

Coverage and predictors of vaccination against 2012/13 seasonal influenza in Madrid, Spain

Analysis of population-based computerized immunization registries and clinical records

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Abbreviations: ACM, Autonomous Community of Madrid ; EHSS, European Health Survey for Spain; ICPC, International Classification for Primary Care; SNHS, Spanish National Health Survey

We aim to determine 2012–13 seasonal influenza vaccination coverage. Data were analyzed by age group and by coexistence of concomitant chronic conditions. Factors associated with vaccine uptake were identified. We also analyze a possible trend in vaccine uptake in post pandemic seasons.

We used computerized immunization registries and clinical records of the entire population of the Autonomous Community of Madrid, Spain (6 284 128 persons) as data source.

A total of 871 631 individuals were vaccinated (13.87%). Coverage for people aged ≥ 65 years was 56.57%. Global coverage in people with a chronic condition was 15.7% in children and 18.69% in adults aged 15–59 years.

The variables significantly associated with a higher likelihood of being vaccinated in the 2012–13 campaign for the age groups studied were higher age, being Spanish-born, higher number of doses of seasonal vaccine received in previous campaigns, uptake of pandemic vaccination, and having a chronic condition.

We conclude that vaccination coverage in persons aged <60 years with chronic conditions is less than acceptable. The very low coverage among children with chronic conditions calls for urgent interventions. Among those aged ≥ 60 years, uptake is higher but still far from optimal and seems to be descending in post-pandemic campaigns. For those aged ≥ 65 years the mean percentage of decrease from the 2009/10 to the actual campaign has been 12%.

Computerized clinical and immunization registers are useful tools for providing rapid and detailed information about influenza vaccination coverage in the population.

Introduction

Seasonal influenza is a major public health and medical challenge.^{1,2} Severe influenza and influenza-related complications typically occur in the very young and elderly, as well as in persons with underlying chronic medical conditions.^{1,2}

In Spain, all-cause influenza-associated excess hospitalizations and mortality attributable to influenza mainly affect adults older than 64 y.^{3–5}

The efficacy and effectiveness of influenza vaccination for multiple possible outcome measures, including the prevention of medically attended acute respiratory illness, prevention of laboratory-confirmed influenza, prevention of influenza-

pneumonia-associated hospitalizations or deaths, and prevention of seroconversion to circulating influenza virus strains, has been assessed in clinical trials and observational studies in different populations.^{1,2,4–6} In a recent meta-analysis, Osterholm et al.² found that influenza vaccines can provide moderate protection against virologically confirmed influenza, but that such protection is greatly reduced or absent in some seasons. Even so, current influenza vaccines will continue to play a role in reducing the morbidity of influenza until more effective interventions are available.²

Every year, observational studies are conducted to assess the current effectiveness of the seasonal influenza vaccination, and several have analyzed the effectiveness of vaccination during the

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Table 1. Distribution of the population residing in ACM (Spain) according to study variables

Variables		Age groups					
		6 mo–14 y		15–59 y		60 or more	
		N	%	N	%	N	%
Age groups ^a	Low	329 020	33.51	999 298	25.01	596 101	45.60
	Middle	350 410	35.69	1 731 287	43.34	405 048	30.99
	High	302 425	30.80	1 264 523	31.65	306 016	23.41
Sex	Male	503 927	51.32	1 957 303	48.99	553 220	42.32
	Female	477 928	48.68	2 037 805	51.01	753 945	57.68
Origin	Spanish born	841 547	85.71	3 312 733	82.92	1 275 870	97.61
	Immigrant	140 308	14.29	682 375	17.08	31 295	2.39
Number of doses from 2008/9 to 2011/12	None	897 628	91.42	3 698 062	92.56	537 008	41.08
	1	35 031	3.57	126 698	3.17	105 293	8.06
	2	18 934	1.93	60 461	1.51	114 900	8.79
	3	16 292	1.66	53 881	1.35	220 434	16.86
	4	13 970	1.42	56 006	1.40	329 530	25.21
Vaccination in 2009 pandemic campaign	No	973 035	99.10	3 936 833	98.54	1 177 775	90.10
	Yes	8 820	0.90	58 275	1.46	129 390	9.90
Chronic conditions that constitute an indication for vaccination	No	842 142	85.77	3 550 875	88.88	752 008	57.53
	Yes	139 713	14.23	444 233	11.12	555 157	42.47
Total		981 855	100	3 995 108	100	1 307 165	100

ACM Autonomous Community of Madrid. ^a Age groups are as follows: “Low”: 6 mo to 4 y for children; 15–29 y for adults; 60–69 y for those ≥60 y. “Middle”: 5–9 y for children; 30–44 y for adults; 70–79 y for those ≥60 y. “High”: 10–14 y for children; 45–59 y for adults; 80 y or over for those ≥60 y.

