
Influenza vaccination—acceptance in an industrial population

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Smith, J. W. G., Pollard, R., Fletcher, W. B., Barker, R., and Lewis, J. R. (1974). *British Journal of Industrial Medicine*, 31, 292-297. **Influenza vaccination—acceptance in an industrial population.** Influenza vaccination was offered in a pharmaceutical factory of approximately 6 000 employees in December 1971 and again in December 1972. The rate of acceptance of vaccination was 42% in 1971 but fell to only 27% in 1972, and was highest among middle-aged married women and lowest among young men. Only 57% of employees who were vaccinated in 1971 and were still employed in 1972 accepted vaccination on the second occasion. Re-vaccination was commoner in staff (64%) than in works employees (52%) in all age and sex categories, and was commoner in older than in younger employees. Only 6% of employees who did not accept vaccination in 1971 accepted the vaccine in 1972. Among new employees who were not in the factory in December 1971 the acceptance rate was 21% in 1972.

Between January 1971 and 1972 vaccinated employees left the factory less commonly (15%) than those who had not accepted vaccination (22%). Loss of working time in April to September 1972, i.e., when it is unlikely that influenza would have influenced the returns, was 21% higher among non-vaccinated employees than in vaccinated employees, the difference being due to certified illness of more than three days' duration.

The benefit to be derived from offering influenza vaccination to a factory or office population will depend, among other factors, on the proportion of employees who accept the offer and on the characteristics of this volunteer group. The low take-up rate (27%) observed in the second year suggests that annual influenza vaccination is unlikely at the present time to have a marked effect on absence during outbreak periods. In comparison with the non-volunteers in the present study, the volunteers included a higher proportion of married women, older persons, and staff employees and were less inclined to leave employment, and lost less working time from certificated sickness absence. The value of offering vaccine may therefore be greatest in an established office employing a high proportion of older women. The differences between the volunteers and non-volunteers, particularly the better sickness absence record of the former, indicates that the effect of influenza vaccination cannot reliably be assessed only from a comparison of absence returns between vaccinated and unvaccinated employees.

Sickness absence due to influenza is costly to industry (Walker, 1971) and its prevention by vaccination could be valuable to a firm, as well as to the individual employee. However, the value of influenza vaccination in preventing illness in a factory or office

population is uncertain and must depend on a number of factors. Many of these factors are virological and immunological in nature such as the magnitude of the influenza outbreak to which the population is subsequently exposed, the effectiveness

of the vaccine in protecting the individual recipient, and the proportion of the population who are immune before vaccination. The benefits to be secured from vaccination will also depend on how many employees accept the offer of vaccine, and on the characteristics of those who accept or do not accept the offer. If, for example, a high proportion of vaccinated employees frequently move to new jobs, the value of the vaccination programme to the factory concerned would be impaired. This paper describes the factors associated with acceptance of influenza vaccination by employees in the factories, offices, and warehouses of a large pharmaceutical firm, the Boots Company Ltd, in the north-midlands of England.

Materials and methods

The factory

The factories and offices studied together occupy one of the manufacturing sites of the company, which does not manufacture influenza vaccine nor is vaccine distributed from the site. The working conditions in all sections of the factory, production, packing, despatch, and offices, are of a high standard.

Vaccination

All employees were offered a single dose of influenza vaccine in 1971 and also in 1972. The offers were made in late November by individual letters from the company medical officer, supported by articles in the company journal and by means of posters.

Vaccination was organized in sessions over a three-day period in early December each year, and was carried out by needle and syringe or jet-gun injector.

The vaccine

Standard commercial bivalent influenza vaccine (BDH Admune) was used in a dose of 1.0 ml. In 1971 approximately half the doses were given with a needle and syringe and half with a portable injection gun (Port-o-jet,

Schuco Scientific Limited). In 1972 almost all the doses were given by injector gun.

Returns of vaccine acceptance and sickness absence

Arrangements were made to obtain computer returns to provide the following information:

1. A census of both 'works' and 'staff' employees in the factory according to age group, sex, marital status of women, and vaccination status.

Works employees consisted of those paid weekly; most worked in production or despatch departments. Staff employees largely consisted of office and management workers but included a small number employed in warehousing and distribution. Most staff employees were paid monthly.

