

Social distancing

Evidence summary

This document summarises the evidence presented in:

Evidence compendium and advice on social distancing and other related measures for response to an influenza pandemic, Prof R Booy and Dr J Ward, National Centre for Immunisation Research and Surveillance

The full literature review and other supporting documents are available on the Australian Government Department of Health and Ageing website at www.health.gov.au

Contents

1	Introduction.....	4
1.1	Background.....	Error! Bookmark not defined.
1.3	Overview of results.....	Error! Bookmark not defined.
2	Social distancing measures for pandemic influenza	4
2.1	Proactive school closure	4
2.2	Reactive school closure	5
2.3	Workplace closure	6
2.4	Working from home	7
2.5	Voluntary isolation of cases	8
2.6	Voluntary quarantine of contacts.....	8
2.8	Cancellation of mass gatherings	9
	References	10

1 Overview of results

Social distancing measures are an important part of mitigating pandemic influenza. They complement individual approaches in decreasing the likelihood of its spread.

Since the 2009 influenza pandemic, useful evidence has been generated from clinical and epidemiological studies, mathematical modelling and personal clinical experience about the potential impacts of social distancing and other related measures. However, the overall quality of the evidence is not strong. Overall, social distancing measures were found to be moderately effective and many are likely to be acceptable in Australia as temporary measures, especially where the economic and social impacts are minimal.

School closure, whether proactive or reactive, appears to be moderately effective in reducing the transmission of influenza and in delaying the peak of an epidemic, but this measure is associated with very high economic costs and social impacts. School closures should therefore be considered only in a severe pandemic and for the shortest duration possible. Individual school closure can be as effective as entire school-system closure. A limited duration of closure would be acceptable to the Australia public, especially if it was reactive rather than proactive, but it is likely that most children will continue to make contacts through outdoor activities during the period of closure, which may negate some or many of the benefits expected to be achieved.

From available but limited evidence, workplace-related interventions like work closure and working from home are also modestly effective and are acceptable or even popular among employees, especially if compensation is provided. However, a fairly high proportion of workplace closures (about 33%) would be needed for a significant impact, and workplace closures could cause considerable economic hardship and social distress.

Voluntary self-isolation of cases is also an effective and acceptable measure, especially where access to antiviral resources is limited, but there is an increased risk of intrahousehold transmission from index cases to contacts, especially where bathroom facilities are shared. Isolation of contacts is also considered an effective and acceptable measure.

2 Social distancing measures for pandemic influenza

This review assessed the following social distancing measures: proactive and reactive school closure, workplace closure, working from home, voluntary isolation of cases, isolation of contacts, internal travel restrictions (noted in the border measures summary) and cancellation of mass gatherings.

2.1 *Proactive school closure*

The objective of proactive school closure is to reduce influenza transmission among children as they are at greater risk of transmission and more susceptible to most respiratory viral infections than adults. It also may be more feasible than some other interventions (e.g. closing all workplaces).

Proactive school closure appears to be moderately effective in reducing the transmission of influenza, with studies suggesting that school closure reduces transmission of influenza by up to 50%, delays the epidemic peak by a week or two (depending on the timing of the closure),¹ and attenuates epidemic waves.² This finding is supported by observational studies from a variety of countries (e.g. China,³ United States,⁴ Israel,⁵ Thailand,⁶), which have found a reduction in influenza transmission when seasonal influenza outbreaks or

pandemics coincide with school holidays or unrelated school closures. However, another United States study found no difference between schools that had a one-week break during winter and schools that remained in session.⁷

While modelling studies, in particular, strongly support school closure, in reality, the ameliorating effects of school closure could be smaller than predicted, depending on assumptions about how contacts are made by schoolchildren during the closure period. For example, in a survey conducted in Western Australia, 74% of students participated in activities outside the home on more than one occasion, resulting in an average of 3.7 out-of-home activities for each student.⁸

The direct costs of planning and maintaining proactive school closures are substantial,⁹ although they depend to a large extent on the duration of the closure.⁹ These costs include time and effort in planning and maintaining school closures, shutting down power, heating or cooling systems, transport and security in schools, and communicating school closures to the teaching staff, pupils, parents and other relevant authorities.