2012–13 season.^{7–9} Current results for the US estimate vaccine effectiveness for preventing laboratory-confirmed influenza virus infection associated with medically attended acute respiratory illness to be 56% (95% CI, 47–63%).⁷ In a nested test-negative case-control analysis performed in Spain, the adjusted vaccine effectiveness in preventing laboratory-confirmed influenza was 86% (95% CI, 45–96%).⁸

For many years, the health authorities in Spain have recommended annual influenza vaccination for all individuals above the age of 64 y and, regardless of age, persons who have medical disorders and are at increased risk for severe complications from influenza, such as health care workers and residents of nursing homes and other chronic care facilities.^{10,11} In all such cases, vaccination is administered free of charge.¹¹ In 2005, the age range for influenza vaccination in the Autonomous Community of Madrid (ACM) was extended by 5 y to cover all those aged 60 y and over.¹²

Despite strong recommendations, seasonal influenza vaccination coverage rates in Spain remain unacceptable, even in high-priority groups.^{13–16}

Data from the 2011–12 Spanish National Health Survey (SNHS) revealed influenza coverage of 58.3% for individuals aged ≥65 y; based on the same methodology, the corresponding figures for the years 2003 and 2006 were 63.7% and 66.8%, respectively.^{13,14}

For other target groups in Spain, such as persons aged <60 y with associated chronic conditions, results from the 2006 SNHS and the European Health Interview Survey for Spain 2009 have hardly varied, with coverage percentages ranging from 23% to 25%.¹⁵

These values are still far from the World Health Organization objective of 75% vaccination coverage in the elderly by 2010 and the European Union objective of reaching seasonal influenza vaccination coverage of ≥75% in target groups for 2014–15.^{17,18}

Studies conducted in Spain and in other countries suggest a decrease in vaccination coverage across all target groups in the post-pandemic seasons.^{19–22}

Therefore, the uptake of seasonal influenza vaccines should be carefully monitored to determine whether this trend is confirmed and to guide public health authorities in developing more effective vaccination and communication strategies for seasonal influenza vaccination.²³

Computerized vaccination records are useful for monitoring coverage and for providing public health authorities with feedback.^{16,19} The information they provide can prove even more useful if early season vaccination coverage is available so that urgent interventions for high-risk groups can be implemented.^{16,19}

Using computerized primary care records and an immunization registry as a data source, we determined the 2012–13 influenza vaccination coverage in ACM, Spain. Data were analyzed by age group and by coexistence of concomitant chronic conditions that might constitute an indication for vaccination. Factors associated with vaccination uptake in this population were also analyzed.

Results

Study population

A total of 6284128 individuals were included in the computerized primary care records (men, 47.96%; women, 52.04%).

Table 2. Influenza vaccination coverage for the 2012/13 campaign among the population residing in ACM (Spain) according to study variables

Variables		Age groups					
		6 mo–14 y		15–59 y		60 or more	
		N	%	N	%	N	%
Age groups ^a	Low	12 655	3.85	23 630	2.36	220 166	36.93
	Middle	16 019	4.57	53 286	3.08	240 118	59.28
	High	12 313	4.07	104 211	8.24	189 233	61.84
Sex	Male	23 767	4.72	79 404	4.06	277 883	50.23
	Female	17 220	3.60	101 723	4.99	371 634	49.29
Origin	Spanish born	38 742	4.60	167 388	5.05	642 641	50.37
	Immigrant	2 245	1.60	13 739	2.01	6 876	21.97
Number of doses from 2008/9 to 2011/12	None	8 040	0.90	38 288	1.04	41 801	7.78
	1	6 479	18.50	28 261	22.31	46 449	44.11
	2	5 824	30.76	27 944	46.22	76 317	66.42
	3	9 811	60.22	38 262	71.01	185 079	83.96
	4	10 833	77.54	48 372	86.37	299 871	91.00
Vaccination in 2009 pandemic campaign	No	36 502	3.75	150 219	3.82	540 143	45.86
	Yes	4 485	50.85	30 908	53.04	109 374	84.53
Chronic conditions that constitute an indication for vaccination	No	19 053	2.26	98 110	2.76	302 786	40.26
	Yes	21 934	15.70	83 017	18.69	346 731	62.46
Total		40 987	4.17	181 127	4.53	649 517	49.69

ACM Autonomous Community of Madrid. ^aAge groups are as follows: "Low": 6 mo to 4 y for children; 15–29 y for adults; 60–69 y for those ≥ 60 y. "Middle": 5–9 y for children; 30–44 y for adults; 70–79 y for those ≥ 60 y. "High": 10–14 y for children; 45–59 y for adults; 80 y or over for those ≥ 60 y.

