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Abstract

Objective. Investigate which individual characteristics influenced the uptake of the 2009 H1N1 vaccination in England. The vaccination was provided for free to a specified target group who also received invitation letters, but the coverage rate was still far from universal among them.

Methods. Data from the 2010 edition of the Health Survey for England are used (size of the estimation sample: 7,211). In order to partial out the effect of unobservable time costs, attitudes or access to vaccinations, immunisations against the seasonal and pandemic influenza are jointly estimated.

Results. Health risks, health behaviours and preferences, and exposure to various information help explain the immunisation decision. Receiving the seasonal flu vaccine increases the probability of H1N1 vaccination uptake by 20 percentage points.

Conclusions. The widespread refusal of the vaccination can be worrying for the control of potential future pandemics. Providing clear, well targeted information, ensuring that high risk groups are contacted, and raising the level of health consciousness can increase the coverage rate with vaccinations.

1 Introduction

In April 2009 the WHO announced the emergence of a novel influenza A virus of the H1N1 strain. H1N1 vaccinations were available in England from late October 2009. Initially the vaccination was available only to certain groups as specified by the NHS (National Health

Service), who received invitation letters: pregnant women, people with diabetes, chronic lung, heart, kidney, liver or neurological disease, and immunosuppression, people who lived in the same house as someone whose immune system was compromised, and front-line health or social care workers. At the same time, free seasonal vaccinations were also available to people aged 65 and above.

There are recent international empirical results on the uptake of H1N1 vaccinations (Bone et al. (2010), Maurer et al. (2010), Poland (2010), Bish et al. (2011), among others). My study extends this literature by using a novel set of indicators of health preferences and beliefs from a representative survey of the English population. The data make it possible to analyse the actual vaccination uptake rather than only the intentions. I partial out the influence of some unobserved characteristics by a joint analysis of the pandemic and seasonal vaccination uptake. The applied statistical methods are innovative compared to other studies that analyse the effect of past seasonal flu vaccination on the uptake of H1N1 vaccine (Mauer et al. (2009), Eastwood et al. (2010), among others). The empirical strategy of this paper is possible only because the pandemic and seasonal flu vaccinations were available at the same time. The objective is to estimate which demand-side factors had the strongest influence on the pandemic flu vaccination uptake. Understanding the motivating factors of vaccination uptake is important for the controlled spread of potential future epidemics.

2 Methods

2.1 Data

I use the 2010 edition of the Health Survey for England, an annually repeated cross sectional study, representative for private households. I restrict the sample to respondents aged 18 and above, as from this age no parental consent is needed for the vaccination. I use weighted data, with weights for analysis of the core interview sample.

The survey of 2010 asks if since October 2009 the respondent has received a flu jab, and the date and type of each vaccination. It is possible for respondents interviewed early in 2010 that the vaccination happened after the interview. This is a measurement error which can increase the standard errors of the estimates.

I classify a respondent to the target group if has any of the following long-standing illnesses: cancer, diabetes, heart attack or angina, kidney problems, bronchitis or emphysema. Based on the survey the other categories of the target group cannot be identified precisely enough.

2.2 Statistical analyses

Specification (1) is a probit model of H1N1 jab uptake. The probit estimates are subject to bias if the unobserved time cost of receiving the vaccination or the unobserved access to or attitudes towards vaccinations are correlated with any of the included regressors. I follow two approaches to handle this problem. Specification (2) is a bivariate probit model of pandemic and seasonal flu vaccinations, where the unobserved properties are captured by the inclusion of the seasonal flu uptake as a control variable in the equation of pandemic vaccination. This specification takes into account the potential endogeneity of the seasonal flu vaccination, and the model is identified by functional form. In specification (3) I restrict the estimation sample to respondents who received seasonal flu vaccination, thus for whom the marginal time cost of the additional H1N1 vaccination can be assumed to be zero and accessibility is not an issue. The three specifications are expected to give similar results only if the influencing role of the unobserved properties are negligible.

