The Economic Benefits of Research into Emerging Infectious Disease

A submission to the Productivity Commission

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Australian Biosecurity Cooperative Research Centre Emerging Infectious Disease

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Summary
The purpose of this submission to the Productivity Commission is to highlight the potential value of research into emerging infectious disease and to outline a possible approach to determining that value. An example is presented that shows how this process could be applied. The application of this type of approach will require further study.

Introduction
Commercial return on investment into research can come in many forms. These include a product that is produced and sold by a company in Australia; intellectual property that brings a return to Australia; the development of a highly skilled workforce; or the generation of information that when taken up and used results in a more efficient process or results in a saving.

Some of the benefits are quantitative, some qualitative and some have clear large economic implications but are difficult to measure. Measurement of the benefits of research to improve disease response capability is difficult as there is no clear method or process.

The benefit of applied research into disease
The cost of disease outbreak can be very high. This cost can be reduced through planning for a response and improving the national response capability. Research plays a critical role in an improved national response. Research can result in improved tools and methods to detect disease in the laboratory and the field, enhanced surveillance strategies for demonstration of freedom from disease, and early detection of disease outbreaks. In addition, research that improves disease control in neighbouring countries further adds to Australia's biosecurity.

It remains a challenge to realistically ascribe economic value to an improved level of preparedness to respond to an emergency disease outbreak and the subsequent reduction in risk profile.

There are often no market drivers for the adoption and uptake of these research outcomes where there is a broad national benefit. This is especially the case in the public health sector.

The benefits of improved disease detection, control and response capacity come through reduced public health costs, and the maintenance and expansion of market access in the agricultural sector.

Estimating the cost of disease outbreaks
The cost of an incursion of a disease into Australia varies widely and affects different sectors. It has been estimated that an outbreak of a disease such as foot-and-mouth disease in livestock would have a very large impact on trade and would cost $5.8 billion in the first year[1]. The cost of an epidemic of influenza in humans stemming from the current avian influenza pandemic in birds has large public health costs[2]. The outbreak of SARS resulted in a loss of income through reduced tourism and demand for Australian products[3]. An estimate of the likelihood of a disease outbreak or incursion also needs to be made.

Estimating the benefits
Estimating the benefits of research that reduce the likelihood or impact of an outbreak of disease depends on a number of factors. These include:

- The estimated cost of the incursion or outbreak
- The likelihood of an incursion or outbreak
- The contribution of research to reducing that risk
- The attribution of the research to a particular outcome or agency
- The adoption of the research
- The validation of the consequent reduction in risk and saving.

A further factor is the consequence of timing. The benefit ascribed to a reduced risk could be considered to be recurrent. The national and international environment will also contribute to a changed risk profile. For example, the continued spread of the current epidemic of avian influenza in birds increases the risk of spread to humans.

Process
Estimates of the cost of a disease outbreak or disease incursion, and an assessment of the likelihood of an outbreak can be a complex process, as seen in the recent estimation of the economic impact of an influenza outbreak by the Lowey Institute[2].

There is then a need to obtain an understanding of the scope and nature of research focused on the particular diseases. In addition, there may be components of a research portfolio that will have an impact on multiple diseases. This collective information can then be used to estimate the part played by research in reducing the probability of a disease outbreak. Such an estimate is to a large extent subjective and it may be appropriate to use a range from lowest to highest. Such an estimate requires validation by stakeholders. This must be done with clarity and transparency.

This has been undertaken for three model diseases as an <u>example only</u> and is outlined below. They have not been validated.

Rationale
Development of an advanced early warning system is well beyond the current financial and organisational capacity of front-line beneficiaries. As such, market forces alone will not induce an effective response to the economic threat posed by emerging infectious diseases (whether of exotic or endemic origin). Thus, a case for government support exists providing the expected gains exceed expected costs from a national perspective.

The cost should a particular exotic disease find its way into Australia, is effectively the benefit that can be ascribed to measures proposed to stop the disease agent from establishing in the first place. However, to estimate the cost of an infectious disease before it occurs one must take into account the probability of the disease

gaining entry and establishing, under the circumstances applying to Australia, with and without particular preventive strategies. By combining the cost of a disease event and the probability of it gaining entry and establishing, the expected cost (and the amount that can be realistically saved if entry is prevented) can be estimated. Thus, with respect to exotic diseases, the economic value of AB-CRC research depends on the degree to which it reduces the risk of entry and establishment of the pathogen/disease, relative to current arrangements. The prospects are illustrated for several exotic diseases in the following table.

The cost of an outbreak of foot-and-mouth disease of similar size to the one experience in the UK has been estimated to be $5,800 million in the first year[1]. The cost of a mid-level influenza pandemic has been estimated to cost 0.8% of GDP[2]. A treasury report estimated that SARS had a one-off cost to Australia of 0.13% GDP[3]. The figures are based on the GDP of $703billion in 2003 and $970billion in 2006.

