

Factors Associated with Performance of Influenza Immunization among the Elderly

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Abstract

Background: Influenza is a major cause of morbidity and mortality in the elderly. While immunization has been shown to reduce these complications, many of the elderly are not immunized.

Objective: To identify correlates for under-utilization of influenza immunization among the elderly.

Methods: A telephone survey was conducted among a random sample of patients aged 65 and over registered at a Jerusalem primary care community clinic. The 626 questionnaires were analyzed for associations of immunization receipt for the latest influenza season. Multivariate logistic regression was performed to identify independent correlates. Respondents were also asked what factors had influenced their decision about immunization.

Results: The most frequently reported influence on getting immunized was a physician's recommendation. Immunization was independently associated with the identity of the primary care physician ($P < 0.0001$) and with having visited the physician during the previous 3 months ($P = 0.0006$). Immunization was more likely among persons who believed that it provides complete protection from influenza ($P < 0.0001$) and less likely among those who believed immunization can cause influenza ($P < 0.0001$). Higher immunization rates were also associated with being married ($P = 0.0031$).

Conclusion: Through their influence on patient knowledge and the effect of their recommendation, primary care physicians play a pivotal role in determining immunization rates. Physicians should routinely discuss the effects of immunization and recommend it to the elderly.

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Influenza and its complications are major causes of morbidity and mortality in the elderly [1]. Immunization against influenza is associated with reduced morbidity, hospitalizations and deaths during the influenza season, with accompanying health cost benefits [2,3]. Yearly immunization of people aged 65 years and over is recommended by national public health services in the United States [4],

Israel, and many other industrialized countries [5]. Despite a gradual increase in immunization rates, according to a 1997 U.S. national survey as many as 34.5% in this age group were not immunized [6].

A number of studies have investigated determinants of performance of immunization among high risk patients. Most studies did not find immunization to be correlated with demographic variables such as age, gender, marital status, or education [7-14]. Evidence supports the effects of health service usage and providers' recommendation [7,8,14-17] and the influence of knowledge and beliefs about influenza vaccination [7-12,17]. The results regarding association with health and functional status have been conflicting [7,10-12,14,16].

Compared to younger chronically ill patients, the elderly, including the healthy elderly, may have different motivations and behavior, and differences in immunization and its determinants. Only a small number of studies [8,9,11,13] were targeted specifically at a general (healthy and chronically ill) elderly population.

In order to better understand utilization of immunization and enable improved intervention for increasing it, we addressed these and other potential correlates of influenza vaccination among patients aged 65 or more who were registered at a Jerusalem community health clinic. The majority of elderly residents in this community are registered at this health center. The 7,500 patients at this clinic are mostly middle-class and Jewish, and close to a quarter (1,800) are aged 65 and over. Influenza immunization was provided at the clinic free of charge (homebound patients were immunized at home). Pre-season postcards were sent to all patients aged 65 and over.

Many of the previous studies were conducted in hospital-based settings. A study such as ours, performed in the community, can provide a fuller picture of the behavior of the elderly – and not only of those who visit university hospitals. Our study, targeting a specific community served by a local clinic, demonstrates the use of surveys in a way that is applicable to any primary care practice that tries to address the health needs of the community as well as caring for its individual members. The importance of this community diagnosis, as described in the context of COPC – community-oriented primary care [18], is furnishing a better understanding of influenza immunization in this community

and possibly in others. A community level investigation can form the basis for future intervention and its evaluation.

The study includes a number of variables not examined in previous studies that investigated general elderly populations. These are: identity of the treating physician, general satisfaction with one's life situation, having someone close to discuss feelings with, working, smoking, exercise, and religiosity.

Methods

A telephone survey administered by trained interviewers in 1997, after the influenza season, was conducted among patients registered at a Jerusalem primary care community clinic. The survey was addressed to a random sample of patients aged 65 and over with identified telephone numbers (89% had such numbers). The respondents were asked about influenza immunization and a number of potentially relevant variables.

Those who reported having been immunized for the latest influenza season were asked what outside influences had effected this decision, and those who reported not having been immunized were asked the reasons, and specifically if a physician or a nurse had recommended immunization. Two questions concerning knowledge and attitude were included: Does immunization provide complete protection against getting influenza?, and can the immunization itself cause influenza? Information was also collected on age, gender, country of birth, marital status, education, religiosity, disability in activities of daily living, mobility outside the house, general satisfaction with one's life situation, the presence of a close person with whom they can discuss feelings and problems, work (paid or voluntary), self-appraisal of health, heart disease, chronic lung disease, diabetes, chronic kidney disease and other chronic diseases, smoking, regular exercise, and number of doctor visits at the clinic during the previous 3 months. The identity of the treating physician and his level of training (general physician or certified family physician) were also noted.