The secondary economic and social impacts of proactive school closures are potentially massive but also duration dependent, although in the Australian context they are not well known. However, it has been estimated that up to 45% of parents could remain absent from work to take care of children in Australia,^{8,10} with lesser percentages likely in other countries (e.g. between 16% and 27% in the United States and Taiwan^{11, 12, 13, 14, 15}). There is also the potential for imposition of childcare responsibilities on other family members, and it is likely that disadvantaged people would be disproportionately affected. There is a risk of children being left without care or in the care of underaged siblings,¹⁶ so that school closure may lead to increases in risky behaviours such as underage drinking and drug use.¹⁶ Additionally, children from poor and ethnic minority backgrounds may disproportionately encounter educational delays due to prolonged school closure.¹⁶ Other social costs include the disruption of school curricula and other programs, possible examination delays, and the loss of free or reduced-cost school meals,^{15, 17} although the latter is less relevant in the Australian context. Further, some studies have shown that closing schools in fact results in substantially higher net economic and social costs than not closing schools.¹⁸

School closure may be acceptable to a large proportion of the population but only for a limited period. Practical implementation of school closure needs to take into account the objectives of the closure and the legal framework by which it can be enacted, which can vary between jurisdictions. For a short-duration closure, it is relatively more effective to close after a longish delay from the first day of infection; for long-duration closure, it is better to initiate closure as soon as possible.

2.2 *Reactive school closure*

As with proactive school closure, the objective of reactive school closure is to reduce influenza transmission among children in school settings.⁹ Its effectiveness varies, but has generally been found to be moderately effective overall. Mathematical modelling and observational studies suggest that reactive school closures may reduce the attack rate of influenza-like illness by about 7% to 15%,^{19, 20, 21, 22} while a few modelling studies (e.g. from the United States,²³ Greece,²⁴ Japan²⁵ and the United Kingdom²⁶) have shown much higher effectiveness. However, as with proactive school closures, the actual effects are thought to be smaller than the large impacts predicted by the modelling studies because a substantial proportion of children also mix outside of school, play sport, visit relatives and go to public places.^{11, 12, 13, 14, 27}

As with proactive school closures, the indirect economic and social impacts of reactive school closure are likely to be massive,⁹ but reduced in scale commensurate with the number of schools closed. Similar primary and secondary impacts would be expected. The secondary effects of reactive closure are likely to be much less than proactive closure because reactive closure requires detection in a school before closure and thus does not occur across all schools at once, in turn affecting a smaller proportion of households. This means that reactive closure would affect relatively few schools, particularly when the incidence is low. When used as a sole intervention, limited school closure was found to be significantly more cost-effective compared to continuous school closure.²⁸

Acceptability and expectations about reactive school closures vary: a survey conducted in 2007 suggested that about 97% Australian households were prepared to keep their children away from others if schools were closed due to pandemic influenza,²⁹ although a survey conducted during the 2009 influenza pandemic showed that actually only 47% of parents deemed school closures to be appropriate.⁸

Modelling studies show that any type of school closure may need to be maintained throughout most of the epidemic (i.e. at least 8 weeks) to have any significant effect on the overall attack rate.^{30,31} However, the practicalities of keeping schools closed for a long duration are considerable as the secondary effects will be amplified. Additionally, school closure alone may not be enough to interrupt transmission, so closing other related social events and extracurricular activities could be vitally important. The timing of closure is not known for certain, but should be considered when the attack rate of influenza-like illnesses reaches 5%. A trigger level should be agreed to enact school closure (e.g. when the rate of symptomatic influenza reaches 5% of the population for proactive closure, or when a single-day influenza-related absentee rate in a school reaches 5% for reactive closure).^{32,33}

2.3 Workplace closure

The objective of workplace closure is to reduce transmission of influenza following introduction of the virus into workplace settings.⁹ Proactive workplace closure is not considered as a measure due to the difficulties obtaining evidence of certainty of transmission, but reactive closure is worth considering after introduction of the virus, especially in parallel with local school closures. An intermediate step would be to temporarily minimise or eliminate meetings in the workplace to reduce transmission.

