The Effects of Socioeconomic Factors on the Decision to be Vaccinated: the Case of Flu Shot Vaccination

Shosh Shahrabani DSc[1] and Uri Benzion PhD[2]

[1] Department of Economics and Management, Max Stern Academic College of the Yezreel Valley, Yezreel Valley, Israel
[2] Department of Economics, Ben-Gurion University of the Negev, Beer Sheva, Israel

Key words: influenza, vaccination, sociodemographic characteristics, health survey, Probit model

Abstract

Background: Anti-influenza vaccination has proven cost-effective for society. In Israel, however, vaccination rates remain relatively low in comparison to other countries.

Objectives: To analyze the socioeconomic and health status factors affecting the decision to be vaccinated against flu and to compare these factors to results from other countries in order to determine which segments of the adult population should be targeted for increased coverage in influenza vaccination programs.

Methods: Our source was the 1999/2000 Health Survey of the Central Bureau of Statistics for the group aged 25 and above, comprising 16,033 individuals. We used statistical methods such as the Probit regression model to estimate the effects of socioeconomic and health status variables on the decision to get a flu shot. The variables included gender, age, marital status, education, ethnic origin, religious affiliation and housing density, as well as chronic illnesses, smoking, hospitalizations, membership in health management organizations and kibbutz membership.

Results: Our findings indicate that being a post-1990 immigrant from the former Soviet Union, living in a densely populated house, being unmarried and smoking heavily are important factors in predicting the decision not to be vaccinated. In contrast, chronic illness, previous hospitalizations, older age, and kibbutz membership positively affected the decision to take the vaccine.

Conclusions: It is necessary to identify the socioeconomic and health variables marking population sectors that are less likely to be vaccinated in order to design a suitable policy to encourage vaccination.

IMAJ 2006;8:630–634

Influenza vaccination has been shown to be cost-effective in reducing morbidity and mortality in the older adult population, and in decreasing morbidity, lost work days and use of healthcare resources among the working healthy adult population [1-4]. Yet in Israel, vaccination rates have remained very low. During the winter of 2000 only 9% of the population received flu shots [5]. In comparison, vaccination levels (doses distributed/1000 population) for 2003 were 344 in Canada, 286 in the United States and 230 in Japan [6]. Among the risk-targeted group of people aged 65 and over, the vaccination rate was 44.7% in Israel versus 64% in the U.S. [5,7].

In other countries, studies of the working age group have reported reductions of 34%–44% in physician visits, 25% in antibiotic use for influenza-associated illnesses, and 32–45% in lost workdays for those vaccinated [1-3]. In addition, averted costs ranging from approximately $60 to $4000 per illness were estimated among healthy persons aged 18–64 [8].

Influenza vaccine acceptance was also found to be associated with vaccine cost, recommendation, perceived seriousness of influenza infection, and different beliefs regarding influenza [9-11]. For healthy adults, flu shot acceptance was predicted by perceived effectiveness of the vaccine, perceived likelihood of vaccine side effects, and having received the shot the previous year [12]. In addition, an individual's sociodemographic background, economic status and health status affect his or her decision to be vaccinated. In empiric studies conducted in the USA, it was found that people with more education, higher incomes and better insurance coverage are more likely to get flu shots [13-16]. Moreover, vaccination levels among blacks and Hispanics continue to lag behind those among whites [7]. In addition, marital status, drinking alcohol, smoking, and engaging in regular exercise are all significant factors that affect flu vaccination [17]. On the other hand, low vaccination rates can also be explained by physicians' failure to strongly recommend influenza vaccination to their elderly and high risk patients [18]. For the Israeli data, Kaufman and Green (2003) [19] found that lack of physician recommendation and low degree of risk perception are the major reasons for low compliance among the elderly.

The current study is an empiric analysis intended to identify factors predictive of influenza vaccination, in order to determine which segments of the adult population in Israel should be targeted for increased coverage in flu vaccination programs. Unlike Kaufman and Green [19] who refer to the elderly, our study covers healthy working adults as well as risk-targeted groups. In addition, we extend the sociodemographic and economic variables. Since no nationally based data analysis of the socioeconomic factors involved in the decision to get flu shots has been reported in Israel, our study fills this void.

