



Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine



Coverage and predictors of influenza vaccination among adults living in a large metropolitan area in Spain: A comparison between the immigrant and indigenous populations

Rodrigo Jiménez-García^{a,*}, Valentín Hernández-Barrera^a, Pilar Carrasco-Garrido^a, Ana Lopez de Andres^a, Maria Mercedes Esteban y Peña^b, Ángel Gil de Miguel^a

^a Preventive Medicine and Public Health Teaching and Research Unit, Health Sciences Faculty, Rey Juan Carlos University, Avda de Atenas s/n, Alcorcón 28402 Madrid, Spain

^b Instituto de Salud Pública - Madrid Salud, Ayto de Madrid C/ Juan Esplandiú no. 11, 28001 Madrid, Spain

ARTICLE INFO

Article history:

Received 21 April 2008

Received in revised form 14 May 2008

Accepted 20 May 2008

Available online xxx

Keywords:

Influenza

Vaccine

Immigrants

ABSTRACT

This study sought to evaluate influenza vaccination coverage in Madrid (Spain). Coverages were estimated for vaccine target groups and special attention was placed on the immigrant population. Individual data from 7341 adults included in the Madrid City Health Survey conducted in 2005 was used. Overall influenza vaccination coverage was 24%. Compliance with age-based influenza vaccine guidelines (≥ 65 years) was 63.9%, among those < 65 years who had an associated chronic condition, it was 37.9% and 24.1% among HCWs. Immigrants accounted for 12.4% of the sample. Overall crude coverage was significantly lower among immigrants than among the indigenous population (11.2% vs. 25.9%), but once the multivariate analysis had been performed, the association became non-significant. In conclusion, it must be said that all the available evidence indicates an inadequate level of influenza vaccination coverage among HCWs and high-risk subjects < 65 years. On the other hand, coverages among subjects aged ≥ 65 years are acceptable and there is no observable difference in vaccine use between immigrants and indigenous subjects. Strategies that have demonstrated their effectiveness in enhancing vaccination coverages should be applied in Madrid.

© 2008 Elsevier Ltd. All rights reserved.

1. Introduction

Influenza is a very important cause of morbidity. It leads to excess mortality and a large number of hospitalisations each year, and as a consequence results in an enormous annual economic burden [1–4].

This is so despite the fact that clinical trials and observational studies have demonstrated the effectiveness of influenza vaccine in reducing the onset of the illness among healthy subjects under the age of 65, and in reducing influenza complications, hospital admissions and death among both the over-65 age group and all subjects with underlying medical disorders regardless of age [5–8].

For over many years, the health authorities in Spain have – as in the USA and most other developed countries – been recommending annual influenza vaccination for all subjects above the age of 64 years, younger subjects with chronic diseases that ren-

der sufferers susceptible to influenza-related complications, and health care workers (HCWs) [5,9,10]. In all such cases vaccination is administered free of charge.

The WHO and a number of authors have highlighted the usefulness and importance of studying influenza vaccination coverages and factors associated with such vaccination in target populations [5,11–14].

Spanish vaccination coverage studies targeting the over-64 age group have recorded values as high as 50–70%, which are comparable to those reported by other European countries and the USA [5,15–17]. For other target groups in Spain these proportions are significantly lower, i.e., 30.5% for high-risk subjects aged < 65 years, and 19.65% for HCWs in 2003 [18].

One reason for conducting studies on urban populations is that researchers both here in Spain and abroad have found use of preventive services, including influenza vaccination, to be greater in rural than in large metropolitan areas [17,19–22]. The different demographic composition of urban and rural areas, particularly in terms of the percentage of the immigrant population, may also contribute to such differences [23]. To date, hardly any information has been available in Spain on immigrants' use of preventive care in general, and influenza vaccination in particular [18,23].

* Corresponding author at: Unidad de Docencia e Investigación en Medicina Preventiva y Salud Pública, Facultad de Ciencias de la Salud, Avda de Atenas s/n, 28922 Alcorcón, Madrid, Spain. Tel.: +34 91 4888853; fax: +34 91 4888848.

E-mail address: rodrigo.jimenez@urjc.es (R. Jiménez-García).

This sought to evaluate influenza vaccination coverage in Madrid (Spain), using data from the 2004–2005 Madrid City Health Survey. Coverages were estimated for target groups, such as the elderly, subjects with concomitant chronic illnesses that constitute an indication for vaccination and HCWs, with special attention to immigrants. Reasons for vaccine uptake in these groups were also analysed.