Modelling studies based on United States data suggests that, on average, the baseline epidemic scenario causes 18.6% of the population to develop influenza symptoms. If 10% of affected workplaces are closed, the overall attack rate is reduced to 11.9% and the peak time is slightly delayed. In contrast, if 33% of affected workplaces are closed, the attack rate decreases to 4.9%, and the peak time is delayed by 1 week.³⁴ This suggests that at least one-third of workplaces would need to be closed to bring an epidemic under control. However, major direct costs would result from the closure of one-third of workplaces, both to employers and employees,²⁸ starting with the costs of planning and consultation before the closure is enacted, followed by direct business losses. Losses would escalate as the duration of the closure increased, with some businesses not surviving a lengthy closure such as the 2–3 months that a pandemic would be likely to affect a local area.⁹

Secondary impacts of workplace closure on businesses that provide services to or are reliant on outputs from the closed businesses would also occur.⁹ Consumers could be deprived of essential and important goods,⁹ and the public more broadly is likely to experience concerns about job security and economic strain on families if business

closures are prolonged.³⁵ Ultimately, and for some smaller countries, the national economy could be detrimentally impacted.

There appears to be a high level of willingness of workers to stay at home from external places of employment, especially when they are educated about the nature of pandemic diseases. For example, about 90% of Australians reported being willing to avoid social gatherings before the term ‘pandemic influenza’ was explained to them, and 97% reported being willing after the term was explained.²⁹

The difficulties of closing workplaces would be considerable for several reasons:³⁶

- some businesses and organisations simply could not close for an extended period
- it may be impractical to completely close some workplaces and not others
- a fairly large proportion (at least one-third) of workplace closures would be necessary to bring the epidemic under control.

In addition, some businesses would need to increase operations in a pandemic (e.g. medical supplies) while being forced to have reduced outputs due to staff absenteeism.⁹ Workplace closure is likely to be acceptable to employees, particularly if they are sufficiently compensated, but not acceptable to business owners unless there was some form of compensation for them also. The timing of workplace closures is most effective when it takes place at the same time as school closures.

2.4 Working from home

The objective of home working is to allow employees who may or may not be infectious to work from home and thus reduce transmission outside the home.⁹ Working from home is potentially moderately effective in reducing transmission of influenza. In a trial conducted in Japan, a workplace policy of being able to remain at home on full pay was shown to reduce the overall risk of infection with the 2009 pandemic influenza by about 20%,³⁷ and a United States study suggests that teleworking when a family member is affected may reduce the risk of acquisition of severe influenza symptoms among employees by about 30%.³⁴

Direct costs of working from home are likely to be moderate or variable,⁹ but this has not been studied well. These costs could result from instituting sick leave policies, maintaining business continuity of operations, and other factors such as staff transportation after hours. These will obviously vary by industry and organisation; for example, teleworking is more suited to service industries than manufacturing.⁹

Secondary effects are also likely to be moderate for working from home (especially compared with business closures), although they would impact disproportionately on small businesses and self-employed people. In a United States survey, self-employed respondents were twice as likely as those who worked for an employer to say that they would experience serious financial difficulties if isolated from work for 7–10 days. Those who were not able to work from home were significantly more likely than those who were able to work from home to experience serious financial problems if isolated from work.³⁸

Working from home is likely to be highly acceptable, especially on a full-pay policy and where computing technology already exists⁹, [Dalton, 2008 #41] and should be considered during the ‘initial action’ stage and onward.

