Occup. Med. Vol. 48, No. 2, pp. 85–90, 1998

0962-7480/98

The impact of influenza and influenza-like illness on productivity and healthcare resource utilization in a working population

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Four hundred and eleven subjects who either reported to Occupational Health at onset of influenza or influenza-like illness (I/ILI) symptoms or on return to work completed questionnaires on entry to the study and after 28 days. On average they were incapacitated or confined to bed for 2.4 days, missing 2.8 days from work per episode of illness. On return to work, they reported reduced effectiveness and inability to resume normal activity until a mean 3.5 days after the onset of symptoms. Each participant reported a mean of 6.5 I/ILI symptoms. There was a positive correlation between the number of symptoms and bed days ($r = 0.24$) and missed work days ($r = 0.18$). There was a positive correlation between the number of healthcare contacts and the number of reported symptoms ($r = 0.23$).
A relatively high level of contact with general practitioners and pharmacists was observed and there was substantial use of both prescription and over-the-counter medication. In conclusion, the impact of I/ILI on productivity in a working population and the resultant cost to employers and employees may be considerable.

Key words: Healthcare utilization; influenza; influenza-like illness; productivity.

Occup. Med. Vol. 48, 85–90, 1998

Received 14 April 1997; accepted in final form 18 August 1997.

INTRODUCTION

Influenza infection is an important cause of morbidity and mortality.[1,2] Indeed, so significant are the potential consequences of the disease, that influenza has been characterized as the 'last great uncontrolled plague of mankind'.[3] While cases of influenza are recorded every winter, the magnitude of epidemics is highly variable, being predominantly dependent on the properties of the infecting virus and the degree of immunity within the affected community.

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For most patients, influenza and influenza-like illness (I/ILI) infrequently result in long-term sequelae. The onset of symptoms following naturally acquired infection is generally rapid, with fever, chills, myalgia, headache, malaise, sore throat and cough rarely persisting beyond a week.[4] However, patients are generally confined to bed while the fever is present and are incapable of routine activity whether at work, at school or in the home.[5]

Influenza has been estimated to account for 10–12% of all sickness absences from work, which is roughly equivalent to the number of absences attributed to musculoskeletal disorders and twice that attributed to psychiatric disorders.[6] Research conducted in the US suggests that 15 million working days are lost to influenza each year.[7] However, the actual impact of an influenza epidemic on a working population has

been poorly documented, with few studies shedding light on the socio-economic consequences of influenza and influenza-like infections, whether in terms of impact on productivity, caregiver support or consumption of health care resources.

The objective of the present study was to examine the variety of ways in which employees of a large company were affected by I/ILI and to quantify its impact. Data from self-administered questionnaires and diaries were combined to document and quantify the burden of I/ILI on employee and caregiver productivity, as well as healthcare resource utilization.

METHODS

Study design

The study was conducted between October 1994 and April 1995. Participants were employees of a large pharmaceutical company in the United Kingdom and were either recruited to the study at the onset of influenza symptoms or on return to work. I/ILI was defined as feeling 'feverish' and the presence of at least two of four additional symptoms (headache, sore throat, myalgia or cough). All employees were encouraged to donate a blood sample for storage of serum before the start of the study. The study was open to all company employees (n = 3,417), including a very small number who had been vaccinated against influenza for the current season as they were believed to be 'at risk'. Employees were predominantly administrative personnel, research scientists and support staff.

Subjects who were recruited at symptom onset contacted Occupational Health (OH) either by telephone or in person within five days of the onset of symptoms and completed a baseline questionnaire and diary card giving details of the illness on days 1–6. Employees who were recruited on return to work submitted either a self-certificate form giving diagnostic information suggestive of I/ILI infection or a doctor's medical certificate stating a diagnosis of I/ILI or upper respiratory tract infection. These participants completed a retrospective questionnaire. All participants completed a follow-up questionnaire 21–28 after symptom onset.