2. Patients and methods

A descriptive, cross-sectional study was conducted on influenza vaccination coverage among adult subjects (ages 16 years and over) living in Madrid, Spain's capital city having a population of approximately 3.2 million [24].

Our study was based on individual data drawn from by the Madrid City Health Survey (Encuesta de Salud de la ciudad de Madrid – ESCM 05). This survey was undertaken by the Madrid City Council from November 2004 to June 2005 on a representative sample of the non-institutionalised Madrid city population. The sampling procedure was conducted in two stages, with stratification by clusters. The survey covered a total of 7341 adults, and the estimated overall sample error was $\pm 0.7\%$.

Information was collected by personal, home-based interviews using a structured questionnaire. Details of ESCM 05 methodology are described elsewhere [24].

To assess influenza vaccination status, we considered the response (yes or no) to the question, “Did you have a flu shot in the latest campaign?”.

The following independent variables were analysed: age; sex; nationality (immigrant or indigenous); occupation as a HCW; and presence of any associated chronic conditions that indicate the advisability of influenza vaccination (diabetes, asthma, chronic bronchitis and heart or brain disease). The dichotomous (yes/no) variable, “comorbidity”, was created on the basis of self-reported presence of any of the chronic diseases analysed.

The immigrant population selected comprised subjects who, when asked “What is your nationality?”, answered ‘foreign’, and whose country of origin was neither a European Union (EU) country nor the USA or Canada. Such persons are regarded as “economic immigrants” [24].

Among vaccinated subjects, the reason given for receiving the vaccination was analysed. This included four possible categories, i.e., recommendation by a physician, own request, vaccination at the workplace and others.

Anti-influenza coverage was calculated by estimating the proportion of individuals who were vaccinated against influenza, and their corresponding 95% confidence intervals. Influenza coverages were described and compared according to the study variables. Specific comparisons were made between indigenous subjects and immigrants.

Multivariate logistic regression models were generated so that, using influenza vaccination as the dependent variable, we could

then determine which of the variables covered was independently associated with influenza vaccination.

Estimates were made using the “svy” (survey commands) functions of the STATA program, which enabled us to incorporate the sampling design and weights into all our statistical calculations (descriptive, confidence intervals, logistic regression). Statistical significance being set at $p < 0.05$ (p values are two-tailed).

3. Results

The initial response rate for the ESCM 05 was 40%, with the main reasons for replacement being “repeated absence” (43.6%) and “refusal to participate” (25.2%). Details on the evaluation of non-respondents can be found elsewhere [24]. Finally, 7341 adults were interviewed.

Overall influenza vaccination coverage for the total sample was 24%. Table 1 shows the results of the analysis of influenza vaccination coverage by age group, according to subjects' sex and occupation.

The prevalence of individuals in the study sample who reported receiving influenza vaccine rose significantly with age ($p < 0.001$), with coverages of 9.1% and 63.9% in evidence for the 16–34 and over-64 age groups, respectively. The increase with age was significant for all the subgroups analysed. Crude influenza vaccination uptake was significantly higher among females.

Among HCWs, influenza vaccination coverage was 24.1%, a figure that was significantly higher ($p < 0.001$) than for non-HCWs (12.5%).

The overall prevalence of any chronic conditions (comorbidity) that might represent an indication for influenza vaccination was 14.4%. Table 2 shows influenza vaccination coverage by age group, according to the different chronic diseases analysed.

The frequency of individuals who reported having received vaccine was higher ($p < 0.001$) among persons who suffered (56.1%) than among those who did not suffer from chronic disease (18.7%), with these differences proving significant across all age groups.

Subjects with any of the four specific chronic diseases studied were also vaccinated in significantly greater numbers than were subjects who did not suffer from these illnesses ($p < 0.01$). In addition, coverage among any of the chronic-disease sufferers increased with age. The highest coverages were observed for individuals with diabetes and heart disease.

The proportion of the population classified as being at “increased risk” for influenza complications (ages > 64 years or < 65 years with a chronic condition) was 28.8% and of these, 58.6% reported being vaccinated. Hence, compliance with age-based influenza vaccine guidelines (≥ 65 years) was 63.9%, and among those under this age who had an associated chronic condition it was 37.9%.