2.5 Voluntary isolation of cases

The objective of voluntary isolation of cases is to reduce transmission by reducing contact between infectious cases and uninfected people.⁹ The few modelling studies that have attempted to measure the impact of isolation of affected cases at home (e.g. in Japan³⁹ and Mexico⁴⁰) suggest that its overall effectiveness is moderate, but may be particularly useful where access to antiviral resources is limited.⁴¹

While the direct costs of voluntary isolation have not been studied in depth, they are thought to be moderate and relate primarily to employment loss as a result of having to stay home from work for 7–10 days in the event of a pandemic influenza outbreak.³⁸ Direct costs are likely to disproportionately affect lower income groups, as would the potential decrease in job security.³⁸ Secondary effects are thought to be moderate, with household members of the index case likely to be at greater risk of acquiring the infection. In addition, those affected by isolation and quarantine are likely to report distress due to fear and risk perceptions, especially if there is a lack of clear guidelines on how to minimise infection at home and in quarantine.⁴²

Acceptability and expectations of voluntary isolation of cases are variable. Willingness to self-isolate varies: surveys in Australia and the United States regularly show at least three-quarters of people willing to stay at home;^{43, 44, 45} however, one United States study showed that less than 10% of students and university staff with acute respiratory infections were willing to self-isolate.⁴⁶ Information about the impact of influenza pandemics can have a positive effect on self-isolation decisions,⁴⁷ and compliance is higher in households who are well informed about quarantine than in those who are not well informed. Consideration may need to be given to support mechanisms such as financial, social, physical, and other needs of the patient and caregivers, if voluntary home isolation of infected cases is used to limit the spread of influenza in the community during a pandemic.⁴⁸

An important practical issue is to precisely define the isolation period. The current standard period for isolation in Australia is 7 days, or until resolution of the fever (if that period is longer).⁴⁹ However, at least one study of the 2009 pandemic influenza has shown that up to one-quarter of patients may be infectious beyond that period,⁵⁰ which suggests that the currently practised standard period of isolation should be reviewed. Self-isolation should be considered during the Initial Action stage and onward.

2.6 Voluntary quarantine of contacts

The aim of isolating household contacts (i.e. quarantine) is to reduce transmission of influenza through seclusion of individuals with potential infection in the home.⁹

Modelling studies show that isolation of household contacts of index cases is moderately effective in reducing the peak case load and in delaying the peak of a pandemic.^{1, 37, 51, 52} Home isolation of direct contacts of index cases could result in a substantial number of people being absent from work, leading to major economic loss for individuals, businesses and the community.⁹ Home isolation of contacts who share the same facilities as index cases significantly increases the risk of acquiring the infection among the contacts, with consequent disruptions to work and society.^{53, 54} Acceptability of quarantine measures is likely to be high in Australia, especially if the public are well informed about the consequences of a pandemic (surveys suggest around 80–98%^{29, 45}); there is also strong public support for quarantine in the United States.⁵⁵

Since those affected by isolation and quarantine are likely to report distress due to fear and risk perceptions,^{42, 56} consideration should be given to support their psychological, financial, social, physical and other needs.⁴⁸ It is particularly important to consider that contacts remain highly susceptible to acquiring the infection from the index cases if they are quarantined in the same rooms and share the same facilities.⁵⁴ Quarantining of household contacts should be considered during the Initial Action stage and onward.