The questionnaires collected data on demography, symptomatology and the impact of I/ILI on productivity and use of healthcare resources. The diary card served to document symptoms.

Productivity assessment

The aim of the specially developed productivity questions was twofold: to document the impact of influenza and its treatment on the ability of both employee and caregiver to maintain normal levels of activity and to document the impact of employee illness on the employer in terms of reallocation of staff, or use of additional staff to cover the daily functions of absent colleagues.

The impact of influenza on productivity was assessed from the following: number of days employees were absent from work; estimated employee effectiveness at work while symptomatic; number of days employees were confined to bed or incapacitated; effect of employee illness on caregiver productivity; and effect of illness on employee's ability to maintain normal levels of activity at home and during leisure time.

Healthcare resource utilization assessment

Participants were asked to describe their use of healthcare resources from the first influenza symptom to the end of the study. In particular, the questionnaires collected data on the following: use of non-prescription over-the-counter (OTC) medications, either for influenza or its sequelae; number and type of medications prescribed during the course of the study; admission to hospital, unscheduled general practitioner (GP) visits or use of emergency care facilities during the month following the onset of symptoms.

Serology tests

Only participants who presented to OH within five days of symptom onset were asked to provide a baseline blood sample for serology. A second sample was requested 21–28 days later. Both samples were tested for the presence of antibodies to influenza A by haemagglutination inhibition and for the presence of antibodies to influenza B by single radial haemolysis. Predefined criteria in both assays were used to assess influenza infection.

Analysis

Data were summarized for the I/ILI population who had completed at least one questionnaire.

Productivity variables were evaluated by means of summary statistics and frequency distributions for the I/ILI population. Lost productivity arising from missed work days was valued on the basis of mean salaries by grade for company employees, excluding National Insurance and pension contributions by employer. Days lost by caregiver were valued on the basis of mean salary for all full-time employees.[8]

Correlations between the number of symptoms reported at entry to the study and productivity details recorded on the follow-up questionnaire (days in bed, missed work days, effectiveness at work, interference with work in the home, interference with leisure activities and caregiver help required) were calculated.

Summary statistics on healthcare utilization as a result of hospitalization, use of Accident and Emergency Departments and GP visits (both in the clinic and to the employee's home by day and night) are presented. Data on unit costs of resources used were collected from a number of UK sources.[9–12] The relationship between the number of symptoms and the number of occasions on which healthcare professionals

were consulted was examined using Pearson's correlation.

Symptoms were summarized by counting the number of employees who cited each of the 24 symptoms listed in the questionnaire. Frequency distributions were used to summarize the severity of symptoms recorded on the diary card for each day relative to the onset of symptoms.

RESULTS

Participants

A total of 628 employees with influenza-like symptoms entered the study and completed at least one questionnaire, of whom 411 fulfilled the entry criteria and comprised the I/ILI population. The majority of subjects were female (55%) and white (85%), with a mean age of 34.2 (SD = 9.0) years. Of the 411 participants enrolled, only 11 had been vaccinated against influenza for the season under study, most of them in the previous October.

Paired blood samples were provided by 43 of the 44 employees who enrolled at symptom onset. Of these, five patients had confirmed influenza B infection; the remaining employees were influenza negative.

Productivity loss

The mean number of missed work days was 2.8 days, with means ranging from 3.2 days for secretarial/administrative staff, to 1.8 days for managers (Table 1). In 59% of cases (n = 221), absent employees were not temporarily replaced, their work being completed by a colleague in 35% of cases (n = 131) (data not shown). The majority of employees were confined to bed or incapacitated for more than two days. 'Effectiveness at work' scores, for those who returned to work while symptomatic, showed that employees felt only moderately effective. Caregiver assistance was required by approximately half of the employees at a cost to the caregiver of an average of 0.4 day lost from their work (Table 1).

Seventy-three per cent of subjects (n = 287) reported that the illness had interfered with work in or around the home 'all or most of the time' and 84% (n = 334) reported that the illness had interfered with leisure or recreational activities 'all or most of the time'.