With regard to subjects' reasons for seeking vaccination, Table 3 shows “recommended by a physician” as the reason most cited by subjects aged 18–64 years (75.6%) and ≥ 65 years (91.8%), followed by “vaccination at place of work or study” among the young (13.2%),

Table 1
Influenza vaccination coverage by age group, according to subjects' socio-demographic variables and occupation

Variable	Category	16–34 years	35–49 years	50–64 years	≥ 65 years	Total
Sex	Male	8.45 \pm 0.93 (1098)	9.88 \pm 1.11 (866)	23.20 \pm 1.71 (706)	64.71 \pm 2.05 (646)	21.85 \pm 0.77 (3316)
	Female	9.70 \pm 0.96 (1078)	12.34 \pm 1.12 (1053)	20.62 \pm 1.49 (888)	63.44 \pm 1.62 (983)	25.81 \pm 0.74 (4002)
HCWs*	No	8.89 \pm 0.67 (2109)	10.78 \pm 0.08 (1812)	20.86 \pm 1.13 (1523)	N/A	12.47 \pm 0.48 (5444)
	Yes	14.60 \pm 4.80 (64)	19.20 \pm 4.57 (95)	44.24 \pm 6.77 (63)	N/A	24.06 \pm 3.13 (222)
Total		9.05 \pm 0.67 (2176)	11.19 \pm 0.79 (1919)	21.79 \pm 1.13 (1594)	63.93 \pm 1.27 (1629)	23.98 \pm 0.53 (7318)

Entries show percentage influenza vaccination in the latest campaign (coverage), $\pm 95\%$ confidence interval half-width, with sample size (n). In the case of health care workers (HCWs), the 16- to 34-year age group only included subjects aged 18 to 34 years. N/A: not available.

Table 2
Influenza vaccination coverage by age group and presence of chronic disease

Variable	Category	16–34 years	35–49 years	50–64 years	≥65 years	Total
Brain disease	No	8.95 ± 0.67 (2169)	11.13 ± 0.79 (1909)	21.46 ± 1.13 (1569)	64.02 ± 1.30 (1553)	23.51 ± 0.54 (7200)
	Yes	60.91 ± 27.67 (4)	14.66 ± 13.60 (7)	42.91 ± 10.75 (24)	63.35 ± 6.08 (73)	55.53 ± 5.12 (108)
Diabetes	No	8.79 ± 0.66 (2159)	10.83 ± 0.79 (1889)	19.72 ± 1.13 (1480)	62.92 ± 1.37 (1420)	22.16 ± 0.53 (6948)
	Yes	42.83 ± 13.90 (14)	37.63 ± 10.87 (25)	49.65 ± 5.15 (113)	71.03 ± 3.29 (206)	61.12 ± 2.77 (358)
Respiratory disease ^a	No	8.75 ± 0.67 (2087)	10.35 ± 0.77 (1855)	20.79 ± 1.13 (1535)	62.42 ± 1.33 (1502)	22.76 ± 0.54 (6979)
	Yes	15.51 ± 4.24 (87)	35.08 ± 6.97 (59)	49.60 ± 7.01 (58)	81.46 ± 3.62 (123)	48.92 ± 3.00 (327)
Heart disease	No	9.06 ± 0.67 (2155)	10.64 ± 0.78 (1888)	19.72 ± 1.12 (1490)	62.27 ± 1.44 (1296)	21.36 ± 0.53 (6829)
	Yes	6.19 ± 6.05 (16)	39.68 ± 10.56 (26)	52.36 ± 5.47 (101)	70.15 ± 2.70 (328)	62.03 ± 2.43 (471)
Comorbidity	No	8.43 ± 0.67 (2055)	9.67 ± 0.67 (1803)	16.33 ± 1.10 (1333)	59.83 ± 1.61 (1051)	18.66 ± 0.53 (6242)
	Yes	19.15 ± 3.93 (114)	33.19 ± 5.01 (110)	50.65 ± 3.40 (257)	71.36 ± 2.01 (571)	56.10 ± 1.66 (1052)

Entries show percentage influenza vaccination in the latest campaign (coverage), ±95% confidence interval half-width, with sample size (n). “Comorbidity” includes subjects suffering diabetes and/or asthma and/or chronic bronchitis and/or heart and/or brain disease.

^a Respiratory disease includes asthma or chronic bronchitis.

Table 3
Reason for vaccination by age group and presence of associated chronic condition

Reason	Age 16–64 years			Age ≥65 years		
	Associated chronic condition			Associated chronic condition		
	No	Yes	Total	No	Yes	Total
Recommended by a physician	70.78 ± 2.19 (385)	91.22 ± 2.14 (156)	75.60 ± 1.79 (541)	90.76 ± 1.25 (553)	93.47 ± 1.33 (362)	91.84 ± 0.92 (915)
Own request	11.87 ± 1.54 (74)	2.33 ± 1.08 (11)	9.62 ± 1.22 (85)	8.73 ± 1.22 (50)	6.23 ± 1.32 (23)	7.73 ± 0.91 (73)
Vaccination at place of work or study	15.49 ± 1.75 (61)	5.65 ± 1.63 (5)	13.17 ± 1.42 (66)	N/A	N/A	N/A
Other	1.87 ± 0.73 (7)	0.80 ± 0.80 (1)	1.62 ± 0.59 (8)	0.51 ± 0.26 (4)	0.31 ± 0.23 (2)	0.43 ± 0.18 (6)

