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Influenza and Workplace Productivity Loss in the Marshfield Epidemiologic Study Area

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Influenza and Workplace Productivity Loss in the Marshfield Epidemiologic Study Area

By

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Bachelor of Arts
Macalester College
2010

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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Abstract

Influenza and Workplace Productivity Loss in the Marshfield Epidemiologic Study Area
By Anna Gajewski

Background: Acute respiratory illnesses (ARIs) cost the U.S. tens of billions of dollars annually in direct medical care. Indirect ARI-associated costs are predicted to account for similar economic burden, but have not been widely examined. Influenza plays a significant role in workplace productivity loss due to widespread occurrence, severe symptom profile, and variable seasonal vaccine coverage. However, no studies to date have compared laboratory confirmed influenza cases to other ARIs in terms of short-term impact on workplace absenteeism (time away from work), presenteeism (impairment while at work), or total combined productivity loss.

Methods: An analysis was conducted using data from employed participants in the 2012-13 Rapid Analysis of Influenza Vaccine Effectiveness (VE) study. Multiple linear regression was used to test the association between influenza status at the time of VE study enrollment and overall workplace productivity loss during the 1-2 week period following ARI symptom onset. Workplace productivity loss (0-100%) was measured per a modified Work Productivity and Activity Impairment questionnaire.

Results: Unadjusted total productivity loss was 70.5% for participants with influenza and 60.8% for participants with other ARIs. After adjusting for sex, week of symptom onset, and smoking, influenza was significantly associated with an 8.1% increase in workplace productivity loss. Sub-analyses on absenteeism and presenteeism outcomes indicated that missed workdays were the principal driver of workplace productivity loss in the influenza-positive group.

Discussion: Influenza was associated with workplace productivity loss above that observed by non-influenza ARIs. This additional productivity loss in the influenza group was primarily attributable to hours absent from work. More research is needed to better understand the full economic implications and how much variability there is between flu seasons.

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Background

Influenza is a viral respiratory illness that affects the nose, throat and lungs. Acute respiratory infections (ARIs), including influenza, create a significant morbidity and mortality burden in the United States. Collectively, influenza and pneumonia are the eighth leading cause of death among American adults (1). The World Health Organization estimates that influenza costs the United States between $71 and $167 billion annually (2). In 2002, O'Reilly, et al. estimated that the indirect costs of ARIs far exceed direct medical care expenditures (3). Much of this cost is attributable to absenteeism and decreased productivity of workers who attend work while ill (presenteeism).

The field of workplace productivity loss is fairly young. Some of the first studies focused on work quality and productivity in those living with HIV/AIDS. In the late 1990's, researchers began to focus on productivity in those with chronic migraines. Today, the majority of workplace productivity loss research remains within the realm of chronic illness. However, a few researchers have begun to quantify productivity loss due to acute illness.

In 2010, Palmer, et al. published results of a prospective cohort study comprised of working adults in three large US companies. They found that in a single flu season, participants with at least one ARI episode were twice as likely to miss at least one day of work, compared to those with no ARI episodes. In addition, 72% of participants with at

least one episode of influenza-like-illness (ILI) missed at least one day of work, while only 30% of employees reporting no respiratory illness had at least one absence (4). The frequency and widespread occurrence of seasonal influenza, coupled with vaccination rates that vary by season, position influenza as one of the primary drivers of workplace productivity loss. Influenza has more severe symptoms than other ARIs; and as a result, influenza is likely responsible for much of the workplace productivity loss attributable to ARIs.

The purpose of this study is to assess the amount of total productivity loss attributable to influenza compared to other ARIs, in a single season. We postulate that after controlling for potentially confounding variables, participants presenting with influenza infection will have significantly greater overall workplace productivity loss relative to participants presenting with other non-influenza ARIs. Sub-analyses will also be conducted that disaggregate the workplace productivity loss outcome, examining the impact of influenza on absenteeism and presenteeism separately.