In the region, immigrants represented 13.59% (853 978 people). The overall proportion of persons suffering a chronic condition was 18.12% (1 139 103). The most prevalent chronic condition among children and adults aged 15–59 y was asthma with figures of 12.89% and 5.30% respectively. The second in prevalence (2.16%) among adults aged 15–59 y and the most prevalent (17.94%) among those aged 60 y or over was diabetes. The other chronic conditions with prevalences over 5% in the older age group included; Other cardiovascular disease (11.96%); Cancer (6.34%) and COPD (6.05%). **Table 1** shows the distribution of the population according to the study variables in each age group.

Vaccination coverage

Table 2 shows vaccination coverage in the 2012–13 campaign. Overall, 871 631 people were vaccinated (13.87%). The highest percentage was recorded for people aged ≥ 60 y (49.69%); within this group, coverage increased with age (36.93%) for those aged 60–69 y to 61.84% for those ≥ 80 y. Coverage reached 56.57% for people aged ≥ 65 y and for those aged 60 to 64 y 28.17%. Spanish-born people were vaccinated more frequently than immigrants in all 3 age groups.

Global coverage in people with a chronic condition was 39.65%, although several differences were found between the groups, with the highest coverage attained in those aged ≥ 60 y (62.46%). Based on specific diseases (**Table 3**), the coverage achieved differed according to the age groups. Higher percentages were reached in persons with diabetes (aged 6 mo to 14 y), heart failure (aged 15 to 59 y), and chronic obstructive pulmonary disease (aged ≥ 60 y).

People with chronic diseases had higher percentages of vaccination than those who did not, regardless of the age group.

Factors associated with influenza vaccination

The multivariate analysis (**Table 4**) showed that the variables that were significantly associated with a higher likelihood of being vaccinated in the 2012–13 seasonal campaign for the age groups studied were higher age with adjusted ORs (aOR) of 1.12, 2.90, and 2.24 among children, adults 15–59 y and those aged 60 y or over respectively, being Spanish-born (aOR: 1.37, 1.24, and 1.68), higher number of doses of seasonal vaccine received in previous campaigns (aOR: 4.98, 5.15, and 3.28), uptake of pandemic vaccine in 2009 (aOR: 1.40, 1.70, and 1.35), and having a chronic condition (aOR: 2.58, 2.73, and 1.29). Female sex was associated with lower coverage for children and those aged ≥ 60 y (aOR: 0.91 and 0.93) and higher coverage for those aged 15 to 59 y (aOR: 1.26).

Discussion

Development of technology and information systems has enabled us to cross data from different registries in order to include the whole population and calculate vaccination coverage rapidly, systematically, and exhaustively.

To our knowledge, this is the first report on influenza vaccination coverage for the entire 2012–13 season. In the US, early season estimates (mid-November) have been published.²² These data were collected using an Internet panel survey of adults (National Internet Flu Survey), conducted from November 2 to 15, 2012, and an ongoing telephone survey of parents (National Immunization Survey), conducted from October 4 to November 17, 2012.²²

The total coverage for our study population was around 14%, which is much lower than early estimates for the US (36.5%).

Table 3. Prevalence of chronic conditions and influenza vaccination coverage for the 2012/13 campaign among the population residing in ACM (Spain) according to age groups