In all three specifications I control for individual characteristics capturing health preferences (age, gender, smoking, alcohol consumption, religion, being loved), access to the vaccine (belonging to the target group, living in London), potential benefits and opportunity costs of the vaccinations (age, labour force status, belonging to the target group), or the available information related to the vaccinations (education level, general interests, living in London). I also include a binary indicator of age 65 and above, since above that age the seasonal flu vaccine is offered for free.

3 Results

Descriptive statistics are presented in Table 1. The vaccination rate within the generated target sample (40.7%) is higher than the official statistics (37.6%, according to Pedoby and Sethi (2010)).

The estimated average marginal effects of the three probit models are reported in Table 2. Specification (1) shows correlations: the strongest results are that people living in London are 5.4 percentage points less likely to receive H1N1 vaccination, whereas those belonging to the target group are 14.6 percentage points more likely.

The results of specification (2) can be interpreted as causal effects. The main difference from the results of specification (1) is that people aged 65 and above are 3 percentage points less likely to receive the pandemic flu vaccine, ceteris paribus. Feeling loved increases, whereas general interests decrease the uptake of the H1N1 vaccine. Being an ex smoker has 1.9 percentage points positive effect, living in London has 4.9 percentage points negative

effect. Belonging to the target group and receiving the seasonal flu jab both have strong positive effect on the uptake of the pandemic vaccination.

The sign pattern of the results of specifications (2) and (3) are similar, but the magnitude of the estimated effects are larger if the sample is restricted to those who received the seasonal flu jab. For example, the marginal effect of living in London is 17.8 percentage points under this specification.

4 Discussion

Conditional on receiving the seasonal flu jab, people aged less than 65 are more likely to receive the pandemic vaccination, suggesting high benefits of or positive attitudes towards flu vaccinations. The positive effect of having the seasonal flu vaccine can be due to unobserved positive attitudes towards immunisation, higher risks of falling ill with a flu, and lower marginal time cost of H1N1 vaccination once the seasonal flu vaccine is received. The higher probability of uptake among those who report being loved reflects the higher subjective benefits of being vaccinated. The estimated effect of general interests can capture exposure to information related to the alleged risks of the vaccinations.

The finding that people living in London are significantly less likely to receive the H1N1 vaccination is in line with the NHS (2010a) report. Previous explanations include problems in the information system and the unique demographic and socio-economic composition of the population of London (NHS (2010b)). However, since these results are stronger conditional on receiving the seasonal flu vaccine, it is more likely that beliefs and exposure to information drive the London-effect.

Being an ex smoker is related to the uptake of pandemic flu vaccination potentially due to health preferences (Hersch and Viscusi (1990), Hsieh and Lin (1997)).

The uptake rate of the H1N1 vaccination in England remained relatively low, which can be worrying for the control of potential future pandemics. Plans-Rubió (2012) documents that herd immunity in case of the H1N1 pandemic of 2009 could be achieved with 9-29% of vaccination rate. However, much higher immunisation rates might be needed if the relative number of secondary cases is higher. My results suggest that providing clear, well targeted information on the risks and benefits of the immunisation, and raising the level of health consciousness can increase the coverage rate with vaccinations. The variations among those who received the seasonal flu vaccine indicate that better information provision at general practices could have increased the uptake of the pandemic vaccine, and the low uptake rate cannot be solely explained by lack of access or by general aversion against flu vaccinations. These implications are in line with the results of Maurer (2009) who documents the impor-

tance of physician quality on seasonal flu vaccination uptake.

As the results of this paper are based on the immunisation against a single flu pandemic in England, these can be relevant to but not fully representative for other countries or other, potentially more severe epidemics.

5 Conclusions

The results of this paper indicate that even if the marginal time cost of receiving the pandemic flu vaccination is zero and general attitudes towards flu vaccinations are controlled for, there still remains individual heterogeneity in the likelihood of pandemic flu vaccination uptake. Health preferences, exposure to information, and subjective beliefs on the benefits of the vaccine all influence the uptake probability. Clear, well targeted information, and raising the level of health consciousness can increase the coverage rate with vaccinations.

Conflict of Interest

The author declares there is no conflict of interest.

References

Ayyagari P, 2007. Do Health Shocks Affect Preventive Behavior? Department of Economics, Duke University.