2. A print-out for both works and staff employees of the total number of days lost from work due to sickness absence according to age group, sex, marital status in the case of women, and vaccination status. Absence returns included figures of both long-term medically certified illness and short-term (3 days and less) non-certified illness.

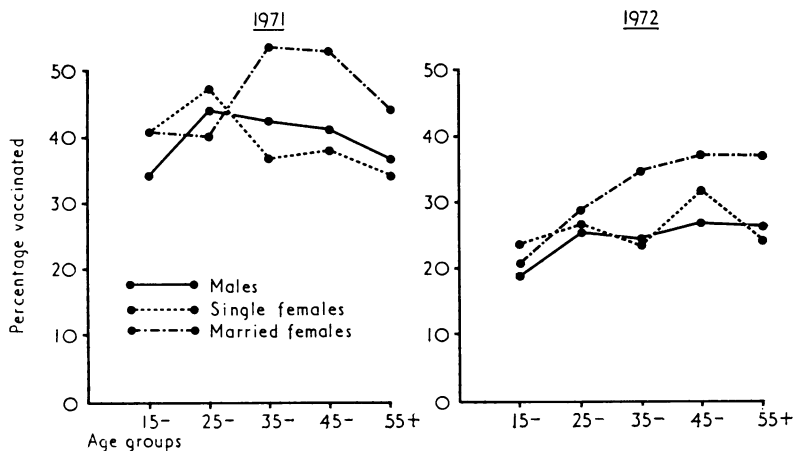
Returns were made weekly for works employees and monthly for staff employees.

Results

Acceptance rates in 1971 and 1972

Out of 5 928 persons employed in early December 1971, 2 472 (42%) accepted vaccination against influenza. In the second year of vaccination, however, the acceptance rate fell considerably. In December 1972, when 6 158 persons were employed, only 1 636 (27%) took up vaccination.

In both 1971 and 1972 acceptance tended to be low in young men aged 15-24 years and high in married women over the age of 34 years (Figure). The proportion of works and staff employees who were vaccinated in 1971 was similar in each of the age and sex categories with the same overall rate of 42%. In 1972 however, vaccination was significantly



Acceptance of influenza vaccination in December 1971 and December 1972, according to age group, sex, and marital status of women.

TABLE 1
ACCEPTANCE OF INFLUENZA VACCINATION IN DECEMBER 1972 IN EMPLOYEES
NOT PRESENT IN DECEMBER 1971

Category of employee	Sex and marital status	Age group (years)								All ages			
		15-24		25-34		35-44		45-54				55+	
		N ¹	% ²	N	%	N	%	N	%	N	%	N	%
All (staff + works)	Males	219	15	166	20	100	21	91	25	84	23	660	20
	Single females	288	22	13	—	7	—	8	—	9	—	325	21
	Married females	55	20	118	29	110	23	72	24	20	—	375	24
	Total	562	19	297	24	217	22	171	25	113	19	1360	21

¹N = Number employed²% = Percentage vaccinated³— = % for fewer than 30 employees not calculated

more common ($\chi^2 = 19.0$; $P < 0.001$) in staff employees (30%) than in works employees (25%); the difference was due mainly to the male employees and also to the single women aged 15-24 years.

Among 1360 new employees not present in December 1971, only 21% accepted the offer of vaccination in December 1972 (Table 1). The rate was significantly higher ($\chi^2 = 6.09$; $P < 0.02$) in the staff employees than in works employees (25% and 19% respectively; figures not included in Table 1). This relatively poor acceptance was evident in each of the age and sex categories and could not therefore be attributed to the preponderance of young people among the new employees.

Re-vaccination

When only those employed both in 1971 and 1972 are considered (Table 2), the fall in acceptance rate remains evident: of 2090 employees vaccinated in 1971 and still employed in 1972 only 57% accepted the vaccine in the second year. Revaccination was accepted more often ($\chi^2 = 28.1$; $P < 0.001$) among staff than works employees (64% and 52% respectively), and the difference was evident in all age groups. Revaccination was accepted more often by married women (62%) than by men (53%) and in older rather than younger age-groups ($\chi^2 = 16.8$; $P < 0.001$).

