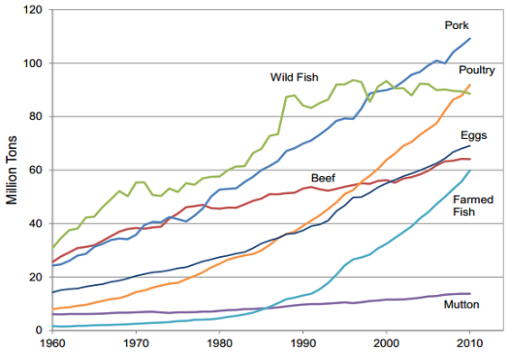
New emerging diseases in man may be EIDs of animals or diseases that have been recognised in animals for some time but have now crossed the species barrier. Major disease events in man that have a livestock association include influenza both the worldwide epidemicof H1N1 and the more regional threat of H5N1 and the localised outbreak of Nipah in Malaysia.

A further issue that might be considered an EID is the increasing concern over the loss of antimicrobial sensitivity. It is apparent that many of the traditional first line antibiotics are no longer effective against a number of pathogens and this has resulted in second and third generation, more costly antimicrobials being used. Even so there are a number of pathogens of man that are now widely resistant including multiple resistant *Staphylococcus aureus* (MRSA), multiple resistant *Salmonella* species including particularly *Typhimuium* and totally drug resistant *Mycobacteria tuberculosis.* The role of livestock in the development is debated but it is apparent that the widescale use of broad spectrum antimicrobials in animal health is a likely cause of increasing resistance.

FUTURE RISKS

It is widely accepted that the risk of EIDs is increasing. The increase in EIDs is a result of a number of demographic, economic and cultural factors including: (1) Increased human population, urbanization, economic development and demand for animal protein; (2) Increased livestock production and intensification; (3) Climate change, increased degradation and pressure on ecosystems, co-mingling of species; and (4) Increased globalization with more trade in animals and animal products and increased personal travel.

The Picture 4 shows the dramatic rise in animal protein from 1960 to 2010. It can be seen that products such as poultry have increased ten fold, from less than 10 million to nearly 100 tonnes, dramatic increases can also be seen in pork meat and eggs. Production of farmed fish has markedly increased, whereas the wild fish catch has plateaued.



Picture 4. World animal protein production by type, 1950-2010

Source: Worldwatch, FAO

RISK MITIGATION

It is apparent that none of the risks of EIDs can simply be eliminated and so their effects must be mitigated as much as possible. Considering the four risk categories listed above we can consider the following as priority risk reduction strategies:

Reduce the risk of EID emergence:

1. Segregate production systems for the different animal species
2. Improve husbandry and stress on animals to reduce disease incidence and the use of anti-microbials
3. Separate animal production from human populations
4. Improve waste management to reduce contamination of the ecosystem
5. Scan international developments and reports of EIDs to prevent/reduce the risk of spread into Indonesia
6. Ensure effective animal and animal product quarantine is established
7. Protect/manage wildlife resources and their consumption

Reduce the impact of EIDs:

1. Establish sensitive surveillance program for the early detection of EIDs, including
   a. Strong industry/farmer awareness of the need to report
   b. Competent field veterinary services to investigate
   c. Enhanced laboratory diagnostic capabilities
   d. Strengthened epidemiological skills to investigate and assess
   e. Livestock identification system to assist in tracing and risk assessment
2. Develop the capability to respond effectively to EIDs, including
   a. Political understanding for the need to respond effectively to EIDs
   b. Establishing an emergency preparedness and response system
   c. Having well practiced disease response plans
   d. Trained and competent staff
   e. Access to adequate funding, equipment and other resources
3. Improve the biosecurity of production to reduce the risk of spread of any disease
   a. Improve husbandry to lower stress on animals to reduce susceptibility to disease
   b. Develop and implement ‘best practice’ vaccination programs to improve livestock health and to promote early detection of adverse events
   c. Develop animal genetics for greater resistant to disease
   d. Promote high biosecurity production systems by providing commercial advantage–improved market access and higher returns.

CONCLUSION

Emerging infectious diseases will continue to occur and can be expected to increase as the human population increases, livestock production becomes more intensive, globalization continues and the ecosystem suffers further degradation.

Livestock EIDs will continue to have a range of impacts on animal production and marketing, public health, food security and on the economy as a whole. To mitigate the impact of EIDs potential disease threats should be identified as early as possible so sensitive detection and surveillance systems are required. Risky practices such as rearing species together in poor husbandry conditions should be eliminated or at least reduced. Emergency preparedness and response systems must be well developed to respond effectively and efficiently to EIDs to reduced the cost of control and limit the impact on livestock producers and traders, food safety and security and the economy.

There is much work to be done:

1. The government must show leadership in developing policies to identify and mitigate the threat of EIDs
2. Strong engagement and support must be obtained from animal and public health experts from the universities and research institutes and from the private sector
3. Sensitive early warning, surveillance and response systems must be developed to reduce the impact of EIDs on livestock production and traders and supporting industries, food security and economic development

Emergency management systems should be developed, tested and made fully operational to ensure the early and effective response to disease incursions which will make control more likely and more cost effective.

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