Entries show percentage proportion ±95% confidence interval half-width, with the sample size (n). N/A: not available.

and “own request” (7.7%) among the elderly. Distribution of this variable by presence of concomitant chronic disease showed a significantly higher percentage of individuals receiving vaccine as a result of medical indication among study subjects suffering from these diseases, across both age groups ($p < 0.01$).

The number of persons who declared being foreigners totalled 1011. Of these, 908 were classified as “immigrants” for study pur-

poses, and so immigrants accounted for 12.4% of the sample. As for the immigrants' country of origin, 74.1% came from Latin America, 11% from Eastern European countries, 9.1% from Africa, and 3.7% from Asia.

Table 4 shows the distribution, influenza vaccination coverage and reason for vaccination among indigenous subjects and immigrants living in Madrid.

Table 4
Distribution, influenza vaccination coverage and reason for vaccination among indigenous subjects and immigrants living in Madrid

	Distribution (% ± 95% CI)		Vaccination coverage (% ± 95% CI)	
	Indigenous	Immigrant	Indigenous	Immigrant
Age ^{a,b}				
Mean 95% CI	48.37 ± 0.26	35.85 ± 0.41	25.85 ± 0.59	11.21 ± 1.13
16–49 years	55.64 ± 0.67	88.09 ± 1.09	10.23 ± 0.58	9.19 ± 1.13
50–64 years	20.86 ± 0.53	8.83 ± 0.96	22.23 ± 1.17	12.90 ± 3.73
>64 years	24.50 ± 0.57	3.08 ± 0.58	63.92 ± 1.28	63.78 ± 9.13
Sex ^{a,b}				
Male	45.78 ± 0.68	49.60 ± 1.82	23.75 ± 0.85	9.92 ± 1.56
Female	54.22 ± 0.68	50.40 ± 1.82	27.61 ± 0.81	12.47 ± 1.62
Comorbidity ^{a,b}				
No	84.80 ± 0.48	93.37 ± 0.91	20.02 ± 0.58	9.99 ± 1.12
Yes	15.20 ± 0.48	6.63 ± 0.91	58.03 ± 1.69	26.60 ± 0.59
Risk group ^{a,b}				
<65 years and comorbidity	6.55 ± 0.33	5.31 ± 0.83	41.10 ± 2.58	11.52 ± 0.46
>64 years and comorbidity	8.33 ± 0.37	1.12 ± 0.35	72.39 ± 2.06	88.04 ± 8.87
HCWs ^a				
No	95.61 ± 0.59	98.03 ± 0.8	13.11 ± 0.97	9.10 ± 1.99
Yes	4.39 ± 0.61	1.97 ± 1.01	24.63 ± 4.91	13.33 ± 11.3
Reason for vaccination ^{a,c}				
Recommended by a physician	85.52 ± 0.96	70.11 ± 5.09	NA	NA
Own request	9.42 ± 0.79	18.81 ± 4.40	NA	NA
Place of work or study	4.27 ± 0.55	7.99 ± 2.90	NA	NA

“Comorbidity” includes subjects suffering diabetes and/or asthma and/or chronic bronchitis and/or heart and/or brain disease. HCWs: health care workers.

^a Statistically significant association ($p < 0.05$) on comparing the distribution of variables between indigenous subjects and immigrants.

^b Statistically significant association ($p < 0.05$) on analysing vaccine coverages among indigenous subjects and immigrants.

^c Percentages do not sum 100% as a little proportion answered “Other” to this question.

Table 5
Crude and adjusted odds ratios (OR) for variables associated with influenza vaccination, by age group

