

Factors affecting influenza vaccine uptake among health care workers

F. W. O'Reilly¹, G. W. Cran² and A. B. Stevens³

Background	In 2000, the UK Departments of Health recommended influenza immunization to employees directly involved in patient care. Uptake of this immunization had tended to be variable and usually low.
Aims	To assess personal and organizational factors associated with influenza immunization uptake among Health Care Workers (HCWs).
Methods	A cross-sectional survey of all HCWs within the Health and Social Care Trusts in Northern Ireland and a parallel-group study of nursing staff within Elderly Care using self-administered questionnaires.
Results	Of 203 nurses working in elderly care units 76(37%) were immunized and 127(63%) declined. Almost 70% of those not immunized perceived themselves to be 'healthy' and gave this reason for declining immunization. Nurses were more likely to be immunized by a factor of four if they believed there was benefit for healthy HCWs, three if they felt at-risk of contracting influenza and nine on a recommendation from the occupational health (OH) unit. Fifteen OH units participated in a survey of HCWs at the time of immunization. Five thousand two hundred and thirty (9.7%) HCWs were immunized. Increased uptake was correlated with immunization in area of work ($r = 0.74$, $P = 0.02$) and when provided out of hours ($r = 0.83$; $P < 0.001$) and by a factor of two with individual targeting of availability ($P < 0.001$) and when individuals had been previously immunized ($P < 0.001$).
Conclusion	Uptake of influenza immunization is low. Attitudes to one's health and to the value of influenza immunization affect the uptake as does the delivery of the immunization programme.
Key words	Absenteeism; attitude; health care sector; health personnel; immunization; influenza; influenza vaccine; sick leave; workplace.

Introduction

Influenza transmission, in health care settings, presents a risk to both staff and patients [1,2]. Immunization may have a role in reducing morbidity and mortality, both for patients and staff [3–7]. There has been a trend to recommend immunization of Health Care Workers (HCWs) in Western Countries. Since 1984 guidance in the USA has recommended immunization of HCWs who have extensive contact with persons in high-risk groups [8]. Comparison of the policies of 28 European countries in 1995 showed that most advocate immunization of HCWs [9].

The UK Departments of Health produced guidance since 2000, advising influenza immunization for employees directly involved within patient care [10]. During that year, occupational health (OH) units servicing all 19 Health & Social Service Trusts in

the health care region of Northern Ireland organized influenza immunization programmes using differing approaches. The uptake of immunization varied between the trusts, with an overall average of 13% [11]. Studies from countries world wide have documented immunization rates in a range from 2 to 60% among HCWs [12–20]. The health service in Northern Ireland was set an immunization target, for the 2001/2002 season, of 20% [21].

Research elsewhere has identified personal and organizational factors that influence uptake of influenza immunization by HCWs [12–15,20,22]. The aim of this study was to determine those factors that influence uptake of influenza immunization in HCWs in Northern Ireland. Part one investigated personal factors and the second part investigated organizational factors.

Methods

Part one

This was a comparison of a cohort of nurses working in care of the elderly units at three Belfast hospitals, who

¹Rolls Royce plc, Derby, UK.

²Department of Epidemiology & Public Health, Queen's University, Belfast, UK.

³Department of Risk and Occupational Health, Royal Hospitals Trust, Belfast, UK.

Correspondence to: F. W. O'Reilly, Rolls Royce plc, PO Box 31, Derby DE24 8BJ, UK. e-mail: frank.o'reilly@Rolls-Royce.com

had either participated or not, in an immunization programme. Immunization was made available to all nursing staff in these units, through clinics provided in ward areas. The investigation was undertaken over six weeks from the beginning of October 2001 onwards.

All nursing staff, on day and night duty, were notified of the immunization programme's availability by a direct approach. Clinic attendees were requested to complete a self-administered questionnaire at the time of the immunization. Those staff members on duty, who did not attend, were identified and asked to complete the same questionnaire. Those staff members on leave or off-duty, when the clinics were run, were not included in the investigation. The questionnaire enquired about demographic details, whether the individual had accepted immunization or not and the reason(s) for acceptance/non-acceptance. Nine statements assessed knowledge and attitudes to influenza immunization, using Likert scales for responses. Responses were also aggregated to create dichotomous variables and compared using odds ratios (OR).