Begum F, Pedoby R, 2010. Seasonal influenza vaccine uptake among the 65 years and over and under 65 years at risk in England. Winter season 2009-10. UK Department of Health.

Bish A, Yardley L, Nicoll A, Michiea S, 2011. Factors associated with uptake of vaccination against pandemic influenza: A systematic review. Vaccine 29: 6472– 6484.

Bone A, Guthmanna J-P, Nicolaua J, Lévy-Bruhl D, 2010. Population and risk group uptake of H1N1 influenza vaccine in mainland France 2009–2010: Results of a national vaccination campaign. Vaccine 28: 8157–8161.

Eastwood K, Durrheim DN, Jones A, Butler M, 2010. Acceptance of pandemic (H1N1) 2009 influenza vaccination by the Australian public. Med J Aust 192(1): 33-36.

Hersch J, Viscusi WK. 1990. Cigarette Smoking, Seatbelt Use, and Differences in Wage-Risk Tradeoffs. J Hum Resour 25(2): 202-227.

Hsieh C-R, Lin S-J, 1997. Health Information and the Demand for Preventive Care among the Elderly in Taiwan. J Hum Resour 32(2): 308-333.

Maurer J, 2009. Who has a clue to preventing the flu? Unravelling supply and demand effects on the take-up of influenza vaccinations. J Health Econ, 28: 704–717.

Maurer J, Harris KM, Parker A, Lurie N, 2009. Does receipt of seasonal influenza vaccine predict intention to receive novel H1N1 vaccine: Evidence from a nationally representative survey of U.S. adults. Vaccine 27: 5732–5734.

Maurer J, Uscher-Pines L, Harris KM, 2010. Perceived seriousness of seasonal and A(H1N1) influenzas, attitudes toward vaccination, and vaccine uptake among U.S. adults: Does the source of information matter? Prev Med 51(2): 185-187.

NHS. 2010a. NHS Immunisation Statistics. England. 2009-10. The The Health and Social Care Information Centre, Public Health Indicators and Population Statistics team.

NHS. 2010b. Childhood immunisation for London. The London context. NHS, Commissioning Support for London.

Pedoby R, Sethi M, 2010. Pandemic H1N1 (Swine) Influenza Vaccine Uptake amongst Patient Groups in Primary Care in England. 2009/10. UK Department of Health.

Plans-Rubió P, 2012. The vaccination coverage required to establish herd immunity against influenza viruses. Prev Med 55(1): 72-77.

Poland GA, 2010. The 2009–2010 influenza pandemic: effects on pandemic and seasonal vaccine uptake and lessons learned for seasonal vaccination campaigns. Vaccine 28S: D3–D13.

Table 1: Descriptive statistics, Health Survey for England 2010, weighted data restricted to age 18+

	Whole sample N = 7,211	Target sample N = 742	Received seasonal flu jab N = 2,056
seasonal flu jab, N (%)	1,803 (25.0)	497 (67.0)	
swine flu jab, N (%)	905 (12.6)	302 (40.7)	884 (43.0)
both flu jabs, N (%)	775 (10.8)	281 (37.8)	884 (43.0)
age, mean (SD)	47.70 (18.09)	62.80 (14.57)	63.68 (16.42)
female, N (%)	3,705 (51.4)	350 (47.2)	1,106 (53.8)
employee, N (%)	3,618 (50.2)	183 (24.6)	539 (26.2)
self employed, N (%)	576 (8.0)	44 (5.9)	85 (4.1)
unemployed, N (%)	368 (5.1)	16 (2.1)	38 (1.8)
retired, N (%)	1,589 (22.0)	390 (52.5)	1,176 (57.2)
other inactive, N (%)	1,060 (14.7)	110 (14.8)	219 (10.7)
higher education or full time student, N (%)	2,830 (39.2)	204 (27.5)	581 (28.2)
have been feeling loved past 2 weeks 1:never - 5: all the time, median (IQR)	4 (2)	4 (2)	4 (2)
interested in new things past 2 weeks 1:never - 5: all the time, median (IQR)	4 (1)	3 (1)	4 (1)
current smoker, N (%)	1,432 (19.9)	121 (16.3)	238 (11.6)
ex regular smoker, N (%)	1,917 (26.6)	305 (41.1)	806 (39.2)
alcohol past 12 months 0: none - - 7: almost every day, median (IQR)	4 (3)	3 (4)	4 (3)
not religious, N (%)	1,851 (25.7)	120 (16.2)	293 (14.3)
religion - Christian, N (%)	4,866 (67.5)	585 (78.8)	1,664 (80.9)
other religion, N (%)	494 (6.9)	37 (5.0)	99 (4.8)
London, N (%)	967 (13.4)	94 (12.7)	224 (10.9)
heart problems, N (%)	111 (1.5)	126 (16.9)	88 (4.3)
diabetes, N (%)	345 (4.8)	392 (52.8)	289 (14.1)
cancer, N (%)	169 (2.3)	191 (25.8)	114 (5.6)
lung disease, N (%)	44 (0.6)	50 (6.7)	37 (1.8)
kidney disease, N (%)	56 (0.8)	63 (8.6)	32 (1.5)
in target group, N (%)	654 (9.1)		500 (24.3)