Variables	Category	Age 16–64 years		Age ≥65 years	
		Crude OR (95% CI)	Adjusted OR (95% CI)	Crude OR (95% CI)	Adjusted OR (95% CI)
Gender	Female	1	1	1	1
	Male	0.90 (0.76–1.07)	0.95 (0.79–1.13)	1.06 (0.84–1.32)	1.03 (0.82–1.29)
Age group (years)	16–34	1	1	N/A	N/A
	35–49	1.27 (1.01–1.58)	1.21 (0.96–1.52)	N/A	N/A
	50–64	2.80 (2.28–3.44)	2.27 (1.83–2.81)	N/A	N/A
	65–74	N/A	N/A	1	1
	≥75	N/A	N/A	1.72 (1.38–2.15)	1.65 (1.32–2.06)
HCWs	No	1	1	N/A	N/A
	Yes	2.22 (1.57–3.14)	2.29 (1.58–3.33)	N/A	N/A
Nationality	Immigrant	1	1	1	1
	Indigenous	1.49 (1.15–1.927)	1.16 (0.88–1.54)	1.01(0.46–2.22)	1.04 (0.49–2.30)
Comorbidity	No	1	1	1	1
	Yes	5.12 (4.10–6.39)	4.43 (3.53–5.56)	1.67 (1.32–2.11)	1.66 (1.31–2.11)

N/A: not available, HCWs: health care workers. “Comorbidity” includes subjects suffering diabetes and/or asthma and/or chronic bronchitis and/or and heart and/or brain disease.

Compared to indigenous subjects, immigrants were younger, had a smaller proportion of females and HCWs, and suffered from fewer comorbidities ($p < 0.05$). Total unadjusted vaccination coverage was significantly lower among immigrants than indigenous adults (11.2% vs. 25.9%). Even after stratification by study variables, coverages remained lower among immigrants.

The influenza vaccination coverage was 11.4% for those immigrants that have Spanish as their natal language (Latin Americans) and 11.1% for those coming from countries where other languages are spoken; this difference was not statistically significant.

The reasons for seeking vaccination differed significantly between immigrant and indigenous adults ($p < 0.01$): immigrants received the vaccine at their “own request” to a greater extent than did indigenous subjects (18.8% vs. 9.4%), and less frequently because it had been “recommended by a physician” (70.1% vs. 85.5%).

The multivariate analysis (Table 5) showed that, for the 18–64 age group, the variables associated with a greater probability of having received influenza vaccine were higher age, HCW status, and presence of an associated chronic disease. For those aged ≥65 years, as with the younger group, the adjusted odds ratio increased significantly with age and with the presence of an associated chronic disease. After adjustment for possible confounders, no significant association was found between nationality and influenza vaccination in any of the age groups analysed.

4. Discussion

Overall influenza vaccination coverage for the total sample was 24%, a figure that is almost the same as that reported by Müller and Szucs in a population-based survey conducted on a sample of 2000 Spanish adults during the 2004/05 influenza season (23%) [15].

Coverage of the elderly living in Madrid was 63.9%, which was also very similar to the percentage obtained with data from the 2003 Spanish National Health Survey (NHS) (63.7%), though lower than the results for Spain reported by Kroneman et al. (67%) [17,18,25]. Moreover, coverage of the Madrid elderly population was higher than that of the USA in 2005 (59.6%) [5].

Yet, despite the fact that the vaccination coverage among the elderly living in Madrid is acceptable and similar to that in other European countries, a major effort is still needed to reach WHO objectives for 2010 (75% vaccination coverage rate in the elderly population) [15,26].

Among Madrid HCWs the estimated influenza vaccination coverage was 24.1%, a rate higher than the Spanish average (19.7%)

according to the 2003 NHS, similar to that of other European countries, and far lower than that reported for the USA (33.5%) [5,15,16,18]. A special effort is thus called for to identify the reasons for such low coverage and improve vaccination coverages among HCWs living in Madrid.

Our study revealed that, though coverage for subjects aged 16–64 years with an associated chronic condition was low (37.9%), it was nonetheless better than that observed the previous year in Spain (35.3%) [18]. This figure is higher than that registered for US subjects (aged 18–64 years) with high-risk conditions included in the 2005 National Health Interview Survey (25.3%) and close to the average coverage (38%) reported for 5 European countries in 2004/05 [5,15].

The difficulty of attaining acceptable coverages in under-65 risk groups has been previously described [5,15,18]. We feel that this may be due to one of two reasons: either, influenza vaccination campaigns are not being implemented in this subgroup with as much intensity as they are in the 65-and-over age group, among which acceptable coverages are obtained; or alternatively, such campaigns are indeed being implemented with similar intensity but are not proving equally effective. In the specific case of Madrid, we see the second reason as being more likely, as there is evidence to show that age-based strategies are more successful in increasing vaccine coverage than are patient-selection strategies based on medical conditions [27].

Recently, the Madrid Regional Public Health Authority modified the influenza vaccination guidelines by reducing the age at which the recommendation is universal, to 60 years. The recommendation was changed in the 2006/07 season and so far no data about the results of this modification have been published.

Our study indicated that the reason most cited by subjects for being vaccinated was medical indication. The great importance of medical advice in ensuring influenza vaccination has been highlighted in other studies [13,15,16].