Part two

Organizational factors were assessed, by comparing the programme of vaccine delivery offered, by different OH units within Northern Ireland, during the 2001/2002 influenza season. These OH units covered approximately 55 000 HCWs. All OH units in the region agreed to participate. All HCWs, who were immunized by participating OH units, were requested to complete a self-administered questionnaire at the time of the immunization programme.

This questionnaire requested information on the occupational group of the vaccinee, area of work, demographic details, how they became aware of the immunization programme and where they were immunized. Information was also requested from employing trusts on total staff numbers, broken down by occupational groups, gender and age. This information was in aggregated form and individuals were not identifiable. The survey was undertaken from the beginning of October 2001 to early January 2002. Occupational groups were used to identify staff engaged in direct patient care, as described elsewhere [15,17–19]. To determine those factors that predict higher uptake, comparison was made between the three best performing OH units and the three lowest performing OH units. The various methods of publicity were aggregated into three categories shown in Box 1.

Methods of awareness provided under 'other' on the questionnaire were categorized as appropriate.

All data were anonymized. Participation in both studies was voluntary. The Research Ethics Committee of Queen's University, Belfast, granted ethical approval.

Box 1

General: Leaflet, Letter to area of work, Staff Newsletter, Poster

Targeted: Flyer/Staff pay slip, e-mail

Cascade: Colleague, Line Manager/Supervisor, Ward Sister

Data were analysed using Statistics Package for Social Sciences (v10). In the study of organizational factors contingency tables were analysed using the chi-square test (Likelihood Ratio test statistic) or Fisher's Exact Test, as appropriate. Hypotheses of equal population means were tested using the *t*-test (equal variances not assumed). The Z-test and Chi-square Goodness-of-Fit test were used for comparison of samples against hypothesized parameter values. Associations between uptake of immunization and organizational factors were analysed using the Pearson correlation coefficient.

Further analyses of dichotomous outcome variables were performed using a backward stepwise procedure for a multivariate logistic regression model with the modelling strategy recommended by Hosmer [23]. The results of fitting a logistic regression model are expressed in terms of OR: in future discussion it will be convenient to describe an OR of four as the numerator event being 'four times more likely' as the denominator event.

Results

Part one

All the nursing staff on duty ($n = 203$), out of approximately 400 staff in total, agreed to participate. Seventy-six (37%) were immunized and 127 (63%) declined. Vaccine recipients were more likely to be male (14 versus 6%, $P = 0.04$), full-time (71 versus 50%, $P = 0.005$) and to previously have had influenza immunization (47 versus 17%, $P < 0.001$).

The commonest reason given for acceptance of immunization, cited by 96% of recipients, was to protect themselves against influenza, while only 14% gave protection of patients as a reason. Of those who declined immunization, the commonest reason given was that there was no personal benefit as they were healthy (69%). The second commonest reason, given by 19%, was concern about side-effects.

Differences in knowledge and attitudes between the two groups are summarized in Table 1. From the column of *P* values the responses to all the statements, except 2, 4 and 6, are significantly different at the 5% level for the immunized and non-immunized groups. In particular, the responses to statements 1, 5, 7–9 exhibit very highly