Most of these variables were later collapsed into dichotomies. The data were analyzed with the aid of SPSS-PC and PEPI [19]. Associations with having received an immunization for the latest season were examined using Pearson's chi-square test. Multivariate analysis was performed with immunization history as the dependent variable using multiple logistic regression. First-degree interactions were also examined in the model.

Results

Of the 795 patients who were telephoned 626 (78.7%) answered the questionnaire, 61 (7.7%) could not be reached despite repeated attempts, 34 (4.3%) could not be interviewed because of communication problems, and 74 (9.3%) refused.

The average age of the respondents was 73.8 years. The age and sex distribution did not differ significantly from that of the total study population ($P=0.34$ by chi-square).

Distribution by identity of treating physician was also not significantly different from that of the study population ($P=0.20$).

Only 30.9% of the respondents were born in Israel, 97.6% of the others had come to Israel at least 20 years previously. Over half (55.3%) were born in Europe or America and the rest (13.7%) in Asia or Africa. The percentage with over 8 years of schooling was 83.2. The total of those reporting any chronic disease was 39.8%. Smoking was reported by 7.5%. Only 18.8% of the sample reported not having visited their primary care physician during the last 3 months.

The reported percentage of influenza immunization for the latest influenza season was 68.1 (95% confidence interval 64.8–71.1%), with 25.2% (95% confidence interval 21.9–28.9%) reporting never having been immunized. The most common external influence reported to effect a positive decision on immunization was a physician's recommendation, reported by 50.6% of those who were immunized. Other influences were communication media (11.6%), mail reminders (8.3%), and family (5.9%). A nurse and friends also influenced some (3.6% each). Among those who were not immunized, only 28.0% reported that a physician had recommended immunization, and only 6.3% reported a nurse having recommended it. Of those whose physician did not recommend immunization 24.4% believed that they would have had an immunization if their physician had recommended it. A nurse's recommendation would have caused 7.2% to immunize. The other most frequent reasons given for non-immunization were personal experience of "not suffering from flu" (17.0% of those not immunized for the last season), fear of side effects or disease caused by the immunization (15.0%), disbelief in its efficacy (15.0%), general objection to medications or immunizations (12.5%), and medical reasons (mostly unjustified, such as being chronically ill or having allergies to drugs) (10.0%). None of the non-immunized respondents mentioned medical service problems, such as accessibility, as reasons for not being immunized.

The responses to the knowledge questions showed that 23.3% believed wrongly that immunization provides complete protection from influenza, and 29.0% believed wrongly that immunization can cause influenza.

Immunization varied in different subgroups. Table 1 lists the prevalence of different subgroups in the study population, their immunization rates, the level of statistical significance of the (bivariate) associations, their odds ratio and 95% confidence level. Variables whose P value for their association with influenza immunization was not under 0.1 are not shown. Immunization rates for the latest influenza season were significantly lower among women (60.3% compared to 76.1% for men, odds ratio 2.09, $P=0.00002$), among those who were born in Asia (not including Israel) or Africa (54.8% vs. 71.2% for others, O.R. 2.04, $P=0.0026$), among those not presently married (55.9% vs. 73.9% for married, O.R. 2.34, $P=0.00001$), those with less years of education (54.9% for up to 8 years of schooling vs. 71.8% for

