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Influenza vaccination prevalence and demographic factors of patients and GPs in primary care in Austria and Croatia: a cross-sectional comparative study in the framework of the APRES project

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ABSTRACT

Background: The aim of this study was to compare influenza vaccination coverage rates in Austria and Croatia, countries with missing data in the Eurosurveillance and European Centre for Disease Prevention and Control reports. In addition, we assessed demographic factors of GPs and patients and calculated associations regarding vaccination rates. Methods: This cross-sectional study was conducted within the context of thethe appropriateness of prescribing antibiotics in primary health care in Europe with respect to antibiotic resistance (APRES) project. Between November 2010 and July 2011, 40 GP practices attempted to recruit 200 patients to complete questionnaires about their influenza vaccination status and demographics. Statistical analyses included subgroup analyses and logistic regression models. Results: Data from 7269 patient questionnaires could be analyzed (3309 Austria and 3960 Croatia). The vaccination coverage rates were low (2009/2010: A 18.2 vs. C 20.9%, $P < 0.001$; 2010/2011: A 13.7 vs. C 18.6%; $P < 0.001$). The rates were found to be highest in persons aged 65 years and older (2009/2010: A 35.1 vs. C 49.5%, $P < 0.001$; 2010/2011: A 31.1 vs. C 45.7%, $P < 0.001$) and lowest in children

(2009/2010: A 8.5 vs. C 2.0%, P < 0.001; 2010/2011: A 4.3 vs. C 1.6%, P = 0.002). Besides, demographics in the adjusted regression model for Austria being vaccinated was associated with consulting a female GP (OR, 4.20; P < 0.001) and in Croatia with five or more GP consultations per year (OR, 4.41; P < 0.001). Conclusion: The vaccination coverage rates for Austria and Croatia were low, with the highest rates found in persons aged 65 years and older, showing that public coverage of the vaccination costs might increase vaccination rates. However, other factors seem to be relevant, including the engagement of GPs.

INTRODUCTION

Seasonal influenza is a highly contagious viral respiratory infection. Although influenza is usually self-limiting, it can cause an enormous impact on the daily life of a person and moderate-to-severe illnesses with potentially dangerous complications such as secondary bacterial pneumonia, myocarditis or worsening of existing chronic pulmonary or cardiopulmonary diseases.[1–6] This results in a public health burden not only due to increased demand on health services and decreased productivity of the workforce but also because of the association with increased morbidity and mortality rates during influenza epidemics.[1–6] The European Centre for Disease Prevention and Control (ECDC) has estimated that ~40 000 persons die prematurely each year from influenza in European Union (EU) countries.[1] Certain groups are at a higher risk, such as the elderly, and those with chronic diseases.[1–6] Annual influenza vaccination represents the most effective single public health intervention for amelioration of the burden.[1–6] Therefore, in 2003, the World Health Assembly recommended influenza vaccination for all people at risk. All EU member states committed themselves to the goal of attaining vaccination coverage, e.g. of the elderly population of at least 50% by 2006 and 75% by 2010, and to having mechanisms to monitor uptake.[5,7] However, despite this commitment influenza coverage rates across European countries vary widely ranging from 50% of the total population in Malta to 23% in Austria and to 14% in Latvia, or for the elderly from 1% in Estonia to 82% in the Netherlands in 2008/2009.[4,8] In 2015, some countries still could not provide any group-specific coverage data, among them Austria.[4,9] Croatia has belonged to the EU since 2013 and was not included in the Vaccine European New Integrated Collaboration Effort (VENICE) I and II projects[10] and the resulting Eurosurveillance publications.[2–6] So far, only the coverage rates for persons aged 65 years and older (30%) and the rate for healthcare worker (19%) were published from Croatia in the ECDC report of 2015.[9] Both Austria and Croatia do not have a national action plan to improve vaccination coverage for seasonal influenza, but a respective policy is in place. Austria recommends influenza vaccination for children aged between 7 and 48 months, persons aged 50 years and older, persons with chronic medical conditions, pregnant women, all healthcare workers and persons with frequent exposure to crowds.[9] Despite these recommendations, all persons have to pay the vaccination out-of-pocket with the exception of healthcare workers where sometimes the employer takes over part of the costs.[11] Vaccination is administered via GPs, specialists (Austria has no gatekeeping system), or public health institutions. The respective patient pays the costs for the vaccine and for the vaccination procedure. The costs for the procedure can vary depending on the physician.