Evaluable diary card data provided by 38 subjects showed that the mean number of days to the resumption of normal activities was 3.5 days (SD ± 2.0).

Healthcare utilization

The most common contacts made by the subjects were 'visits to GP' (29% of total participants, mean = 1.2 visits), 'pharmacist consultations' (15% of total participants, mean = 1.4 visits) and telephone calls to GP (10% participants, mean = 1.4) (Table 2).

Overall, 95% of participants used medication for I/ILI symptoms (Table 3). Approximately 70% of participants who visited their GP received a prescription (84/116), 18% of whom received antibiotics and 3% received other medication.

I/ILI symptoms

All participants reported a relatively high number of symptoms at diagnosis [mean = 6.5 (SD ± 1.5)]. The most commonly reported symptoms at diagnosis were feverishness (97%; 400/411), weakness (85%; 351/411) and headache (79%; 323/411). Symptoms reported to be the most troublesome during the illness were: sore throat (13%; 51/395); dry cough (12%; 48/395); cough producing phlegm (11%; 44/395); headache (10%; 40/395); and malaise/tiredness (10%; 40/395). Symptoms which commonly took longest to resolve were: cough producing phlegm (13% ; 52/395); dry cough (11%; 44/395); and runny nose (8%; 32/395).

Participants gave fever as the most common reason for absence from work (29%), followed by malaise/tiredness (15%), headache and feeling faint/dizzy (9%) and muscle aches (8%). Other reasons for absence were given by no more than 6% of patients.

There were positive, but moderate, correlations between the number of reported symptoms and the number of days confined to bed (r = 0.24; n = 382),

Table 1. Productivity

Variable	*No. of responses (%)*	*No. of employees (%)*	*Mean ± SD*
Lost work days			
All employees*	393 (96%)	—	2.8 ± 2.0
Secretarial/administrative staff		46 (12%)	3.2 ± 2.1
Scientists		236 (62%)	2.9 ± 2.0
Managers		50 (13%)	1.8 ± 1.4
Unknown status		51 (13%)	3.0 ± 2.2
Days confined to bed	393 (96%)	—	2.4 ± 1.6
Effectiveness at work**	332 (81%)	—	4.6 ± 1.9
Days when caregiver assistance was required	393 (96%)	202 (51%)	0.4 ± 1.0

* All I/ILI employees who answered the questionnaire.
** Scored from a scale where 1 = totally ineffective, 10 = fully effective.
— = same as number of responses.

Table 2. Healthcare utilization and costs

Units of healthcare utilization	*Employees n (%)*	*Mean (± SD) units of healthcare utilization*[a]	*Total units of healthcare utilization*[a]	*Standard cost (£)*	*Total cost*[a] *(£)*
Total number of employees[b]	393				
Pharmacist consultations	60 (15%)	1.4 ± 0.6	84	na	na
Telephone calls to GP	39 (10%)	1.4 ± 0.6	54	na	na
Visits to GP	116 (29%)	1.2 ± 0.5	136	11.90[c]	1,618
Daytime home visits by GP	4 (1%)	1.0 ± 0.0	4	11.90[c]	48
Night-time home visits by GP	1 (< 1%)	2.0	2	45[d]	90
Visits to A and E departments	0			24[e]	0
Hospital stays	0			162[f]	0
Other	9 (2%)			na	na

[a] For employees utilizing healthcare resources.
[b] Data from 393 employees who returned the follow-up questionnaire.
[c] Average cost of GP consultations (1993/1994 figures).[6]
[d] Average cost of night-time home visit by GP (1990 figures).[7]
[e] Accident and emergency attendance (1990/1991 figures).[8]
[f] Average cost of in-patient day (1992/1993 figures).[9]

Table 3. Summary of medication use

Category	*Response*
Number of employees	411
Number of employees taking medication *n* (%)	389 (95)
Number of employees taking OTC medication *n* (%)	376 (91)
Number of employees taking prescription medicine *n* (%)	
Antibiotics	75 (18)
Other	13 (3)
Total	84 (20)
Number of medications/employee	
Mean	2.46
Range	(0–7)
Number of OTC medications/employee	
Mean	2.22
Range	(0–7)
Number of prescribed medications/employee	
Mean	0.24
Range	(0–3)

OTC = Over the counter.

and between the number of symptoms reported and the number of work days missed ($r = 0.18$; $n = 382$).