Examples of expected benefit of an enhanced preventive capacity

Disease (first year cost if disease gains entry)	Probability of event		Expected cost		Net annual benefit due to AB-CRC
	Pre AB-CRC	With AB-CRC	Pre AB-CRC	With AB-CRC	
			$m	$m	$m
FMD ($5800m)	.005	0.00495 – 0.0025	29	28.7-14.5	0.29 – 14.5
Influenza ($7800m)	0.05	0.0495 – 0.025	390	386 - 195	3.9 - 195
SARS ($913m)	0.01	0.0099 – 0.005	9.1	9.0 – 4.6	0.09 – 4.6

The table shows how reducing the probability of a disease event can result in huge opportunity savings for the nation. For example, if the probability of an incursion of FMD is reduced from a one–in-200 years event to a one-in-400 years event, the expected cost reduces from $29 million in the first year to just $14.5 million, a saving of $14.5 million each and every year.

Estimates for a shift in probability of a disease outbreak and the affect of research on the probabilities are subjective and are presented as a range. This is illustrated in Figure 1.

A further variable is in the probability of an event. The estimates of the probabality of a disease outbreak can also be highly variable. There is also considerable variability between diseases. Hence there is value in considering this over a range. This is shown in Figures 2,3 and 4 for the three diseases considered in the table.

Figure 1 – Expected benefit through reduced outbreak risk for FMD, Influenza and SARS

