Border measures

Evidence summary

This document summarises the evidence presented in:

Development of an evidence compendium and advice on travel-related measures for response to an influenza pandemic and other communicable diseases, L Selvey, R Hall, C Antão, School of Public Health, Curtin University

And includes some evidence reported in:

Evidence compendium and advice on social distancing and other related measures for response to an influenza pandemic, H Rashid*, I Ridda*, C King*, M Begun†, H Tekin*, JG Wood† and R Booy*. *National Centre for Immunisation Research and Surveillance and †School of Public Health & Community Medicine, University of New South Wales.

The full literature review and other supporting documents are available on the Australian Government Department of Health website.

Contents

Abbreviations and acronyms

SARS	severe acute respiratory syndrome
WHO	World Health Organization

1 Introduction

1.1 Background

Australia rapidly implemented border measures following the declaration by the World Health Organization of a public health emergency of international concern under the *International Health Regulations 2005* (IHR) for H1N1 in 2009.[1] Border measures commenced on 27 April 2009 with in-flight announcements and removal of automatic pratique on all incoming aircraft originating from North, Central and South America. Border nurses, thermal scanners and health declaration cards were employed two days later. These measures continued until 22 June 2009.

The *Review of Australia's health sector response to pandemic (H1N1) 2009*[1] identified a range of issues with the implementation of border measures in Australia. These included that the measures continued after local transmission had been established in Australia and that maintaining border measures and their consequent contact-tracing activities placed a heavy burden on public health resources. This in turn limited the capacity of jurisdictions to undertake other control measures such as case detection and contact tracing within the community.

Interviews with representatives from jurisdictions affirmed these views. It was agreed that the border measures were ineffective in reducing the transmission of pandemic (H1N1) 2009 in Australia, and that there was a significant opportunity cost of the border measures that reduced the capacity of jurisdictions to undertake community-level surveillance and control activities.[2] However, some communications with incoming passengers (particularly in-flight announcements and health declaration cards) were thought to be useful, and there is strong public support for border measures, at least among travellers.

1.2 Overview of results

Overall, the quality of evidence about the effectiveness of border measures was low, with few analytical studies. Most studies either involved modelling or described recent experiences with border measures involving severe acute respiratory syndrome (SARS) or pandemic (H1N1) 2009 and most were pessimistic about the ability of border measures to substantially change the epidemiology of an influenza pandemic. Modelling studies were consistent in the finding that a combination of measures was more effective in reducing the spread of the virus than the use of individual measures, although not all combinations of strategies were effective and the choice of strategies to implement primarily depended on the resources available.

Border measures—either travel restrictions, or quarantine and isolation—can theoretically delay the peak of the epidemic curve, but in most simulations, only by a maximum of a few weeks. The objective of controlling transmission by delaying introduction, delaying the peak incidence, reducing the peak incidence or increasing the time course of an epidemic are not feasible using currently available methods. Considering this evidence, using border measures to achieve such an objective should not be attempted.

2 Border measures for pandemic influenza

Communication measures

Communication with all potential stakeholders is crucial to a successful border response to pandemic influenza,[3] both in the very early stages to limit its importation and communicate influenza messages to all arrivals, and at later stages to advise passengers with symptoms about relevant containment measures and where to obtain clinical care. Communications should include all transport and ground staff, and other airport and ship personnel. Along with communication, effective strategies to inform and educate the community, decision makers and health workers are essential to increase engagement and improve preparedness.[3]

The WHO 'outbreak communication guidelines' state the importance of restoring the trust and confidence of the community through early and clear announcements of disease outbreaks. Good communication from the government and health organisations will result in greater public resilience and potentially improve appropriate public participation to support the rapid containment of an outbreak, consequently limiting morbidity and mortality.[4] Methods used for communication should be culturally and linguistically appropriate, and include regular updates of initiatives being undertaken to enable people to make the right choices to protect themselves and others.[3]