2.8 Cancellation of mass gatherings

The objective of cancelling mass gatherings is to reduce transmission of influenza by limiting the number of potentially ill contacts that an individual is exposed to. It also reduces the chance of developing illness away from home.⁹ Certain types of mass gatherings may be particularly associated with magnified risk of transmission of influenza,⁵⁷ with key factors being event duration, degree of crowding, type of venue, and event timing in relation to the period either side of the epidemic peak.⁵⁸

The direct costs of cancelling a mass event could be substantial. Any decision to cancel an event over a period of time would be controversial because staging events is very expensive and public opinion may be divided on the need for its cancellation. Event organisers, hosts, sponsors and attendees would be directly affected. Secondary economic impacts would be felt, especially by the tourism and hospitality industries.⁹ The issues of financial liability, insurance and compensation would also need to be considered. Contingency plans are usually in place for cancellation of large meetings and mass events, but it is also possible that by applying rigorous containment measures, influenza could be controlled at mass gatherings without cancelling them.⁵⁹

The public should be encouraged to avoid mass gatherings during an epidemic or pandemic but the evidence is not strong enough to advocate legislation or proscription to cancel events. There is some evidence that it is possible to safely organise a mass gathering in the midst of pandemic influenza by taking rigorous control measures.⁵⁹ The public may be prepared for cancellation of mass gathering,²⁹ but acceptability would vary depending on the type and significance of the gathering. For example, in the United States, one study revealed that the public opposed closure of religious gatherings, citing the need for 'shared support and worship during times of crises'.³⁵ To be effective, this measure should be enacted within 10 days before an anticipated peak of an epidemic.

References

1. Bolton KJ, McCaw JM, Moss R, Morris RS, Wang S, Burma A, et al. Likely effectiveness of pharmaceutical and non-pharmaceutical interventions for mitigating influenza virus transmission in Mongolia. *Bulletin of the World Health Organization* 2012;90(4):264–271.
2. Earn DJ, He D, Loeb MB, Fonseca K, Lee BE, Dushoff J. Effects of school closure on incidence of pandemic influenza in Alberta, Canada.[Summary for patients in *Ann Intern Med*. 2012 Feb 7;156(3):I28; PMID: 22312154]. *Annals of Internal Medicine* 2012;156(3):173-181.
3. Yu H, Cauchemez S, Donnelly CA, Zhou L, Feng L, Xiang N, et al. Transmission dynamics, border entry screening, and school holidays during the 2009 influenza A (H1N1) pandemic, China. *Emerg Infect Dis* 2012;18(5):758-766.
4. Wheeler CC, Erhart LM, Jehn ML. Effect of school closure on the incidence of influenza among school-age children in Arizona. *Public Health Reports* 2010;125(6):851–859.
