Influenza vaccination landscape in Italy: A comprehensive study through the OBVIOUS project lens

Angelo Capodici, Marco Montalti, Giorgia Soldà, Aurelia Salussolia, Giusy La Fauci, Zeno Di Valerio, Francesca Scognamiglio, Maria Pia Fantini, Anna Odone, Claudio Costantino, Heidi J. Larson, Julie Leask, Jacopo Lenzi, Davide Gori & the OBVIOUS Board

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Influenza vaccination landscape in Italy: A comprehensive study through the OBVIOUS project lens

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ABSTRACT
Influenza annually claims an estimated 8,000 lives in Italy. Despite no-cost vaccinations for high-risk groups, hesitancy persists. This study aims to pinpoint social and behavioral vaccination determinants, forming strategies to bolster vaccine uptake. From April 11 to May 29, 2022, we surveyed a demographic-stratified sample of 10,000 Italian adults, employing the WHO’s Behavioral and Social Drivers of Vaccination (BesD) framework. Of those, 4,613 (46.1%) were eligible for the influenza vaccine and included in the analysis. Roughly a third remained unvaccinated and unwilling. Central Italy showed the highest resistance, with significant percentages of seniors and professionals like teachers, law enforcement, and healthcare workers expressing noncompliance. A lack of awareness of being in a target group correlated significantly with vaccine refusal or delayed acceptance. Other refusal factors included female gender, being aged 45–54, rural residency, absence of higher education, perceived vaccine unsafety, and having vaccine-opposed acquaintances. Thus, addressing these perceptions and enhancing awareness can potentially increase vaccination rates and lessen disease impact.

Introduction
Influenza, a pervasive public health concern, impacts approximately 8% of Italy’s population each year and it claimed around 68,000 deaths between 2013 and 2017.1,2 Certain individuals face higher risks, including those over 65, people with preexisting conditions such as diabetes or chronic respiratory and cardiovascular diseases, very young children, and pregnant women.3 Alarmingly, across the European Union, influenza accounts for around 15,000–70,000 premature deaths each year.3

Vaccination stands out as the most effective approach to mitigating influenza transmission and reducing its burden on society.4,5 The World Health Organization (WHO) and the Italian National Vaccine Prevention Plan have established ambitious coverage targets for influenza vaccination, aiming for a minimum of 75% and an optimal goal of 95% among individuals over 65 and those in at-risk groups.6,7 To make vaccination more accessible, Italy offers it free of charge to those with an elevated risk of influenza-related complications; these groups encompass people aged 65 and older, and people living with pulmonary, kidney, hepatic, hematological or heart diseases, people living with diabetes, people living with neoplastic diseases, people living with chronic inflammatory diseases, immunosuppressed and splenectomized patients, people scheduled to undergo major surgical procedures, patients with underlying neuromuscular disorders, and those who live in assisted-living structures at any age and pregnant women. Furthermore, the influenza vaccine is recommended and offered free of charge to specific working classes, such as healthcare workers (HCWs), teachers, law-enforcement members (LEM) and people working with animals.7,8 Collaborative efforts between Public Health Departments of Local Health Authorities and family physicians ensure the efficient delivery of vaccinations to patients in risk categories, especially in the Italian context, in which each region can autonomously decide how to deliver the vaccine to the aforementioned risk groups. Even though regions can decide how to deliver the vaccine, and how to advertise it to their own population, most regions are currently working with general practitioners to deliver the vaccine, as well as with their local health authorities, which being located widely throughout the territory, ensure comprehensive coverage.

CONTACT Giorgia Solda giorgia.solda@studio.unibo.it Department of Biomedical and Neuromotor Science, Alma Mater Studiorum - University of Bologna, Via San Giacomo 12, Bologna, Italy.

*Observatory on Vaccine Hesitancy in Italy – Online UniBo Surveys (Angelo Capodici, Claudio Costantino, Michele Conversano, Mirko Degli Esposti, Zeno Di Valerio, Maria Pia Fantini, Davide Gori, Andrea Grignolio, Giusy La Fauci, Heidi Larson, Julie Leask, Marco Montaliti, Anna Odone, Daniel Remondini, Francesca Scognamiglio, Aurelia Salussolia, Giorgia Solda, Federico Toth, Francesco Vitale).