SD = standard deviation, IQR = interquartile range

Table 2: Estimated average marginal effects on H1N1 vaccination uptake probability in percentage points, Health Survey for England 2010, weighted data restricted to age 18+

	(1)	(2)	(3)
	Probit	Bivariate probit	Probit, conditional on seasonal vaccination
age	0.21 (0.14,0.28)***	0.03 (-0.04, 0.10)	-0.09 (-0.36, 0.18)
age ≥ 65	2.09 (-0.73, 4.91)	-2.99 (-5.97, -0.01)**	-15.58 (-23.92, -7.25)***
female	1.66 (0.16, 3.17)**	1.50 (0.18, 2.82)**	-1.70 (-6.41, 3.02)
self employed	-2.77 (-5.88, 0.35)*	-1.02 (-3.73, 1.69)	7.95 (-4.37, 20.26)
unemployed	-2.22 (-6.50, 2.07)	-2.13 (-6.06, 1.81)	-6.82 (-24.07, 10.43)
retired	2.08 (-0.61, 4.77)	0.67 (-1.67, 3.01)	2.31 (-5.89, 10.51)
other inactive	-0.20 (-2.50, 2.11)	-1.41 (-3.54, 0.71)	-3.18 (-11.84, 5.48)
higher education	1.16 (-0.44, 2.76)	1.21 (-0.20, 2.62)*	-0.59 (-5.95, 4.77)
loved (1-5)	1.43 (0.59, 2.27)***	1.09 (0.37, 1.81)***	2.16 (-0.38, 4.70)*
interests (1-5)	-1.16 (-1.96, -0.36)***	-0.84 (-1.52, -0.17)**	-2.66 (-4.99, -0.33)**
smoker	-2.65 (-4.81, -0.48)**	-1.62 (-3.63, 0.39)	-6.42 (-14.23, 1.39)
ex smoker	2.83 (1.24, 4.42)***	1.90 (0.51, 3.28)***	4.45 (-0.30, 9.19)*
alcohol (0-7)	-0.19 (-0.55, 0.17)	-0.20 (-0.50, 0.11)	-0.84 (-1.88, 0.19)
Christian	1.55 (-0.36, 3.47)	0.36 (-1.35, 2.06)	1.86 (-4.94, 8.65)
other religion	2.48 (-1.22, 6.18)	0.23 (-3.27, 3.73)	-3.56 (-17.20, 10.08)
London	-5.42 (-8.17, -2.66)***	-4.87 (-7.39, -2.34)***	-17.77 (-26.29, -9.25)***
target group	14.57 (12.58, 16.55)***	8.45 (6.43, 10.47)***	16.65 (11.78, 21.52)***
seasonal vaccination		19.67 (14.48, 24.86)***	
sample size	7,211	7,211	2,056
pseudo R^2	0.13		0.05
correlation of the error terms		0.21 (0.01, 0.41)**	

95% confidence interval in parentheses, *significant at 10%; ** significant at 5%; *** significant at 1%