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The burden of influenza-like illness in the US workforce

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Abstract

Background—The disease burden of influenza-like illnesses (ILIs) on the working population has been documented in the literature, but statistical evidence of ILI-related work absenteeism in the USA is limited due to data availability.

Aims—To assess work absenteeism due to ILIs among privately insured employees in the USA in 2007–8 and 2008–9.

Methods—We used the 2007–9 MarketScan® research databases. Full-time employees aged 18–64 years, with the ability to incur work absence and continuously enroled in the same insurance plan during each season were included. We identified ILI episodes using ICD-9 codes for influenza and pneumonia (480–487). For each season, we calculated the mean work-loss hours per ILI episode and the proportion of employees who had at least one ILI episode. Work-loss hours and ILI rates were examined by subgroups.

Results—The mean number of work hours lost per ILI episode was 23.6 in 2007–8 and 23.9 in 2008–9. The proportion of employees with at least one ILI was 1.7% in 2007–8 and 1.2% in 2008–9. In both seasons, the proportion with ILI was higher among older (2.1 and 1.5%) and hourly workers (2.0 and 1.3%), workers in the southern region (1.9 and 1.3%) and those in oil, gas or mining industries (1.9 and 1.4%).

Conclusions—Our results indicate that the disease burden associated with ILIs in the working population is not trivial and deserves attention from policymakers and health care professionals to design effective strategies to reduce this burden.

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Conflicts of interest
None declared.

Keywords

Disease burden; influenza-like illness; work absenteeism

Introduction

In 2009, influenza and pneumonia were the eighth leading cause of death in the USA, with around 54 000 associated deaths [1]. In 2006, influenza and pneumonia were the first-listed diagnosis for around 1300 hospital discharges [2]. Although influenza-associated deaths and hospitalizations mostly occurred among children and the elderly adults [3–7], the disease burden on the working population has been well documented in the literature [8–11]. However, most of these studies used data from European countries, where the mean number of days of work lost associated with ILIs was between 0.3 and 5.9 [11–17]. Few studies have assessed the burden of ILIs on US working adults. Kavet [18] used the National Health Survey and reported that an average of 3.2 work days were lost per ILI case. Using the 1996 Medical Expenditure Panel Survey, Akazawa *et al.* [10] reported an average of 1.3 work days missed due to influenza (defined as ICD-9 code 487) among employees aged 22–64. Nichol *et al.* [8] surveyed employees aged 50–64 and reported 1.5 work days lost to ILIs (defined as fever or feeling feverish with cough or sore throat). A North Carolina study found that ILIs caused around 1.5 work loss days [19]. These studies examined self-reported ILIs [8,10,18,19] in a single influenza season [8,10,19], used old data [10,18,19] and were geographically limited or based on small samples [8,19]. We, therefore, examined work hours lost to ILIs in a large sample of full-time privately insured US employees over two influenza seasons.

Methods

We included in our study population full-time employees aged 18–64 continuously enroled in the same health insurance plan in 2007–8 or 2008–9. We restricted our analyses to employees who were eligible to incur work absence and who reported work absence hours daily. We used the commercial claims and encounters database (CCAE) and the health and productivity management database (HPM) portion of the MarketScan database for 2007–9 [20]. The CCAE data track insurance claims (a formal request to an insurance company asking for a payment based on the terms of the insurance policy) from providers using a nationwide sample of enrolees who are under the age of 65. It collects information from employers, health plans and state-level Medicaid agencies. The subjects include employer-sponsored insured employees and their spouses and dependents. The CCAE collects information on enrolment records, inpatient, outpatient and drug medical claims and associated costs. The retrospective data contain a large proportion of the US privately insured population (around 28 million individuals in 2009). A subset of those enrolled in the CCAE is included in the HPM data, which are collected from employer payroll systems and contain absence records and workers' compensation records for around 3 million employees in 2009. The HPM data allow users to determine when employees were absent from work, number of absence hours and the reason for the absence. MarketScan Database assigns a unique identifier to each subject, and thus, medical claims in the CCAE can be linked to work absence records in the HPM.

