

Vaccination practices of Quebec family physicians

Influenza vaccination status and professional practices for influenza vaccination

Geneviève Baron, MD, MSC, FRCPC Philippe De Wals, MD, PHD François Milord, MD, MSC, FRCPC

ABSTRACT

OBJECTIVE To assess influenza vaccination status and influenza vaccination practices of family physicians in Quebec.

DESIGN Mail survey of a random sample of 1000 family physicians.

SETTING Family practices in the province of Quebec.

PARTICIPANTS Of 1000 Quebec family physicians sent questionnaires, 550 responded. After excluding physicians who worked only in institutions, had no patients older than 65 years, or did clinical work less than 20% of the time, 379 respondents were eligible for the study.

MAIN OUTCOME MEASURES Vaccination status of family physicians in 1996 and professional practices based on six clinical and administrative activities pertaining to influenza vaccination.

RESULTS Prevalence of vaccination was 35.5% (95% confidence interval 30.8% to 40.4%) among responding physicians and was higher among those 60 years and older, those with a chronic condition, and those perceiving high peer pressure to get vaccinated. Most respondents frequently assessed the current influenza vaccination status of their patients, risk factors for influenza-related complications, and contraindications to the vaccine. They also frequently provided education about influenza and its vaccine, recommended vaccination, and administered the vaccine. Only a few reported assessing prior influenza vaccinations or recording vaccination status regularly. Finally, vaccinated physicians recommended the vaccine more frequently to their patients than unvaccinated physicians did.

CONCLUSION Promotion programs focusing on peer influence could increase vaccination of family physicians. This could in turn improve vaccination coverage of elderly patients.

RÉSUMÉ

OBJECTIF Évaluer le statut de vaccination contre la grippe et les pratiques à cet égard chez les médecins de famille au Québec.

CONCEPTION Un sondage postal envoyé à un échantillon aléatoire de 1 000 médecins de famille.

CONTEXTE Des pratiques familiales dans la province de Québec.

PARTICIPANTS Des 1 000 médecins de famille québécois à qui le questionnaire a été envoyé, 550 ont répondu. Exclusion faite des médecins qui ne travaillaient que dans des établissements hospitaliers, qui n'avaient pas de patients de plus de 65 ans ou qui consacraient moins de 20% de leur temps au travail clinique, 379 répondants étaient admissibles aux fins de l'étude.

PRINCIPALES MESURES DES RÉSULTATS Le statut de vaccination des médecins de famille en 1996 et les pratiques professionnelles entourant six activités cliniques et administratives relatives à la vaccination contre la grippe.

RÉSULTATS La prévalence de la vaccination se situait à 35,5% (intervalle de confiance à 95% entre 30,8% et 40,4%) chez les médecins répondants et était plus élevée chez ceux de 60 ans et plus, ceux souffrant de maladie chronique et ceux qui percevaient de fortes pressions à se faire vacciner. La plupart des répondants évaluaient fréquemment le statut de vaccination actuel de leurs patients, les facteurs de risque de complications associées à la grippe ainsi que les contre-indications au vaccin. Ils dispensaient aussi fréquemment de l'éducation concernant la grippe et le vaccin afférent, recommandaient la vaccination et l'administraient. Seuls quelques-uns ont signalé vérifier que l'état de la vaccination antigrippale antérieure ou consigner le statut de vaccination régulièrement. Enfin, les médecins vaccinés recommandaient plus fréquemment le vaccin à leurs patients que ceux qui ne l'étaient pas.

CONCLUSION Les programmes de promotion insistant sur l'influence par les pairs pourraient augmenter le taux de vaccination chez les médecins de famille. Cela pourrait en retour améliorer le taux de vaccination chez les patients âgés.

This article has been peer reviewed.

Cet article a fait l'objet d'une évaluation externe.

Can Fam Physician 2001;47:2261-2266.

RESEARCH

.....