Table 1. Knowledge and attitudes about influenza and influenza immunization

Immunized and non-immunized nurses' responses to questionnaire		Immunized No. (%)	Non-immunized No. (%)	<i>P</i>	Dichotomous variables	OR [95% confidence interval (CI)]
1 Influenza vaccination is not required for a healthy person	SD	10 (13)	5 (4)	<0.001	SD, D versus U, A, SA	6.2 (3.3–11.5)
	D	43 (57)	29 (23)			
	U	16 (21)	35 (28)			
	A	6 (8)	41 (33)			
	SA	1 (1)	15 (12)			
2 Influenza vaccination does not work	SD	8 (10)	16 (13)	0.077	SD, D versus U, A, SA	2.0 (1.1–3.6)
	D	44 (58)	49 (39)			
	U	22 (29)	54 (43)			
	A	2 (3)	6 (5)			
	SA	0 (0)	0 (0)			
3 Influenza vaccination can cause an illness like flu	SD	3 (4)	6 (5)	0.042	SD, D versus U, A, SA	1.8 (0.9–3.4)
	D	23 (31)	22 (18)			
	U	29 (39)	44 (36)			
	A	20 (26)	43 (35)			
	SA	0 (0)	8 (6)			
4 The trust will expect no sickness absence because of flu if you are vaccinated	SD	14 (18)	20 (16)	NS	SD, D, U versus A, SA	1.4 (0.7–2.7)
	D	43 (56)	64 (52)			
	U	12 (16)	21 (17)			
	A	5 (7)	12 (10)			
	SA	2 (3)	6 (5)			
5 Staff are at greater risk of flu compared with the public	SD	1 (1)	6 (5)	<0.001	SA, A versus U, D, SD	3.9 (2.1–7.0)
	D	14 (18)	59 (47)			
	U	12 (16)	20 (16)			
	A	40 (53)	34 (27)			
	SA	9 (12)	6 (5)			
6 Flu is a serious illness for the frail and elderly	SD	0 (0)	1 (1)	NS	SD, D, U, A versus SA	1.1 (0.6–2.1)
	D	3 (4)	2 (2)			
	U	1 (1)	1 (1)			
	A	23 (30)	37 (30)			
	SA	49 (65)	84 (67)			
7 Influenza vaccination of staff will help patients avoid the flu	SD	2 (3)	4 (3)	<0.001	SA, A versus U, D, SD	5.0 (2.7–9.3)
	D	13 (17)	40 (32)			
	U	6 (8)	38 (30)			
	A	50 (66)	36 (30)			
	SA	5 (6)	7 (5)			
8 I would be influenced by the OH department recommendation for vaccination	SD	2 (3)	2 (2)	<0.001	SA, A versus U, D, SD	17.2 (8.1–36.5)
	D	5 (7)	54 (43)			
	U	4 (5)	37 (30)			
	A	54 (71)	29 (23)			
	SA	11 (14)	3 (2)			
9 I would be influenced by the DOH recommendation for vaccination	SD	1 (1)	4 (3)	<0.001	SA, A versus U, D, SD	10.3 (5.3–20.3)
	D	9 (12)	56 (45)			
	U	7 (9)	34 (27)			
	A	50 (67)	29 (23)			
	SA	8 (11)	2 (2)			

SD = strongly disagree, D = disagree, U = unsure, A = agree, SA = strongly agree.

The *P* values relate to the chi-square tests of the 5 × 2 tables.

Table 2. Variables independently associated with uptake of influenza vaccine

Factor	OR	95% CI	P
Influenza vaccination can be a requirement for a healthy person	4.2	1.9–8.9	<0.001
Staff can be at greater risk of influenza compared with the public	2.7	1.2–5.8	0.014
Influence by the occupational health department unit recommendation for vaccination	8.9	3.9–20.4	<0.001

significant differences. The relative importance of these latter statements can be assessed from their OR values in the final column: the two 'influence' statements 8, 9 show the largest differences between the two groups, followed by the two 'attitude' statements 1 and 7.

The combined influence of the dichotomous variables representing the statements in Table 1 on the acceptance of influenza immunization has been investigated by means of logistic regression modelling where the dependent variable is the immunized or non-immunized state. Table 2 presents the contributions of the significant variables influencing acceptance, adjusting for the presence of the other variables.

Part two

The HCW population totalled 53 808 employees. In the period of the study, 5230 (9.7%) were immunized, of whom 5031 (96%) completed the questionnaire. Those immunized on average were older (41.6 versus 39.7 yrs, $P < 0.001$) and had worked longer (13.9 versus 8.7 yrs, $P < 0.001$).