Additionally, each season sees differences in the strains of influenza in circulation. As an additional analysis we will examine the impact, if any, of influenza sub-type on productivity loss. Another secondary analysis will attempt to quantify the impact, if any, of the influenza vaccine in mitigating the effects of influenza illness on productivity loss. Among those with laboratory confirmed influenza, we will examine the effects of vaccination on overall workplace productivity loss.

Methods

The Rapid Analysis of Influenza Vaccine Effectiveness (VE) study is an annual study conducted by the Marshfield Clinic Research Foundation with support from the US Centers for Disease Control and Prevention. Methods for the 2012-13 VE study were similar to those previously described by Belongia, et al. during the 2007-08 season (5). The 2012 – 2013 season survey differed in that it included additional questions on employment and productivity.

Source population. Study participants were recruited from the source population of the Marshfield Epidemiologic Study Area (MESA) Central region. MESA Central is a 14 zip code area surrounding the Marshfield Clinic's central campus in Marshfield, WI and captures vital health information on over 54,000 people (6). In this region, nearly all residents receive their medical care from Marshfield Clinic and its affiliates (7). MESA Central has validated coverage of the area and captures greater than 97% of residents, 99% of deaths, 90% of hospital discharges, and 90% of outpatient visits (6). MESA residents were eligible for inclusion in the 2012-13 VE cohort if they had at least 12 months of constant residence in MESA as of January 1, 2013. Individuals with high risk medical conditions were defined as those with 2 or more visits during 2012 with an ICD-9-CM diagnosis code corresponding to any of the following chronic conditions: cardiac, pulmonary, renal, liver, diabetes mellitus, immunosuppressive disorders, malignancies, neurological/musculoskeletal, metabolic, cerebrovascular, and circulatory system.

Influenza vaccination status. Marshfield Clinic and its associates use the Registry for Effectively Communicating Immunization Needs (RECIN) to record and track all immunizations received by patients. RECIN (http://www.recin.org) is a real-time, internet-based registry that has been validated and shown to capture 95% of influenza vaccinations among MESA residents and has been shown to be more reliable than self-report (8). From RECIN, we extracted the date of influenza immunization. Participants were categorized as vaccinated if the immunization date was more than 14 days prior to their clinical visit for ARI.

Recruitment and Sample Collection. Participant eligibility was defined as anyone who had a cough at enrollment (assessed by self report on the day of their medical encounter) whose illness onset was fewer than 8 days prior to his medical encounter. Those will illness duration of 8 or more days were deemed ineligible due to limited influenza test sensitivity. Trained research coordinators used an electronic appointment system to identify and track potential study participants from primary care departments, including: Pediatrics, Family Practice, Internal Medicine, and Urgent Care. Participants were also recruited from St. Joseph's hospital, an acute care facility associated with Marshfield Clinic. Enrollment occurred on weekdays, evenings, and weekends. Patients not approached during their medical encounter were reached via phone after being identified using ICD-9-CM codes for cough or respiratory illness which were entered by the physician during their appointment. After screening, eligible subjects were invited to participate in the study. All participants completed a short interview to determine illness onset, presence of symptoms, and demographic data. Participants provided a

nasopharyngeal swab, either while at their visit or at their home if they were enrolled via phone.

Participant enrollment began on December 12, 2012 and continued for 12 weeks, with the last enrollment on March 5, 2013. The study began enrolling participants once the Marshfield Clinic Research Foundation received confirmation from the Marshfield Laboratories and the Wisconsin State Laboratory of Hygiene that there had been laboratory confirmed cases of influenza in the area.

Influenza virus detection. Swabs taken during enrollment were placed in M4 viral transport media, refrigerated or stored on ice, and taken to the Marshfield Clinic CORE laboratories. Real-time reverse transcriptase PCR was used to determine the presence of influenza virus in each sample. Exact methods have been described previously (5). Samples were typically processed within 1 day of collection. Samples collected over the weekend were processed on Monday.