Vaccination practices of Quebec family physicians

Influenza remains a serious public health problem in Canada in terms of morbidity, mortality, and cost to society.^{1,2} Vaccination of people at high risk of influenza-associated complications has been recommended for many years.³

Health care workers, among them family physicians, who have substantial contact with high-risk patients should also be vaccinated. Indeed, a recent literature review suggests that they have been involved in transmitting the virus to patients in several outbreaks.⁴ Immunization of health care workers has been associated with a decrease in mortality in long-term care hospitals during the flu season.^{5,6} Also, vaccination against influenza could have direct health and economic benefits for healthy working adults.⁷⁻⁹

Vaccination coverage among Canadian health care workers, including family physicians, was 18% in 1991.¹⁰ Among doctors, coverage rates of 26% and 40% have been documented in the United States and France, respectively.^{11,12} Avoidance of illness, concerns about transmitting the virus to patients, and prevention of income loss because of illness are some of the reasons mentioned by health care professionals to justify vaccination.¹¹⁻¹³ Fear of side effects, forgetfulness, low perception of personal threat, concerns about vaccine efficacy, and limited access to the vaccine are some reasons given for not getting vaccinated.¹¹⁻¹⁵

Family practitioners also have a prominent role in reaching national influenza vaccination objectives, which are set at 70% for noninstitutionalized seniors and 95% for residents of long-term care facilities.¹⁶ Many studies have shown the importance of physicians' influence on patients' decisions to get vaccinated.^{10,17,18} In Quebec, about 80% of the population consult a family physician at least once yearly,¹⁹ and 77% of influenza vaccine doses are administered in private clinics, compared with 23% in local community health centres and hospitals.²⁰ Family practitioners are thus in a position to increase vaccination coverage in Canada, which reached only 51% among noninstitutionalized adults aged 65 years and older in

Dr Baron is a scholar, and **Dr De Wals** and **Dr Milord** are Professors in the Department of Community Health Sciences in the Faculty of Medicine at Sherbrooke University in Quebec. **Dr Baron, Dr De Wals, and Dr Milord** are consultants for the Direction de la santé publique, de la planification et de l'évaluation, Régie régionale de la santé et des services sociaux de la Montérégie.

Dr De Wals is also a member of the Centre for Research in Gerontology and Geriatrics at the Sherbrooke University Institute of Geriatrics.

1996-1997²¹ and was about 80% among those in long-term care facilities in 1991.²² In Quebec, vaccination rates reached 38% in adults older than 65 and 75% among those in long-term care facilities in 1998.^{23,24}

Little is known about family physicians' influenza vaccination status in Canada. Little is also known of their practices regarding their patients' vaccination. Some evidence suggests²⁵ that the personal vaccination status of physicians influences their role in promoting the vaccine among their patients.

This study assessed personal vaccination status and professional practices regarding influenza vaccination of family physicians in Quebec. The association between these two behaviours, and the factors that influence them, were also investigated.

METHODS

In September 1997, a mail survey was sent to a random sample of family doctors selected from the membership list of the Quebec Federation of General Practitioners. This federation encompasses the entire population of family physicians in the province.

The self-administered, anonymous questionnaire had previously been assessed for content validity and pretested among a group of family practitioners. It included questions about demographic characteristics, practice settings, personal risk factors for influenza-related complications, beliefs and perceptions about influenza and the vaccine, personal vaccination status in the years 1992 to 1996, opinions about barriers to vaccination of patients older than 65 years, and professional practices regarding vaccination of those patients. Based on the work by Johns and co-workers,²⁶ who developed a model describing the different roles assumed by primary care physicians in health promotion, questions pertaining to six aspects of professional immunization practices were designed. Questions covered assessment of patients' immunization status, education about influenza and its vaccine, recommendation of immunization, administration of the vaccine, record keeping, and involvement in organizing the influenza vaccination program. A reminder, with a copy of the questionnaire, was sent 3 weeks after the initial mailing. The study protocol was approved by the ethics committee of the Sherbrooke University Institute of Geriatrics.

