Evidence Review – Influenza vaccination and healthcare workers (HCW)

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NSW GOVERNMENT

NSW Ministry of Health
73 Miller Street
NORTH SYDNEY NSW 2060
Tel. (02) 9391 9000
Fax. (02) 9391 9101
TTY. (02) 9391 9900
www.health.nsw.gov.au

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Overview

The hospital patient population has high rates of serious underlying illnesses, making influenza more dangerous in this setting. Annual healthcare worker (HCW) vaccination against influenza is an important adjunct to infection control practices, with seasonal influenza immunisation providing effective influenza protection for HCW when antigenically well matched to circulating strains. Voluntary annual influenza campaigns fail to achieve sufficient uptake amongst HCW, thus mandatory programs are being introduced to protect vulnerable patients, HCW, and their families.

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What is the risk of influenza among HCW and patients?

• Influenza infects 10 per cent of unvaccinated adults each year

Influenza is an important cause of morbidity and mortality in most communities every winter. A recent systematic review of influenza vaccine randomised control trials estimated that approximately 20 per cent of unvaccinated children and 10 per cent of unvaccinated adults were infected by seasonal influenza annually, with rates of symptomatic influenza roughly half of these estimates (1).

• Hospital patients are more vulnerable to severe influenza complications

The hospital patient population is more likely to have risk factors for severe influenza, such as immune suppression, chronic respiratory and cardiovascular diseases, and diabetes, and so are at greater risk of influenza infection when in hospital for other reasons (2). Older patients have higher clinical attack rates during hospital outbreaks of influenza (3), due in part to the lower effectiveness of influenza vaccines in people aged over 65 years (4).

• HCW may be at increased risk of influenza infection through their work – the research is inconclusive

Because of their contact with patients or infective material from patients, many HCW are at risk for exposure to (and possible transmission of) vaccine-preventable diseases, such as influenza. There is debate about whether the risk to a HCW of acquiring influenza at work is significantly greater than their risk of acquiring influenza in other settings.

Two studies during the 2009 influenza pandemic investigated whether HCW were at greater risk of contracting pandemic influenza than either non-clinical hospital workers (5), or people working in 'office-type' environments not associated with health care (6). Both studies found no overall difference in influenza infection rates between HCW and their comparison groups, but their findings may not be generalizable to seasonal influenza epidemics where infection control practices are likely to be different. Interestingly, both studies showed that the risk of influenza varied among HCW. The first study by Marshall et al. showed wearing gloves during clinical care reduced the risk of infection, and working in an intensive care unit increased the risk of infection. The second study by Kuster et al. found that adherence to hand hygiene recommendations reduced the risk of infection while exposure to aerosol-generating medical procedures increased the risk.

Other studies have suggested higher rates of influenza-like illness in HCW than would be expected in the community based on self-report (7), and high rates of sero-conversion to influenza at the end of an influenza season (8).

One study which looked at confirmed influenza during the 2007–08 influenza season in Berlin, Germany found no association between HCW status and overall influenza risk but found HCW were at slightly higher risk of reporting any respiratory infection (9). They also found that only 28 per cent of true influenza cases reported an influenza-like illness and suggested that HCW cannot rely on this syndrome to guide their actions in protecting their patients (such as by taking sick leave).

Whether influenza is acquired at work or in the community, infected HCW may become an important source of influenza infection for their vulnerable patients.

• Vulnerable patients in healthcare facilities are put at risk by influenza outbreaks

Influenza can cause explosive outbreaks in hospitals because of its short incubation period and efficient spread from person to person. During periods of increased influenza activity in the community and subsequent higher numbers of patients with influenza in hospitals, the risk increases for nosocomial transmission from infected patients, healthcare workers, other hospital employees, or visitors.

Nosocomial influenza outbreaks are regularly reported but are still likely to be substantially under-recognised. Serious outbreaks occur frequently in residential aged care facilities, but hospital outbreaks have been well described in a range of settings including general adult and paediatric wards, renal, transplant and oncology units, and neonatal and adult intensive care units (10,11,12).

In NSW in 2017 there were 591 laboratory-confirmed influenza outbreaks reported in institutions, including 43 (7.3%) in hospitals and 536 (90.7%) in residential aged care facilities (unpublished data, NSW Health influenza surveillance program).

Patients with underlying risk factors for severe

influenza are at greater risk of acquiring infection through nosocomial transmission. An analysis of the national FluCAN sentinel hospital surveillance system for acute respiratory disease requiring hospitalisation for 2010-2011 identified 26 cases of nosocomial influenza (4.3% of all hospitalised influenza cases), including two deaths (2). All of these patients had chronic co-morbidities and were significantly more likely to be immunosuppressed or have an underlying malignancy. Where vaccination status was known, over a third had been vaccinated against influenza in the current season. A similar study in the United Kingdom involving 75 hospitals found that 2.0 per cent of hospitalised influenza patients (30/1520 cases) had nosocomial influenza, with 80 per cent of adults and 93 per cent of children having serious underlying illnesses (13).