There was a positive correlation between the number of symptoms and healthcare utilization ($r = 0.23$). The main symptoms to cause or likely to cause subjects to visit a GP were: fever (14%; 56/395); difficulty breathing (14%; 56/395) and cough producing phlegm (13%; 56/395).

Costs

In terms of loss of productivity, the overall total cost to the employer of missed work days was an estimated £111,679. Managerial staff accounted for the greatest cost. The total cost of lost caregiver work was £4,785 (Table 4).

The overall cost of healthcare utilization by participants was an estimated £1,756, at an average cost of £14 per participant who consulted a GP over the period of illness (Table 2). However, no associated standard cost was assigned to 'pharmacist consultations' and 'telephone calls to GP' on which to impute the total cost. These data, therefore, have not been included in the overall estimates. Nor was any pharmaceutical cost applied.

DISCUSSION

To our knowledge, this study is the first of its kind to assess lost productivity, caregiver support and healthcare utilization resulting from I/ILI within a well-defined working population of adults served by an Occupational Health department. Previously, the

Table 4. Cost of work days missed by employee and caregiver

	Employees			*Missed work days*		*Standard cost/day (£)*	*Total cost (£)*
	Total n	*I/ILI positive[b] n (% of total)*		*Mean (a)*	*Total (b)*	*(c)*	*(b x c)*
Employees[a]							
All employees	3,417	393	(11.5)	2.8	1,096	101.92	111,679
Secretarial/ administrative	314	46	(14.6)	3.2	146	66.28	9,693
Scientists	2,291	236	(10.3)	2.9	676	101.35	68,462
Managers	516	50	(9.6)	1.8	89	195.25	17,280
Other	296	51	(17.2)	3.0	156	56.88	8,845
Unknown status		10		3.0	30		
Caregivers							
All caregivers		202		0.4	76	63.38	4,785

[a] Mean salaries of company employees.
[b] All I/ILI positive employees who answered the question.
[c] New Earnings Survey 1993, Department of Employment. Mean salary for all full-time employees.
NB Excludes employer's National Insurance and pension contributions.

impact of influenza on healthcare has been assessed from data collected from sentinel general practices in the US and Europe.[1,13] Other studies which have used working adults have concentrated on the effects of vaccination policies.[14,15]

Absences from work observed in this present study were lower than those reported in a previous study involving postal workers in the UK and spanning five years up to 1979. In that study an average leave of absence of 10 days per employee per episode of illness was used in a cost-benefit analysis.[15] The impact of I/ILI on a particular population depends on characteristics of the population in question and the type and severity of the infecting virus. The present study was conducted during the winter of 1994/95, a year when the outbreak of influenza in the UK was small and predominantly limited to the milder influenza B virus. Consequently, the study was unable to recruit more than a few employees with confirmed influenza. Nevertheless, data were obtained from 411 patients who fulfilled the entry criteria and had I/ILI. If a similar study were to be conducted in the future it is recommended that recruitment should only commence when influenza is confirmed in the locality, as this would increase the proportion of influenza positive cases in the study population.

An important factor to consider in quantifying the impact of I/ILI on a working population is the relationship between the seniority of employment (whether administrative or managerial) and the duration of sickness absence. This relationship has been noted elsewhere.[16,17] In the present study, managerial staff returned to work, on average, 1.4 days earlier than secretarial or administrative staff. It may be that more senior staff felt obliged to return to work at the earliest possible opportunity. This association may explain differences in absence levels attributed to influenza observed both in this study and in previous studies.