In Croatia, influenza vaccination is recommended for persons aged 65 years and older, persons with chronic medical conditions, pregnant women with chronic medical conditions, all healthcare workers and laboratory workers.[9] Costs for vaccination are covered by the health insurance for health workers, patients older than 65, patients with chronic diseases and patients with immunodeficiency.[12] Vaccination is organised via GP offices, primary care paediatricians and public health institutions. Paediatricians vaccinate mainly children with chronic diseases younger than 7 years; older patients get the vaccination in the GP office or go directly to a public health institution. The physician has to pay back all money earned with the vaccination to the health insurance.

The EU-funded project 'APRES—the appropriateness of prescribing antibiotics in primary health care in Europe with respect to antibiotic resistance'[13] provided an opportunity to assess and compare influenza vaccination coverage rates in primary health care in 2009/2010 and 2010/2011 in Austria and Croatia, two countries with missing data in the VENICE I–III publications and ECDC reports. The year 2009 was a special year regarding influenza because with H1N1 a global outbreak of a new strain of influenza A occurred, which raised the awareness of the population not only regarding influenza in general but also in terms of influenza vaccination.[14]

In addition, we assessed demographic factors of both GPs and patients and calculated associations regarding the flu vaccination rates.

METHODS

Design

This cross-sectional study took place in Austria and Croatia between November 2010 and July 2011 within the context of the EU APRES project.[13,15,16] The APRES project included nine European countries and aimed to assess the appropriateness of prescribing antibiotics in primary care. About 4000 nasal swabs from children (aged 4 years and older), adults and the elderly as well as questionnaires covering demographic factors and the flu vaccination status for 2009/2010 and 2010/2011 were collected by 20 General Practitioner (GP) practices in each country.

The study design and analysis was designed in accordance with the STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) statement for cross-sectional studies.[17]

Recruitment of study participants

In Austria, a stratified sample of 20 GPs roughly representing the national GP population regarding sex, age and federal states was recruited in accordance with the APRES study protocol.[13] In Croatia, a sample of 20 GPs from the Family Medicine research club of the Department of Family Medicine at the Zagreb University School of Medicine with respect to geographical distribution was recruited.[13] In both countries between November 2010 and July 2011, each of these 20 GPs attempted to recruit 200 consecutive patients aged 4 years and older resulting in 4000 patients per country. We included patients aged 4 years and older because it was a requirement of the APRES study protocol as described above.[13]

Inclusion and exclusion criteria for the patients were the same for both countries and were published elsewhere[13,16]; patients did not have any infection at the time of the visit (and no antibiotic use in the previous 3 months) or had not been hospitalised in the previous 3 months. The patient population was therefore community based without signs and symptoms of infections, and this was considered a proxy for the general population.[13]

The participating patients had to complete the questionnaire indicating their sociodemographic data and their vaccination status in relation to influenza. This information was included in the questionnaire as nasal swabs were collected and tested *for Staphylococcus aureus* and *Streptococcus pneumoniae*.[13] Each participant had to complete a written informed consent form before participation. If the patients were younger than 18 years, one parent signed an additional written informed consent form in addition to the child/adolescent who signed a specially prepared written informed consent form.