Chronic condition	Age group								
	6 mo–14 y			15–59 y			60 y or over		
	Cases	Prevalence %	Coverage %	Cases	Prevalence %	Coverage %	Cases	Prevalence %	Coverage %
COPD	3 375	0.34	16.21	20 858	0.52	31.22	79 022	6.05	67.87
Asthma	126 544	12.89	16.16	211 927	5.30	15.76	60 991	4.67	64.74
Other pulmonary disease	835	0.09	11.14	6 416	0.16	17.05	10 016	0.77	58.70
Ischemic Heart Disease	521	0.05	15.74	22 411	0.56	29.40	98 179	7.51	65.72
Heart failure	818	0.08	20.17	3 493	0.09	33.07	35 996	2.75	67.24
Other cardiovascular disease	3 134	0.32	13.40	52 012	1.30	15.84	155 900	11.93	66.19
Diabetes Mellitus	1 556	0.16	36.25	86 157	2.16	29.99	234 495	17.94	62.86
AIDS/HIV infection	427	0.04	16.86	16 240	0.41	32.24	1 131	0.09	59.68
Immune-depression	1 159	0.12	14.15	11 578	0.29	22.74	13 776	1.05	59.41
Nephropathy	773	0.08	15.52	4 112	0.10	17.92	2 846	0.22	60.40
Cerebral vascular accident	705	0.07	16.17	9 138	0.23	23.17	41 375	3.17	63.12
Neuromuscular disease	210	0.02	8.10	8 158	0.20	15.97	48 030	3.67	63.25
Chronic Anaemia	4 386	0.45	8.60	22 044	0.55	8.78	16 612	1.27	62.17
Cancer	1 736	0.18	8.18	47 834	1.20	11.21	82 814	6.34	57.63
Morbid obesity (BMI > 39)	NA	NA	NA	12 775	0.32	20.63	13 968	1.07	64.88
Any chronic condition	139 713	14.23	15.70	444 233	11.12	18.69	555 157	42.47	62.46

ACM, Autonomous Community of Madrid; NA, not applicable.

Excepting differences in methodology, this discrepancy can be explained by the fact that, in this country, since 2010, yearly influenza vaccination has been recommended for everyone aged 6 mo and older.^{2,22}

Our results reveal coverage of only 15.7% in children with a high-risk condition, which is far from ideal. Results from the SNHS conducted in 2006 showed that coverage reached 19.1% in children with chronic conditions.¹⁴ The uptake observed among children is lower than that found in the US (even before the universal recommendation) and England and similar to that recorded in France.^{22,24–27}

Coverage during the 2012–13 season was unacceptably low among adults (15–59 y), for whom the vaccine is recommended when a chronic condition is present (18.69%). According to the 2009 European Health Survey for Spain (EHSS), seasonal influenza vaccination coverage for the Spanish population in this age and risk group was around 25%.¹⁵

The SNHS and the EHSS are home-based, personal interviews examining a nationwide, representative sample of the civilian, non-institutionalized population aged 16 y or over, residing in main family dwellings (households) of Spain.^{14,15}

The early 2012–13 estimates from the US are that among those aged 18 to 64 y with high-risk conditions, uptake was 42.1%; the equivalent figures for complete previous seasons reached 45–50%.^{22,24,25} Results from England and France show higher coverage than ours, and similar results are reported from Germany.^{20,21,27}

In Madrid, the highest coverage is found among those aged ≥60 y (49.69%) with figures for persons with and without chronic conditions of 62.46% and 40.26%, respectively. According to data published by the public health authorities of ACM in the Health Report for 2012 the coverage for the age group 60–64 y was around 32% in the 2009/10 campaign showing therefore a 4% decrease to the actual campaign.²⁸

In the latest SNHS, conducted from July 2011 to June 2012, uptake was 58.3% for persons aged ≥65 y; this percentage is lower than that recorded in the previous SNHS conducted in 2006.^{13–15} In our population, the 2012–13 coverage for this age group was 56.57%; the corresponding figures in 2009/10 and 2010/11 were 69% and 60% respectively.²⁸

The latest available complete data from the US (2011–12 campaign) show an estimated coverage among adults aged ≥65 y of 70.8%, which is slightly lower than 1 year previously (74.7%).²⁵ In England, coverage for 2011–12 reached 74% and remained stable compared with previous seasons.²⁷ Results from France (54.0% in 2011) and Germany (54.2% in 2010) are similar to ours, also with a slight decline over time.^{20,21} Germany recommend vaccination for individuals >59 y as does the ACM whereas France starts at 65 y in the absence of any risk factors.^{20,21}

It has been suggested that controversial public discussion about the safety and benefits of pandemic influenza vaccination may have contributed to the very low uptake of pandemic vaccination and decreased uptake of seasonal influenza vaccination in post-pandemic seasons.²⁰

Table 4. Factors associated to Influenza vaccination uptake for the 2012/13 campaign among the population residing ACM (Spain) according to age groups