Outcome Measures. Productivity was assessed using a modified version of the Work Productivity and Activity Impairment Questionnaire (WPAI) (9), which includes hours missed due to illness and a 0 to 9 productivity ranking to assess presenteeism. Total productivity scores were calculated by combining absenteeism and presenteeism scores (9) and ranged from 0% to 100% with 0% indicating no productivity loss (perfect productivity) and 100% indicating complete productivity loss (total productivity

impairment) (Appendix A). The WPAI is considered one of the best short-form instruments for measuring workplace productivity loss (10).

Statistical Analysis. An analysis was conducted using data from employed, adult participants in the 2012-13 Rapid Analysis of Influenza Vaccine Effectiveness (VE) study. Multiple linear regression was used to test the association between influenza status at the time of VE study enrollment and overall workplace productivity loss during the period following ARI symptom onset. Workplace productivity loss (0-100%) was measured using an adaptation of the Work Productivity and Activity Impairment questionnaire as described above. A variety of secondary predictors and confounders were considered for inclusion in the model based upon their clinical significance or their inclusion in other similar studies. Predictors and confounders considered include: age, gender, receiving influenza vaccination for the current season, number of household members under the age of 12, the week of symptom onset, expected work hours per week, current asthma, having a high risk condition (as defined in the methods), current smoking status, body mass index, MESA region (three regions, by zip code, North, South, and Central), and length of follow up from symptom onset until follow-up phone interview. Predictors and confounders were entered into the original model and were eliminated in a stepwise manner via backwards elimination. Effect modification was considered for influenza vaccination status. Secondary analyses were conducted using the same stepwise backwards elimination to evaluate the association between total productivity loss and influenza sub-type and total productivity loss and influenza vaccination. All analyses were performed using SAS version 9.3 (Cary, NC).

The study protocol and procedures were reviewed and approved by the Marshfield Clinic Internal Review Board. All participants provided written, informed consent.

Results

During the 2012 – 2013 influenza season, 4685 patients were approached at primary care facilities. Subjects were asked screening questions about respiratory illness symptoms. Fourteen refused screening. Of the 4671 screened, 557 were eligible, but refused participation. 2538 were ineligible due to having symptom duration of greater than 7 days, having a non-respiratory illness, lacking a cough, or not being able to complete the interview in English. 1576 were enrolled and tested for influenza. This study was restricted to participants over the age of 18, which excluded 766 of the total enrolled. Of the 810 adults in the 2012 – 2013 VE study, a total of 445 were excluded from analysis due to incomplete follow-up, under employment (fewer than 20 hours per week), missing data points, or pregnancy (Figure 1). The final analytic sample contained 365 participants.

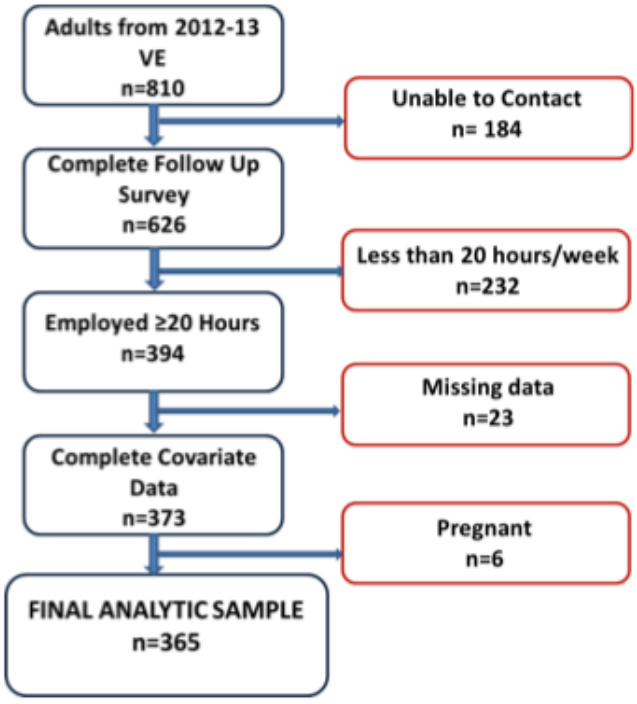

Figure 1. Eligibility flow chart for inclusion in the study.