Questionnaire

For the purpose of this analysis, we used the questions about flu vaccination status, sex, age, number of years living in the respective country, profession, number of GP visits within the past 12 months prior to the study and whether children between 0 and 5 years of age were living in the same household. Age was clustered into three groups: 4–18 years (children), 19–64 years (adults) and 65 years and older (senior citizens). Profession was assessed by asking 'Do you work in any of the following occupational fields?' with the answer categories 'healthcare', 'livestock farming', 'kindergarten teacher/day nanny' and 'others' because these profession groups were relevant for the detection of *Staphylococcus aureus* within the APRES study.[13] All these sociodemographic factors were defined as demographic explanatory variables. The influenza vaccination status was defined as the dependent variable. It was assessed with the two questions 'Did you have an influenza vaccination in winter 2009/2010?' and 'Did you have an influenza vaccination in winter 2010/2011?' with the answer categories 'yes', 'no' and 'don't know'. The answer categories were dichotomised into 'yes' vs. all other answer options.

Furthermore, gender and years of professional experience (10 years and more or less) of the GPs were taken into account.

Data analyses

First, the dependent and explanatory variables were assessed and compared between Austria and Croatia. Second, the sociodemographic data of the patients and GPs were set in contrast to the influenza vaccination status for the winter seasons 2009/2010 and 2010/2011 by using descriptive statistical methods (absolute and relative frequencies) and compared between the two countries by means of cross-tabs and statistical tests: the chi-square independency test was applied. Finally, multivariable logistic regression models were conducted for Austria and Croatia, respectively. Positive vaccination status was the dependent variable; all explanatory variables as well as the two GP variables (sex and experience) were included in the regression model simultaneously. In addition, this model was adjusted for the GP practice to avoid confounding of the descriptive results for the individual by a possible interpractice effect. This was performed by building a dichotomous dummy variable for each GP practice, which was included in the model.

The significance level for all calculations was $P < 0.05$ and the 95% CI. SPSS Statistics version 22.0 was used for the statistical analyses.

Ethical considerations

All patients had to complete a written informed consent form before participation. Participants younger than 18 years completed a special informed consent form for children/adolescents in addition to one parent. Personal data from patients and GPs were strictly confidential and were anonymised. The study was approved by the Ethics Committee of the Medical University Vienna (EC no. 568/2010).

RESULTS

Sample

Altogether, 7393 GP patients (3380 Austria/4013 Croatia) were recruited by the 40 GPs (20 Austria/20 Croatia) from the two countries participated in this study. In Austria, 71 out of 3380 patient data had to be excluded (4 did not meet the age inclusion criterion and 67 because of a lack of patients data); in Croatia, 53 out of 4013 (1 did not meet the age inclusion criterion and 52 because of the lack of patients data) were excluded.
Data from 7269 patient questionnaires could be analyzed (3309 Austria/3960 Croatia). The distribution of the demographic factors and the flu vaccination status of Austrian and Croatian GP patients and their comparison is presented in **table 1**. In the Croatian sample, significantly more children between 4 and 18 years were included, whereas more healthcare workers were present in the Austrian sample.

[TABLE 1]

Flu vaccination coverage rates are low in both countries but higher in Croatia

Table 1 shows the overall flu vaccination rates for primary healthcare patients in Austria and Croatia and their comparison between the countries. Croatia had a significantly higher vaccination rate for both seasons assessed, 2009/2010 and 2010/2011 although a decreasing trend could be observed from the 2009/2010 to 2010/2011 in both countries.
Table 2 depicts the distribution of the explanatory variables among the vaccination variables and compares them between Austria and Croatia. Elderly patients had the highest coverage rates in both countries and seasons. However, Croatia had a significantly higher rate of vaccination for persons aged 65 years and older, and in contrast the vaccination rate was significantly lower for children. Healthcare workers had the highest vaccination rates and kindergarten teachers the lowest rates, with no differences between the countries. In addition, the influence of GP factors differed in the two counties. Although female GPs and GPs with less than 10 years of experience in Austria had significantly more flu-vaccinated patients compared with those in Croatia, male GPs and experienced GPs in Croatia had more vaccinated patients (**table 2**).

[TABLE 2]

Associations of vaccination status of patient and GP demographic factors

In Austria, an age younger than 65 years was a significant factor for not being vaccinated. In contrast, having had five or more GP visits in the past 12 months prior to the study, being a healthcare worker or visiting a female GP, was a significant indicator for an increased likelihood of being vaccinated (table 3).