All statistical analyses were performed on SPSS 7.5 for Windows.²⁷ Because of the great number of ordinal variables pertaining to respondents' beliefs and perceptions about influenza and the vaccine, a non-linear principal component analysis was performed.

This analysis allowed synthesis of information contained in many variables by creating a few new, independent variables that could more easily be interpreted and entered into the logistic regression model. Details of this analysis are available upon request from the authors.

Fisher exact or χ^2 tests were used for bivariate analyses of categorical data. Multivariate logistic regression was performed to identify variables that were independently associated with receipt of influenza vaccine in 1996. Candidate variables for inclusion in the model were demographic characteristics (age, sex, and region of practice), practice setting, personal risk factors for influenza-related complications, and respondents' beliefs and perceptions about influenza and the vaccine derived from the principal component analysis. As suggested by Hosmer and Lemeshow,²⁸ only variables that differed between vaccine recipients and nonrecipients at the $P < .25$ level in the univariate analysis were included in the model. When necessary, variables were dichotomized to facilitate interpretation using odds ratios.

Using a 20% estimate for the proportion of health care workers vaccinated against influenza,¹⁰ a margin of error of 5%, and an α of 5% (bilateral test), sample size calculations determined that 246 subjects were necessary to conduct this study (Z test for a proportion and only one sample). Because response rates in mail surveys focusing on the determinants of influenza vaccination among health care workers might reach only 26%,²⁹ the final sample for this study thus included 1000 family practitioners.

RESULTS

Characteristics of respondents

Overall response rate was 55.0%. Among the 550 respondents, 379 were judged eligible for the study. Those not eligible worked exclusively in institutional settings ($n=111$), did not treat patients older than 65 years ($n=20$), or devoted less than 20% of their time to clinical tasks ($n=1$). A few ineligible respondents met more than one exclusion criterion ($n=4$). Participants who were retired ($n=9$) and those whose eligibility was impossible to determine because of missing or incomplete data ($n=26$) were also excluded.

More than half the 379 eligible respondents were men (62.0%); their mean age was 43 years ($SD \pm 10$ years). They practised mainly in private offices (71.6%), local health and community centres (15.8%), acute care hospitals (10.1%), or such other settings as long-term care hospitals, public health departments, or rehabilitation centres (2.5%).

Beliefs and perceptions

A minority of respondents considered their own susceptibility to influenza to be high (40.0%), but most considered their risk of complications following infection to be low (96.0%). A few did not believe that the vaccine is effective at preventing the illness (13.0%), doubted its ability to prevent transmission of the virus to patients or family (20.0%), and doubted its ability to prevent disruption of professional activities (41.0%). Half the respondents questioned the vaccine's effectiveness in preventing loss of income because of infection. Finally, more than 90.0% of respondents were unworried by side effects of influenza vaccination.

Personal vaccination status

During the 1996 season, 35.5% (confidence interval [CI] 30.8%-40.4%) of respondents had been vaccinated against influenza, a moderate increase from 29.2% in 1992. Those 60 years or older ($\chi^2_1=9.31$; $P=.002$), those with a chronic condition (chronic cardiovascular or pulmonary disease, diabetes mellitus, chronic renal insufficiency, or immunosuppressive states) (Fisher's exact test; $P=.008$), and those perceiving high peer pressure to get vaccinated (high peer pressure corresponds to the perception that getting vaccinated is fairly, very much, or enormously encouraged by colleagues) ($\chi^2_1=17.34$; $P < .001$) were more likely to have been vaccinated than others.

Sex, region of practice, and main practice setting were not significantly associated with vaccination status. Neither were beliefs about the benefits of immunization, beliefs about costs of vaccination, nor perceived threat of influenza. In the multivariate logistic model, presenting a risk factor for influenza-related complications (age older than 60 or chronic disease) and perceiving high peer pressure to get vaccinated remained significantly associated with receipt of flu shots in 1996 (Table 1). Separate analysis showed that prior influenza vaccination was highly associated with being vaccinated in 1996 (relative vaccination rate 9.87; CI 5.79-16.89). In fact, the proportion of 1996 vaccine recipients tended to increase as respondents reported none (6.7%), one (30.8%), two (42.9%), three (16.7%), or four (93.9%) vaccinations between 1992 and 1995 (χ^2 test for trend = 166.62; $P < .001$).