		6 mo–14 y		15–59 y		60 or more	
		OR	95% CI	OR	95% CI	OR	95% CI
Age groups ^a	Low ^b	NA	-	1		1	
	Middle	1		1.66	(1.62–1.69)	2.21	(2.19–2.22)
	High	1.12	1.09–1.15	2.90	(2.83–2.95)	2.24	(2.22–2.26)
Sex	Male	1		1		1	
	Female	0.91	(0.89–0.94)	1.26	(1.24–1.27)	0.93	(0.92–0.94)
Origin	Immigrant	1		1		1	
	Spanish born	1.37	(1.31–1.44)	1.24	(1.21–1.27)	1.68	(1.62–1.74)
Number of doses from 2008/9 to 2011/12	Continuous	4.98	(4.92–5.04)	5.15	(5.12–5.18)	3.28	(3.26–3.29)
2009 Pandemic vaccine	No	1		1		1	
	Yes	1.40	(1.31–1.49)	1.70	(1.66–1.75)	1.35	(1.32–1.37)
Chronic conditions that constitute an indication for vaccination	No	1		1		1	
	Yes	2.58	(2.51–2.66)	2.73	(2.69–2.77)	1.29	(1.27–1.30)

ACM, Autonomous Community of Madrid; CI, Confidence Interval; NA, Not available. ^aAge groups are as follows: "Low": 6 mo to 4 y for Children; 15–29 y for adults; 60–69 y for those ≥60 y. "Middle": 5–9 y for Children; 30–44 y for adults; 70–79 y for those ≥60 y. "High": 10–14 y for Children; 45–59 y for adults; 80 y or over for those ≥60 y. ^bChildren aged 4 y could not be vaccinated against 2009 Pandemic vaccine.

Vaccination coverage varies depending on the chronic condition analyzed. Among children, it is remarkable that coverage in those with asthma was low (16.16%). Results from the SNHS conducted in 2006 show a similar value (18.8%).²⁹ In a recent review Olivier CW discussed the Influenza vaccination coverage rate in children in different countries.³⁰ For children with asthma, which is the most frequent chronic condition in children low coverages are found in most countries.^{29–33} Rancé F et al. reported figures of 15.7% among French children for the 2006–2007 season.³¹ In the US estimations range from 10% to 43% for various influenza seasons.³² Recent data from England show a coverage of 40.7% among children aged 2 to 16 suffering a chronic respiratory disease.³³ The difficulties in the diagnosis of asthma in children and the lack of information and misconceptions about influenza and immunization that affect providers and parents can justify this constant low coverage over time.^{29,34}

The results of the multivariate analysis show that among individuals aged ≥60 y, those with a chronic condition have only a 29% (OR 1.29; 95%CI, 1.27–1.30) greater probability of being vaccinated than those without. Among children, suffering a chronic condition that constitute an indication for vaccine is a strong driver to get the vaccine as increases the probability 2.58 times and even more among adults aged 15–59 with an adjusted OR of 2.73. These findings may be explained because campaigns based on patient selection by medical condition are less effective than age-based strategies.^{23,35,36}

In all the age groups studied, we found that, after adjusting for possible confounders, being an immigrant was significantly associated with a lower probability of uptake than being Spanish-born. This disparity has previously been reported in the ACM, as well as in Spain and other countries.^{15,16,19,22,25} Continued efforts to increase vaccination coverage among adults from different racial and ethnic groups are necessary to decrease these disparities.³⁷

Multivariate analysis showed that having received more doses of the seasonal influenza vaccine in previous seasons was the strongest predictor for receiving the 2012–13 vaccination. In addition, the precedent of pandemic influenza vaccine uptake increased coverage in the latest campaign.

The proportion of subjects vaccinated increased in all age groups as the number of doses in the previous seasons raised. For example among children those with vaccination in all 4 previous seasons was 77.54%, for adults aged 15–59 y 86.37% and for those aged 60 y or over 91%. The corresponding figures for those who had received none doses in the previous 4 campaigns were only 0.90% in children, 1.04% in adults, and 7.78% in elderly. The high correlation between uptake of seasonal and pandemic vaccine and adherence to future vaccinations highlights the significance of habitual behavior in decisions on influenza vaccination, as described by other authors in Spain and elsewhere.^{16,19,20,38,39}

We must continue research in this field in order to determine which factors affect the decision to indicate, on the one hand, and to receive/request, on the other, annual seasonal influenza vaccination in our population. Only knowledge of these factors will help us establish measures that increase coverage.

Strengths and limitations

The use of data from computerized clinical records has some advantages over survey data. Memory bias is avoided (data are not self-reported), and most of those conditions that indicate vaccination can be identified using the International Classification for Primary Care code (ICPC). In addition, data can be analyzed for subsequent annual campaigns and do not depend on the frequency with which the survey is applied.