Subjects and Methods

We hypothesize that the decision to get a flu shot depends on the following variables:

- *Gender*: We expect that women will be more likely to be vaccinated than men, since some researchers have shown that women are more aware of their health status than men are [20].
- *Social environmental variables* (including kibbutz membership and marital status): We expect that kibbutz members will

tend to take the vaccine since it is often available on the kibbutz where they live. Moreover, living on a kibbutz may have a positive "group" effect on members' decision to be vaccinated. In addition, the positive "group" effect may also influence the vaccination decision of married individuals. Therefore, we expect that married people will tend to take the vaccine, as was found in the USA [17].

- E*ducation*: Those with more education may be better informed about the potential benefits of preventive actions [21]; therefore, we expect that individuals with more education will tend to take the vaccine.
- N*ew immigrants*: It is possible that new immigrants are less informed than more veteran citizens; therefore we expect they will tend not to take the vaccine.
- E*conomic status variable* (including housing density): We expect that higher housing density, as an indicator of lower economic status, will decrease the tendency to be vaccinated.
- S*moking*: We use smoking as an indicator for attitude toward healthcare. Some evidence indicates that preventive behaviors may be highly correlated with one another, so that individuals who avoid smoking, are conscious of their diet and exercise regularly will also be more likely to take advantage of medical screening and other preventive services [22]. Therefore, we expect that heavy smokers (21+ cigarettes per day) will have a lower probability of taking the vaccine.
- H*igh risk group variables* (including age group, chronic illness and past hospitalization): Infection probability and severity of illness are higher for the high risk group; therefore, we expect to find that the tendency to get the vaccine will increase with age, and will be higher for individuals with chronic illnesses and those who had at least one hospitalization, as was found in other countries [13]. Moreover, for this group it is recommended to get a flu shot each year.

In addition to all the above dependent variables, we also controlled for the following variables: ethnic origin, nationality, and membership in a health management organization.

We used the 1999/2000 Health Survey of the Central Bureau of Statistics in Israel to analyze the sociodemographic characteristics of individuals who are vaccinated against the flu. Although the survey includes all age groups in the population, our study was restricted to individuals aged 25 and above, comprising 16,033 persons (7434 males and 8599 females).

At the supply side we should note that during the winter of 1999/2000 there was no shortage in the supply system of vaccination among the HMOs. In addition, all four HMOs had a similar policy: physicians advised the risk group to take the vaccine (at no cost) and, in addition, reminder letters (in Hebrew, Arabic or Russian) were sent to them (Individuals not included in the risk group paid 11 shekels [approximately $2.5] to get the flu shot).

We used the Probit regression model, where a number of independent variables are regressed on a dichotomous dependent variable. This variable is equal to 1 if an individual has had a flu shot during the last 12 months, and to zero if not. The independent variables included demographic characteristics and variables indicating the health status of the individual, as well as membership in the various HMOs [Table 1]. The Probit model enables us to evaluate the effect of each independent variable on the decision to get a flu shot.

HMO = health management organization

Results

Table 1 summarizes the basic demographic information for the sample, and the anti-influenza vaccination percentages for each variable. In 2000 only 15% of men and 14.8% of women in the sample received the vaccine. The flu shot rate increases with age, but decreases as housing density increases. In addition, the vaccination percentages among individuals who have at least one chronic illness and those who have had at least one hospitalization are higher than among individuals who do not have a chronic illness and those who have not been hospitalized, respectively. However, post-1990 immigrants from the former Soviet Union have the lowest vaccination rates. In addition, kibbutz members have higher vaccination rates than do non-members. The data also indicate that 16.7% of non-smokers versus 9.1% of smokers got flu shots during the 1999/2000 winter season. Although all HMOs in Israel recommend that elderly individuals and those with chronic illness get the anti-influenza vaccine each year, we found relatively low compliance rates among the risk groups in all HMOs in Israel. The highest rate was in the Clalit Health Services (55%), and the lowest in the Leumit Healthcare Organization (36.8%). Moreover, among post-1990 immigrants with chronic illness, compliance rates in all the HMOs were by far lower than these rates among persons with chronic conditions in the general population.

