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Do we consider paid sick leave when deciding to get vaccinated?

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ABSTRACT

This study investigated the effect of paid sick leave on workers' decisions to obtain vaccinations for the seasonal flu. Our vaccination decision model suggested that the marginal effect of paid sick leave depended on the reduced cost of obtaining a vaccination now and the expected income benefit from claiming paid sick leave after flu infection. Our hypothesis was that these effects vary according to workers' income levels. To confirm this hypothesis, we examined 11,702 participants in the National H1N1 Flu Survey (NHFS) conducted in late 2009 to early 2010 and measured the marginal effect using a Bayesian endogenous covariates regression model. The results of our estimation indicate that having paid sick leave did affect workers' vaccination decisions differently based on their income levels. Low-income workers were willing to be vaccinated because of the positive expected income benefit. High-income workers were willing to be vaccinated because the positive cost effect dominated the negative expected income benefit.

1. Introduction

Although people regard flu infection as a mild infectious disease, its severity and mortality cannot be ignored. The World Health Organization (WHO) estimated that the flu epidemic results in about 3–5 million cases of severe illness, and about 250,000 to 500,000 annual deaths worldwide (WHO, 2016). Annual vaccinations are the most effective way to prevent seasonal flu, and the sufficient vaccination coverage protects high-risk population, such as children and older adults with chronic disease, from flu infection. However, the global targets for vaccination coverage rate for this purpose have not been satisfied in most countries, in particular, for those aged 65 and older (OECD, 2017; Palache et al., 2015).

Several models have been used to explain the insufficient vaccination coverage based on the gap between infectious disease and human behaviors (Funk et al., 2010; Verelst et al., 2016). Among the models, first, game theory blames selfish individuals who enjoy positive externalities without cost (Bauch et al., 2003; Bauch and Earn, 2004; Yamin and Gavious, 2013). This model posits that these free riders prevent society from achieving the optimal vaccination coverage rate. Second, the Health Belief Model (HBM) attributes insufficient coverage to poor perceptions of susceptibility and severity (Rosenstock, 1974). This model suggested that these weak perceptions lead to failure to reach a sufficient vaccination rate. The model this study focused on analyzes economic factors, including the cost and benefits of vaccination (Brito et al., 1991). This model regarded the lack of financial benefit or accessibility to vaccination as a significant factor in the insufficient vaccination rate.

The lack of economic benefit leads to presenteeism. Presenteeism is defined as the cost associated with workers who are present in a workplace while suffering from diseases which bears high costs to both employees and employers (Liao et al., 2012). If this cost is not covered by an employer, a worker with flu-like symptoms will be more willing to work to avoid losing his/her salary. This behavior could lead to further flu endemics in the workplace (Kumar et al., 2013).

One of the economic interventions used to deal with this problem is paid sick leave. Paid sick leave is defined as a paid absence from work because of sickness or disability. Also, for flu infections, simulation and observational studies have shown that, if paid sick leave is available and covers the potential loss of workers' income, it prevents them from severe flu infections and the loss of workplace productivity (Lovell, 2004; Liao et al., 2012; DeRigne et al., 2017). However, other researchers have argued that if a company offers paid sick leave, it might suffer financial hardship by paying for absent workers. This ultimately could reduce workers' benefits and undermine their job stability (Colla et al., 2014; Drago and Lovell, 2011; Nelsen, 2014).

Furthermore, it is also unclear whether offering paid sick leave affects workers' vaccination decisions. To the best of our knowledge, only one study has analyzed the relation between paid sick leave and vaccination decisions (Wilson et al., 2014). This study suggested that workers with paid sick leave were likely to be vaccinated, and paid sick leave had a positive effect on the economy and healthcare system.

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However, this study did not focus on any differential benefit, for example, who enjoys this benefit and who does not. Paid sick leave influenced the vaccination decision in two ways: reduced cost of receiving a vaccination now, and the expected benefit of claiming paid sick leave after flu infection. We analyzed the differential benefit by identifying these two decisions.

Therefore, the purpose of this study was to investigate the differential benefit of paid sick leave depending on income levels, as well as the effect of paid sick leave on the decision to obtain a vaccination. We constructed an endogenous structural regression model with an instrumental variable. Then, we estimated the marginal effects of the reduced cost and expected benefit in subgroups classified by income levels. Based on the estimation results, we investigated and discussed which subgroup benefitted from paid sick leave and which did not.

In the following section, we introduce a theoretical model of the vaccination decision by applying the expected utility framework. Then, in the next two sections, we describe the analysis of the survey data and present the econometric model used in this study. In the results and discussion sections, we present and discuss our estimation results, and provide conclusions in the final section.