Overall crude coverage was significantly lower among immigrants than among the indigenous population but these differences could be a result of the confounding effect of age and comorbidities, as shown by the fact that, once the multivariate analysis had been performed, the association became non-significant.

Carrasco et al compared 502 immigrants (economic immigrants) to 1004 Spaniards, matched by age, sex, size of town or city and autonomous region, and found that, when asked about influenza vaccination as a preventive measure, 11.8% of the former and 9.6% of the latter groups had been vaccinated, though these differences were not statistically significant [23].

This as well as other studies conducted abroad have observed that immigrants make less use of preventives services such as screening programmes, though fortunately this would not appear to affect influenza vaccination in Spain [23,28,29].

The other study that was conducted in Spain and focused on influenza vaccine uptake, reported a higher percentage of foreign subjects who were vaccinated [18]. It analysed all foreigners, including those coming from the EU, USA and Canada, plus the entire population aged over 6 months. Its authors argue that their results are in line with findings yielded by studies undertaken in other European countries, which indicate that primary-care services – whereby influenza vaccine is delivered – are used more frequently by immigrants than by the native population [30,31].

In a recent review, Fiscella proposed several potential explanations for disparity in influenza vaccination among minorities: firstly, less frequent use of care due to access barriers; secondly, lower educational levels, in as much as education level is a strong predictor of receipt of preventive care; thirdly, patients' knowledge and attitudes towards the intervention might differ by race and ethnicity; fourthly, unconscious health care provider bias may affect delivery of care, so that a provider may be more likely to vaccinate a white rather than a minority-group patient; and lastly, minority patients may see providers who are less inclined to administer these vaccinations [32].

The differences in the reasons for vaccination cited by immigrants and indigenous subjects could be partially accounted for by the explanations suggested above, and by the different age distribution and lower prevalence of chronic conditions among immigrants.

In the multivariate analysis, the influence exerted by age and the presence of associated chronic conditions on influenza coverage was observed for both age groups studied. This relationship between age and influenza vaccine coverage has been observed in studies undertaken both here in Spain and elsewhere [5,15–18,20].

It is only logical that suffering from a concomitant chronic condition would influence the likelihood of being vaccinated, since suffering from such a disease constitutes an indication for vaccination in Spain, and this same phenomenon has been observed by different studies [5,15–18,20]. Nevertheless, even if suffering from a chronic disease significantly ($p < 0.01$) did increase the probability of subjects aged 18–64 years being vaccinated (OR 4.43), as mentioned above, the coverage attained among such subjects would still have to be regarded as low.

There are a number of limitations to our study. Firstly, the use of unvalidated self-reported data on vaccination could entail possible bias. In this respect, however, several studies which have compared the results of self-response against medical records observe that self-report on influenza vaccination is highly sensitive and evinces a high degree of agreement [33,34]. Secondly, the ESCM 05 only includes non-institutionalised subjects, something that may possibly underestimate influenza coverages among older age groups, since coverages in old-age homes and residences may well be above the mean.

Thirdly, any information obtained within an interview context may be subject to recall error or the tendency of interviewees to give socially desirable responses.

Lastly, the initial response rate to the NHS was 40%, and the non-response rate was slightly higher among females, individuals with a lower educational level and immigrants, so that the existence of a possible non-response bias should therefore be considered [24]. With regard to the immigrant population, it is logical to think that those having legal residence status or a longer residence period in Madrid would be over represented in the sample.

In Madrid, campaigns targeting all persons at risk of suffering influenza-related complications are conducted every year, and include television, radio and newspaper advertising as well as

notices at health centres. Similarly, campaigns have also targeted health-care professionals with the aim of enhancing their knowledge about influenza vaccine recommendations and effectiveness.

Some other strategies that have demonstrated their effectiveness in enhancing vaccination coverages, and should thus also be considered and recommended, include: lowering the age at which the influenza vaccination recommendation becomes universal; telephoning or mailing personal reminders; compliance monitoring; using computerised systems to identify high-risk patients; improving medical records; empowering nurses to vaccinate patients directly; and drawing up purpose-made influenza-vaccination timetables [5,27,35].

We agree with Ompad et al., when they state that few studies have made a concerted attempt to analyse and deliver influenza vaccination to difficult-to-reach populations, such as the homeless, substance users, elderly shut-ins and undocumented immigrants, and this must therefore continue to be a priority for future research and intervention [36].