The laboratory-confirmed influenza case group and the non-influenza ARI comparison group differed significantly in their proportions of females, proportion of vaccinated individuals, distributions of illness onset, proportion of participants experiencing fever and sore throat, and the length of follow-up period. Table 1 outlines the descriptive characteristics for the full sample, the influenza-positive group and the influenza-negative group within the analytic sample.

Initial analysis of the crude model indicated that total productivity loss was greater in those with influenza than in those without influenza (mean percent difference = 9.7 ± 3.1, p = 0.002). The mean unadjusted total productivity loss in the influenza group was 70.5% ± 28.1% versus 60.8% ± 31.2%, p = 0.002 (table 2). Percent of hours lost due to absenteeism was higher in the influenza group (38.6% ± 27.0) compared to the non-influenza group (24.1% ± 24.3, p = <0.0001). However, percentage of productivity loss due to presenteeism was higher in those with non-influenza ARIs, 37.6% ± 22.2 compared to only 34.7% ± 23.8 in those with influenza.

After backwards-stepwise elimination, the final model for combined workplace productivity loss only included influenza status and week of symptom onset. Table 3 shows the full and reduced models for overall productivity loss. Laboratory confirmed influenza was associated with an additional 8.1% (SE = 3.3%) in total productivity loss compared to other non-influenza ARIs. After adjusting for week of symptom onset, the influenza group lost 70.1% (SE = 2.2) of their total productivity, compared to 61.2% (SE = 2.2) in the non-influenza ARI group.

Using the same backwards elimination method to create models for absenteeism, we found that influenza status, week of symptom onset, current smoking status, and length of follow-up were significant predictors of workplace productivity loss due to absenteeism (table 4). The influenza group lost 12.5% (SE = 2.8) more productivity due to absenteeism than the non-influenza ARI group after controlling for these factors. Being a current smoker was associated with an additional 9.5% (SE = 3.3) workplace productivity loss due to absenteeism. After adjustment for week of symptom onset, smoking status, and length of follow up, those with influenza lost 37.8% (SE = 1.0) of their total productivity to absenteeism, while those with other non-influenza ARIs lost 25.0% (SE = 1.0).

Additional models for loss of productivity due to presenteeism found that only influenza status was a significant predictor. Contrary to our findings for total productivity loss and loss due to absenteeism, those with laboratory confirmed influenza had less total productivity loss due to presenteeism than those with non-influenza ARIs (table 5). Those with non-influenza ARIs lost 37.6% (SE = 1.8) of their total productivity to presenteeism, while those with influenza lost 31.8% (SE = 1.7) of their total productivity due to presenteeism.

As a secondary analysis, we assessed the impact of influenza sub-type (A vs. B) on total workplace productivity loss among only those with influenza. Influenza sub-type was not a significant predictor of total workplace productivity loss (table 6). However, when the

influenza group was disaggregated into influenza sub-type, region became a significant predictor of total workplace productivity loss.

Additional analysis of the impact of influenza vaccination on workplace productivity among only those with influenza showed that during the 2012 – 2013 influenza season, vaccination did not mitigate the impact of influenza on workplace productivity loss.

Discussion

These findings were consistent with previous research, indicating that influenza leads to greater productivity loss. Similar to Palmer's 2010 study (4), this study incorporated both absenteeism and presenteeism into a total productivity loss score. While the Palmer study compared influenza-like illness to other acute respiratory illness and to those with no acute respiratory illness, this study used laboratory confirmed-influenza to more accurately quantify the amount of productivity loss attributable to seasonal influenza. To our knowledge, this study is the first to use laboratory-confirmed influenza to assess total workplace productivity loss.