5. Heymann AD, Hoch I, Valinsky L, Kokia E, Steinberg DM. School closure may be effective in reducing transmission of respiratory viruses in the community. *Epidemiology & Infection* 2009;137(10):1369-1376.
6. Chieochansin T MJ SK, Payungporn S, Poovorawan Y. Novel H1N1 2009 influenza virus infection in Bangkok, Thailand:effects of school closures *Asian Biomedicine* October 2009;3(5):469-475.
7. Rodriguez CV, Rietberg K, Baer A, Kwan-Gett T, Duchin J. Association between school closure and subsequent absenteeism during a seasonal influenza epidemic. *Epidemiology* 2009;20(6):787–792.
8. Effler PV, Carcione D, Giele C, Dowse GK, Goggin L, Mak DB. Household responses to pandemic (H1N1) 2009-related school closures, Perth, Western Australia. *Emerging Infectious Diseases* 2010;16(2):205–211.
9. European Centre for Disease Prevention and Control. Guide to public health measures to reduce the impact of influenza pandemics in Europe: ‘The ECDC Menu’; Stockholm, September 2009. Accessed on. Available from: http://www.ecdc.europa.eu/en/publications/Publications/0906_TER_Public_Health_Measures_for_Influenza_Pandemics.pdf
10. Dalton CB, Durrheim DN, Conroy MA. Likely impact of school and childcare closures on public health workforce during an influenza pandemic: a survey. *Communicable Diseases Intelligence* 2008;32(2):261–262.
11. Gift TL, Palekar RS, Sodha SV, Kent CK, Fagan RP, Archer WR, et al. Household effects of school closure during pandemic (H1N1) 2009, Pennsylvania, USA. *Emerging Infectious Diseases* 2010;16(8):1315–1317.
12. Centers for Disease C, Prevention. Impact of seasonal influenza-related school closures on families - Southeastern Kentucky, February 2008. *MMWR - Morbidity & Mortality Weekly Report* 2009;58(50):1405-1409.
13. Chen WC, Huang AS, Chuang JH, Chiu CC, Kuo HS. Social and economic impact of school closure resulting from pandemic influenza A/H1N1. *Journal of Infection* 2011;62(3):200–203.
14. Borse RH, Behraves CB, Dumanovsky T, Zucker JR, Swerdlow D, Edelson P, et al. Closing schools in response to the 2009 pandemic influenza A H1N1 virus in New York City: economic impact on households. *Clinical Infectious Diseases* 2011;52 Suppl 1:S168-172.
15. Centers for Disease C, Prevention. Parental attitudes and experiences during school dismissals related to 2009 influenza A (H1N1) --- United States, 2009. *MMWR - Morbidity & Mortality Weekly Report* 2010;59(35):1131-1134.
16. Berkman BE. Mitigating pandemic influenza: the ethics of implementing a school closure policy. *Journal of Public Health Management & Practice* 2008;14(4):372-378.
17. Jarquin VG, Callahan DB, Cohen NJ, Balaban V, Wang R, Beato R, et al. Effect of school closure from pandemic (H1N1) 2009, Chicago, Illinois, USA. *Emerging Infectious Diseases* 2011;17(4):751–753.
18. Brown ST, Tai JH, Bailey RR, Cooley PC, Wheaton WD, Potter MA, et al. Would school closure for the 2009 H1N1 influenza epidemic have been worth the cost?: a computational simulation of Pennsylvania. *BMC Public Health* 2011;11:353.