In our opinion some possible strategies to increase the use of preventive programs among undocumented immigrants could be involving a diverse community team, including relevant member of the minorities, in planning and implementation of vaccination programs, conduct specific campaigns to offer vaccine in non-traditional setting (such as social services), translate and distribute information in the natal languages of minorities, and finally it is essential to investigate the reasons and as a consequence reduce the access to health care barriers among these populations.

In conclusion, it must be said that all the available evidence indicates an inadequate level of influenza vaccination coverage among HCWs and high-risk subjects under the age of 65 years. On the other hand, coverages among subjects aged ≥ 65 years are acceptable and there is no observable difference in vaccine use between immigrants and indigenous subjects.

Acknowledgements

This study forms part of a research project funded by Health Research Fund (Fondo de Investigaciones Sanitarias – FIS) grant PI060452 from the Carlos III Institute of Public Health.

The authors are grateful to the Public Health Institute of the Madrid City Council (Instituto de Salud Pública – Ayuntamiento de Madrid) for furnishing the 2005 Madrid City Health Survey database.

References

- [1] Thompson WW, Shay DK, Weintraub E, Brammer L, Bridges CB, Cox NJ, et al. Influenza-associated hospitalizations in the United States. *JAMA* 2004;292(11):1333–40.
- [2] Thompson WW, Shay DK, Weintraub E, Brammer L, Cox NJ, Anderson LJ, et al. Mortality associated with influenza and respiratory syncytial virus in the United States. *JAMA* 2003;289(2):179–86.
- [3] Nichol KL. Influenza vaccination in the elderly: impact on hospitalisation and mortality. *Drugs Aging* 2005;22(6):495–515.
- [4] Molinari NA, Ortega-Sanchez IR, Messonnier ML, Thompson WW, Wortley PM, Weintraub E, et al. The annual impact of seasonal influenza in the US: measuring disease burden and costs. *Vaccine* 2007;25(27):5086–96.
- [5] Fiore AE, Shay DK, Haber P, Iskander JK, Uyeki TM, Mootrey G, et al. Advisory Committee on Immunization Practices (ACIP), Centers for Disease Control and Prevention (CDC). Prevention and control of influenza. Recommendations of the Advisory Committee on Immunization Practices (ACIP), 2007. *MMWR Recomm Rep* 2007;56(RR-6):1–54.
- [6] Nichol KL, Nordin JD, Nelson DB, Mullooly JP, Hak E. Effectiveness of influenza vaccine in the community-dwelling elderly. *N Engl J Med* 2007;357(14):1373–81.
- [7] Bridges CB, Thompson WW, Meltzer MI, Reeve GR, Talamonti WJ, Cox NJ, et al. Effectiveness and cost-benefit of influenza vaccination of healthy working adults: a randomized controlled trial. *JAMA* 2000;284(13):1655–63.
- [8] Hak E, Buskens E, van Essen GA, de Bakker DH, Grobbee DE, Tacken MA, et al. Clinical effectiveness of influenza vaccination in persons younger than 65

