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# Vaccination of healthcare workers to protect patients at increased risk of acute respiratory disease: summary of a systematic review

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Healthcare workers (HCWs) are at increased risk of exposure to respiratory pathogens and may transmit infection to vulnerable patients. This study summarises a recent systematic review, which aimed to assess evidence that influenza or pneumococcal vaccination of HCWs provides indirect protection for those patients most at risk of severe or complicated acute respiratory infection. A number of healthcare databases and sources of grey literature were searched using a predefined strategy, and citations screened for eligibility in accordance with specified inclusion criteria. Risk of bias was assessed using validated tools and results summarised qualitatively. Twenty papers were included in the final review, all of which considered influenza vaccination of HCW. As such, planned subanalysis of pneumococcal vaccination was discarded. The majority of primary research studies included (11/14) were conducted in long-term care facilities, but there was marked heterogeneity in terms of the population, intervention/exposure and outcomes considered. Consistency in the direction of effect was observed across several different outcome measures, suggesting that influenza vaccination of HCWs is likely to offer some protection. Further evidence is, however, required from acute care settings.

**Keywords** Vaccination, Medical staff, Influenza, Human, Transmission, Patients, Public health.

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## Introduction

Respiratory pathogens cause significant morbidity and mortality, particularly amongst those vulnerable to severe or complicated infection. Evidence-based strategies for the prevention and control of respiratory infection are therefore essential. Healthcare workers are likely to be at increased risk of exposure and may transmit respiratory infections to their patients through the very nature of their work. Indeed, a number of outbreaks of respiratory illness have been described in healthcare settings,[1–10] often involving healthcare workers. Both influenza and pneumococcal infections are important causes of acute respiratory disease and are vaccine preventable. Whilst there is generally considered to be insufficient evidence for the routine use of pneumococcal vaccine amongst healthcare workers, influenza vaccination has been widely recommended.[11,12] Despite efforts to encourage influenza vaccination, however, coverage has been historically poor and ethical arguments for mandatory vaccination have been raised, focusing not only on direct protection for workers themselves, but indirect protection for those they care for. To date, evidence for the indirect protection of vulnerable groups following either influenza or pneumococcal vaccination of healthcare workers has been uncertain. The following article summarises a recently published systematic review that addresses this issue. The primary manuscript can be accessed for further detail through the following citation: 'Dolan et al. Vaccination of HealthCare Workers to Protect Patients at Increased Risk for Acute Respiratory Disease. EID 2012;**18**(8):1225–1234.'

## Methods

Multiple electronic healthcare databases, sources of evidence-based reviews, guidelines and grey literature were searched using a pre-defined, peer-reviewed search strategy. A three-stage process was used to assess eligibility for inclusion, screening citations first by title, then abstract and then full text. Inclusion criteria considered appropriate study design, subject population (patients of all ages at higher risk of severe

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or complicated illness as a result of acute respiratory infection), intervention (influenza or pneumococcal vaccination of any person providing health care to higher risk groups), and outcomes (cases or consultations, death or hospitalisation for acute respiratory disease, influenza, influenza-like-illness (ILI) or pneumococcal disease). A number of validated tools were used to assess the risk of bias at outcome level, and data were synthesised qualitatively using a narrative approach.

## Results

A total of 12 352 citations were identified (10 713 from healthcare databases and the remainder from additional sources). No articles considering pneumococcal vaccination were identified, but twenty studies addressing the effect of influenza vaccination of healthcare workers met the inclusion criteria. Fourteen (70%) of the 20 studies were primary research articles (four randomised controlled trials and ten observational studies) and six different reports of two pre-existing systematic reviews. There was marked heterogeneity in the populations, interventions/exposures and outcomes considered. The majority (11/14) of the primary research papers were conducted in long-term residential care settings with the remainder conducted in a renal dialysis facility (1 study);[13] a paediatric hospital (1 study);[14] and an adult oncology hospital (1 study).[15] All identified studies were judged to be at some risk of bias. Table 1 summarises the qualitative synthesis of evidence for each specified outcome measure.

## Conclusion

Since no articles considering pneumococcal vaccination of healthcare workers were identified, findings from this review were restricted to influenza vaccination only. They highlight that evidence for the effectiveness of influenza vaccination of healthcare workers in providing indirect protection for vulnerable groups is limited. Studies were primarily conducted amongst long-term residential care settings, thus presenting challenges for direct extrapolation of the findings to other at risk groups, and to short-stay acute care settings. Two previous systematic reviews[23,28] indicate that influenza vaccination of healthcare workers might be effective in reducing death and ILI amongst residents of elderly care homes, but the authors concluded that evidence was lacking and confined to non-specific outcome measures. This review considers additional observational data and indicates in general, a uniform direction of effect across multiple outcome measures, suggesting that influenza vaccination of healthcare workers is likely to offer some protection to vulnerable patients. Whilst this provides further evidence to support current recommendations for vaccinating healthcare workers against influenza, it should be considered alongside ethical arguments (particularly the balance between autonomy and non-maleficence) when formulating policy decisions. Future well-designed studies that strengthen the existing evidence base (especially amongst other at risk groups and in acute care settings) might, however, encourage compliance with guidelines and result in improved uptake. Studies concerning the effect of pneumococcal vaccine should also be considered. In practice, both influenza and pneumococcal vaccination should be seen as important elements of a broad package of infection prevention and control measures including good hand and respiratory hygiene, environmental cleaning, protection against respiratory droplets and cohorted care during outbreaks.[29,30]