Professional practice

Nearly all respondents believed in the effectiveness of the vaccine for preventing complications of influenza in their older patients (98.0%). A few thought that this measure was often refused by patients (33.0%) and that there was too little time during visits for this intervention

RESEARCH

Vaccination practices of Quebec family physicians

Table 1. Analysis of physicians' vaccination status in 1996, using multivariate logistic regression (n=353)

INDEPENDENT VARIABLE*	1996 VACCINE RECIPIENTS (%)	UNADJUSTED ODDS RATIO	ADJUSTED ODDS RATIO	95% CONFIDENCE INTERVAL
Risk factor for influenza-related complications [†]				
• None	33.5	Reference	Reference	Reference
• One or more	61.8	3.20	2.76	1.30 - 5.84
Perceived peer pressure to get vaccinated [‡]				
• Low	25.6	Reference	Reference	Reference
• High	46.4	2.52	2.39	1.51 - 3.78
Perceived benefits of vaccination [§]	–	1.18	1.14	0.92 - 1.43

*Only variables significant at $P < .25$ level in univariate analysis were included in the multivariate model.

[†]"Age over 60" and "suffering from a pathology related to influenza complications" both correspond to risk factors defined by the National Advisory Committee on Immunization (1998) (chronic cardiovascular or pulmonary disease, diabetes mellitus, chronic renal insufficiency, or immunosuppressive states) were combined into one unique "risk factor" variable.

[‡]Peer pressure was defined as perceived encouragement, by colleagues, to get vaccinated. Low peer pressure corresponds to the perception that getting vaccinated against influenza is not at all, very little, or little encouraged by colleagues, whereas high peer pressure corresponds to the perception that getting vaccinated is fairly, very much, or enormously encouraged by colleagues.

[§]Odds ratios are for an increase of one unit score along the new, independent variable (perceived benefits of vaccination) obtained from the nonlinear components analysis.

(15.0%). Only four of 10 respondents (40.0%) believed that influenza vaccination was adequately remunerated.

Answers to questions about different aspects of professional vaccination practice are shown in **Table 2**. Most respondents frequently assessed their patients' current influenza vaccination status, risk factors for influenza-related complications, and contraindications to the vaccine. They also frequently provided education about influenza and its vaccine, recommended vaccination, and administered the vaccine. On the other hand, only a minority reported assessing prior influenza vaccinations or recording the vaccination status of their patients regularly. Questions related to involvement in the organization of immunization activities were answered by 370 respondents (97.6% of total): few reported active involvement in ordering the vaccines (36.9%), in notifying eligible patients (25.4%),

Table 2. Respondents' professional practices regarding vaccination of patients 65 years or older (n=375)

PROFESSIONAL PRACTICE	"NEVER" OR "ALMOST NEVER" DONE (%)	"OCCASIONALLY" OR "OFTEN" DONE (%)	"ALMOST ALWAYS" OR "ALWAYS" DONE (%)
Assessment			
• Of risk factors for influenza-related complications	8.3	33.2	58.6
• Of contraindications to vaccine	4.0	12.0	83.9
• Of prior influenza immunizations	12.8	44.5	42.7
• Of current immunization status	2.1	26.1	71.8
Educating about influenza and its vaccine	2.2	31.6	66.3
Recommending the vaccine to unvaccinated patients	1.6	21.6	76.8
Administering the vaccine to patients	14.7	15.6	69.7
Recording immunization status of patients	25.2	41.5	33.5

or in informing other workers about the influenza program (31.1%).

Personal vaccination status and professional practice

Vaccinated respondents advised flu vaccination to their older patients more frequently than unvaccinated respondents (85.5% versus 72.2% recommended the vaccine "almost always" or "always") ($\chi^2_1=8.44$; $P=.004$).