Table 1. Associations between selected variables and influenza immunization

Variable	Bivariate analysis			Logistic regression				
	Prevalence (%)	Immunized (%)	<i>P</i>	Odds ratio	95% C.I.	<i>P</i>	Odds ratio	95% C.I.
Gender			.00002			.32		
Female	50.6	60.3						
Male	49.4	76.1		2.09	1.48-2.96		1.28	0.79-2.09
Country of birth			.0026			.16		
Asia /Africa	13.7	54.8						
Other	86.3	71.2		2.04	1.27-3.26		1.61	0.83-3.10
Marital status			.00001			.0031		
Unmarried	30.3	55.9						
Married	69.7	73.9		2.34	1.56-3.21		2.13	1.29-3.51
Schooling (yr)			.00075			.18		
0-8	16.8	54.9						
9+	83.2	71.8		2.09	1.36-3.24		1.04	0.98-1.10
Religiosity			.00030			.067		
Religious	15.7	53.2						
Not religious	84.3	72.0		2.26	1.44-3.54		1.71	0.96-3.03
Chronic disease			.0067			.23		
No	60.2	64.7						
Yes	39.8	75.2		1.65	1.15-2.38		1.32	0.84-2.08
Exercise			.076			.87		
No	52.9	65.6						
Yes	47.1	72.3		1.37	0.97-1.94		1.04	0.66-1.64
Visited physician in 3 months			.00036			.0006		
No	18.8	54.5						
Yes	81.2	71.8		2.13	1.40-3.25		2.60	1.51-4.78
Identity of treating physician			.00001					
Type of physician*			.0008			<.0001		
General	20.7	53.5						
Family	79.3	71.7		2.20	1.48-3.27			
Does shot give 100% protection?			<.00001			<.0001		
No (or don't know)	76.7	61.7						
Yes	23.3	93.5		8.96	4.45-18.07		14.93	6.45-34.56
Can vaccine cause flu?			<.00001			<.0001		
Yes	29.0	49.1						
No (or don't know)	71.0	77.1		3.49	2.40-5.08		3.23	2.02-5.16

* Not included in the logistic regression model.

over 8, O.R. 2.09, $P=0.00075$), and those who defined themselves as religious (53.2% vs. 72.0% for non-religious, O.R. 2.26, $P=0.00030$). Immunization was higher among respondents reporting chronic diseases (75.2% vs. 64.7%, O.R. 1.65, $P=0.0067$) and those having visited their physician during the previous 3 months (71.8% vs. 54.5%, O.R. 2.13, $P=0.00036$). Large differences in immunization rates were observed between patients of the various physicians ($P=0.00001$), the highest rate being 83.1% and the lowest 48.6%. Patients treated by certified family physicians had a higher immunization rate than those treated by general physicians (71.7% vs. 53.5%, O.R. 2.20, $P=0.00008$). Persons who wrongly believed that immunization affords complete protection from influenza were more likely to have been immunized (93.5% vs. 61.7%, O.R. 8.96, $P<0.00001$), while those who wrongly believed that the immunization can cause influenza were immunized less (49.1% vs. 77.1%, O.R. 3.49, $P<0.00001$). Differences that

were not statistically significant were the higher rates among non-smokers (69.7% vs. 60.0%, $P=0.18$) and among those exercising at least twice a week (72.3% vs. 65.6%, $P=0.076$). Subgroups of the other examined variables did not show appreciable differences in immunization rates. These were age, disability in activities of daily living, mobility, satisfaction with life, someone to discuss feelings with, work, and self-appraised health.

The results of logistic regression analysis, which shows the effect of each variable while controlling for the others, are also presented in Table 1. Variables whose associations with influenza immunization had P values less than 0.1 were included in this logistic model with influenza immunization as the dichotomous dependent variable. Age was also included. Type of physician (family vs. general) was not included as this would not improve the model, which included identities of individual physicians. The chi-square of this logistic regression model, which tests the null

hypothesis that the coefficients for all independent variables are zero, showed significant improvement with $P < 0.0001$. The variables that remained highly significantly associated with immunization were marital status (odds ratio 2.13 for married, $P = 0.0031$), a visit to physician during the last 3 months (O.R. 2.60 for having visited, $P = 0.0006$), the identity of the primary care physician ($P < 0.0001$), and the two knowledge questions ($P < 0.0001$). The association of having been immunized with not being religious had a P value of 0.067 (O.R. 1.71). Other associations were far from significant: age, gender, country of birth, years of schooling, chronic disease and exercise. Substituting the physician's identity with physician type had little effect on the model, with physician type having a significant association with immunization ($P = 0.0008$, O.R. = 2.35).

All first-degree interactions were tested in this model, but only that between religiosity and the belief that the vaccine can cause influenza had a statistically significant association with having been immunized ($P = 0.033$). When controlling for all the other factors in the model, influenza vaccination was less common in those believing it can cause influenza, but significantly more so among religious (O.R. 5.26) than non-religious (O.R. 2.57) respondents.