Of the 2708 employees who were not vaccinated

TABLE 2
ACCEPTANCE OF INFLUENZA VACCINATION IN DECEMBER 1972 IN EMPLOYEES
VACCINATED IN DECEMBER 1971

Category of employee	Sex and marital status	Age group (years)								All ages			
		15-24		25-34		35-44		45-54				55+	
		N ¹	% ²	N	%	N	%	N	%	N	%	N	%
Works	Males	58	31	133	46	107	43	183	50	182	52	663	47
	Single females	62	33	15	—	6	—	13	—	5	—	101	44
	Married females	17	—	39	49	144	58	197	64	77	66	474	60
	Total	137	33	187	48	257	54	393	56	264	56	1238	52
Staff	Males	38	68	87	60	104	63	136	60	88	67	453	63
	Single females	99	57	20	—	11	—	18	—	18	—	166	61
	Married females	37	41	38	63	48	63	75	76	35	88	233	67
	Total	174	56	145	61	163	63	229	66	141	72	852	64
All	Total	311	46	332	54	420	57	622	60	405	61	2090	57

¹N = Number employed²% = Percentage vaccinated³— = % for fewer than 30 employees not calculated

in 1971 and who were still employed in 1972, only 6% accepted vaccination on the second occasion.

Vaccination and leaving employment

The rate at which unvaccinated employees left the factory or retired during the 12-month period from 9 January 1972 to 7 January 1973 was significantly higher (22%) than the rate for those who came forward for vaccination in December 1971 (15%) ($\chi^2 = 35.4$; $P = <0.001$). Female employees left more commonly than males: 27% of unvaccinated women left the factory in the 12-month period (Table 3). Works employees left more commonly (21%) than staff employees (16%).

TABLE 3

PERCENTAGE OF EMPLOYEES LEAVING BETWEEN 9 JANUARY 1972 AND 7 JANUARY 1973, ACCORDING TO ACCEPTANCE OF VACCINATION IN DECEMBER 1971

	Vaccinated in Dec. 1971		Unvaccinated in Dec. 1971	
	No.	% leaving	No.	% leaving
Male	1 268	12	1 974	18
Female	1 204	19	1 482	27
Total	2 472	15	3 456	22

Sickness absence

An analysis of sickness absence in relation to influenza is being made and will be reported elsewhere. However, it is of interest to find out whether sickness absence among those who accept vaccine differs from that among those who do not, irrespective of

the presence of influenza. Thus, if vaccinees form a group with good absence records, benefits attributed in a firm to influenza vaccine may in fact be due only to the selection of a group who are not inclined to be off work. The absence figures were examined for a period when influenza was unlikely to affect the returns. Influenza in the winter of 1971-72 was present from mid-December 1971 to about the end of February 1972 (Smith and Pollard, 1973a). It is unlikely, therefore, that absence figures for the period April to September 1972 would be affected by differences attributable to the prevention of influenza by vaccination, and the returns for this six-month period are given in Table 4. The unvaccinated employees lost more working days than the vaccinated employees in each of the six months, and over the whole period the excess was 21%. The differences were observed in men and in single and married women, and (results not included in Table 4) in all age groups, and in both works and staff employees. If the percentages of working time lost by the vaccinated and unvaccinated employees are standardized for age and sex, the excess loss by the unvaccinated group remains at 21%. It appears that non-acceptance of influenza vaccination may be added to those characteristics known to be associated with increased sickness absence (Taylor, 1968). This conclusion is supported by the sickness absence records of the vaccinated and unvaccinated employees in the 12 months *before* they were offered vaccine. A random sample of 26% of the employees was selected from the computer file and the sample comprised 881 employees who were not vaccinated and 679 who were later to accept vaccination in December 1971. The ratio of days lost from sickness absence in the period was found to be vaccinated/unvaccinated = 0.74.

When the uncertificated short-term absences of three days and less for the April-September period

TABLE 4

PERCENTAGE OF WORKING DAYS LOST DUE TO SICKNESS ABSENCE IN VACCINATED AND UNVACCINATED EMPLOYEES, APRIL-SEPTEMBER 1972

	No. of employees at 2 Apr. 1972	Percentage working days lost in time period:											
		April	May	June	July	Aug.	Sept.	April to September					Total
								Males	Single females	Married females	Less than 4 days	More than 3 days	
Vaccinated	2 395	2.66	2.68	2.95	2.89	2.98	2.94	2.63	3.00	3.10	0.94	1.90	2.84
Unvaccinated	3 256	3.36	3.23	3.47	3.08	3.89	3.80	3.28	3.48	3.76	0.93	2.50	3.43
Excess loss of working time of unvaccinated compared to vaccinated employees		26%	21%	18%	7%	31%	29%	25%	16%	21%	-1%	32%	21%

are compared with those of more than three days for which a medical certificate was required it appears (Table 4) that the excess absence among the non-vaccinated employees was confined to illnesses of over three days' duration.