2.1 Inflight announcements/onboard announcements (ships)

By providing information on the symptoms and the modes of disease transmission, inflight and onboard announcements aim to increase awareness of the symptoms of influenza, as well as options for screening and access to clinical care. This measure encourages and legitimises self-reporting of symptoms by travellers, thereby reducing the time from onset of symptoms until isolation.[5] Inflight and onboard announcements are much less resource intensive than entry and exit screening, although if they are used as part of entry screening, border nurses would still be required to follow up incoming passengers who report having symptoms.[1]

2.2 Distribution of communication materials

Different ways of providing information to passengers and crew have been used in past epidemics. During the SARS epidemic, travellers had access to videos, signs, inflight announcements and health alert cards.[6] During the pandemic (H1N1) 2009, of 56 countries surveyed, 91% reported that both air and maritime industries were actively involved in disseminating pandemic-related health information to travellers.[7] However, due to the lack of evaluation studies and the difficulty in separating out communication from other interventions, evidence of the effectiveness of methods of providing information about SARS and pandemic (H1N1) 2009 to travellers is limited.[6, 8] The effectiveness of these measures is also likely to depend on the mode of communication and what was communicated.

The resources required for providing information to passengers will depend on the mode used. More effective communication is likely to be more resource intensive, as effective communication requires multiple modes of communication and messages tailored for the audience.[9]

2.3 Information for border staff

Providing information to staff is also vital. Ensuring that they receive adequate information about the risks associated with contact with infected passengers and other staff, and about measures they can take to help protect themselves, is likely to reduce transmission among this high-risk group, and from them to others.[3] However, as information alone does not necessarily result in behaviour change, individuals also need to be provided with both education and the means to prevent infection (such as personal protective equipment).

Identification measures

Border measures for pandemic influenza must be implemented very early in the disease outbreak, when a new strain is identified in a country other than Australia.[10] This usually occurs in World Health Organization (WHO) phase 4 when there is sustained human-to-human transmission.[11] However, if WHO phase 4 is missed, or is too short to be recognised, the identification and characterization of the new strain is only possible during WHO phases 5 or 6.[11] Any delay in recognising the potential for a pandemic results in delays in developing effective methods to prevent or reduce further spread.[12] Although an early and effective detection strategy cannot prevent the entry of infected individuals, it constitutes an important basis for the implementation of an effective intervention. In fact, the effectiveness of the intervention strategies depends on how well and promptly the cases are identified.[11]

2.4 Entry screening

Exit and entry screening are a combination of two or more public health measures that aim to detect infected passengers arriving from or departing to affected areas. Although entry and exit screening are similar, exit screening has a higher reported effectiveness, which seems to be related to the reduced numbers of infected passengers on board the aircraft and consequent decreased transmission.[13, 14]

Evidence from past events and results from modelling studies suggest that entry screening is ineffective, largely because of limited sensitivity in detecting all cases, including asymptomatic cases and people incubating the infection. The value of entry screening is questionable since, at best, modelling suggests that it can only delay local epidemics for a short period of time.[15, 16, 17, 18] It is also resource intensive, and both evaluations and modelling studies have concluded that entry screening is not particularly effective in preventing the introduction of pandemic influenza into a country.[8, 19, 20] However, despite the ineffectiveness of entry screening, it may be useful in providing valuable information for increasing the traceability of cases with travel history, but only for those cases identified through screening.[21]

2.4.1 Negative pratique

In Australia, pratique for passengers and crew to disembark from an overseas vessel or aircraft is granted by the Department of Agriculture after it has been determined that the vessel or aircraft is free from any quarantinable disease. In normal circumstances, pratique is automatic, although there is an onus on the pilot or captain to report the presence of any ill passenger or crew member aboard the aircraft or ship before landing or docking.[22] In-flight announcements are made advising passengers and crew to self-report influenza-like illnesses. When notified of unwell passengers, public health staff must screen for symptoms and prepare for treatment and management after landing, either at the border or in the community. If a passenger is diagnosed with a pandemic strain, further assessment and specific treatment can be performed.[1]