19. Cauchemez S, Ferguson NM, Wachtel C, Tegnell A, Saour G, Duncan B, et al. Closure of schools during an influenza pandemic. *The Lancet Infectious Diseases* 2009;9(8):473-481.
20. Egger JR, Konty KJ, Wilson E, Karpati A, Matte T, Weiss D, et al. The effect of school dismissal on rates of influenza-like illness in New York City schools during the spring 2009 novel H1N1 outbreak. *Journal of School Health* 2012;82(3):123-130.
21. Halder N, Kelso JK, Milne GJ. Developing guidelines for school closure interventions to be used during a future influenza pandemic. *BMC Infectious Diseases* 2010;10:221.
22. Orellano PW, Grassi A, Reynoso JI, Palmieri A, Uez O, Carlino O. [Impact of school closings on the influenza A (H1N1) outbreak in Tierra del Fuego, Argentina]. *Pan American Journal of Public Health* 2010;27(3):226-229.
23. Glass RJ, Glass LM, Beyeler WE, Min HJ. Targeted social distancing design for pandemic influenza. *Emerging Infectious Diseases* 2006;12(11):1671-1681.
24. Sypsa V, Hatzakis A. School closure is currently the main strategy to mitigate influenza A(H1N1)v: a modeling study. *Euro Surveillace: Bulletin Europeen sur les Maladies Transmissibles = European Communicable Disease Bulletin* 2009;14(24):18.
25. Kawaguchi R, Miyazono M, Noda T, Takayama Y, Sasai Y, Iso H. Influenza (H1N1) 2009 outbreak and school closure, Osaka Prefecture, Japan. *Emerging Infectious Diseases* 2009;15(10):1685.
26. Jackson C, Mangtani P, Vynnycky E, Fielding K, Kitching A, Mohamed H, et al. School closures and student contact patterns. *Emerging Infectious Diseases* 2011;17(2):245-247.
27. Miller JC, Danon L, O'Hagan JJ, Goldstein E, Lajous M, Lipsitch M. Student behavior during a school closure caused by pandemic influenza A/H1N1. *PLoS ONE [Electronic Resource]* 2010;5(5):e10425.
28. Halder N, Kelso JK, Milne GJ. Cost-effective strategies for mitigating a future influenza pandemic with H1N1 2009 characteristics. *PLoS ONE [Electronic Resource]* 2011;6(7):e22087.
29. Eastwood K, Durrheim D, Francis JL, d'Espaignet ET, Duncan S, Islam F, et al. Knowledge about pandemic influenza and compliance with containment measures among Australians. *Bulletin of the World Health Organization* 2009;87(8):588-594.
30. Lee BY, Brown ST, Cooley P, Potter MA, Wheaton WD, Voorhees RE, et al. Simulating school closure strategies to mitigate an influenza epidemic. *Journal of Public Health Management & Practice* 2010;16(3):252-261.
31. Uchida M, Tsukahara T, Kaneko M, Washizuka S, Kawa S. How the H1N1 influenza epidemic spread among university students in Japan: experience from Shinshu University. *American Journal of Infection Control* 2012;40(3):218-220.
32. Zhang T, Fu X, Ma S, Xiao G, Wong L, Kwok CK, et al. Evaluating temporal factors in combined interventions of workforce shift and school closure for mitigating the spread of influenza. *PLoS ONE [Electronic Resource]* 2012;7(3):e32203.
33. Sasaki A, Hoen AG, Ozonoff A, Suzuki H, Tanabe N, Seki N, et al. Evidence-based tool for triggering school closures during influenza outbreaks, Japan. *Emerging Infectious Diseases* 2009;15(11):1841-1843.
34. Rousculp MD, Johnston SS, Palmer LA, Chu BC, Mahadevia PJ, Nichol KL. Attending work while sick: implication of flexible sick leave policies. *Journal of Occupational and Environmental Medicine* 2010;52(10):1009-1013.
35. Baum NM, Jacobson PD, Goold SD. "Listen to the people": public deliberation about social distancing measures in a pandemic. *American Journal of Bioethics* 2009;9(11):4-14.
36. Mao L. Evaluating the combined effectiveness of influenza control strategies and human preventive behavior. *PLoS ONE [Electronic Resource]* 2011;6(10):e24706.
37. Miyaki K, Sakurazawa H, Mikurube H, Nishizaka M, Ando H, Song Y, et al. An effective quarantine measure reduced the total incidence of influenza A H1N1 in the workplace: another way to control the H1N1 flu pandemic. *Journal of Occupational Health* 2011;53(4):287-292.
38. Blake KD, Blendon RJ, Viswanath K. Employment and compliance with pandemic influenza mitigation recommendations. *Emerging Infectious Diseases* 2010;16(2):212-218.
39. Yasuda H, Suzuki K. Measures against transmission of pandemic H1N1 influenza in Japan in 2009: simulation model. *Euro Surveillace: Bulletin Europeen sur les Maladies Transmissibles = European Communicable Disease Bulletin* 2009;14(44).