Immunization uptake, across the 15 participating OH units, was in the range 3.4–17.6%. Immunization clinics offered within the area of work ranged from 0 to 86.7%. The percentage of HCWs immunized within their area of work was positively correlated with the percentage uptake of immunization by HCWs in the respective OH units (correlation coefficient = 0.74, $P = 0.02$). Twenty-eight (8%) of OH immunization clinics were provided outside usual office hours. The percentage of the clinics provided 'out of hours' was positively correlated with the ranked uptake per OH unit (correlation coefficient = 0.83; $P < 0.001$).

The higher performing OH units immunized significantly more in the area of work than the lower performing OH units (82 versus 26%; $P < 0.001$).

There was a statistical difference ($P < 0.001$) in how those immunized in the three higher performing OH units became aware of the availability of the immunization compared with the three lower performing OH

Table 3. Comparison of higher and lower performing units on how HCWs were made aware of immunization availability

Category	Number HCWs per category (%)	
	Lower	Higher
General	273 (46.1)	427 (27.9)
Target	166 (28.0)	635 (41.5)
Cascade	136 (23.0)	432 (28.2)
Unknown	17 (2.9)	36 (2.4)
Total	592 (100)	1530 (100)

$P < 0.001$.

units (Table 3). It appears that 'targeting' has a positive influence on acceptance, with possibly the 'cascade' method also having a positive effect.

The influence of age, gender, previous influenza immunization, employment status, length of service, place of immunization and awareness of the availability of immunization on membership of high/low uptake units was investigated by multivariable logistic regression. The final model results are presented in Table 4. The last two variables have three unordered categories that were compared using deviation contrasts, i.e. the effect of each category was compared with the overall mean effect of the variable. The high uptake units tend to have employees who are younger, male and have had previous immunization. Immunization in area of work and dining room had a positive effect on uptake by a factor of approximately two and three, respectively. Individual targeting of availability also increased the odds of uptake by a factor of two.

Proportionally fewer staff involved in direct patient care took up immunization as compared with staff not involved in direct patient care (8.2 versus 11.7%; $P < 0.001$).

Table 4. Multivariable logistic regression results comparing high uptake OH units to low uptake OH units

Variable		OR (95%CI)	P
Where immunized	OH department	0.2 (0.1–0.3)	<0.001
	Area of work	1.7 (1.0–2.9)	0.032
	Dining room	3.2 (1.2–8.4)	0.020
Awareness of availability	General	0.6 (0.5–0.7)	<0.001
	Target	1.9 (1.5–2.3)	<0.001
	Cascade	0.9 (0.7–1.1)	NS
Previous influenza immunization		1.9 (1.4–2.5)	<0.001
Gender (male)		1.6 (1.1–2.2)	0.006
Age		0.97 (0.95–0.98)	<0.001

The variables 'Employment status' and 'Length of service' were not significant and hence were removed.

Box 2. Summary points**Positive influences on immunization**

If agree is required even when healthy
 If believe may be at greater risk of contracting influenza
 If recommended by OH department
 When convenient to area of work
 When convenient to shift
 When information is individually targeted
 If have been immunized previously
 Some influence of older age, longer service and male gender

The positive influences on immunization are summarized (see Box 2).

Discussion

This study showed that individual beliefs about health were important in determining uptake of influenza immunization. Logistic regression showed that if the individual believed it was required for healthy adults, he/she was four times more likely to be immunized. Other European studies [12,19,24] concur with this result. It could be argued that the use of the phrase 'required' overstates the therapeutic indication and that the difference between the two groups is consequentially more significant. However, the free responses accord with this finding in that 69% of those who were non-immunized gave as the reason, their perception that they were healthy.

In contrast to our findings, the principal reasons for declining immunization in North American studies were the avoidance of medications and the fear of adverse reactions. This latter fear may be due to an apparent excess of cases of Guillain-Barre syndrome that had occurred among recipients of swine influenza vaccine during that 1976 season [25]. This may have had an effect on the perception of risk among the general public [26].