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## Author contributions

Protocol design: GD, RCH, RH, JSN-V-T; Execution of search strategy & screening: GD, RCH, MM, HH, LB, YC, SE, SM, JT, JP, AZ, RH; Risk of bias assessment & acquisition of data: GD, RCH, MC, RS, GM, MM, HH, LS; Analysis & interpretation of data: GD, JVT; Manuscript preparation: GD, RCH, JSN-V-T; Final manuscript approval: All listed authors have read and approved the final manuscript.

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**Table 1.** Summary of findings by outcome measure

| Outcome | Evidence available | Narrative synthesis |
|---|---|---|
| Acute respiratory disease | Statistical estimates from one randomised controlled trial[16] providing two different measures of effect (clinical episodes of viral illness/lower respiratory tract infection). | Inconsistent effect but uniform in direction, suggesting possible protection. Difficult to ascertain whether this may be attributable to influenza infection due to the non-specific nature of the measures used. |
| Clinically defined cases of influenza-like-illness (ILI) | Statistical estimates of clinically defined ILI from three randomised controlled trials[16–18] and two prospective cohort studies.[19,20] Additional statistical estimate of cases of influenza from one cross-sectional study[21] and observational data from two further studies providing no statistical estimates.[13,22] | Pooled data[23] from the three randomised controlled trials suggest a statistically significant protective effect when adjusted for clustering. This is supported by observational data, of which two of the five remaining studies also demonstrate statistically significant reductions in risk,[19,20] although noted to be at higher risk of bias. |
| GP consultations for ILI | Statistical estimate from one randomised controlled trial.[18] | Inconsistent effect across different seasons. Small, statistically significant reduction in the rate of consultations for one season only, although overall statistically significant, protective effect when converted to an adjusted odds ratio.[23] |
| Outbreaks/clusters of ILI | Statistical estimates from three observational studies.[20,24,25] | All three studies demonstrate statistically significant, protective effects, although different ILI definitions employed, imprecise estimates and a high risk of bias. |
| Laboratory diagnosed influenza | Statistical estimates from one randomised controlled trial[26] and two observational studies.[14,15] Observational data, with no statistical analysis from a further randomised controlled trial.[16] | Pooled data from the two RCTs[23] suggest a small non-significant protective effect. Direction of effect supported by data from two additional observation studies[14,15] which demonstrate statistically significant protective effects. Notable risk of bias and imprecision due to very small sample sizes. |
| Laboratory confirmed outbreaks of influenza | Statistical estimate from one observational study.[27] | No statistically significant difference although vaccination coverage appeared higher in homes experiencing outbreaks. Analyses are, however, unadjusted and imprecise due to small numbers. |
| Respiratory mortality | Statistical estimates from four randomised controlled trials[16–18,26] although each provides a different measure (deaths associated with pneumonia,[16] respiratory deaths,[17] deaths with ILI[18] and laboratory diagnosed influenza at death.[26]) | Pooled estimates[23] using data for deaths associated with pneumonia[16] and respiratory deaths[17] suggest a small, non-significant protective effect. Small non-significant protective effects for mortality following ILI[18] and mortality due to laboratory confirmed influenza[26] are also demonstrated in individual studies. |
| All-cause mortality | Statistical estimate from four randomised controlled trials.[16–18,26] | Inconsistent effect, but uniform in direction. Pooled data[23] suggest a statistically significant, protective effect when adjusted for clustering. |
| Hospitalisation | Statistical estimates from two randomised controlled trials[17,18] providing three different measures of effect (hospitalisation,[17,18] hospitalisation for respiratory causes[17] and admission with ILI.[18]) | No clear effect demonstrated. |

## Conflict of interest

The University of Nottingham Health Protection Research Group is currently in receipt of research funds from Glaxo-SmithKline (GSK). The group has recently accepted an unrestricted educational grant for influenza research from F. Hoffmann- La Roche. Research on influenza funded by an unrestricted educational grant from Astra-Zeneca is also underway. JSN-V-T has given a talk on a related topic for which expenses were paid by the European Society for Clinical Microbiology and Infectious Diseases; he has received speaker honoraria from Sanofi-Pasteur, MSD, F. Hoffmann- La Roche and GSK; and remuneration for consultancy work from Baxter AG, GSK, F. Hoffmann-La Roche, Novartis and Solvay. All such paid consultancy and speaker engagements ceased in September 2010. JSN-V-T is a former employee of SmithKline Beecham, F. Hoffmann-La Roche and Sanofi-Pasteur MSD, all prior to 2005. RH is currently working on a project funded by

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Astra-Zeneca, which considers attitudes to the use of intranasal influenza vaccine. RCH serves as a consultant for GlaxoSmithKline (GSK) Vaccines, which began after major contributions to manuscript. GPD has no potential conflicts to declare.

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