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Vaccine uptake, however, is influenced by a complex array of factors, such as beliefs, emotions, social influences, and practical or logistical issues.\(^9\)\(^-\)\(^11\) Vaccine hesitancy, as redefined by the WHO,\(^12\) presents a considerable obstacle in Italy. In a study conducted by Rossi\(^13\)\(^,\) the authors highlighted the consistently low coverage of the influenza vaccine from 1999 to 2019, specifically falling below the minimum threshold of 75% for individuals aged 65 and older. Similar findings were presented by Stefanoni\(^14\), who reported sub-optimal vaccination rates in people with chronic heart diseases, consistently failing to reach the 75% threshold. Examining HCs, Montagna\(^15\) revealed that influenza vaccine coverage also failed to meet the desired minimum of 75%, even among Italian public health physicians, with only 66.5% of the 2,030 surveyed participants reporting vaccination. Alas, limited research has been conducted on influenza vaccine hesitancy and uptake in the Italian population, leaving little data available on the factors driving and hindering vaccine uptake in Italy.

Addressing hesitancy and uptake is critical, and understanding the full spectrum of drivers and barriers to influenza vaccination is essential for crafting evidence-informed policy and programmatic solutions. With this study, we aim to present the key social and behavioral drivers of influenza vaccination among those recommended to receive the vaccine in Italy, therefore empowering decision-makers with evidence-based results.

**Methods**

**Study design and data collection**

This study was conducted as a cross-sectional computer-assisted web interviewing (CAWI) questionnaire. From April 11 to May 29, 2022, the professional online provider Dynata (https://www.dynata.com/) surveyed 10,000 Italian citizens aged ≥18 years using a stratified sampling based on proportionate allocation by first-level NUTS (Nomenclature...
Table 2. Clinical characteristics of the study respondents who provided information about their own seasonal influenza vaccine uptake, overall and by NUTS statistical region.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Italy (n = 4613)</th>
<th>Northwestern Italy (n = 1278)</th>
<th>Northeastern Italy (n = 917)</th>
<th>Central Italy (n = 1034)</th>
<th>Southern Italy (n = 474)</th>
<th>Insular Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregnant in October/November 2021</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>230 (5.0%)</td>
<td>57 (4.5%)</td>
<td>45 (4.9%)</td>
<td>46 (5.1%)</td>
<td>57 (5.5%)</td>
<td>25 (5.3%)</td>
</tr>
<tr>
<td>No</td>
<td>4021 (85.8%)</td>
<td>1139 (88.9%)</td>
<td>380 (41.4%)</td>
<td>399 (43.3%)</td>
<td>440 (42.0%)</td>
<td>224 (47.3%)</td>
</tr>
<tr>
<td>Not applicable</td>
<td>2362 (51.2%)</td>
<td>632 (49.5%)</td>
<td>492 (53.7%)</td>
<td>470 (51.6%)</td>
<td>543 (52.5%)</td>
<td>225 (47.5%)</td>
</tr>
<tr>
<td>Problems with daily living tasks due to physical or mental impairment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>652 (14.1%)</td>
<td>139 (10.9%)</td>
<td>204 (22.2%)</td>
<td>91 (10.0%)</td>
<td>162 (15.7%)</td>
<td>56 (11.8%)</td>
</tr>
<tr>
<td>No</td>
<td>3961 (85.9%)</td>
<td>1139 (88.9%)</td>
<td>713 (77.8%)</td>
<td>819 (90.0%)</td>
<td>872 (84.3%)</td>
<td>418 (88.2%)</td>
</tr>
<tr>
<td>BMI ≥30 kg/m²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1200 (26.0%)</td>
<td>286 (22.4%)</td>
<td>232 (25.3%)</td>
<td>260 (28.6%)</td>
<td>284 (27.5%)</td>
<td>138 (29.1%)</td>
</tr>
<tr>
<td>No</td>
<td>3413 (74.0%)</td>
<td>992 (77.6%)</td>
<td>685 (74.7%)</td>
<td>650 (71.4%)</td>
<td>750 (72.5%)</td>
<td>336 (70.9%)</td>
</tr>
<tr>
<td>Respiratory diseases</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>592 (12.8%)</td>
<td>152 (11.9%)</td>
<td>114 (12.4%)</td>
<td>109 (12.0%)</td>
<td>144 (13.9%)</td>
<td>73 (15.4%)</td>
</tr>
<tr>
<td>No</td>
<td>4021 (87.2%)</td>
<td>1136 (88.1%)</td>
<td>803 (87.6%)</td>
<td>801 (88.0%)</td>
<td>890 (86.1%)</td>
<td>401 (84.6%)</td>
</tr>
<tr>
<td>Cardiovascular diseases</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>649 (14.1%)</td>
<td>179 (14.0%)</td>
<td>135 (14.7%)</td>
<td>109 (12.0%)</td>
<td>168 (16.2%)</td>
<td>58 (12.2%)</td>
</tr>
<tr>
<td>No</td>
<td>3964 (85.9%)</td>
<td>1099 (86.0%)</td>
<td>782 (85.3%)</td>
<td>801 (88.0%)</td>
<td>866 (83.8%)</td>
<td>416 (87.8%)</td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>828 (17.9%)</td>
<td>193 (15.1%)</td>
<td>240 (26.2%)</td>
<td>121 (13.3%)</td>
<td>191 (18.5%)</td>
<td>83 (17.5%)</td>
</tr>
<tr>
<td>No</td>
<td>3785 (82.1%)</td>
<td>1085 (84.9%)</td>
<td>677 (73.8%)</td>
<td>789 (86.7%)</td>
<td>843 (81.5%)</td>
<td>391 (82.5%)</td>
</tr>
</tbody>
</table>