In a logistic regression model excluding the two knowledge variables, two additional associations showed statistical significance – namely, males vaccinated more than females ($P = 0.049$, O.R. = 1.55, 95% C.I. = 1.00–2.40), and non-religious more than religious ($P = 0.015$, O.R. = 1.89, 95% C.I. = 1.14–3.14). Examination of the relationship of these two variables with the knowledge questions demonstrated a more favorable attitude towards immunization among males and the non-religious. These groups had higher percentages of people who believed that influenza immunization afforded complete protection, and lower percentages believing that immunization can cause influenza. These associations were statistically significant for gender ($P = 0.024$ for complete protection and $P = 0.007$ for causing influenza) but not for religiosity ($P > 0.1$).

Discussion

The influenza immunization rate of 68.1% compares favorably with other reports on immunization in the 65+ age group, e.g., the 1997 United States figure of 65.5% [6]. Immunization rates in Israel are generally lower. A study in Jerusalem reported rates of about 30% for 1989–90 [20], and a recent report from national surveys in Israel showed rates of about 50% in 1998–99 and 1999–2000 [21]. A number of factors not examined in our study may have contributed to the relatively high immunization rate, among them the fact that immunizations were free and highly accessible, thus overcoming potential barriers [15], and the pre-season reminder mailing.

Response rates were high. We demonstrated that the survey participants did not differ significantly from the total study population in their age and sex distribution and their treating physician. Even so it is possible that immunization

rates were lower in the non-participants: people whose telephone number could not be identified, those who were not home when called, those with communication problems, and refusers may all have had less contact with medical services and lower immunization rates.

The significantly higher immunization rates among men and among those with more schooling is different to that found in most previous studies [7–11,13,14], but after controlling for the effect of other variables these associations disappeared. We were able to demonstrate that the association with gender loses its significance only when multivariate analysis included the knowledge questions. Men had more positive beliefs concerning influenza immunization, i.e., more men than women stated that immunization provides complete protection from influenza, and less stated that immunization can cause influenza. This most probably resulted in more immunization among men. The similar immunization rates in different age groups are consistent with results of most previous studies [7–11,13,14]. The lower immunization rates among those born in Asia and Africa were the result of other differences (e.g., different physicians) and disappeared in multivariate analysis.

The highly significant association between increased immunization and being married is practically equivalent in this population to the association with not living alone. This may demonstrate the importance of social support, though we did not find immunization to be associated with the presence of a person with whom one could discuss feelings, or with working. Studies in other populations did not show this association with being married [7,13,14] or with living alone [10]. General satisfaction with one's life situation was also not related to immunization.

The lack of association with disability and with difficulty in mobility, consistent with previous reports [11,14], and the fact that these were not reported as reasons for not immunizing, may be related to high accessibility and to the availability of home visits for homebound patients. The higher rates of immunization among persons who exercise and among non-smokers, though not statistically significant in our study, may be the result of their general tendency to healthy behavior. Previous studies demonstrated a significant association between cigarette smoking and failure to receive the vaccine [14,17].

Studies have varied in their findings on whether immunization rates are higher among the chronically ill [7,11,16]. One would hope for more immunization among patients with chronic disease in which the consequences of influenza may be worse. In our study, there was no association between immunization and self-appraised health, which is an acceptable measure of health [22]. The association with chronic disease lost its significance in multivariate analysis, possibly because of the positive association of chronic disease with the number of visits to a physician during the previous 3 months, a variable that remained significantly associated with immunization. The

positive association between the frequency of visits to a physician and influenza immunization, which has been shown elsewhere [3,16], could be a manifestation also of these patients' general tendency for increased usage of medical care, unrelated to increased morbidity. Visits to the physician could obviously have been an opportunity for receiving the immunization or for getting advice from the physician.

The answers given by both recipients and non-recipients of influenza immunization demonstrate the importance of a physician's recommendation to immunize. This was by far the most common external influence reported (by 50.6% of the immunized) to effect a positive decision to immunize, and in contrast, most (72.0%) of the non-immunized did not recollect any such recommendation. The central role of the provider's recommendation has been demonstrated in a number of studies [7,8,11,13,17,20]. As many as 24.4% of the non-immunized whose physician did not recommend immunization reported that they would have chosen to be immunized had their physician recommended it. This strengthens the impression that the physician's recommendation would convince many abstainers to immunize [8,15,23,24].

Physician influence is demonstrated also by the very different immunization rates of patients treated by different physicians. The association between immunization and identity of primary care physician, which remained highly significant in multivariate analysis, could be partly attributed to the higher immunization rates among patients of certified family physicians. The difference between physician type is not necessarily the result of different training but could also reflect other differences such as physician's age. The number of physicians in this study is not large enough to generalize our finding on association with physician type. A previous study in a hospital outpatient setting [7] also found differences between individual physicians but no association with provider type (faculty physicians, internal medicine residents, nurse practitioners) or level of training.