[TABLE 3]

Adjusted for GP practice code to adjust for interpractice effects.

Table 4 shows the associations for Croatia. In Croatia, having visited a GP more than one time in the past 12 months prior to the study, being a healthcare worker, and not living together with children in the same household was significantly and positively associated with having had a flu vaccination. An age of 64 years and lower was found to be a risk factor for not being vaccinated. No association with the GP factors could be found.

[TABLE 4]

Adjusted for GP practice code to adjust for interpractice effects.

DISCUSSION

This publication is able to present both overall influenza vaccination coverage rates and that for special subgroups for Austria (A) and Croatia (C) and identify patient and GP demographic factors associated with these rates. Overall, the vaccination coverage rates were low for both seasons in both countries. However, the vaccination rate was significantly higher for both seasons in Croatia (2009/2010: A 18.2 vs. C 20.9%, $P < 0.001$; 2010/2011: A 13.7 vs. C 18.6%, $P < 0.001$). The low vaccination rate for Austria is reflected in a previous publication.[18] The overall higher vaccination rate in the season 2009/2010 might be, partly, explained with the occurrence of the swine flu pandemic, which was highly present in the media in 2009 and influenced the awareness of the population as well as the willingness to get vaccinated.[14] This result could also be observed in other countries.[4] An additional explanation for the higher vaccination rate in 2009/2010 could be the sampling time frame of this study, which was between November 2010 and July 2011. This could have led to an underestimation of patients with flu vaccination in 2010/2011, meaning that patients recruited in November 2010 probably were not yet vaccinated.

The highest vaccination rates in both countries were found in persons aged 65 years and older although, particularly, the vaccination rates for these persons differed broadly between the two countries (table 2). These differences might be, partly, explained by the different coverage schemes for influenza vaccination. Although in Austria flu vaccination is recommended but has to be paid out-of-pocket, in Croatia social insurance takes over the costs for high-risk groups like the elderly or healthcare workers. This is in line with previous studies, which showed that financial barriers can hinder the access to vaccination.[4,19,20] European countries like Malta or the Netherlands with public funding for special groups have much higher coverage rates.[4] However, it has to be taken into account that the methodology used to collect and assess vaccination uptake rates also differ throughout the different countries as our method differs from the one used by the VENICE project, which were mainly telephone surveys or based on electronic medical records.[9,21]

In contrast to the older population, the coverage of costs for healthcare workers did not seem to be successful. In both countries, the vaccination rates for healthcare workers were found to be similarly low (table 2). However, in the fully adjusted regression model, being a healthcare worker increased the probability of being vaccinated significantly compared with other professions in both countries (tables 3 and 4). This finding has been observed elsewhere as well; a recent Spanish study, e.g. showed rates of healthcare workers approaching 31%, and a decreasing trend after the year 2009.[22] The results are worrying because vaccination of healthcare workers seems to be associated with a decrease in mortality among patients.[23–25] Further studies should be conducted to assess the specific reasons that hinder healthcare workers from getting vaccinated.

Overall, persons who worked or lived with children (table 2) had a lower vaccination prevalence than others in our analysis, which is concerning as these persons could infect many children once they carry the virus. In Croatia, persons who did not live together with children had a doubled likelihood of being vaccinated when compared with person who lived together with children also in the age-adjusted regression model (table 4). In addition, children were also found to have a very low vaccination rate in both countries, with an even lower rate in Croatia (table 2). Reasons for this finding could be the missing recommendation for flu vaccination for children, the non-existence of financial support, or it might be due to the fear of parents regarding narcolepsy in children after swine flu vaccination, which was discussed extensively in the media.[26,27] On the other hand, the results could be also biased due to the fact that children in Austria and Croatia visit mainly paediatricians instead of GPs and the resulting small subgroup sample size of children for this study.