This measure depends either on the crew identifying unwell passengers or unwell passengers self-identifying to the crew, which could be a challenge on large flights or ships. Further, while negative pratique requires few resources for the initial screening, it needs considerably more resources for adequate follow-up. In Australia during the 2009 (H1N1) pandemic, negative pratique was implemented for incoming aircraft and cruise ships.[23] Initially, it was only applicable to aircraft arriving from the American continent, but it was quickly extended to all incoming flights. A total of 15 457 travellers were identified at the border as being unwell, and 13% of these were identified through this measure.[1]

2.4.2 Passenger locator documents

Health declaration and locator cards for passengers and crew arriving at or departing from affected areas may contain questions about the presence of influenza-like symptoms (e.g. runny nose, blocked nose, sore throat, cough), the use of any medications that might influence the presence of symptoms, previous contacts with ill people,[21] aircraft seat, and previous vaccination and travel history.[24] What is actually asked on the cards varies by jurisdiction (e.g. Australian cards do not ask about vaccination and medications), and some countries include personal details for contact tracing.[8] Detection of influenza through this measure heavily relies on the veracity of the answers provided[24] and the willingness of people to respond to follow-up. Limitations of the effectiveness of the passenger locator cards have been reported from various countries,[1, 6, 8, 24] primarily due to the non-specificity of the cards for SARS and the low prevalence of SARS among international passengers arriving or departing, but also to the reluctance of people who report having symptoms to be followed up. The provision of passenger locator cards is not resource intensive, and customs or Department of Agriculture staff can screen the cards. However, if potential cases are to be identified and managed at the border, border nurses are required to assess any incoming passengers who identify as having symptoms that are consistent with influenza.

During the 2003 SARS pandemic, of the 47.4 million locator cards completed between 1 March and 15 July by travellers arriving in Canada, China, Taiwan and Singapore, 13 000 people reported symptoms, but only 4 cases of SARS were detected.[6] During the 2009 (H1N1) pandemic in Australia, of the 15 457 travellers that were identified at the border as being unwell, 84% self-identified, presumably because of information provided on passenger locator cards.[1] However, only four cases of pandemic (H1N1) 2009 were identified through airport border activities including passenger locator cards, suggesting that some influenza cases were missed, and also that the measure had a low specificity. During the 2009 (H1N1) pandemic, 89% of individuals who were identified for assessment at Sydney airport had self-identified after receiving passenger locator cards (NSW Health Department).

2.4.3 Thermal scanners

Thermal scanners can be used at the border to identify febrile passengers who may be infected with influenza.[25] Scanners are appealing because they are quick and easy to implement, have limited impact on passenger transit time (compared with the use of traditional thermometers), and minimise the risk of transmission between staff and passengers,[26] while not violating any rules of the International Health Regulations relating to restrictions to traffic and trade. However, the method is not without difficulties. For example, the environment where scanners are operated and the body area used for fever screening produce variable results,[26, 27] and it is clear that screening for fever alone (regardless of the method of detection) will not detect all influenza cases.[28]

Further, the cost of using thermal scanners at airports is high in terms of human resources: individuals identified with fever by the scanners need to be followed up by border nurses (through two or more staff shifts each day), and other officers are needed to provide support for

logistics and record-keeping. There is also a significant administrative burden on public health officials who are diverted from community-based control activities to border control activities.

A number of countries implemented thermal scanning during both the SARS and the 2009 (H1N1) pandemics. Evaluation of those interventions suggests that it is questionable whether, at least in the case of SARS, the high costs of implementation justified their use given the low sensitivity in detecting cases.[8] For example, only 12% of imported pandemic (H1N1) 2009 cases were identified on arrival in Singapore using scanners.[29]

2.4.4 Border nurses

It is important that travellers have access to health care in case of infection with pandemic influenza. The presence of skilled healthcare workers, such as border nurses, at exit and entry points can provide information and support for incoming passengers with symptoms.[10] They are essential for entry screening processes, as the screening method alone cannot identify cases. Border nurses are required to interview possible cases, collect samples and arrange testing, perform clinical examination (such as assessing body temperature), provide antiviral treatment, and arrange for the management of probable cases.[1, 30] However, their effectiveness is linked to the effectiveness of entry screening: if the methods are not effective in detecting possible cases, border nurses will not have a significant impact on preventing further transmission from imported cases.