The reluctance of nurses to accept influenza immunization because they are 'healthy' may be explained by the previous accepted policy of recommending immunization to 'at-risk groups' and elderly who are more vulnerable [27]. This previous policy did not advocate immunization for otherwise healthy individuals and therefore may have caused confusion. There may be scope to increase the immunization rate by addressing this misconception.

The value of OH as an advocate for immunization was shown in this study. While it is known that medical recommendation for influenza immunization to other at-risk groups has a positive impact [22], the influence of OH has only been reported to a limited extent among HCWs [28].

The higher uptake of immunization of nurses in part one of this study may be explained by greater availability, the direct approach to each member of staff on duty and the positive effect of the survey itself [19].

Uptake was higher, when access to immunization was locally delivered and available out of hours. A number of studies report inconvenience as the reason for not receiving influenza immunization [13–15,20] and other studies report improved uptake when the immunization is brought to the patient care areas [13,16,17,24,29–33]. Some studies also report a proportionally higher uptake with large congregations of staff [29]. In this study, availability of immunization in the dining area had a stronger influence than availability in the work area. Peer pressure may be operating and affecting uptake in a positive manner.

Few studies have considered the impact of communication on uptake rate of immunization. Personal letters have been reported to increase uptake [29]. Within this study, comparison of the three methods of communication, general, cascading and targeting demonstrated that the independent effect of targeting information to the individual HCW increases the odds of immunization by a factor of two.

Available data indicates that 7% of people in the 15–64 years age group, of the general population in Northern Ireland, are immunized [34]. These are likely to be in 'at-risk' categories. In the working population studied, the number receiving immunization independently of the OH department is likely to be small and would therefore not be expected to significantly affect the comparisons drawn between the immunized and non-immunized groups.

If influenza immunization of HCWs is accepted as a worthwhile activity, then methods to maximize uptake need to be considered. Increasing acceptance can be tackled by improving the delivery programme and influencing beliefs.

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Conflicts of interest

None declared.

References

1. Weingarten S, Friedlander M, Dianne Rascon MT, *et al.* Influenza surveillance in an acute care hospital. *Arch Intern Med* 1988;**148**:113–116.