We defined an ILI season as July 1 to June 30 of the following year to capture ILIs unrelated to influenza epidemics (e.g. pneumonia) [3,5]. We calculated the proportion of employees who had at least one ILI episode in 2007–8 and 2008–9 and the work-loss hours per ILI episode. We examined the proportion and work-loss hours by age group, gender, metropolitan statistical area (MSA), region, industry, employee classification and insurance plan type. We determined statistical significances of differences within group using two-tailed *t*-tests. We used logistic regression analysis to identify factors associated with ILI episodes and linear least squares analysis to identify factors related to work-loss hours per episode. We used the Stata package (Stata 12; Stata Corporation, College Station, TX) for our analyses.

We calculated the mean work-loss hours per ILI episode as follows: Firstly, we generated a work absence file based on the HPM data by combining consecutive absence records into one record. For example, if an employee had two absences of 8 h on both Friday August 17 and Monday August 20, they would have only one absence record in the work absence file with the starting date August 17 and end date August 20 and 16 hours' absence would be recorded.

Secondly, we generated an ILI episode file by extracting ILI-related inpatient and outpatient claims from the CCAE. Previous studies have used two influenza-associated diagnostic categories to define ILIs: Underlying pneumonia and influenza (ICD-9 codes 480–487) and underlying respiratory and circulatory conditions (ICD-9 codes 390–519) [3,5,21]. According to the Centers for Disease Control and Prevention (CDC), an ILI case is defined as having a fever of at least 37.8°C accompanied by cough or sore throat in the absence of a known cause. Underlying pneumonia and influenza were more consistent with this definition as many respiratory and circulatory conditions do not cause cough or sore throat (e.g. heart and cerebrovascular diseases). Thus, we used the ICD-9 codes from 480 to 487 to define ILI-related inpatient and outpatient medical encounters. In the CCAE data, each observation corresponds to one medical encounter. However, one ILI episode may require several medical encounters. In order to identify the case start and end date of an ILI episode, we used the definition in Molinari *et al.* [21]: inpatient and outpatient medical uses incurred 2 weeks before and 4 weeks after the inpatient stay were determined as one ILI episode. If an employee did not have ILI-related hospitalization during the season, ILI-related outpatient visits incurred within 2 weeks were determined as one ILI episode. Thus, in the ILI episode file each ILI episode record had a case start and end date, which were the dates the ILI-related medical encounter was first and last observed in the CCAE, respectively.

Finally, we merged the work absence and ILI episode files based on the subject's identification number. Work absence was attributable to ILIs if the absence start and end dates were within 5 days of the employee's ILI episode duration.

We conducted sensitivity analyses by including both full-time and part-time workers to evaluate the potential impact of part-time workers on work loss. We also redefined the influenza season as September 1 to March 31 of the following year to examine whether outcomes were sensitive to the definition of ILI season. Although our length of an ILI episode was based on study by Molinari *et al.* [21], a consensus of the length was not available in the literature. According to the CDC seasonal influenza information [22], infectivity generally lasts 5–7 days after becoming sick [22]. We, therefore, used 7 days duration to define an ILI episode for the sensitivity analysis. We pooled the 2007–8 and 2008–9 data to perform a multivariate logistic regression analysis on whether an employee had at least one ILI episode during the applicable season. We performed a linear regression analysis on work-loss hours per ILI episode in 2007–8 and 2008–9.

This study was reviewed by the Human Subjects Coordinator at CDC's National Center for Immunization and Respiratory Diseases. As an analysis of secondary data without identifiers, this study was deemed not to require ethical approval.