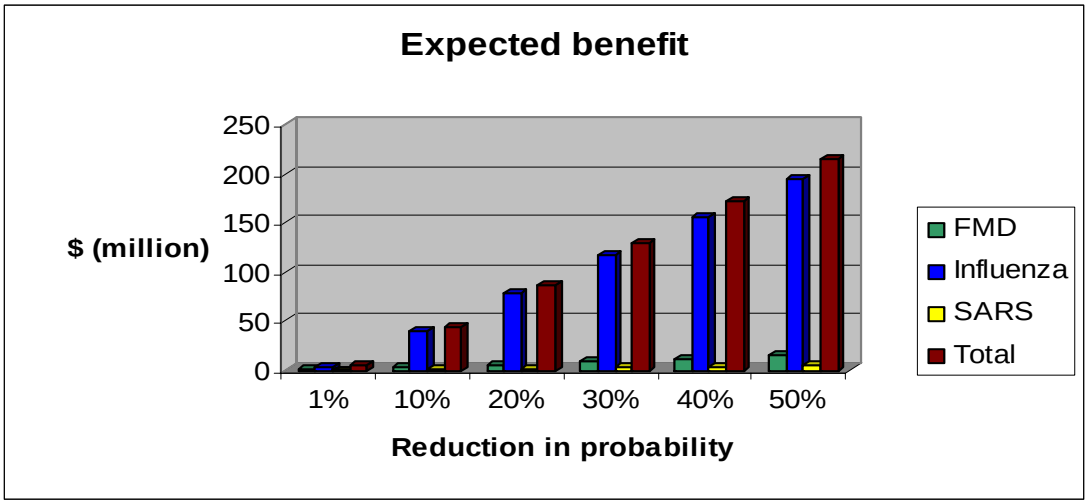


Figure 2 FMD – Expected benefit based on varying outbreak probabilities

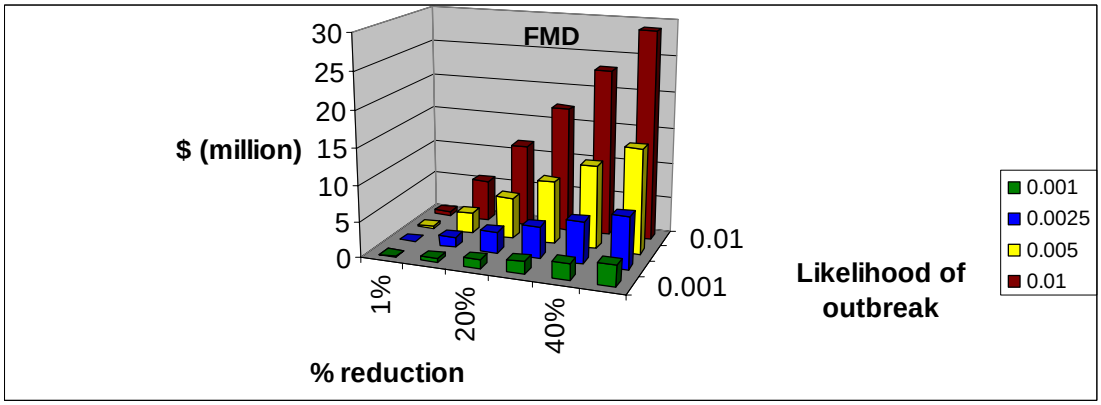


Figure 3 Influenza – Expected benefit based on varying outbreak probabilities

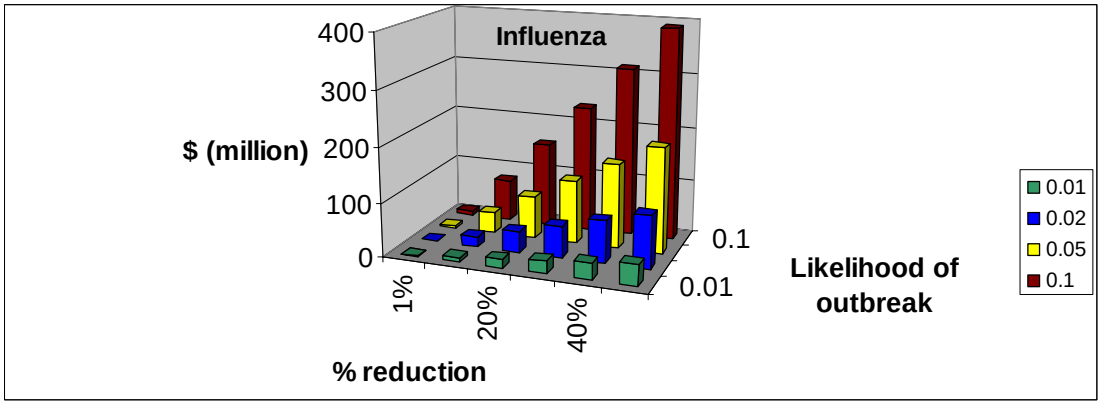
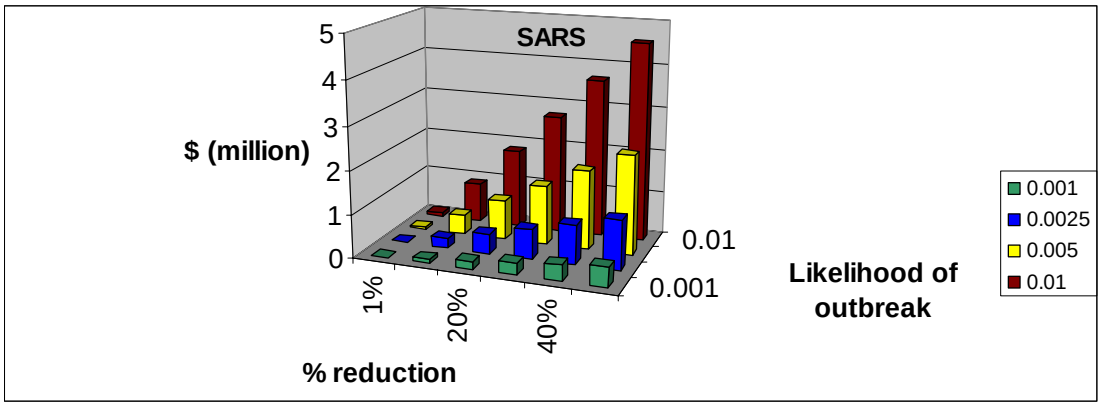


Figure 4 SARS – Expected benefit based on varying outbreak probabilities



The diseases listed below are the subject of research through the AB-CRC. Data on the economic impact for some of these diseases is limited. The diseases are Japanese encephalitis (JE), foot and mouth disease (FMD), west Nile virus (WNV), Murray Valley Encephalitis (MVE), surra, Australian bat lyssavirus (ABLV), dengue, bluetongue virus (BTV), Hendra virus, Nipah virus, avian influenza (AI) and SARS.

To realise the gains indicated in the table, the risk reduction warnings and recommendations coming out of AB-CRC research would have to be acted on with total effectiveness. Thus, as much attention should be given to the warning action scenario as to development of the warning itself. This necessitates the close involvement of relevant government agencies responsible for human and animal health, and the close liaison of the AB-CRC with governments and industry through the partnership arrangement established via Animal Health Australia — as is provided for in the structure of the AB-CRC Board.

Conclusion

It is clear that an improved capability and capacity to prevent and respond to the outbreaks of disease provide an economic benefit to Australia. The processes to determine these benefits remain challenging, but estimates that have a level of validity can be made using available information.

References

1. Animal Health Australia. Proposal to build the national capacity to address FMD & BSE risks. 2001.

2. Lowey Institute. Global macroeconomic consequences of pandemic influenza. 2006 http://www.lowyinstitute.org

3. The Treasury, Australian Government. The economic impact of Severe Acute Respiratory Syndrome (SARS) 2003 http://www.treasury.gov.au/documents/677/HTML/docshell.asp?URL=economicimpact_sars.asp