- years with high-risk medical conditions: the PRISMA study. *Arch Intern Med* 2005;165(3):274–80.
- [9] Costa Tadeo X, Navarro Aznarez G, Campos Abellana C, Esporin Bosque C, Romero Ruiz Al. The evaluation of noncompliance in an anti-influenza vaccination program. *Aten Primaria* 1991;87:544–56 [in Spanish].
- [10] van Essen GA, Palache AM, Forleo E, Fedson DS. Influenza vaccination in 2000: recommendations and vaccine use in 50 developed and rapidly developing countries. *Vaccine* 2003;21(6):1780–5.
- [11] World Health Organization. Influenza: Report by the WHO Secretariat, World Health Assembly, available from: <http://www.who.int/gb/ebwha/pdf.files/WHA56/ea5623.pdf>; May 2003 [accessed 19 February 2008].
- [12] Guerin N. Assessing immunization coverage: how and why? *Vaccine* 1998;16(Suppl.):S81–3.
- [13] Kamal KM, Madhavan SS, Amonkar MM. Determinants of adult influenza and pneumonia immunization rates. *J Am Pharm Assoc (Wash)* 2003;43(3):403–11.
- [14] Kroneman M, Paget WJ, van Essen GA. Influenza vaccination in Europe: an inventory of strategies to reach target populations and optimise vaccination uptake. *Euro Surveill* 2003;8(6):130–8.
- [15] Müller D, Szucs TD. Influenza vaccination coverage rates in 5 European countries: a population-based cross-sectional analysis of the seasons 02/03, 03/04 and 04/05. *Infection* 2007;35(5):308–19.
- [16] Szucs TD, Müller D. Influenza vaccination coverage rates in five European countries—a population-based cross-sectional analysis of two consecutive influenza seasons. *Vaccine* 2005;23(43):5055–63.
- [17] de Andres AL, Garrido PC, Hernández-Barrera V, Del Pozo SV, de Miguel AG, Jiménez-García R. Influenza vaccination among the elderly Spanish population: trend from 1993 to 2003 and vaccination-related factors. *Eur J Public Health* 2007;17(3):272–7.
- [18] Jiménez-García R, Hernández-Barrera V, Carrasco-Garrido P, Sierra-Moros MJ, Martínez-Hernández D, de Miguel AG. Influenza vaccination coverages among Spanish children, adults and health care workers. *Infection* 2006;34(3):135–41.
- [19] Zhang P, Tao G, Irwin KL. Utilization of preventive medical services in the United States: a comparison between rural and urban populations. *J Rural Health* 2000;16(4):349–56.
- [20] Jimenez R, Larrauri A, Carrasco P, Esteban J, Gomez-Lopez LI, Gil A. Influenza coverages in Spain and vaccination-related factors in the subgroup aged 50–64 years. *Vaccine* 2003;21(25–26):3550–5.
- [21] McAuley WJ, Spector WD, Van Nostrand J, Shaffer T. The influence of rural location on utilization of formal home care: the role of Medicaid. *Gerontologist* 2004;44(5):655–64.
- [22] Larson SL, Fleishman JA. Rural-urban differences in usual source of care and ambulatory service use: analyses of national data using Urban Influence Codes. *Med Care* 2003;41(7 Suppl.):III65–74.
- [23] Carrasco-Garrido P, De Miguel AG, Barrera VH, Jiménez-García R. Health profiles, lifestyles and use of health resources by the immigrant population resident in Spain. *Eur J Public Health* 2007;17(5):503–7.
- [24] Madrid City Council. Madrid City Health Survey (Encuesta de Salud de la ciudad de Madrid, ESCM 05), available at <http://www.madridsalud.es/publicaciones/encuesta-salud2005.pdf> [accessed 14 April 2008].
- [25] Kroneman M, van Essen GA, John Paget W. Influenza vaccination coverage and reasons to refrain among high-risk persons in four European countries. *Vaccine* 2006;24(5):622–8.
- [26] WHO: Resolution of the World Health Assembly WHA 56.19. Prevention and control of influenza pandemics and annual epidemics, 56th WHA, 10th plenary meeting, 28 May, 2003, 2003.
- [27] Honkanen PO, Keistinen T, Kivela SL. The impact of vaccination strategy and methods of information on influenza and pneumococcal vaccination coverage in the elderly population. *Vaccine* 1997;15(3):317–20.
- [28] Carrasquillo O, Pati S. The role of health insurance on Pap smear and mammography utilization by immigrants living in the United States. *Prev Med* 2004;39(5):943–50.
- [29] Visser O, van Leeuwen FE. Cancer risk in first generation migrants in North-Holland/Flevoland, The Netherlands, 1995–2004. *Eur J Cancer* 2007;43(5):901–8.
- [30] Reijneveld S. Reported health, lifestyles, and use of health care of first generation immigrants in the Netherlands: do socioeconomic factors explain their adverse position? *J Epidemiol Community Health* 1998;52(5):298–304.
- [31] Stronks K, Ravelli AC, Reijneveld SA. Immigrants in the Netherlands: equal access for equal needs? *J Epidemiol Community Health* 2001;55(10):701–7.
- [32] Fiscella K. Commentary—atomy of racial disparity in influenza vaccination. *Health Serv Res* 2005;40(2):539–49.
- [33] Mac Donald R, Baken L, Nelson A, Nichol KL. Validation of self-report of influenza and pneumococcal vaccination status in elderly outpatients. *Am J Prev Med* 1999;16(3):173–7.
- [34] Zimmerman RK, Raymund M, Janosky JE, Nowalk MP, Fine MJ. Sensitivity and specificity of patient self-report of influenza and pneumococcal polysaccharide vaccinations among elderly outpatients in diverse patient care strata. *Vaccine* 2003;21(13–14):1486–91.
- [35] Willis BC, Ndiaye SM, Hopkins DP, Shefer A. Task force on community preventive services. Improving influenza, pneumococcal polysaccharide, and hepatitis B vaccination coverage among adults aged <65 years at high risk: a report on recommendations of the Task Force on Community Preventive Services. *MMWR Recomm Rep* 2005;54(RR-5):1–11.
- [36] Ompad DC, Galea S, Vlahov D. Distribution of influenza vaccine to high-risk groups. *Epidemiol Rev* 2006;28(1):54–70.