Results

Our analysis included 186 056 and 195 366 employees in 2007–8 and 2008–9, respectively. Characteristics of the study population were similar (Table 1). We identified 2406 ILI-related work absence records in 2007–8 and 1675 in 2008–9. ILI-related work absenteeism peaked in February during both seasons. The mean work-loss hours per ILI were 23.6 in 2007–8 and 23.9 in 2008–9 (Table 2). Work-loss hours per episode were greater if the ILI episode was associated with hospitalization: 47.0 in 2007–8 and 46.1 in 2008–9. The mean length of hospital stay was 4.4 days in 2007–8 and 4.9 in 2008–9. In both seasons, workers in the oldest age group had the most work-loss hours: 25.2 in 2007–8 and 24.1 in 2008–9 (Table 3).

Table 4 shows the proportion of employees having at least one ILI: 1.7% of 186 056 employees in 2007–8 and 1.2% of 195 366 in 2008–9. The proportion having a single ILI episode in the first season was 1.6 and 0.2% had at least two episodes. The corresponding numbers for 2008–9 were 1.0 and 0.1%. Employees in the oldest age group had the highest proportion of ILI-related medical encounters (2.1%, $P < 0.001$, in 2007–8 and 1.5%, $P < 0.001$, in 2008–9). In both seasons, the proportion was higher among employees residing in the southern region (1.9 and 1.3%), employees working in the oil, gas or mining industries (1.9 and 1.4%) and hourly workers (2.0 and 1.3%).

The inclusion of part-time workers did not change our results noticeably. In 2007–8, ILI-related work-loss hours per episode were 23.6 and 1.2% of 187 089 workers had at least one ILI. The corresponding numbers in 2008–9 were 22.7 and 1.2% (of 196 388 employees). Results were similar as we redefined the influenza season. Proportions of employees with ILIs did not change if we used a 7-day duration to define an ILI episode. Work-loss hours associated with ILIs were slightly lower, at 21.7 and 22.2 in 2007–8 and 2008–9, respectively.

Controlling for age group, gender, MSA, region, industry, employee classification and type of insurance plan, the odds of having an ILI were lower in 2008–9 (odds ratio (OR = 0.7, $P < 0.01$) compared with the 2007–8 season. The odds of having an ILI were higher among employees in the oldest age group (OR = 1.5, $P < 0.01$) and hourly workers (OR = 1.3, $P < 0.01$) compared with the reference groups. Compared with employees in the southern region, the odds of having an ILI were significantly lower among workers located in other regions.

Age, region and industry were significantly associated with ILI-related work-loss hours. Workers aged 55–64 had 3.1 ($P < 0.001$) more ILI-related absence hours than workers in the 18–34 age group. Employees in the northeast region had fewer ILI-related work-loss hours (−3.5 h, $P < 0.001$) than employees in the southern region. ILI-related work-loss hours were lower (around −3 h, $P < 0.05$) among workers in manufacturing industry compared with workers in the oil, gas or mining industries.

Discussion

We found that the mean work hours lost per ILI episode were 23.6 and 23.9 in 2007–8 and 2008–9, respectively. The proportion of employees having at least one ILI episode was 1.7% in 2007–8 and 1.2% in 2008–9. The prevalence of ILIs was higher among older and hourly workers, those in the southern region and those in oil, gas or mining industries. To our knowledge, this is the first study to use insurance claims data to analyse work absences associated with ILIs in the USA. Our data sources cover a large proportion of the privately insured population and allowed analyses of two influenza seasons. Our findings provide an updated evaluation of the disease burden of ILIs in the US working population. By considering medically attended and physician-diagnosed ILIs, this study offers a different perspective from previous studies in the USA using self-reported data.