2. Yassi A, McGill M, Holton D, Nicolle L. Morbidity, cost and role of health care worker transmission in an influenza outbreak in a tertiary care hospital. *Can J Infect Dis* 1993;**4**: 52–56.
3. Gross PA, Hermogenes AW, Sacks HS, *et al.* The efficacy of influenza vaccine in elderly persons: a meta-analysis and review of the literature. *Ann Intern Med* 1995;**123**: 518–527.
4. Howells CHL, Vesselinova-Jenkins CK, Evans AD, *et al.* Influenza vaccination and mortality from bronchopneumonia in the elderly. *Lancet* 1975;**1**:381–383.
5. Gross PA, Quinnan GV, Rodstein M, *et al.* Association of influenza immunization with reduction in mortality in an elderly population: a prospective study. *Arch Intern Med* 1988;**148**:562–565.
6. Potter J, Stott DJ, Roberts MA, *et al.* Influenza vaccination of HCW in long-term hospitals reduces the mortality of elderly patients. *J Infect Dis* 1997;**175**:1–6.
7. Carman WF, Elder AG, Wallace LA, *et al.* Effects of Influenza vaccination of HCW on mortality of elderly people in long term care: a randomised control trial. *Lancet* 2000;**355**:93–97.
8. Centers for Disease Control and Prevention. Recommendations of the Immunisation Practices Advisory Committee (ACIP) Prevention and control of Influenza. *MMWR* 1984;**33**:253–260.
9. Nicholson KG, Snacken R, Palache AM. Influenza immunisation policies in Europe and the United States. *Vaccine* 1995;**13**:365–369.
10. Donaldson L. Influenza immunisation programme 2001/2002 (letter). Department of Health (London) 2001; PL/CMO/2001/4.
11. Stevens AB. Flu vaccine audit for 2000/2001 season. *Regional Audit Gleanings* 2002; **14**: 36–37 HPSSPS (NI).
12. Ballada D, Biasio LR, Cascio G, *et al.* Attitudes and behaviour of health care personnel regarding influenza immunisation. *Eur J Epidemiol* 1994;**10**:63–68.
13. Nichol KL, *et al.* Influenza immunisation of healthcare workers. *Infect Control Hosp Epidemiol* 1997;**18**:189–194.
14. Heimberger T, Hwa-Gan C, Shaikh M, *et al.* Knowledge and attitudes of Healthcare Workers about influenza: why are they not getting vaccinated? *Infect Control Hosp Epidemiol* 1995;**16**:412–414.
15. Watanakunakorn C, Ellis G, Gemmel D. Attitudes of Health Care personnel regarding influenza immunisation. *Infect Control Hosp Epidemiol* 1993;**14**:17–20.
16. Pachucki CT, Walsh Pappas SA, Fuller GF. Influenza A among hospital personnel and patients: Implications for recognition, prevention and control. *Arch Intern Med* 1989;**149**:77–80.
17. Doebbeling BN, Edmond MB, Davis CS, *et al.* Influenza Vaccination of Health Care Workers: Evaluation of factors that are important in acceptance. *Prev Med* 1997;**26**: 68–77.
18. Begue RE, Gee SQ. Improving influenza immunization among healthcare workers. *Infect Control Hosp Epidemiol* 1998;**19**:518–520.
19. Beguin C, Boland B, Ninane J. Health care workers: Vectors of influenza virus? Low vaccination rate among hospital health care workers. *Am J Med Quality* 1998;**13**: 223–227.
20. Weingarten S, Reidinger M, Bolton LB, *et al.* Barriers to influenza vaccine acceptance. A survey of physicians and nurses. *Am J Infect Control* 1989;**17**:202–207.
21. Campbell H. Influenza immunisation programme for winter 2001–2002 (Letter) HSS(MD)18/01 <http://www.dhsspsni.gov.uk>
22. Nichol KL. Preventing influenza: The physician's role. *Semin Respir Infect* 1992;**7**:71–77.
23. Hosmer DW, Lemeshow S. *Applied Logistic Regression*, 2nd edn. New York: John Wiley and Sons, 2000; 118 pp.
24. Harbath S, Siegrist C-A, Schira J-C, *et al.* Influenza immunization: Improving compliance of health-care workers. *Infect Control Hosp Epidemiol* 1998;**19**: 337–342.
25. Safraneck TJ, Lawrence DN, Kurland LT, *et al.* Reassessment of the association between Guillain-Barre syndrome and receipt of swine influenza vaccine in 1976–77: Results of a two-state study. *Am J Epidemiol* 1991;**133**:940–951.
26. Pachucki CT, Jackson GG. Attitudes and behaviour of health care personnel regarding the use and efficacy of influenza vaccine. *J Infect Dis* 1985;**151**:1170–1171.
27. Calman K. Influenza immunisation: Extension of current policy to include all those aged 75 years and over (Letter). Department of Health London PL/CMO/98/04.
28. Yassi A, Murdzak C, Cheang M, *et al.* Influenza immunization: Knowledge, attitude and behaviour of health care workers. *Can J Infect Control* 1994;**9**:103–108.
29. Ohrt CK, McKinney WP. Achieving compliance with influenza immunisation of medical house staff and students: a randomised controlled trial. *JAMA* 1992;**267**: 1377–1380.
30. Decker MD, Schaffner W. Immunisation of hospital personnel and other health care workers. *Infect Dis Clin North Am* 1990;**4**:211–221.
31. Girasek DC. Increasing hospital staff compliance with influenza immunisation recommendations. *Am J Public Health* 1990;**80**:1272–1273.
32. Adal KA, Flowers RH, Anglim AM, *et al.* Prevention of Nosocomial Influenza. *Infect Control Hosp Epidemiol* 1996;**17**:641–648.
33. Fedson DS. Influenza vaccination of medical residents at the University of Virginia: 1986 to 1994. *Infect Control Hosp Epidemiol* 1996;**17**:431–433.
34. Influenza vaccination programme Winter 2001/02. *Communicable Diseases Monthly Report CDSC(NI)* 2002; **11**: 3–4.