Sickness absence was particularly high in those over 60 years of age (6.8% working days lost compared with 2.9% days lost for the remaining age groups) and acceptance of vaccine was also lowest in this age group (Figure).

Discussion

The value of influenza vaccination in such places as factories and offices must be affected by the proportion of employees who accept inoculation. An acceptance rate of 42% was found in the first year of the present study, and a similar rate was also found in the first year of influenza vaccination programmes in a number of other factories and offices in different parts of the United Kingdom (Smith and Pollard, 1973b). In the second year of the vaccination programme the rate of acceptance fell from 42 to 27% despite the fact that the offer of vaccination was equally well publicized; of those vaccinated in 1971, only 57% accepted the inoculation in 1972. We have observed falls in other factories (unpublished observations) and previous workers have also recorded a decline of acceptance in successive years (Richardson and Kilpatrick, 1964; Kennedy and Veys, 1966). It is not clear why acceptance of vaccine declines. One factor may be adverse reactions to the vaccine which although minor are known to be not uncommon (Meichen, Rogan, and Howell, 1962; Howell and Mackenzie, 1964) and may be recorded by as many as two-thirds of the recipients of zonally purified influenza vaccine (unpublished observations). In addition, the outbreak of influenza experienced in January-February 1972 was small, and benefit from vaccination would have been difficult for employees to notice. Thus returns from the Royal College of General Practitioners (personal communication) suggest that in the 1971-72 epidemic only about 3% of the working-age population had an attack of 'influenza'. Nevertheless, whatever the explanation the fall in take-up rate was appreciable and it is probable that it may be a general phenomenon.

In considering the likely benefit to be secured from influenza vaccination in an industrial population, it is also necessary to take into account the characteristics of the volunteer population. Acceptance of influenza vaccination varied with age and sex (Figure), being low in young men and high in middle-aged women. These observations differ from those of Richardson and Kilpatrick (1964), who reported that acceptance rates were higher in younger age groups. The different experience may partly be due to the

smaller population that was studied, 700 persons compared with 6 000 in the present study. Re-vaccination was commoner among staff than works employees, and among older than younger age-groups. It is possible, therefore, that vaccination programmes at the present time would be of greater benefit in offices than in factories, particularly in established offices with a high proportion of middle-aged women and older employees. The findings also indicate that loss of vaccinated employees should not significantly affect the value of vaccination.

In a six-month period when influenza was unlikely to have influenced the returns, the amount of working time lost from all certificated illness in non-recipients of influenza vaccine was found to be 21% higher than in recipients (Table 4), and the difference remains the same when the two groups of employees are standardized for age and sex. Meichen *et al.* (1962), on the other hand, reported that records of certified respiratory illness during nine months prior to vaccination were similar in those who had been vaccinated and in a control group randomly selected from the non-volunteers, matched for age, sex, and length of service. However, the findings reported in the present study indicate that the non-vaccinees represent a different population from the vaccinees, differing in age and sex structure and probably in length of service (Table 3). Moreover, the figures reported by Meichen *et al.* (1962) in their Table 4 indicate that the non-vaccinated employees lost from respiratory illness 8.5% more days per 100 persons at risk than the vaccinated employees over a 10-month period. The excess absence in non-vaccinees we have reported may therefore represent an excess from respiratory illness together with an excess from other certificated illness. There is no reason to believe that the difference in absence figures would not also operate during influenza periods so that, irrespective of the specific effect of the vaccine, absence among those who have accepted influenza vaccine is liable to be lower than among the non-volunteers who did not accept vaccine. It is important that industrial firms should not attribute such differences solely to the beneficial effects of vaccination.

We wish to thank Sir Austin Bradford Hill and Dr W. K. S. Moore for their work in the planning and organization of the study, and the Boots Company nursing staff and Sister Gillhouley for help in the vaccination sessions. We are also particularly grateful to Mrs B. Gedney for organizing the vaccination programmes enthusiastically and efficiently. The work forms part of the PHLS influenza study programme organized by the Epidemiological Research Laboratory.

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Received for publication 30 July 1973

Accepted for publication 20 March 1974