- **Infected HCW have been linked to influenza outbreaks in healthcare facilities**

While the source of hospital-acquired (nosocomial) influenza transmission may not always be clear, HCW have been implicated in the transmission of influenza to inpatients (14,15), and this can lead to hospital outbreaks. One review of nosocomial influenza outbreak reports found probable transmission by HCW was documented in 10 (36%) of the 28 studies reported (16).

Influenza outbreaks not only cause harm to affected patients and staff members, but also disrupt patient services through staff absenteeism and service cancellations (17).

- **Influenza is spread from person to person, either by respiratory droplets or by direct or indirect contact with infected hands, meaning HCW and patients are at risk from each other**

While there is agreement that influenza is transmitted from the respiratory tract of an infected person both directly through the airborne spread of respiratory droplets or indirectly through contact with surfaces contaminated by those droplets, the relative importance of each remains a matter of debate.

The close interactions between HCW and patients provide opportunities for transmission of influenza from both routes. While standard infection control precautions, such as hand hygiene and respiratory etiquette, will reduce the risk of influenza spreading from infected HCW to patients in hospital settings, these precautions are not full-proof or universally applied.

- **Studies confirm HCW regularly come to work with respiratory symptoms**

One argument used to question the need to increase influenza vaccination rates among HCW is that HCW can simply avoid patient contact when ill as is widely recommended. Although HCW may report a willingness to comply with this recommendation, in reality many HCW routinely come to work with symptoms of influenza-like illness putting vulnerable patients at risk.

In one national US survey of HCW during the 2014-2015 influenza season, among the 22 per cent of HCW with self-reported ILI, 41 per cent reported working during their illness for a median duration of three days (18). An earlier survey in a US hospital found over three quarters of hospital employees with an influenza-like illness cared for patients while ill (19).

Illness in HCW may also be under-reported because these people are highly motivated and typically do not want to burden co-workers, consider their roles important, and may not feel ill enough to stay home.

- **Influenza can be spread before symptoms start and possibly also spread from asymptomatic infections**

HCW may also be unaware that they are infectious to others. Healthy adults are able to infect others beginning one day before their symptoms start (20), and an estimated 16 to 50 per cent of influenza cases are asymptomatic (1,20). More than a half of asymptomatic influenza cases shed the virus for at least three days (22), suggesting a significant potential for influenza virus transmission from infected persons to their close contacts even in the absence of clinical symptoms.

What is the impact of HCW influenza immunisation on the risk of influenza for HCW and their patients?

- **Influenza vaccines are effective but the level of protection they provide depends upon their match to the strains circulating each winter**

When antigenically well-matched, seasonal influenza immunisation provides safe and effective influenza prevention for HCW. A recent Cochrane review of randomised control trials over many seasons estimated that influenza vaccines had a efficacy against laboratory-confirmed influenza of

59 per cent (RR 0.41, 95% CI 0.36-0.47) for healthy individuals aged 16 to 65 years (23).

During seasons where one or more of the circulating influenza virus strains shows significant drift away from the vaccine strains, influenza vaccine effectiveness in the community is usually reduced.

- **HCW influenza vaccine efficacy studies have consistently demonstrated personal protection and reduced absenteeism**

A recent systematic review of HCW influenza vaccination studies showed an overall vaccine efficacy against laboratory-confirmed cases of 60% (pooled RR 0.40, 95% CI 0.23-0.69) (24), similar to the Cochrane review estimate (23). It also found that while the overall incidence of absenteeism was not changed by vaccine, ILI absenteeism was significantly reduced and the duration of absenteeism was also shortened.

One older systematic review also concluded that HCW vaccination was effective with minimal adverse effects, and an accompanying economic evaluation found HCW vaccination was cost saving, estimated at £12 per vaccinee (25). In the most pessimistic scenario it cost £405 per patient life-year gained.

- **Staff influenza vaccination has a protective effect on residents of aged care facilities, but there are few controlled studies on the effect of HCW influenza vaccination on hospital patient outcomes**

Increased vaccine uptake by HCW has been shown to reduce morbidity and mortality in aged care residents. Four landmark randomised controlled studies of the impact of HCW vaccination on morbidity and mortality in these facilities have demonstrated substantial decreases in all-cause mortality and influenza-like illness (26,27,28,29). However, some have argued that the magnitude of the effects reported in these studies is overstated (30). One Cochrane review concluded that these studies were at risk of bias, but supported the conclusion that influenza vaccination of HCW in settings in which residents are also vaccinated provided significant reductions in deaths among elderly patients from all causes and deaths from pneumonia (31). It also concluded that additional randomised controlled trials are needed and this applies to hospital settings also.

While there is a lack of randomised control studies examining the effect of HCW influenza vaccination on influenza transmission in hospital settings, there are a range of observational studies such as the study which reported a decrease in nosocomial, laboratory-confirmed influenza in a hospital after a new mobile HCW vaccination program had led to an increase in HCW vaccination rates (32).