Interestingly, also GP-related factors had an association with the vaccination status of patients. In both countries, the likelihood of being vaccinated increased significantly with the increasing number of GP visits in the past 12 months even in the adjusted model. In Croatia, the rate was about 5-fold for patients with five and more GP consultations for both seasons, in Austria, at least 2-fold for 2009/2010. These findings suggest that GPs, particularly those in Croatia, did a lot to promote flu vaccination and that particularly those patients who visit frequently the GP are more likely to be vaccinated.[20,28] In Austria, there seems to be still some room for improvement, especially regarding male GPs, as patients of female GPs had an around 4-fold increased probability of being vaccinated when compared with patients of male GPs. Strategies in the primary care sector should be addressed and supported like financial or other incentives for GPs because the population has high trust in physicians (82%) regarding influenza information and low trust in media and the Internet (20–30%).[14] Furthermore, around 76% of the Austrian population visits at least once per year a GP.[29]

Strength and weaknesses of the study

The strengths of this study were the large sample size and the similarity of the sample with the Austrian and Croatian population regarding sex, age and educational level.[30,31] However, this still does not mean that the population of practice attenders is really comparable between the two countries. Another strength is that this study adds important information to a research gap in Austria and Croatia regarding influenza vaccination coverage rates in the general population, high-risk groups and subgroups. One limitation is the fact that this study is cross-sectional and, therefore, of limited explanatory power. Furthermore, results are based on descriptive and self-reported survey data. Other limitations were the voluntary recruitment strategy of GPs and patients in the context of the APRES study, which might have led to the selection bias that mainly GPs and patients interested in infectious diseases participated. This could have led to an overestimation of the vaccination rates. Furthermore, the

questionnaire in Austria was available in German only and in Croatia in Croatian only, meaning that mainly patients living in the country for more than 3 years participated. Therefore, no conclusion for other population groups is possible. Regarding the statistical modelling, we decided to calculate an adjusted regression model to avoid confounding of the descriptive results for the individual by a interpractice effect. The variable GP practice was considered only because it might be a confounder, rather than being of direct interest. However, this approach impacts the ability to separate within- and between-cluster effects. In addition, the sampling time frame and the occurrence of the H1N1 pandemic in 2009 could have led to a biased vaccination rate as already mentioned above.
In summary, the vaccination coverage rates for Austria and Croatia were low with highest rates found in persons aged 65 years and older. The example of Croatia for the elderly suggests that public coverage of vaccination costs might increase vaccination rates significantly. However, other factors seem to be relevant too. Some of them could be found in the engagement of GPs regarding flu vaccination, which should be supported strongly and regularly. National GP associations in Croatia and Austria should play an important role in increasing vaccination coverage rates. In addition, public health strategies should be developed in both countries starting with a national action plan to improve vaccination coverage for seasonal influenza including regular assessment of the overall and subgroup coverage rates.

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Conflicts of interest: None declared.

KEY POINTS

- The vaccination coverage rates for Austria and Croatia were found to be low in the 2009/2010 and 2010/2011 seasons.
- Highest rates were found in persons aged 65 years and older, showing that financial incentives for the elderly might have the power to significantly increase vaccination rates.
- Other factors besides public coverage of the vaccination costs seem to be relevant too: some could be found in the engagement of GPs regarding flu vaccination, which should be supported strongly and regularly.
- Public health strategies should be developed in both countries starting with a national action plan to improve vaccination coverage for seasonal influenza including regular assessment of the overall and subgroup coverage rates.

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TABLES AND FIGURES

Table 1: Distribution and comparison of the dependent and explanatory variables between Austrian and Croatian GP patients