This study highlights the significant role of influenza in workplace productivity loss. Both the influenza and non-influenza ARI groups experienced significant loss of productivity during the course of their illness. The group with laboratory-confirmed influenza lost an average of 5.6 more hours of productivity during the duration of their illness compared to the non-influenza ARI group.

After adjusting for many factors, only influenza status and week of symptom onset were significant predictors of total workplace productivity loss. Influenza viruses are typically in wide circulation from December until March. In the case of this study, enrollment began on December 12, 2012 and concluded on March 5, 2013. The influenza cases had a fairly normal distribution and followed a traditional "epidemic outbreak curve", while the distribution of other ARI cases was more sporadic (appendix B).

After disaggregating productivity loss due to absenteeism and productivity loss due to presenteeism, we found that influenza status, week of symptom onset, current smoking status, and length of follow up were predictors for productivity loss due to absenteeism and that those with influenza experienced greater productivity loss due to absenteeism. The Palmer study found that those with influenza-like illness were absent from work more often than those with other respiratory illnesses or those with no acute respiratory illness. The use of laboratory-confirmed influenza brings further evidence to support those claims.

As smoking puts stress on the respiratory tract, it is not surprising that severe respiratory illnesses, such as influenza, would lead to increased absence from work among current smokers. On average, current smokers had an additional 9.5% total productivity loss compared to those who were not current smokers, regardless of illness type. Each additional day of follow up was associated with a decrease in total percent of productivity lost due to absenteeism. The survey was administered at the end of the follow-up period. The longer the period, the more time had passed since the initial onset of symptoms, and the more likely the person was to be recovered or nearly recovered at the time of survey. Due to the methods used in this study, those additional days were included in the expected work hour during illness, even if the person had recovered from their illness.

Contrary to Palmer's findings on presenteeism, those with non-influenza ARIs experienced greater productivity loss due to presenteeism and only influenza status was a significant predictor of productivity loss due to presenteeism. Further studies are

suggested to elucidate the true relationship between influenza and productivity loss due to presenteeism. Additionally, this study should be repeated to determine if the relationship between productivity loss due to presenteeism and influenza remains constant between influenza seasons.

Our sub-analysis on the impact of influenza vaccination among those with influenza vaccine failure (those who were vaccinated, but still became ill with influenza) showed that once the vaccine has failed, it does not offer any protection against productivity loss. Influenza affects millions of people each year, many of whom are working adults. While influenza vaccination does not mitigate the effects of influenza among those with vaccine failure, it is very effective in preventing influenza and should be used widely as a preventative tool.

Each influenza season, there are different combinations of influenza strains in circulation. Future studies should aim to repeat these methods in subsequent years to see if these results are typical and to determine if the relationships between absenteeism, presenteeism, and influenza are the same in subsequent years. Additional studies can be done to obtain baseline levels of workplace productivity during influenza season due to any cause. Then researchers can fully determine the extent of productivity loss attributable to influenza.

This study did have limitations, most notably that the data used to calculate absenteeism, presenteeism, and total productivity loss percentages, were obtained from self-report. The

Marshfield Epidemiologic Study Area is not very diverse in terms of race and ethnicity as 97% (6) of residents are non-Hispanic whites. As such, these results many not be generalizable to other racial and ethnic groups.

Table 1. Demographic Features of Eligible MESA Residents Presenting with Influenza-Like Symptoms During the 2012-13 Influenza Season.