DISCUSSION

This is the first study of influenza vaccination practices in a large and representative sample of family physicians in Quebec. Only one in three physicians was vaccinated against influenza in 1996. Factors significantly associated with vaccination included risk

factors for influenza-related complications, perceiving high peer pressure to get vaccinated, and past vaccination. The association between risk factors for influenza-related complications and vaccination status has been reported previously.¹¹⁻¹³ This finding attests to health care professionals' acknowledgment of national recommendations on vaccination of high-risk groups. It seems that general practitioners apply these recommendations not only to their patients, but also to themselves.

The association between peer pressure and vaccination status is, to our knowledge, a novel finding. Strategies using the influence of colleagues have been advocated frequently to improve the quality of medical practice.³⁰⁻³³ Continuing medical education presented by opinion leaders and evaluation of the quality of medical activity by peers are examples of possible interventions.

In this survey, past vaccination was an important determinant of current vaccine status. As suggested previously,³⁴ specific changes in attitudes could prove important in initial adoption of vaccination behaviour, but habit might be sufficient to explain subsequent behaviour. Clearly, strategies aimed at encouraging the "first" vaccination against influenza are crucial if vaccination coverage is to increase among practitioners. In this regard, vigorous action aimed at vaccinating medical students could be considered. Indeed, high vaccination coverage can be obtained in this population.^{35,36}

Finally, we observed that vaccinated physicians recommended flu vaccine to their patients more frequently than unvaccinated respondents. This finding is very interesting because it raises the possibility that interventions promoting influenza vaccination of family practitioners also have an indirect effect on vaccination rates of their patients.

Main limitations to this study include selection bias due to lack of response and professional desirability bias. The response rate in this study was 55.0%, and respondents' characteristics could not be compared with those of nonrespondents because questionnaires were anonymous. Characteristics of these two groups could, therefore, be different. In particular, vaccination rates against influenza among family practitioners in 1996 could be overestimated based on rates among respondents only.

Questions about professional practices are subject to professional desirability bias, as physicians often overestimate their performance.³⁷⁻³⁹ The extent of this bias cannot be evaluated after the fact, but efforts to minimize it before the survey were made by ensuring

Editor's key points

- This survey of Quebec family physicians describes their personal influenza vaccination status and their practices regarding influenza immunization.
- Slightly more than a third of FPs were vaccinated against influenza.
- Family physicians older than 60, those with a chronic medical condition, those perceiving high peer pressure to get vaccinated, or those previously immunized were most likely to be vaccinated.
- Most FPs assessed their patients' current vaccination status, risk factors for influenza, and contraindications, but fewer kept routine records of vaccination.

Points de repère du rédacteur

- Ce sondage auprès des médecins de famille québécois décrit leur propre statut de vaccination contre la grippe et leurs pratiques entourant l'immunisation contre la grippe.
- Un peu plus du tiers des médecins de famille étaient vaccinés contre la grippe.
- Les médecins de famille de 60 ans et plus, ceux souffrant d'une maladie chronique, ceux qui ressentaient une forte pression de leurs pairs pour se faire vacciner ainsi que ceux qui avaient été vaccinés antérieurement étaient davantage susceptibles d'être vaccinés.
- La plupart des médecins évaluaient le statut de vaccination actuel, les facteurs de risque de la grippe et les contre-indications, mais un nombre moins grand de médecins gardaient systématiquement cette information en dossier.

anonymity for participants. It is likely, however, that trends in reported activities reflect trends in actual activities among various subgroups in our sample. In the future, new methods of assessing professional practices objectively should be developed.

CONCLUSION

This study is the first in the province of Quebec to document vaccination rates against influenza among family practitioners. Vaccination coverage is unacceptably low, and great efforts are needed to increase the number of vaccine recipients in this population. Promotion programs focusing on peer influence should

RESEARCH

.....

Vaccination practices of Quebec family physicians

be tested; if successful, these programs could also lead to increased vaccination coverage of elderly patients. ❖

Acknowledgment

The study was funded by a grant from Biochem Pharma, which was recognized by the "Fonds de la recherche en Santé du Québec" (No. 971104). The Fédération des médecins omnipraticiens du Québec provided useful assistance for the study.