To arrive at the cost estimation used in the present study, costs were applied to the number of missed work days using the company's human resources figures. It may be that the actual loss to society was far less than the estimated indirect costs of loss of potential productivity calculated by this human capital approach.[18,19] The exact relationship between short-term absence and loss of productivity depends on the absentee's profession, the type of organization and the production process.[18] Thus, whereas it may be necessary to replace a train driver in order to maintain continuity of transport services, a scientist may make up for lost time on return to work. Such was predominantly the case in this study, with employees also covering for colleagues during absence. The overall cost to society, therefore, is likely to be lower than the cost to individuals and their employers.

Loss of productivity, however, is not confined to absence. The results of the present study show that the symptoms of illness can interfere with productivity at work. Both the participants who completed a diary card during illness, as well as those who completed a questionnaire after illness, gave their responses to a question relating to daily effectiveness. The results were similar for both recall periods and indicated that a premature return to work before the alleviation of all symptoms can impair effectiveness and affect productivity. However, it is accepted that the assessment is very subjective. Alternative questions looking at both the quantitative and qualitative aspects of productivity are currently being tested to determine whether their use would be more appropriate. Although the majority of the data collected in this study was self-reported, the forms were well-completed with very little missing data. To confirm the accuracy of the data it may be appropriate in future studies to validate the data in a subsample against more accurate measures of missed work days. Medical records could be used to validate medication use and physician visits.

The impact of influenza on productivity and result-

ing costs to employers has led to considerable debate amongst occupational health professionals over the cost-effectiveness of workplace vaccination programmes.[7,14,15,20] Studies of working populations comparing absence rates experienced by vaccinated and non-vaccinated employees are susceptible to bias due to confounding factors. One recent double blind, placebo-controlled study of vaccination of working adults showed modest cost benefits.[14] However, when applying such a policy in a particular workforce, the resulting cost-effectiveness in practice will be influenced by a number of factors including: underlying health status of the workforce; age profile; severity of influenza epidemic; remuneration of staff; company policy with regard to sick pay and extent and distribution of uptake of vaccination amongst the workforce. Computer-assisted economic models incorporating such factors are being developed in a bid to estimate the cost-effectiveness of influenza vaccination in different industrial workforces.[21] The development of new anti-viral treatments for influenza is likely to lead to a similar health economic appraisal of the cost-effectiveness of providing treatments through occupational health services.

The question of impaired performance while suffering from I/ILI has important health and safety implications. It has been shown, for example, that mild episodes of I/ILI are associated with substantially impaired (20–40% reduction) reaction times.[22] By comparison, the consumption of alcohol has been shown to produce a 5–10% reduction.[23] Furthermore, these impaired reaction times following an episode of I/ILI have been observed to persist once the primary symptoms have resolved.[24] In addition, there is evidence to show that people suffering from upper respiratory tract illnesses are particularly susceptible to factors such as noise, fatigue or alcohol on performance.[24] If I/ILI does indeed reduce performance, the safety consequences resulting from employees who continue to perform demanding or dangerous tasks are potentially serious. The magnitude of the potential problem becomes clearer if it is assumed that at least 50% (20 million people) of the UK workforce continue to work while suffering from upper respiratory tract illnesses, and that each person has between one and three such illnesses a year.[24]

The present study supports the view that working adults with I/ILI tend to stay at home to treat their symptoms and are very rarely admitted to hospital because of the infection. The results of this study nevertheless reveal a high number of contacts with GPs and pharmacists, and considerable use of both prescription and OTC medicines.

In summary, even in a non-epidemic year, I/ILI have considerable impact on productivity in the workplace and lead to substantial consumption of healthcare resources. Therefore, I/ILI is associated with considerable cost implications for employers, caregivers and employees alike and is an important occupational health issue.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the assistance of Wendy Jackson, Lisa Waller, Debra Ejiogu and Glaxo Wellcome R&D Occupational Health Department staff with the administration of the study.

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