Our findings should be interpreted in the light of some study limitations. Firstly, considering medically attended ILIs may underestimate the proportion of workers with ILIs and may overestimate work-loss hours per ILI as medically attended ILIs will generally be more severe cases. However, our number of work-loss hours was consistent with studies using physician-diagnosed ILIs (an average of 3.7–5.9 work-loss days) [12,15,23], and our rate of ILIs was consistent with Fowlkes *et al.* [24], which used influenza surveillance data covering six states during the 2009–10 season (the cumulative ILI incidence among adults was 13 per 1000 population). Secondly, our ILIs were not laboratory confirmed. However, they were physician diagnosed and were consistent with the seasonal pattern of ILIs reported by CDC [23]: The number of influenza cases was greater in 2007–8 than in 2008–9 and case numbers peaked in February in both seasons. Regional outpatient illness and viral surveillance data [25] also indicated that the number of influenza positive tests was considerably higher in the southern region in both seasons. Thus, we believe that our analysis represents an acceptably accurate measure of the burden of ILIs on US working adults. Finally, the MarketScan data are collected from large self-insured employers, and therefore, industries that primarily consist of part-time or self-employed workers (e.g. construction, retail, agriculture, forestry and fishing) may be under-represented. Moreover, our analyses included workers with the ability to incur work absence and who were continuously enroled in a private insurance plan, which limits their applicability to the wider US working population. However, this study evaluated the disease burden in a large part of the working population as around 85% of full-time workers aged 18–64 in 2009 were covered by private health insurance [26].

The 2008–9 season included the start of the H1N1 influenza pandemic (April 2009), which may have affected the reporting of ILIs in 2009 compared with the previous season. However, according to CDC, influenza activity peaked in October 2009 (after our 2008–9 season) and had a greater impact on children and young adults. Moreover, according to the US Outpatient Illness Surveillance, during the initial wave of the H1N1 pandemic, the percentage of ILI outpatient visits was around the national baseline level, exceeding the baseline level in August 2009 after our 2008–9 season. Also our sensitivity analysis redefined the season as September 1 to March 31 of the following year with very similar results. Therefore, we believe that the H1N1 pandemic had a modest impact on our analyses.

Consistent with previous studies [4,5], we found that employees in the oldest age group were most vulnerable to ILIs. This may be due to their higher propensity to seek medical care because of co-morbidities, since our identified ILIs were all medically attended. Assuming an 8-h work day, our study indicated that employees lost around 3 days of work per ILI episode. This number was similar to Kavet [18] but greater than in other US studies. The observed differences may be due to differences in study design, inclusion criteria, the definition of ILIs and the severity of ILIs during the study years. Also ILIs and work-loss days were self-reported in previous studies, whereas ours were based on insurance claims in which ILIs were medically attended and physician diagnosed. Studies estimating the rate of ILIs in the working population are limited, but our rate of ILIs was considerably lower than in previous studies. Including medically attended ILIs may underestimate the occurrence rate. Studies with small sample sizes tended to have a high occurrence rate of ILIs [9,27–29].

We found no existing studies of ILI-related work absenteeism or influenza vaccine coverage by industry or employee classification. Variations in ILI-attributable work absence by industry and employee classification may reflect variations in access to care, differences in work benefits (as workplace influenza vaccines are more likely to be available for salaried workers) and differences in regional influenza circulation intensity, as 88% of employees in the oil, gas extraction or mining industries in our study population were located in the southern region.

Previous studies have reported 9 work days lost annually for workers with depressive disorders, around 3 days per month for asthma and 4 days per month for arthritis, diabetes or high blood pressure [30]. Employed adults over 18 lost an average of 4 work days due to illness or injury in the past year (2007 National Health Interview Survey, NHIS). Although difficult to compare directly to sickness absence data from other conditions, the disease burden associated with ILIs in the US working population is not trivial and deserves attention from policymakers and health care professionals to design effective strategies to reduce the burden.

Immunization against influenza has proved to be effective in preventing influenza. However, only 28% of US adults aged 18–64 received an influenza vaccination in the 2008–9 season (2009 NHIS). It is unclear whether increasing vaccination coverage among working adults would reduce the impact of ILIs on sickness absence. At present the only occupational group to which influenza vaccination is usually offered are health care workers. Providing vaccination in other workplaces and extending the vaccination benefit to part-time workers may effectively reduce the transmission of influenza among co-workers and associated work loss. In light of our findings of the variations in ILI-attributable work absence by industry and region, efforts to reduce ILIs could be targeted at specific regions or occupations.