The provision of border nurses is highly resource intensive, with two or three shifts required at airports, supported by administrative staff and resources to recruit and train them. Ideally, border nurses should be in place as soon as possible after the detection of a new strain of influenza overseas (i.e. during the WHO pandemic phase 4). Their usefulness is limited, however, once local transmission has become established. During the 2009 (H1N1) pandemic, Australia provided border nurses to assist passengers who had been identified as being at higher risk of disease, with many clinics established at international terminals to assess incoming travellers, although this reduced the availability of those skilled workers in other health services [1].

2.4.5 Screening of passengers on cruise ships prior to disembarkation

Both historical and modelling evidence suggest that maritime quarantining was successfully implemented in past epidemics because of its greater practicality and acceptability;[31] however, this may not be the case anymore. Cruise ships involve close interactions between large groups of people in enclosed environments, and respiratory diseases are common and can spread rapidly in these environment.[32] Disease surveillance is usually performed on board by designated crew.[33] Public health measures used on cruise ships include isolation of cases, training, advising, cleaning, education about respiratory etiquette and surface disinfection.[33] In the case of suspected cases of quarantinable diseases on board ships, authorities are required to collect samples for diagnosis and report cases so that appropriate measures can be applied on disembarkation.[33]

Overall, cruise ships are more important as incubators of disease than as sources of new influenza strains, given the relatively small numbers of incoming passengers via this route. In fact, due to the more important role of air traffic in spreading the virus, the implementation of control measures at shipping ports seems to be of low value for global disease control.[33] Furthermore, inconsistency of public health measures implemented within and between countries decreases the effectiveness of the control efforts,[33, 34] given that cruise ships visit ports in many different countries.

2.4.6 Voluntary isolation of ill travellers not requiring hospitalisation

Isolation of suspected influenza cases detected at the border was undertaken in many countries during both the SARS and 2009 (H1N1) pandemics. Several modelling studies have attempted to assess the effectiveness of case isolation, with results consistent with the observation that this measure is effective in reducing secondary infection.[29, 35, 36] The effectiveness of isolation in reducing transmission greatly depends on the efficacy of case identification. During entry screening, the challenge of identifying cases relates to inadequate sensitivity of case definitions and detection methods, the occurrence of asymptomatic cases, and individuals travelling during the incubation period. The large number of mild or asymptomatic cases and those incubating infection would not be detected and consequently not isolated. In addition, isolation of cases with mild symptoms will be difficult to enforce. During the early stages of pandemic (H1N1) 2009 in Australia, isolation of cases in hospital who did not require hospitalisation used beds that could have been used for sicker patients.[1] Case isolation does not prevent transmission from unidentified cases in the incubation period or asymptomatic cases who may still be infectious.[1]

However, there are examples where voluntary isolation of travellers has been very successful. During the pandemic (H1N1) 2009 in Australia, one index case on board a cruise ship was responsible for spreading the virus and resulting in 83 cases of H1N1 on the ship. After disembarkation, cases undertook voluntary isolation and asymptomatic passengers were quarantined at home for 7 days. In a follow-up survey of 45 randomly selected quarantined passengers, only two refused quarantine. In this instance, intensive control measures and high compliance with isolation and quarantine successfully contained the outbreak.[32]

2.4.7 Quarantine of contacts at the border

This measure consists of the selective quarantining of the contacts of cases detected at the border. In the impossibility of quarantining all travellers, selecting only the contacts of identified cases is useful because it decreases the number of travellers eligible for quarantine and consequently the resources needed. However, the effectiveness of quarantine of contacts relies on the success of identifying cases, as contacts of nonidentified cases will not be quarantined.[37]

Other limitations to the effectiveness of quarantine are the selection criteria for the contacts, the duration of quarantine required, the need for rapid implementation due to a short serial interval, compliance issues,[38] and the ethical and economic challenges with keeping an individual who is not ill in a confining facility (e.g. hotel room or quarantine unit).[37] Preventive quarantining may also result in psychosocial stress and issues relating to compensation; workforce staffing for individuals, families, employers and governments; as well as problems with compliance.[39] Quarantining significant numbers of inbound passengers carries a risk of intensifying rather than reducing transmission, in that large numbers of people in close proximity, with several symptomatic or asymptomatic influenza cases, constitute a risk for epidemic transmission with that group