Nevertheless, this type of registry is subject to limitations, such as coding errors, nonspecific codes, and the fact that it is not possible to evaluate exceptions to the indication, such as adverse events during previous vaccinations. Similarly, these

registries may lack sociodemographic variables of interest, such as economic, educational status or the reason for vaccination or rejection of the vaccination. Finally, those persons who buy the vaccine in the pharmacy and receive the vaccine outside a health service (public or private) would not be registered in the system and are therefore classified as not vaccinated. However, in Spain, vaccines can only be bought with an official prescription signed by a physician; in addition, these are provided free of charge in health centers. Therefore, we think that the number of potentially non-registered vaccinations is very small. In any case, the real vaccination coverage would be underestimated, especially in those not included in the high-risk groups.

In conclusion, our study shows that vaccination coverage in persons aged <60 y with chronic conditions is less than acceptable, both in children and in adults. The very low coverage among children with chronic conditions calls for urgent interventions. Uptake is higher in persons aged ≥60 y, but remains far from optimal. Poor uptake in 2012–13 was found to be associated with younger age, being an immigrant, and non-adherence to previous seasonal or pandemic vaccines. On the other hand, having 1 chronic condition was associated with greater uptake especially in those aged under 65 y. Computerized clinical and immunization registers provide rapid and detailed information about influenza vaccination coverage in the population.

Patients and Methods

Study population

Our population-based cross-sectional study included all people registered in the individual medical card database of the public health system of ACM, Spain. In September 2012, this population stood at 6284128 persons. According to the latest available data (1 January 2012) the population aged 6 mo or over living in the ACM was 6463564; therefore, our sample represents >97% of the population.⁴⁰

Influenza vaccination campaign

In the 2012–13 season, the influenza vaccination campaign in the ACM ran from 1 October to 15 December. The vaccine used was the trivalent inactivated vaccine, with the composition recommended by the World Health Organization. The vaccine was recommended for all persons aged 60 and over, and for persons with chronic conditions that increase the risk of influenza complications.⁴¹

Information sources and variables

Before the vaccination campaign began, individual records were obtained from computerized primary care records. This registry provided independent socio-demographic variables including sex, age (for study purpose we divided the population in 3 groups: 0–14 y, 15–59 y; and ≥60 y), origin (2 categories: Spanish-born or immigrant), presence or absence of any chronic condition that constitutes an indication for vaccination, and a

body mass index >39. Chronic conditions were recorded in the computerized primary care records as an episode with an International ICPC code. As there could have been a delay between closure of a clinical history (September 2012) in the case of a death, data were corrected according to the updated death records (January 2013).

To assess influenza vaccination status, individual records were obtained from the Food and Public Health Information System (SISPAL). This immunization registry provides current nominal records of the vaccination administered in either public or private health services for any of the following 6 campaigns: seasonal influenza campaign from 2008–09 to 2012–13, and 2009 pandemic influenza campaign. Vaccine uptake in the 2012–13 campaign was considered the dependent variable. Doses of seasonal vaccine received from 2008/09 to 2011–12 were coded in 5 categories (from none to 4 doses), and vaccination in the 2009 pandemic campaign was considered to be dichotomous (yes/no).

The fields common to the different registries and needed to merge both databases were the medical card identification number and the name, surname, date of birth, and sex.

Statistical analysis

All data were analyzed separately for the 3 specific age groups (0–14 y, 15–59 y, and ≥60 y). First, a descriptive analysis was performed by calculating the distribution of the study variables (age group, sex, origin, number of doses of vaccine received from the 2008–09 to the 2011–12 seasonal campaign, vaccination in the 2009 pandemic campaign, and chronic conditions that constitute an indication for vaccination). Second, influenza vaccination coverage in the 2012–13 campaign was calculated according to the study variables for each group. The prevalence of the chronic conditions that constitute an indication for vaccination was also calculated, as was vaccination coverage for the 2012–13 campaign. Finally, 3 multivariate logistic regression analyses were performed using vaccination coverage in the 2012–13 campaign as the dependent variable. All variable that showed a significant association in the bivariate analysis were included in the multivariate models. Adjusted odds ratios (OR) were calculated with their 95% confidence interval.

Estimates were made using the STATA program, and statistical significance was set at a 2-tailed $\alpha < 0.05$.

Ethics

The protocol was approved by the Ethics Committee of Universidad Rey Juan Carlos.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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