40. Velasco-Hernández JX, Leite MC. A model for the A(H1N1) epidemic in Mexico, including social isolation. *Salud Publica de Mexico* 2011;53(1):40–47.
41. Lee S, Chowell G, Castillo-Chavez C. Optimal control for pandemic influenza: the role of limited antiviral treatment and isolation. *Journal of Theoretical Biology* 2010;265(2):136–150.
42. Johal SS. Psychosocial impacts of quarantine during disease outbreaks and interventions that may help to relieve strain. *New Zealand Medical Journal* 2009;122(1296):47–52.
43. Loustalot F, Silk BJ, Gaither A, Shim T, Lamias M, Dawood F, et al. Household transmission of 2009 pandemic influenza A (H1N1) and nonpharmaceutical interventions among households of high school students in San Antonio, Texas. *Clinical Infectious Diseases* 2011;52 Suppl 1:S146-153.
44. Teh B, Olsen K, Black J, Cheng AC, Aboltins C, Bull K, et al. Impact of swine influenza and quarantine measures on patients and households during the H1N1/09 pandemic. *Scandinavian Journal of Infectious Diseases* 2012;44(4):289–296.
45. McVernon J, Mason K, Petrony S, Nathan P, LaMontagne AD, Bentley R, et al. Recommendations for and compliance with social restrictions during implementation of school closures in the early phase of the influenza A (H1N1) 2009 outbreak in Melbourne, Australia. *BMC Infectious Diseases* 2011;11:257.
46. Mitchell T, Dee DL, Phares CR, Lipman HB, Gould LH, Kutty P, et al. Non-pharmaceutical interventions during an outbreak of 2009 pandemic influenza A (H1N1) virus infection at a large public university, April-May 2009. *Clinical Infectious Diseases* 2011;52 Suppl 1:S138-145.
47. Kavanagh AM, Bentley RJ, Mason KE, McVernon J, Petrony S, Fielding J, et al. Sources, perceived usefulness and understanding of information disseminated to families who entered home quarantine during the H1N1 pandemic in Victoria, Australia: a cross-sectional study. *BMC Infectious Diseases* 2011;11:2.
48. Bennett B. Legal rights during pandemics: federalism, rights and public health laws--a view from Australia. *Public Health* 2009;123(3):232-236.
49. (DoHA) AGDoHaA. Australian Health Management Plan for Pandemic influenza, 2008.
50. Chin BS, Chae YT, Choi HK, Baek JH, Jin SJ, Shin SY, et al. Viral shedding of 2009 pandemic H1N1 and evaluation of quarantine recommendations. *Japanese Journal of Infectious Diseases* 2012;65(2):105–110.
51. Haber MJ, Shay DK, Davis XM, Patel R, Jin X, Weintraub E, et al. Effectiveness of interventions to reduce contact rates during a simulated influenza pandemic. *Emerging Infectious Diseases* 2007;13(4):581–589.
52. Navarro-Robles E, Martinez-Matsushita L, Lopez-Molina R, Fritz-Hernandez J, Flores-Aldana BA, Mendoza-Perez JC. [Model to estimate epidemic patterns of influenza A (H1N1) in Mexico]. *Pan American Journal of Public Health* 2012;31(4):269-274.
53. van Gemert C, Hellard M, McBryde ES, Fielding J, Spelman T, Higgins N, et al. Intrahousehold transmission of pandemic (H1N1) 2009 virus, Victoria, Australia. *Emerging Infectious Diseases* 2011;17(9):1599–1607.
54. Chu CY, Li CY, Zhang H, Wang Y, Huo DH, Wen L, et al. Quarantine methods and prevention of secondary outbreak of pandemic (H1N1) 2009. *Emerging Infectious Diseases* 2010;16(8):1300–1302.
55. Tracy CS, Rea E, Upshur RE. Public perceptions of quarantine: community-based telephone survey following an infectious disease outbreak. *BMC Public Health* 2009;9:470.
56. Gostin L. Public health strategies for pandemic influenza: ethics and the law. *JAMA* 2006;295(14):1700-1704.
57. Ishola DAJ PN. Could influenza transmission be reduced by restricting mass gatherings? Towards an evidence-based policy framework. *Journal of Epidemiology and Global Health* 2011;1:33-60.
58. Shi P, Keskinocak P, Swann JL, Lee BY. The impact of mass gatherings and holiday traveling on the course of an influenza pandemic: a computational model. *BMC Public Health* 2010;10:778.
59. Lim HC, Cutter J, Lim WK, Ee A, Wong YC, Tay BK. The influenza A (H1N1-2009) experience at the inaugural Asian Youth Games Singapore 2009: mass gathering during a developing pandemic. *British Journal of Sports Medicine* 2010;44(7):528–532.