Variable	Subvariable	Austria (*n* = 3309), % (*n*)	Croatia (*n* = 3960), % (*n*)	*P* values
Flu vaccination 2009/2010	Yes	18.2 (598)	20.9 (826)	<0.001
Flu vaccination 2010/2011	Yes	13.7 (439)	18.6 (729)	<0.001
Patient sex	Female	56.6 (1850)	59.4 (2316)	0.030
Patient age (years)	65+	23.1 (764)	30.3 (1199)	<0.001
	19–64	72.6 (2406)	54.2 (2316)	
	4–18	4.3 (143)	15.5 (614)	
Living in country (years)	≥3 years	99.2 (3197)	99.7 (3902)	0.003
	<3 years	0.8 (26)	0.3 (10)	
Number of GP consultations (past 12 months)	0	4.9 (169)	5.6 (222)	<0.001
	1–4	51.7 (1698)	51.0 (2011)	
	>5	43.4 (1423)	43.4 (1712)	
Job	Others	79.3 (2627)	78.3 (3101)	0.311
	Livestock farming	3.0 (99)	8.6 (342)	<0.001
	Healthcare worker	6.0 (199)	3.7 (148)	<0.001
	Kindergarten/school teacher/day nanny	1.9 (64)	1.0 (40)	0.002
Children (0–5 years) living in household	Yes	12.1 (395)	13.7 (540)	0.058

Table 2: Distribution and comparison of the explanatory variables among the vaccination variables between Austrian and Croatian GP patients

Variable	Subvariable	Flu vaccination 2009/2010			Flu vaccination 2010/2011		
		Austria, % (*n*)	Croatia, % (*n*)	*P* values	Austria, % (*n*)	Croatia, % (*n*)	*P* values
	Male	17.7 (248)	19.2 (303)	<0.001	14.1 (192)	17.7 (277)	<0.001
Patient sex	Female	18.6 (341)	22.5 (519)	0.001	13.2 (237)	19.6 (449)	<0.001
	65+	35.1 (263)	49.5 (590)	<0.001	31.1 (223)	45.7 (542)	<0.001
	19–64	13.5 (323)	10.4 (224)	<0.001	9.0 (210)	8.3 (177)	0.001
Patient age (years)	4–18	8.5 (12)	2.0 (12)	<0.001	4.3 (6)	1.6 (10)	0.002
Living in country (years)	>3 years	18.4 (583)	20.8 (810)	<0.001	13.9 (429)	18.4 (714)	<0.001
	<3 years	8.0 (2)	30.0 (3)	0.128	4.0 (1)	30.0 (3)	0.061
	0	9.4 (15)	5.4 (12)	0.074	9.2 (14)	3.6 (8)	0.025
Number of GP visits (past 12 months)	1–4	16.0 (270)	12.9 (259)	0.001	11.6 (192)	10.9 (217)	0.061
	>5	21.7 (306)	32.4 (554)	<0.001	16.7 (229)	29.6 (503)	<0.001
	Others	17.7 (461)	21.1 (654)	<0.001	13.6 (348)	18.8 (579)	<0.001
	Livestock farming	10.1 (10)	29.8 (101)	<0.001	7.4 (7)	26.2 (89)	<0.001
	Healthcare worker	26.6 (53)	24.3 (36)	0.603	18.3 (36)	17.7 (26)	0.970
Job	Kindergarten teacher/nanny	7.8 (5)	7.5 (3)	0.943	1.6 (1)	7.5 (3)	0.150
Children (0–5 years) living in household	Yes	11.5 (461)	7.2 (39)	0.038	6.3 (24)	6.2 (33)	0.004
	No	19.1 (547)	23.0 (780)	<0.001	14.7 (410)	20.5 (690)	<0.001
GP sex	Male	16.5 (362)	22.4 (131)	0.001	12.0 (256)	20.3 (117)	<0.001

Variable	Subvariable	Flu vaccination 2009/2010			Flu vaccination 2010/2011		
		Austria, % (*n*)	Croatia, % (*n*)	*P* values	Austria, % (*n*)	Croatia, % (*n*)	*P* values
	Female	21.8 (236)	20.7 (695)	0.001	17.2 (183)	18.3 (612)	0.005
GP experience (years)	10+	17.4 (484)	21.9 (640)	<0.001	13.5 (366)	19.4 (563)	<0.001
	<10 years	22.5 (114)	18.1 (186)	0.010	14.9 (73)	16.3 (166)	0.012