The lower rates of immunization among those defining themselves as religious (in contrast to traditional and secular) remained statistically significant in multivariate analysis only when the knowledge questions were not included. Answers to these questions demonstrated a less favorable attitude towards immunization among religious patients. The effect of a negative attitude toward immunization was also stronger; the association between immunization and the belief that one can get influenza from the immunization was significantly stronger among religious respondents.

Other studies have demonstrated the importance of knowledge and attitudes concerning influenza and influenza immunization in determining its acceptance [7–12,17,25]. Among those associated with failure to immunize were the belief of not being susceptible to influenza, the fear of side effects, and doubt as to the vaccine's effectiveness. These results are echoed in our study in which these beliefs were

the most common reasons given for not getting immunized. A previous smaller study did not find immunization to be significantly associated with belief in high effectiveness or not getting influenza from immunization [15]. Our study demonstrated clearly that both these factors are very strongly associated with immunization: Immunization rates were clearly higher among those who believed, correctly, that influenza immunization could not cause influenza, but also among those who believed, wrongly, that immunization provides complete protection against influenza. This very strong association between the two knowledge questions and immunization practice underlines the importance, in this context, of 'favorable' knowledge and beliefs. In addition to the above mentioned reasons given by the non-immunized, the other main reasons were also related to knowledge and attitude – their general objection to medication and immunizations, and their belief, in most cases wrong, that medical reasons contraindicate immunization. The former may be deeply rooted and difficult to change, but the latter should be amenable to the influence of their physician.

Summarizing our findings, the main factors strongly associated with higher immunization rates among the elderly are physician related: The identity of the specific physician, visits to the physician, and patient knowledge concerning immunization. The primary care physician with his potential influence on patient knowledge, attitude and behavior has a central role in increasing immunization. Physicians should be made aware of this and should recommend immunization and discuss its effects. Future studies should concentrate on identifying physician characteristics associated with patient immunization rates.

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Capsule



Nobel 2000

The Nobel Assembly at Karolinska Institute has decided to award The Nobel Prize in Physiology or Medicine for 2000 jointly to Arvid Carlsson, Paul Greengard and Eric Kandel for their discoveries concerning "signal transduction in the nervous system."

In the human brain there are more than a hundred billion nerve cells. They are connected to each other through an infinitely complex network of nerve processes. The message from one nerve cell to another is transmitted through different chemical transmitters. The signal transduction takes place in special points of contact, the synapses. A nerve cell can have thousands of such contacts with other nerve cells. The three Nobel Laureates in Physiology or Medicine have made pioneering discoveries concerning one type of signal transduction between nerve cells, referred to as "slow synaptic transmission." These discoveries have been crucial for understanding the normal function of the brain and how disturbances in this signal transduction can give rise to neurological and psychiatric diseases. These findings have resulted in the development of new drugs.

Arvid Carlsson (Department of Pharmacology, University of Gothenburg) is rewarded for his discovery that dopamine is a transmitter in the brain and that it has great importance for our ability to control movements. His research has led to the realization that Parkinson's disease is caused by a lack of dopamine in certain parts of the brain and that an efficient remedy (L-dopa) for this disease could be developed. Arvid Carlsson has made a number of

subsequent discoveries that have further clarified the role of dopamine in the brain. He has thus demonstrated the mode of action of drugs used for the treatment of schizophrenia.

Paul Greengard (Laboratory of Molecular and Cellular Science, Rockefeller University, New York) is credited for his discovery of how dopamine and a number of other transmitters exert their action in the nervous system. The transmitter first acts on a receptor on the cell surface. This triggers a cascade of reactions that will affect certain "key proteins," which in turn regulate a variety of functions in the nerve cell. The proteins become modified as phosphate groups are added or removed, causing a change in the shape and function of the protein. Through this mechanism the transmitters can carry their message from one nerve cell to another.

Eric Kandel (Center for Neurobiology and Behavior, Columbia University, New York) is rewarded for his discoveries of how the efficiency of synapses can be modified, and which molecular mechanisms take part. With the nervous system of a sea slug as the experimental model he demonstrated how changes of synaptic function are central for learning and memory. Protein phosphorylation in synapses plays an important role in the generation of a form of short-term memory. For the development of a long-term memory a change in protein synthesis is also required, which can lead to alterations in shape and function of the synapse.