	Eligible Participants (n=365)		Confirmed Influenza Cases[a] (n=184)		Non-Influenza Cases[b] (n=181)		
	No. (mean)	% (SE)	No. (mean)	% (SE)	No. (mean)	% (SE)	p-value[c]
Participant Age, years	43.7	±13.4	44.3	±13.5	43.1	±13.2	>0.20
18-29	62	16.9	29	15.8	33	18.1	>0.20
30-39	94	25.7	49	26.6	45	24.7	
40-49	71	19.4	33	17.9	37	20.3	
50-59	96	26.2	49	26.6	47	25.8	
60-69	44	12.0	24	13.0	20	11.0	
Sex							
Female	221	60.6	100	54.4	121	66.9	0.01
Influenza Vaccine Status							
Vaccinated	172	47.1	72	39.1	100	55.3	0.002
Number of Household Members <12							
None	236	64.7	112	60.9	124	68.5	0.29
One	59	16.2	34	18.5	25	13.8	
Two or more	70	19.2	38	20.7	32	17.7	
Week of Symptom Onset							
Weeks 1-3	92	25.2	40	21.7	52	28.7	0.001
Weeks 4-6	129	35.3	80	43.5	49	27.1	
Weeks 7-9	92	25.2	47	25.5	45	24.9	
Weeks 10-12	52	14.3	17	9.2	35	19.3	
Symptoms							
Cough	367	100.0	185	100.0	182	100.0	
Fever	272	74.1	153	82.7	119	65.4	<0.001
Fatigue	349	95.1	177	95.7	172	94.5	0.60
Wheezing	198	54.0	107	57.8	91	50.0	0.13
Sore Throat	261	71.1	120	64.9	141	77.5	0.01
Nasal Congestion	313	85.3	154	83.2	159	87.4	0.27
Shortness of Breath	219	59.7	119	64.3	100	55.0	0.07
Expected Work Hours, per week	40.26	±10.4	40.52	±9.8	40	±11.0	0.63
20-29	40	10.96	19	10.33	21	11.6	0.44
30-39	61	16.71	26	14.13	35	19.34	
40	167	45.75	85	46.2	82	45.3	
≥40	97	26.58	54	29.35	43	23.76	
Current Asthma							
Yes	60	16.44	60	16.44	60	16.44	0.23
High-Risk Chronic Health Condition	128	35.07	62	33.7	66	36.46	0.58
Smoking Frequency							
Current	69	18.9	32	17.39	37	20.44	0.46
Body Mass Index							
<25	78	21.37	46	25	32	17.68	0.03

25 - 29	104	28.49	58	31.52	46	25.41	
≥30	183	50.14	80	43.48	103	56.91	
Region							
Central	267	73.15	124	67.39	143	79.01	0.04
North	31	8.49	19	10.33	12	6.63	
South	67	18.36	41	22.28	26	14.36	
Follow-up Length, days	10.5	±1.7	10.3	±1.7	10.7	±1.7	0.02

[a]Influenza cases confirmed via laboratory test
[b]The non-influenza comparison was comprised of those presenting with an ARI who did not test positive for influenza
[c]P-value from either a t-test (for continuous variables) or chi square test (for categorical variables)

Table 2. Unadjusted means for productivity loss due to absenteeism, presenteeism, and total productivity loss

	All Participants N=365		Influenza n=184		Non-influenza n=181		
Productivity Measure	**mean**	**SE**	**mean**	**SE**	**mean**	**SE**	**p-value**
Hours lost to absenteeism	18.5	16.5	22.9	17.3	14.1	14.5	<.0001
Percent lost to absenteeism	31.4	26.7	38.6	27.0	24.1	24.3	<.0001
Hours lost to presenteeism	20.9	18.3	19.0	16.8	22.6	16.1	0.049
Percent lost to presenteeism	34.7	23.8	31.8	21.9	37.6	25.2	0.019
Total hours lost	39.4	21.2	41.8	19.8	36.2	22.2	0.026
Total percent lost	65.7	30.0	70.5	28.1	60.8	31.2	0.002

Table 3. Multiple linear regression for total productivity loss, full and reduced models.