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Key points

- This study found that US workers lost approximately 3 days of work per influenza-like illness episode in 2007–9.
- The proportion having influenza-like illnesses was higher among older or hourly workers and workers in the southern USA and in the oil, gas or mining industries.
- Measures to reduce the burden of influenza-like illnesses in the US workforce should be, therefore, considered.

Table 1

Characteristics of the study population by influenza season

	2007–8, *N* = 186 056 *n* (%)	**2008–9, *N* = 195 366 *n* (%)**
Age group		
18–34	37 345 (20)	42 135 (22)
35–44	46 652 (25)	45 857 (23)
45–54	72 838 (39)	75 703 (39)
55–64	29 221 (16)	31 671 (16)
Sex		
Male	130 914 (70)	136 780 (70)
Female	55 142 (30)	58 586 (30)
MSA (metropolitan statistical area)		
Yes	179 327 (96)	188 245 (96)
No	6729 (4)	7121 (4)
Region[a]		
Northeast	17 681 (10)	18 430 (9)
North central	34 687 (19)	37 109 (19)
South	42 979 (23)	45 187 (23)
West	90 709 (49)	94 640 (48)
Industry		
Oil and gas extraction, mining	24 264 (13)	24 235 (12)
Manufacturing, durable	127 638 (69)	134 045 (69)
Manufacturing, non-durable	21 961 (12)	23 800 (12)
Services	12 193 (7)	13 286 (7)
Employee classification		
Salaried	130 975 (70)	135 024 (69)
Hourly	55 057 (30)	59 318 (30)
Unknown	24 (0)	1024 (1)
Plan type		
FFS	1025 (1)	993 (1)
HMO	41 749 (22)	43 721 (22)
Non-capitated POS	18 526 (10)	11 839 (6)
PPO	124 756 (67)	138 813 (71)

Influenza seasons were defined as July 1 through June 30 of the following year. FFS: fee for service; HMO: health maintenance organization; Non-capitated POS: non-capitated point of service; PPO: preferred provider organization.

[a]Northeast region includes Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania and New Jersey. North central region includes Wisconsin, Michigan, Illinois, Indiana, Ohio, Missouri, North Dakota, South Dakota, Nebraska, Kansas, Minnesota and Iowa. South region includes Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Mississippi, Alabama, Oklahoma, Texas, Arkansas and Louisiana. West region includes Idaho, Montana, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico, Alaska, Washington, Oregon, California and Hawaii.

Table 2

Work hours lost per ILI episode by influenza season

	ILI episodes (*n*)	Work-loss hours			
		Mean	*P* value	95% confidence intervals	
2007–8	2406	23.6	NS	22.9	24.4
2008–9	1675	23.9		23.0	24.8
		Work-loss hours associated with only outpatient visits			
2007–8	2295	22.5	NS	21.9	23.2
2008–9	1579	22.5		21.7	23.4
		Work-loss hours associated with hospitalization			
2007–8	111	47.0	NS	39.8	54.2
2008–9	96	46.1		39.0	53.1
		ILI-related hospitalization, Length of stay			
2007–8	111	4.4	NS	3.5	5.2
2008–9	96	4.9		4.0	5.8

Influenza seasons were defined as July 1 to June 30 of the following year. An ILI episode was defined using the ICD-9 codes 480–487.