[Table 3]: Multivariable logistic regression model for Austria

Variable	Subvariable	Flu vaccination 2009/2010 (*n* = 3116)			Flu vaccination 2010/2011 (*n* = 3045)		
		OR	95% CI	*P* values	OR	95% CI	*P* values
Patient sex	Male	1.0			1.0		
	Female	0.92	0.75–1.12	0.383	0.80	0.63–0.99	0.048
Patient age	65+	1.0			1.0		
	19–64	0.29	0.23–0.36	<0.001	0.21	0.16–0.27	<0.001
	4–18	0.17	0.09–0.33	<0.001	0.11	0.04–0.26	<0.001
Living in country (years)	>3 years	1.0			1.0		
	<3 years	0.41	0.09–1.80	0.235	0.29	0.04–2.29	0.242
Number of GP visits (past 12 months)	0	1.0			1.0		
	1–4	1.73	0.98–3.06	0.058	1.06	0.58–1.93	0.858
	>5	2.00	1.12–3.55	0.018	1.22	0.66–2.24	0.524
Job	Others	1.0			1.0		
	Livestock farming	0.40	0.19–0.84	0.016	0.48	0.20–1.18	0.111
	Healthcare worker	1.77	1.09–2.86	0.020	2.06	1.17–3.64	0.012
	Kindergarten	0.40	0.15–	0.068	0.15	0.02–	0.065

Variable	Subvariable	Flu vaccination 2009/2010 (*n* = 3116)			Flu vaccination 2010/2011 (*n* = 3045)		
		OR	95% CI	*P* values	OR	95% CI	*P* values
	teacher/nanny		1.07			1.13	
Children (0–5 years) living in household	Yes	1.0			1.0		
	No	1.21	0.86–1.72	0.272	1.58	0.99–2.49	0.050
GP sex	Male	1.0			1.0		
	Female	4.20	2.08–8.48	<0.001	4.90	2.17–11.06	<0.001
GP experience (years)	>10 years	1.0			1.0		
	<10 years	0.96	0.47–1.95	0.914	0.41	0.14–1.18	0.098
Nagelkerkes R^2		0.134			0.173		

[Table 4]: Multivariable logistic regression model for Croatia

Variable	Subvariable	Flu vaccination 2009/2010 (*n* = 3808)			Flu vaccination 2010/2011 (*n* = 3785)		
		OR	95% CI	*P* values	OR	95% CI	*P* values
Patient sex	Male	1.0			1.0		
	Female	0.98	0.81–1.18	0.816	0.88	0.72–1.08	0.215
Patient age (years)	65+	1.0			1.0		
	19–64	0.13	0.10–0.16	<0.001	0.11	0.09–0.14	<0.001
	4–18	0.01	0.01–0.04	<0.001	0.01	0.00–0.03	<0.001
Living in country (years)	>3 years	1.0			1.0		
	<3 years	1.27	0.26–6.09	0.765	1.57	0.32–7.72	0.577
Number of GP visits within past 12	0	1.0			1.0		
	1–4	2.05	1.07–3.91	0.030	2.50	1.16–5.40	0.020

Variable	Subvariable	Flu vaccination 2009/2010 (n = 3808)			Flu vaccination 2010/2011 (n = 3785)		
		OR	95% CI	P values	OR	95% CI	P values
months							
	5+	4.41	2.31–8.41	<0.001	5.50	2.55–11.86	<0.001
	Others	1.0			1.0		
	Livestock farming	1.35	0.81–2.22	0.248	1.15	0.67–1.95	0.614
	Healthcare worker	3.52	2.04–6.06	<0.001	2.69	1.48–4.87	0.001
Job	Kindergarten teacher/nanny	0.48	0.14–1.71	0.258	0.56	0.15–2.00	0.368
	Yes	1.0			1.0		
Children (0–5 years) living in household	No	1.97	1.35–2.88	<0.001	1.85	1.23–2.79	0.003
GP sex	Male	1.0			1.0		
	Female	0.77	0.43–1.39	0.386	0.70	0.38–1.29	0.254
	>10 years	1.0			1.0		
GP experience (years)	<10 years	0.68	0.39–1.19	0.175	0.51	0.29–0.91	0.022
Nagelkerkes R^2		0.364			0.375		