Contributors

Dr Baron was responsible for protocol design, data collection, data analysis, and writing the paper. Dr De Wals initiated the research and was responsible for coordinating the study and editing the paper. Dr Milord contributed substantially to study design, data analysis, and writing the paper.

Competing interests

None declared

Correspondence to: Dr Philippe De Wals, Département des sciences de la santé communautaire, Université de Sherbrooke, 3001, 12^eme Ave N, Sherbrooke, QC J1H 5N4; fax (819) 564-5397; e-mail pdewals@courrier.usherb.ca

References

1. National Advisory Committee on Immunization (NACI). Influenza in Canada 1997-1998 season. *Can Commun Dis Rep* 1998;24(21):169-76.
2. Upshur REG, Knight K, Goel V. Time-series analysis of the relation between influenza virus and hospital admissions of the elderly in Ontario, Canada, for pneumonia, chronic lung disease, and congestive heart failure. *Am J Epidemiol* 1999;149:85-92.
3. National Advisory Committee on Immunization (NACI). Statement on influenza vaccination for the 1998-1999 season. *Can Commun Dis Rep* 1998;24(Suppl ACS-2):1-12.
4. Evans ME, Hall KL, Berry SE. Influenza control in acute care hospitals. *Am J Infect Control* 1997;25:357-62.
5. Potter J, Stott DJ, Roberts MA, Elder AG, O'Donnell B. Influenza vaccination of health care workers in long-term-care hospitals reduces the mortality of elderly patients. *J Infect Dis* 1997;175:1-6.
6. Carman WF, Elder AG, Wallace LA, McAulay K, Walker A, Murray GD, et al. Effects of influenza vaccination of health-care workers on mortality of elderly people in long-term care: a randomised controlled trial. *Lancet* 2000;355:93-7.
7. Nichol KL, Lind A, Margolis KL, Murdoch M, McFadden R, Hauge M, et al. The effectiveness of vaccination against influenza in healthy, working adults. *N Engl J Med* 1995;333:889-93.
8. Wilde JA, McMillan JA, Serwint J, Butta J, O'Riordan MA, Steinhoff MC. Effectiveness of influenza vaccine in health care professionals. *JAMA* 1999;281:908-13.
9. Saxen H, Virtanen M. Randomized, placebo-controlled double blind study on the efficacy of influenza immunization on absenteeism of health care workers. *Pediatr Infect Dis J* 1999;18:779-83.
10. Duclos P, Hatcher J. Epidemiology of influenza vaccination in Canada. *Can J Public Health* 1993;84:311-5.
11. Doebbeling BN, Edmond MB, Davis CS, Woodin JR, Zeitler RR. Influenza vaccination of health care workers: evaluation of factors that are important in acceptance. *Prev Med* 1997;26:68-77.
12. Barrier JH, Briole V, Peltier P. Le généraliste et la vaccination antigrippale. *Concours Med* 1988;110(1):27-32.
13. Heimberger T, Chang HG, Shaikh M, Crotty L, Morse D, Birkhead G. Knowledge and attitudes of healthcare workers about influenza: why are they not vaccinated? *Infect Control Hosp Epidemiol* 1995;16:412-5.
14. Nichol KL, Hauge M. Influenza vaccination of healthcare workers. *Infect Control Hosp Epidemiol* 1997;18:189-94.
15. Watanakunakorn C, Ellis G, Gemmel D. Attitude of healthcare personnel regarding influenza immunization. *Infect Control Hosp Epidemiol* 1993;14:17-20.
16. Canadian Consensus Conference on Influenza. *Can Commun Dis Rep* 1993;19(17):136-47.
17. Fiebach NH, Viscoli CM. Patient acceptance of influenza vaccination. *Am J Med* 1991;91:393-400.
18. Nichol KL, Lofgren RP, Gapinski J. Influenza vaccination, knowledge, attitudes, and behavior among high-risk outpatients. *Arch Intern Med* 1992;152:106-10.