Results of the Probit model

Table 2 presents the marginal probabilities of the Probit model regressions. This model controls for the various sociodemographic characteristics.

- V*ariables with positive effects*: For the "all ages" group, Table 2 shows that age and chronic illnesses (high risk group variables) have the highest marginal probabilities, indicating that these characteristics are most sensitive regarding the tendency to get the vaccine. For example, an individual with a chronic illness is 15.7% more likely to get a flu shot than individuals who do not have a chronic illness. Moreover, individuals who had at least one hospitalization during the previous 12 months were more likely to get a flu shot than those who had not been hospitalized. The decision to get the flu shot is also positively related to marital status (married) and is more likely for kibbutz members in comparison to others, suggesting that social environment variables influence the vaccination decision. In addition, veteran citizens originally from Europe and America have higher probabilities to get the vaccine as compared to the Israeli-born group.

Table 1. Summary statistics of demographic characteristics and vaccination rates, 2000*

	Total	Anti-influenza vaccination	
		N	%
Gender			
Male	7434	1118	15
Female	8599	1273	14.8
Age group			
25–44	7391	295	4.0
45–59	4559	444	9.7
60–74	2898	1045	36.1
75+	1185	607	51.2
Chronic illness			
At least one chronic illness	4046	1331	32.9
No chronic illness	11987	1060	8.8
Hospitalization			
At least one hospitalization	1636	497	30.4
No hospitalization	14397	1894	13.1
Smoking			
Smoke	3726	338	9.1
Do not smoke	12307	2053	16.7
HMO			
Clalit	9505	1719	18.1
Meuhedet	1555	135	8.7
Leumit	1391	155	11.1
Maccabi	3582	382	10.7
Housing density			
Up to 1.0	10043	1989	19.8
1.01–1.49	2765	213	7.7
1.5+	3216	189	5.8
Marital status	11891		
Married	4133	1721	14.5
Unmarried		670	16.2
Nationality			
Jewish	13424	2170	16.2
Other	2600	221	8.5
Ethnic origin			
Israeli-born	6059	520	8.6
Asia-Africa	2428	571	23.5
Europe-America	1903	692	36.4
USSR (before1990)	665	134	20.2
USSR (after 1990)	2379	223	9.4
Other countries (after 1990)	294	35	11.9
Education (yrs of schooling)			
0–8	3138	781	24.8
9–12	6161	788	12.8
13+	6650	805	12.1
Kibbutz			
Members	233	63	27.0
Not members	15800	2328	14.7

* Data for the various residential districts are not shown

Table 2. Probit marginal probabilities to get flu shot in Israel, 2000, by age group

Independent variables	All ages	25–44	45–59	60–4	75+
Gender (base group males)	-0.005	-0.035	0.014	0.017	-0.010
Age group (base group 25–44)					
45–59	0.098*				
60–74	0.395*				
75+	0.537*				
Chronic illness (0 if no, 1 if yes)	0.157*	0.153*	0.219*	0.171*	0.074*
Hospitalization	0.052*	0.088*	0.027	0.070*	0.039
Smoking (base group non-smokers)					
0–10 cigarettes	0.019	0.032	0.009	0.015	-0.094
11–20 cigarettes	-0.027	-0.032	0.010	-0.093*	-0.003
21+ cigarettes	-0.054*	-0.031	-0.056**	-0.096*	0.008
HMO (base group Clalit)					
Meuhedet	-0.063*	-0.044	-0.077**	-0.095*	-0.014
Leumit	-0.027	0.043	-0.036	-0.056	-0.086
Maccabi	-0.013	-0.024	-0.043	0.039	-0.012
Housing density	-0.073*	-0.088*	-0.083*	-0.064*	-0.045
Marital status					
0 for not-married, 1 for married	0.081*	0.074*	0.018	0.108*	0.130*
Origin (base group Israeli-born Jews)					
Asia-Africa	0.014	-0.061	0.004	0.019	-0.169*
Europe-America	0.059*	0.142*	-0.004	0.055**	-0.108
USSR (before 1990)	-0.023	-0.066	-0.016	-0.011	-0.226*
USSR (after 1990)	-0.144*	-0.010	-0.170*	-0.195*	-0.436*
Other (after 1990)	0.010	0.098	-0.119	-0.117	-0.111
Arabs	0.000	0.005	0.012	-0.035	-0.116
Education (base group 0–8 years)					
9–12	0.001	-0.010	0.004	-0.003	0.084*
13+	0.013	0.020	0.048	-0.001	0.030
Kibbutz members (base group others)	0.148*	0.191*	0.070	0.160*	0.387**
N	16,033	7,391	4,559	2,898	1,185
P = significance of Pearson goodness-of-fit	0.01	0.78	0.48	0.44	0.27

* Indicates that the Probit coefficient is significantly different from zero at a 5% significant level.