	Total Productivity Loss (Absenteeism + Presenteeism)					
	Full Model			Reduced model		
Covariate	**Estimate**	**SE**	**p-value**	**Estimate**	**SE**	**p-value**
Intercept	69.7	13.5	<.0001	65	3.2	<.0001
Laboratory Confirmed Influenza	8.1	3.3	0.0139	8.9	3.1	0.0045
Age, years	0.1	0.1	0.5369			
Female	0.1	0.1	0.5369			
Vaccinated for Influenza	2.9	3.5	0.4062			
Household members <12						
One vs. None	2.5	4.7	0.5861			
Two or more vs. None	0.4	4.5	0.929			
Week of Symptom Onset						
Weeks 1 - 3 vs. Weeks 4 - 6	-14.9	4.2	0.0004	-14.9	4	0.0002
Weeks 7 - 9 vs. Weeks 4 - 6	-1.4	4.1	0.7372	-1.6	4	0.685
Weeks 10 - 12 vs. Weeks 4 - 6	2.4	5	0.6279	2.4	4.9	0.6285
Expected Work Hours, weekly						
20-29 vs. 40	1.5	5.4	0.7844			
30-39 vs. 40	-2.3	4.5	0.6025			
>40 vs. 40	1.6	4	0.6935			
Current Asthma	-5	4.6	0.2761			
High-Risk Chronic Condition	1.1	4	0.7821			
Current Smoker	6.2	4.1	0.1311			
Body Mass Index						
25 - 29 vs. <25	-1.5	4.5	0.7335			
30+ vs. <25	-5.9	4.1	0.1573			
Region						
North vs. Central	-1.1	5.7	0.8481			
South vs. Central	-5.4	4.2	0.1982			
Follow-up Length, days	-1	0.9	0.2857			

Table 4. Multiple linear regression for productivity loss due to absenteeism, full and reduced models.

	Absenteeism					
	Full Model			Reduced model		
Covariate	**Estimate**	**SE**	**pvalue**	**Estimate**	**SE**	**p-value**
Intercept	44.3	11.6	0.0002	48.3	8.6	<.0001
Laboratory Confirmed Influenza	12.5	2.8	<.0001	12.9	2.7	<.0001
Age, years	0.1	0.1	0.2708			
Female	0.0	3.0	0.9895			
Vaccinated for Influenza	0.4	3.0	0.9063			
Household members <12						
One vs. None	-0.7	4.0	0.8659			
Two or more vs. None	-2.9	3.8	0.4475			
Week of Symptom Onset						
Weeks 1 - 3 vs. Weeks 4 - 6	-10.2	3.6	0.0045	-10.3	3.5	0.0031
Weeks 7 - 9 vs. Weeks 4 - 6	0.7	3.5	0.8429	0.0	3.4	0.9907
Weeks 10 - 12 vs. Weeks 4 - 6	-2.6	4.3	0.5473	-2.8	4.2	0.5099
Expected Work Hours, weekly						
20-29 vs. 40	-2.5	4.6	0.5962			
30-39 vs. 40	1.5	3.8	0.7008			
>40 vs. 40	-4.1	3.4	0.2306			
Current Asthma	-3.5	4.0	0.3798			
High-Risk Chronic Condition	3.2	3.4	0.3493			
Current Smoker	11.1	3.5	0.0017	9.5	3.3	0.0045
Body Mass Index						
25 - 29 vs. <25	1.5	3.8	0.7012			
30+ vs. <25	-3.9	3.5	0.2765			
Region						
North vs. Central	0.2	4.9	0.9614			
South vs. Central	-1.4	3.6	0.7000			
Follow-up Length, days	-2.1	0.8	0.0099	-2.1	0.8	0.0071

Table 5. Multiple linear regression for productivity loss due to presenteeism, full and reduced models