Although quarantining contacts of cases can be effective in preventing ongoing transmission, there are considerable practical challenges in identifying cases and contacts at the border. The resource implications of this measure would be very high, particularly if contacts were quarantined in separate facilities rather than in their own homes. Australia does not have facilities for large-scale quarantine. There are also potentially significant indirect costs due to loss of productivity and impacts on tourism due to the confinement of incoming travellers.

2.5 Exit screening

Exit screening appears to be more effective than entry screening, although this seems to be primarily related to the reduced numbers of infected passengers on board the aircraft and consequent decreased transmission.[13, 14] The effectiveness and resource implications of exit screening for the detection of infectious cases of pandemic influenza depends on the effectiveness of the screening method. As with any screening measure, the impossibility of detecting asymptomatic cases or people who are incubating the infection limits its implementation.[14, 40] This is particularly the case with influenza, where cases are infectious during incubation and when asymptomatic.[41]

Despite limited evidence of effectiveness, exit screening was recommended by WHO during pandemic (H1N1) 2009,[42] while entry screening was not recommended. Arguments for the choice of exit screening over entry screening included the possible impact on passengers' behaviours by discouraging ill passengers from travelling abroad, the decreased risk of global transmission due to the reduced numbers of travellers and being most effective in containing a disease at the source.[6, 14, 42] Arguments against exit screening include passenger concerns about the cost of accessing affordable health care in the country of departure if they are not allowed to leave,[43] resulting in failure to disclose possible infections.

2.6 Contact tracing

Assessing all passengers for contact tracing and implementation of public health measures after in-flight exposure is time and resource intensive.[24, 44] Limiting the definition of contacts to the passengers seated within two rows of a case could be more efficient, time and resource saving, but may miss some transmission on the aircraft.[8, 38] This measure is only effective at reducing transmission if it is possible to identify and manage all contacts within 48–72 hours, particularly if antivirals are used to limit infectivity. This is challenging, resource intensive and requires large numbers of public health personnel.[13, 38, 44] There has not been an evaluation of the effectiveness of identifying all cases among contacts in limiting transmission.

Internal travel restrictions

The objective of internal travel restrictions is to delay or prevent the transmission of influenza by limiting either geographically defined travel or certain important travel routes, such as via airports, that are selected to avoid spread of the epidemic.[45]

There has been limited research on this topic since 2008, with conflicting conclusions.[46, 47] In short, unless a high proportion (at least 50%) of internal travel is restricted, the intervention may not make a significant contribution to mitigating influenza transmission. Low-level travel restriction (e.g. 10%) may be of no benefit, or even be detrimental due to increased spread of infections within the local area of people who are prevented from travelling.

Restrictions on travel may cost transport authorities through loss of income, and the direct costs of this intervention are likely to be major.[45] There are also likely to be costs associated with preparing and distributing promotional material, screening on entry at airports, seaports, bus stations and train stations, or closure of airports, which might require compensation.

The secondary effects are likely to be major. Restrictions on travelling could slow or halt trade and business, and impair supply of essential commodities such as the supply of foods and fuel.[45] More localised restrictions would potentially be more disruptive, particularly if all traffic were stopped from entering or leaving certain zones, and might require a police or army presence to be enforced.

Acceptability and expectations are variable, although international studies (United States, Argentina, Mexico, United Kingdom, Japan) have shown that between 11% and 54% of people avoided travelling long distances by aeroplane, train or bus during the 2009 pandemic.[48] In Australia, more than 90% of people who use air transport might be willing to avoid air travel for a month if requested during a potential pandemic.[49] However, in the Australian context, it may be impractical to impose travel restrictions, especially for land travel. Historical data from the 1918–19 pandemic suggest that restrictions were not effective in places where travel was frequent.[50] To be effective, this measure would need to be enacted as soon as the first case was detected in a region.

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