The US Advisory Committee on Immunization Practices has concluded that the evidence from studies examining the association between influenza outbreaks in hospitals and residential aged care facilities and low vaccination rates among HCW and other staff is strong enough to recommend routine annual vaccination for these workers to protect patients and residents (33).

- **It is difficult to conduct randomised controlled trials on the impact of HCW influenza vaccination on patient outcomes when annual vaccination for HCW is widely recommended**

The Australian Immunisation Handbook recommends that all health care providers (particularly those of immunocompromised patients) have annual influenza vaccinations (34). This recommendation is endorsed by the Australian NH&MRC and is also reflected in advice from the World Health Organization (WHO), the Canadian National Advisory Committee on Immunization, the United States CDC and at least 19 European countries (35).

Randomised controlled studies to examine HCW vaccine efficacy in preventing influenza in patients and other specific clinical outcomes would require a 'control' arm of the study where some HCW participants are randomly assigned to not receive the vaccine. As recommendations for HCW to be vaccinated against influenza each year are so widely endorsed it is difficult to see how such studies could be conducted.

- **Requiring facemask use by unvaccinated HCW is likely to reduce the risk of infection for patients and HCW but larger studies are needed to confirm**

The policy to require non-vaccinated HCW working in high-risk clinical areas to wear surgical masks during the influenza season while working with patients aims to reduce the risk of inadvertent transmission of influenza to patients.

The use of facemasks is already recommended in a range of clinical situation to reduce the risk of infection of patients (such as during surgical

procedures) and HCW (such as when performing aerosol generating procedures). While facemasks will not completely remove the risk of influenza transmission to patients they constitute a barrier that reduces the dispersal of cough-related droplets. The consistent use of facemasks by people with acute respiratory illnesses has been linked to reduced risk of influenza and/or other respiratory illness in close contacts in a range of settings, particularly when performed with hand hygiene (36,37,38,39).

Unvaccinated HCW are also a group more vulnerable to influenza. A number of studies have suggested that the consistent use of facemasks in exposed households or by HCW in clinical settings reduces their risk of infection from respiratory viruses (although not as much as with use of P2 respirators), but these studies have been underpowered to give definitive results (40,41,42).

- **Mandatory HCW influenza vaccination programs achieve high coverage**

Mandatory vaccination policies appear to successfully capture a large portion of HCW who are not opposed to receipt of the vaccine but who have not made vaccination a priority. Many voluntary HCW vaccination programs with years of intensive vaccination campaigns focused on increasing accessibility and convenience fail to achieve coverage rates above 60 per cent, unlike mandatory influenza vaccination programs for HCW which report high vaccination rates and low rates of HCW exemption requests or resignations (43,44,45).

Programs for mandatory influenza vaccination for HCW are well-advanced in North America, either by institution or by jurisdiction, and there are growing calls for their introduction in Europe (46,47).

Conclusions

Influenza is an important cause of morbidity and mortality in most communities every winter but it poses special hazards inside healthcare facilities. Because of its short incubation period and efficient respiratory spread from person to person, influenza can cause explosive outbreaks of febrile respiratory illness. The hospital patient population has high rates of serious underlying illnesses, making influenza more dangerous in this setting.

Influenza infections in hospital HCW may lead to nosocomial outbreaks, particularly in immunocompromised or otherwise vulnerable patients. Infections in staff members also leads to staff shortages which can impact services and patient care, and result in higher hospital expenditures.

While the source of nosocomial influenza transmission may not be clear, HCW have been implicated in the transmission of influenza to inpatients. Annual HCW vaccination against influenza is an important adjunct to infection control practices, with seasonal influenza immunisation providing effective influenza protection for HCW when antigenically well matched.

Increased influenza vaccine uptake by HCW has been shown to reduce the impact of influenza in aged care residents and would reasonably be assumed to have similar protective effects for vulnerable hospitalised patients, although randomised studies are lacking. HCW influenza vaccination and infection control measures aimed at reducing the risk that people infected with influenza will expose hospitalised patients are particularly important as this group tends to be more vulnerable to severe influenza.

Hospitalised patients are also likely to have low immunity against influenza because the vaccine is contraindicated for some (such as infants aged under 6 months), and is less effective for others (such as older people and those who are immunocompromised).

There is a growing consensus in Australia and globally that all health care providers should have annual influenza vaccinations to protect their patients, their families and themselves. Currently available inactivated influenza vaccines provide moderate to high levels of protection in most adults for most years with a low rate of adverse events. Inactivated influenza vaccine cannot cause an influenza infection.

Where contraindications for influenza vaccination exist, the consistent use of medical facemasks during clinical care, particularly in high-risk settings, is likely to be an important addition to other standard precautions for infection control, such as hand hygiene, to help reduce the risk of inadvertent nosocomial transmission of influenza to vulnerable patients.

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