	Presenteeism					
	Full Model			Reduced model		
Covariate	**Estimate**	**SE**	**pvalue**	**Estimate**	**SE**	**p-value**
Intercept	28.4	10.8	0.0093	37.6	1.8	<.0001
Laboratory Confirmed Influenza	-5.2	2.6	0.0492	-5.8	2.5	0.0193
Age, years	0.0	0.1	0.7098			
Female	6.4	2.8	0.0237			
Vaccinated for Influenza	1.6	2.8	0.5786			
Household members <12						
One vs. None	2.3	3.7	0.5385			
Two or more vs. None	2.7	3.6	0.4576			
Week of Symptom Onset						
Weeks 1 - 3 vs. Weeks 4 - 6	-5.0	3.3	0.1334			
Weeks 7 - 9 vs. Weeks 4 - 6	-0.9	3.3	0.7879			
Weeks 10 - 12 vs. Weeks 4 - 6	4.5	4.0	0.2685			
Expected Work Hours, weekly						
20-29 vs. 40	3.0	4.3	0.4828			
30-39 vs. 40	-4.9	3.6	0.1694			
>40 vs. 40	5.0	3.2	0.1184			
Current Asthma	-1.9	3.7	0.6058			
High-Risk Chronic Condition	-2.7	3.2	0.3924			
Current Smoker	-2.7	3.3	0.4111			
Body Mass Index						
25 - 29 vs. <25	-2.8	3.6	0.4395			
30+ vs. <25	-1.2	3.3	0.7234			
Region						
North vs. Central	-2.1	4.6	0.6426			
South vs. Central	-4.7	3.4	0.1681			
Follow-up Length, days	0.9	0.8	0.2263			

Table 6. Secondary analysis of the impact of influenza type on total productivity loss among those with laboratory confirmed influenza

	Total Productivity (Absenteeism + Presenteeism) Full Model		
	Estimate	**SE**	**pvalue**
Intercept	89.77	18.65	<.0001
Influenza Type A*	2.05	4.67	0.66
Age, years	0.04	0.21	0.85
Female	7.77	4.39	0.08
Vaccinated	1.21	4.71	0.80
Household members <12			
One vs. None	10.62	6.13	0.09
Two or more vs. None	-0.38	6.29	0.95
Week of Symptom Onset			
Weeks 1 - 3 vs. Weeks 4 - 6	-8.05	5.50	0.15
Weeks 7 - 9 vs. Weeks 4 - 6	-3.95	5.08	0.44
Weeks 10 - 12 vs. Weeks 4 - 6	1.72	7.47	0.82
Expected Work Hours, weekly			
20-29 vs. 40	-10.41	7.39	0.16
30-39 vs. 40	-13.49	6.18	0.03
>40 vs. 40	-7.12	5.11	0.17
Current Asthma	-12.09	6.29	0.06
High-Risk Chronic Condition	3.69	5.07	0.47
Current Smoker	10.73	5.65	0.06
Body Mass Index			
25 - 29 vs. <25	2.70	5.52	0.63
30+ vs. <25	-4.08	5.36	0.45
Region			
North vs. Central	-14.29	6.81	0.04
South vs. Central	-13.22	5.15	0.01
Follow-up Length, days	-1.73	1.26	0.17

*Comparison between those with influenza sub-type A and influenza sub-type B

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Appendix A: Productivity Loss Calculations

Expected work hours during follow up time = expected work hours per week x (follow up days / 7)

Percent lost due to absenteeism = (absentee hours / expected work hours during follow up) x 100%

Remaining expected work hours = expected work hours during follow up – absentee hours

Percent lost due to presenteeism = [((productivity rating / 9) x remaining expected work hours) / expected work hours during follow up] x 100%

Total workplace productivity loss = Percent lost due to Absenteeism + Percent lost due to Presenteeism

Example:

Expected work hours per week: 40
Number of follow up days: 10
Absentee hours: 8
Productivity rating: 4

Expected hours during follow up time = 40 x (10 / 7) = 57.14
Percent lost due to absenteeism = (8 / 57.14) x 100% = 14.00%
Remaining expected work hours = 57.14 – 8 = 49.14
Percent lost due to presenteeism = [((4/9) x 49.14) / 57.14] x 100% = 38.22%
Total workplace productivity loss = 14.00% + 38.22% = 52.22%

Appendix B: Distributions of Symptom Onset