Table 3

Work hours lost per ILI episode by influenza season and employee characteristics

	2007–8, *n* = 2406	*P* value	2008–9, *n* = 1675	*P* value
Age group		<0.05		<0.01
18–34	21.6		21.4	
35–44	23.5		22.4	
45–54	23.8		25.7	
55–64	25.2		24.1	
Sex		NS		NS
Male	23.7		24.1	
Female	23.6		23.5	
MSA		<0.05		NS
Yes	23.5		23.9	
No	27.0		23.1	
Region[a]		<0.01		NS
Northeast	19.0		20.5	
North central	23.9		22.7	
South	24.5		24.5	
West	23.7		24.4	
Industry		<0.05		<0.05
Oil and gas extraction, mining	25.9		26.1	
Manufacturing, durable	23.5		23.7	
Manufacturing, non-durable	21.1		20.6	
Services	23.4		26.6	
Employee classification		NS		NS
Salaried	23.9		23.7	
Hourly	23.2		24.3	
Unknown	—			
Plan type		NS		NS
FFS	18.6		26.6	
HMO	24.1		23.8	
Non-capitated POS	23.3		26.5	
PPO	23.6		23.6	

Influenza seasons were defined as July 1 to June 30 of the following year. FFS: fee for service; HMO: health maintenance organization; Non-capitated POS: non-capitated point of service; PPO: preferred provider organization.

[a]Northeast region includes Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania and New Jersey. North central region includes Wisconsin, Michigan, Illinois, Indiana, Ohio, Missouri, North Dakota, South Dakota, Nebraska, Kansas, Minnesota and Iowa. South region includes Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Mississippi, Alabama, Oklahoma, Texas, Arkansas and Louisiana. West region includes Idaho, Montana, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico, Alaska, Washington, Oregon, California and Hawaii.

Table 4

Proportion of employees having ILI by influenza season and employee characteristics

	2007–8, *n* = 186 056		2008–9, *n* = 195 366	
	***n* (%)**	***P* value**	***n* (%)**	***P* value**
Full	3198 (1.7)		2304 (1.2)	
Age group		<0.001		<0.001
18–34	555 (1.5)		384 (0.9)	
35–44	792 (1.7)		521 (1.1)	
45–54	1235 (1.7)		917 (1.2)	
55–64	616 (2.1)		482 (1.5)	
Sex		NS		NS
Male	2266 (1.7)		1594 (1.2)	
Female	932 (1.7)		710 (1.2)	
MSA		<0.05		NS
Yes	3058 (1.7)		2219 (1.2)	
No	140 (2.1)		85 (1.2)	
Region[a]		<0.001		<0.001
Northeast	243 (1.4)		206 (1.1)	
North central	606 (1.8)		340 (0.9)	
South	835 (1.9)		587 (1.3)	
West	1514 (1.7)		1171 (1.2)	
Industry		<0.001		<0.01
Oil and gas extraction, mining	469 (1.9)		332 (1.4)	
Manufacturing, durable	2216 (1.7)		1597 (1.2)	
Manufacturing, non-durable	317 (1.4)		247 (1.0)	
Services	196 (1.6)		128 (1.0)	
Employee classification		<0.001		<0.001
Salaried	2090 (1.6)		1503 (1.1)	
Hourly	1108 (2.0)		794 (1.3)	
Unknown	0 (0)		7 (0.7)	
Plan type		NS		<0.01
FFS	11 (1.1)		6 (0.6)	
HMO	746 (1.8)		502 (1.2)	
Non-capitated POS	321 (1.7)		174 (1.5)	
PPO	2120 (1.7)		1622 (1.2)	

Influenza seasons were defined as July 1 through June 30 of the following year. FFS: fee for service; HMO: health maintenance organization; Non-capitated POS: non-capitated point of service; PPO: preferred provider organization.

[a]Northeast region includes Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, Pennsylvania and New Jersey. North central region includes Wisconsin, Michigan, Illinois, Indiana, Ohio, Missouri, North Dakota, South Dakota, Nebraska, Kansas, Minnesota and Iowa. South region includes Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Mississippi, Alabama, Oklahoma, Texas, Arkansas and Louisiana. West region includes Idaho, Montana, Wyoming, Nevada, Utah, Colorado, Arizona, New Mexico, Alaska, Washington, Oregon, California and Hawaii.