2. Vaccination decision model

We assumed that an individual will decide to obtain a vaccination if the utility received from vaccination is greater than that from remaining unvaccinated. Based on this assumption, we constructed a vaccination model with an expected utility framework (Brito et al., 1991). Let $u_i(g_i)$ be the utility of income g_i of individual i with the properties given by:

$$u_i'(g_i) > 0 \;\; and \;\; u_i''(g_i) < 0 \tag{1}$$

Then, the utility if an individual i accepts vaccination ($T_i = 1$), is given by:

$$v_i(g_i^H, \theta_i | T_i = 1) = u_i(g_i^H) - \theta_i \tag{2}$$

where g_i^H is the income of a healthy individual and θ_i are additive parameters that represent the individual cost of vaccination. On the other hand, let $p(z)$ be the perceived probability of flu infection without vaccination (PPFI), where z are the parameters that affect this probability. Then, the expected utility if individual i rejects vaccination ($T_i = 0$) is given by:

$$v_i(g_i, z_i, q_i | = 0) = u_i(g_i^H)\cdot[1 - p_i(z_i)] + u_i(g_i^I)\cdot p_i(z_i) \tag{3}$$

where g_i^I is the income of an infected individual with the condition that $g_i^I \le g_i^H$.

The use of $p(z)$ is justifiable for our individual vaccination model. In epidemiology, $p(\phi)$ that is derived from various epidemic models was used rather than $p(z)$ for infectious disease model. $p(\phi)$ denotes the probability that an unvaccinated individual will eventually be infected if the vaccine coverage level in the population is ϕ (Bauch and Earn, 2004). However, individuals do not know the actual or epidemiological coverage level. Thus, we assume that they are vaccinated based on the perception of the probability rather than the epidemically calculated rate.

Let the excess utility of being vaccinated over unvaccinated be the gap between the utility of being vaccinated and unvaccinated. Further, we assumed that paid sick leave, s, will affect individuals' vaccination decisions through an additive cost parameter, θ_i , and the income of an infected worker, $g_i^I(s)$. Thus, the excess utility of being vaccinated against unvaccinated is a difference between (2) and (3) above and written by:

$$\xi_i(g_i, z_i, \rho_i, \theta_i | s) = -\theta_i(s) + [u_i(g_i^H) - u_i(g_i^I(s))] \;\cdot p_i(z_i) \tag{4}$$

Thus, we could conclude that if the excess utility is greater than zero, this individual will be willing to be vaccinated. On the other hand, s/he will reject vaccination if the excess utility is less than zero.

After differentiating (4) with respect to s, the corresponding marginal effect of the paid sick policy is expressed mathematically as:

$$\frac{d\xi_i}{ds} = -\frac{\partial\theta_i}{\partial s} - \frac{\partial u_i}{\partial g_i^I}\cdot\frac{dg^I}{ds}\cdot p_i(z_i) \tag{5}$$

The marginal effect of the excess utility in (5) includes two parts: cost and income effects. First, for the cost effect, we assume that if a worker receives paid sick leave, s/he perceives the low average cost of the vaccine as a form of preventive care and is more willing to receive a flu vaccination. Thus, paid sick leave increases the vaccination probability, as follows:

$$-\frac{\partial\theta_i}{\partial s} \ge 0 \tag{6}$$

The income effect is realized through the PPFI, the marginal utility with respect to a worker's income, and the worker's marginal income with respect to paid sick leave. The first two factors are always positive because of the characteristics of probability and the assumption of a strictly increasing utility function. Thus, the direction of the income effect depends on the last factor, the worker's marginal income against paid sick leave. If workers perceive a high cost from using paid sick leave when they are sick, the marginal income is negative, and the income effect is positive. In this case, they will be willing to be vaccinated and their probability of being vaccinated increases. However, if workers perceive a high benefit of claiming paid sick leave when they are sick, the marginal income is positive and the income effect is negative. In this case, they will be unwilling to be vaccinated and the probability of vaccination decreases. Thus, the income effect can be specified by:

$$-\frac{\partial u_i}{\partial g_i^I}\cdot\frac{dg_i^I}{ds}\cdot p_i(z_i) = \begin{cases} >0 \; if \; \frac{dg_i^I}{ds} < 0 \\ = 0 \; if \; \frac{dg_i^I}{ds} = 0 \\ <0 \; if \; \frac{dg_i^I}{ds} > 0 \end{cases} \tag{7}$$

By combining the cost effect and income effect, we concluded that the probability of vaccination always increases if the income effect is positive. We also concluded that the probability of vaccination is unclear if the income effect is negative. In this case, the vaccination decision depends on the scale difference between the cost and income effects.

3. Econometric model

We observed only vaccination behavior (vaccinated or unvaccinated) rather than the excess utility. Thus, we used the probability of vaccination rather than the excess utility in our econometric model.

For empirical research, we simplified the vaccination decision model as follows. First, we rewrote the individual level utilities of an infected individual as follows:

$$u_i(g_i^I) = u_i(g_i^H) - L_i\cdot s \tag{8}$$

where s denoted an indicator of paid sick leave and $L(<0)$ denoted individual loss if an individual is infected. Also, let $\theta_i(s) = \theta_i\cdot s$. Then, the probability of seasonal flu vaccination based on the excess utility was given by:

$$\xi_i^p(g_i, z_i, \rho_i, \theta_i | s) = -\theta_i\cdot s + L_i\cdot s\cdot p_i(z_i) \tag{9}$$

and the corresponding marginal effect was also given b

$$\frac{d\xi_i^p}{ds} = -\theta_i + L_i\cdot p_i(z_i) \tag{10}$$

Thus, for the evaluation of the cost and income effects, we estimated (9) and (10) where θ_i represented the change of current vaccination cost