19. Régie de l'assurance maladie du Québec (RAMQ). *Statistiques annuelles*. Québec, Qué: Direction des communications, Régie de l'assurance maladie du Québec; 1996.
20. Conseil d'évaluation des technologies en santé du Québec. *Coût-efficacité et coût-utilité d'un programme d'immunisation contre le pneumocoque au Québec*. Montréal, Qué: CETS; 1998.
21. Federal, Provincial and Territorial Advisory Committee on Population Health. *Statistical report on the health of Canadians*. Ottawa, Ont: Health Canada; 1999.
22. McArthur MA, Simor AE, Campbell B, McGeer A. Influenza and pneumococcal vaccination and tuberculin skin testing programs in long-term care facilities: where do we stand? *Infect Control Hosp Epidemiol* 1995;16:18-24.
23. Institut de la statistique du Québec. *Enquête sociale et de santé 1998*. Québec, Qué: Gouvernement du Québec; 2000.
24. Ministère de la santé et des services sociaux du Québec. *Priorités nationales de santé publique 1997-2002. Vers l'atteinte des résultats attendus. 2e bilan*. Québec, Qué: Gouvernement du Québec; 2000.
25. Schwartz JS, Lewis CE, Clancy C, Kinoshian MS, Radany MH, Koplan JP. Internists' practices in health promotion and disease prevention. A survey. *Ann Intern Med* 1991;114:46-53.
26. Johns MB, Hovell MF, Ganiats T, Peddecord KM, Agras WS. Primary care and health promotion: a model for preventive medicine. *Am J Prev Med* 1987;3:346-57.
27. *SPSS Base, Professional Statistics and Categories 7.5*. Chicago, Ill: SPSS Inc; 1977.
28. Hosmer DW, Lemeshow S. *Applied logistic regression*. New York, NY: John Wiley & Sons; 1989.
29. Pachucki CT, Lentino JR, Jackson GG. Attitudes and behavior of health care personnel regarding the use and efficacy of influenza vaccine. *J Infect Dis* 1985;151:1170-1.
30. Eisenberg JM. Physician utilization. The state of research about physician's practice pattern. *Med Care* 1985;23:461-83.
31. Green LW, Kreuter MW. *Health promotion planning. An educational and environmental approach*. Toronto, Ont: Mayfield Publishing Company; 1991.
32. Thompson RS, Woolf SH, Taplin SH, Davis BV, Payne TH, Stuart ME, et al. How to organize a practice for the development and delivery of preventive services. In: Woolf SH, Jomas S, Lawrence RS, editors. *Health promotion and disease prevention in clinical practice*. Baltimore, Md: Williams & Wilkins; 1995. p. 483-504.
33. Walsh JME, McPhee SJ. A systems model of clinical preventive care: an analysis of factors influencing patient and physician. *Health Educ Q* 1992;19:157-75.
34. Buchner DM, Carter WB, Inui TS. The relationship of attitude changes to compliance with influenza immunisation. A prospective study. *Med Care* 1985;23:771-9.
35. Fedson DS. Influenza vaccination of medical residents at the University of Virginia: 1986 to 1994. *Infect Control Hosp Epidemiol* 1996;17:431-3.
36. Ohrt CK, McKinney W. Achieving compliance with influenza immunization of medical housestaff and students. A randomized controlled trial. *JAMA* 1992;267:1377-80.
37. Lewis CE. Disease prevention and health promotion practices of primary care physicians in the United States. *Am J Prev Med* 1988;4(Suppl 4):S9-S16.
38. McPhee SJ, Bird JA. Implementation of cancer prevention guidelines in clinical practice. *J Gen Intern Med* 1990;5(Suppl 5):S116-S122.
39. Montano DE, Phillips RP. Cancer screening by primary care physicians: a comparison of rates obtained from physician self-report, patient survey, and chart audit. *Am J Public Health* 1995;85:795-800.