** Indicates that the Probit coefficient is significantly different from zero at a 10% significant level.

- *Variables with negative effects*: We found that new immigrants from the former Soviet Union (after 1990) are less likely to receive the vaccine than the Israeli-born group. In addition, we found that the tendency to get the flu shot decreases as housing density increases, indicating the impact of economic status on the vaccination decision. As for the healthcare attitude indicator, the results indicate that smoking significantly reduces the tendency to get the vaccine. These results confirm our hypothesis that preventive behaviors may be highly correlated with one another. As for the control variable of membership in a particular HMO, we found that members of the Meuhedet Health Fund are less likely to be vaccinated than members of Clalit.
- *Variables with no effects*: When all other variables are held constant, the results indicate that gender, education and nationality are not significant factors predicting flu-shot vaccination in Israel.

Vaccine-predictive factors by age groups

Table 2 also shows the results by age groups. We chose to separate the regressions by age groups since their vaccination rates

are different. In general, the results are similar to the findings for the "all ages" group. Nevertheless, we found the following results:

- The negative effect of status as new immigrants from the former USSR on the decision to take the vaccine increases with age. For example, new immigrants in the age group of 75+ are 43% less likely to get the flu shot than the Israeli-born group in the same age group.
- The negative effect of heavy smoking is the highest among the 60–74 age group.
- The negative effect of housing density is the strongest among the 25–44 age group.
- The positive effect of marriage is mainly for the aged 60 and above age group.

Discussion

The main finding of this study is that important socioeconomic gradients affected the decision among Israelis in 2000 whether to get vaccinated against the flu, even though accessibility to preventive medical services, including flu shots, is supposed to be the same for the entire population. Similar to findings from other countries [13,14,17,23], our results indicate that high risk group variables, economic status variables, marital status and smoking influence the decision whether to get a flu shot. The finding that economic status, reflected in our study by housing density, influences the probability of getting the vaccine indicates not only the social gap in taking advantage of preventive medical services in Israel but also the higher risks due to the increased probability of infection among families living in conditions of higher housing density.

Our results also indicate another social gap, as reflected by the lower tendency of post-1990 immigrants from the former USSR (especially the elderly) to get the vaccine in comparison to the Israeli-born group. This result is compatible with findings that new immigrant women from the former USSR avoid preventive behavior and screening activities [24]. Unlike the findings for other countries [13,16,17], we did not find any significant differences between education levels and between genders regarding the tendency to get the vaccine. Finally, we found that heavy smokers tend not to get flu shots, which can be seen as evidence of an individual's more general attitude toward healthcare. This result is compatible with evidence indicating that preventive behaviors may be highly correlated with one another [22].

Previous vaccination campaigns carried out in Israel were moderately successful in increasing the coverage of influenza vaccinations in targeted risk groups [19]. Therefore, it is worthwhile to design a policy to encourage vaccination among socioeconomic segments in the population identified as less likely to be vaccinated. Since it is possible, as in other countries, that poor access to care during the weeks when influenza vaccination is offered may be one of the reasons for low compliance [23], it is also recommended to offer vaccinations in convenient locations free of charge.

Acknowledgment. The authors thank Dr. Gregory Yom-Din for performing the statistical tests. This study was funded by a research grant from the Max Stern Academic College of Emek Yezreel.

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Correspondence:: Dr. S. Shahrabani, Dept. of Economics and Management, Max Stern Academic College of Emek Yezreel, Emek Yezreel 19300, Israel.
Phone: (972-4) 953-3686
Fax: (972-4) 642-3522
email: shoshs@yvc.ac.il