Eighty-one respondents who did not recall whether they had been vaccinated are excluded. Northwestern Italy includes the regions of Piedmont, Aosta Valley, Lombardy, and Liguria; Northeastern Italy includes the regions of Trentino-South Tyrol, Veneto, Friuli-Venezia Giulia, and Emilia-Romagna; Central Italy includes the regions of Tuscany, Umbria, Marche, and Lazio; Southern Italy includes the regions of Abruzzo, Molise, Campania, Apulia, Basilicata, and Calabria; Insular Italy includes the regions of Sicily and Sardinia.

BMI, body mass index.

Variables

Cognitive testing was conducted prior to full implementation, and feedback was used to revise the questionnaire. A total of 27 questions were included: gender (four categories: male, female, non-binary, prefer not to say); date of birth; region of residence; municipality of residence; educational attainment (four categories; less than high school diploma, high school diploma, academic degree, post-graduate or doctorate degree); occupation (eight categories: student, medical doctor, other healthcare worker, law enforcement member, teacher, other occupation, unemployed, retired); living arrangement (four categories: alone, in couple, with parents or family of origin, other); ability to pay for things needed in life (four categories: with great difficulty, with some difficulty, quite easily, easily); being pregnant during the 2021–2022 seasonal influenza vaccination campaign (yes or no); problems with daily living tasks due to physical or mental impairment (yes or no); weight in kg; height in cm; suffering from chronic respiratory diseases, cardiovascular diseases and/or diabetes (yes or no); the place where most vaccinations were given (six categories: hospital, pharmacy, family doctor, vaccine hub, home, workplace); preferred place to be vaccinated (same categories listed before); friends and family’s views on vaccination (six categories from very unfavorable to very favorable); having children (yes or no); youngest child’s gender (male or female); youngest child’s date of birth; decision-making agreement between partners on youngest child’s vaccinations (three categories: mostly myself, mostly my partner, equally myself and my partner); if they had gotten the influenza vaccine during the 2021–2022 campaign (three categories: yes, no, not sure) and, if not, would they get it now (yes or no); perceived worry about getting influenza (four categories from not worried to very worried); perceived...
vaccine safety (four categories from very safe to very unsafe); knowledge of higher priority (three categories: yes, no, don’t know); perceived ease of getting the vaccine (four categories from very easy to very difficult). Adults’ age was categorized into six groups (18–24, 25–34, 35–44, 45–54, 55–64, ≥65 years), and children’s age into two (6 months to 3 years, 4–5 years). Regions of residence were collapsed into Italy’s five NUTS groups to reduce data sparsity, while municipality degree of urbanization (three categories: city, town or suburb, rural area) was derived according to the Eurostat Degree of Urbanization (DEGURBA) classification system based on 2011 population grids and 2018 administrative boundaries.

Vaccine-specific sections were developed following the domains of the WHO BesD framework: thinking and feeling; social processes; motivation; practical issues; vaccination. The questionnaire can be found in the Appendix.

**Statistical analysis**

Post-stratification by gender, age group, and area of residence confirmed that non-response to the survey in some strata of Italy’s population was negligible (Supplemental Table S1) and had no substantial effect on the study estimates of the overall sample of 10,000 (results not shown). Adjustment of sampling weights was thus deemed unnecessary to be performed on the targeted subsample of respondents for influenza vaccination (n = 5282).
Eighty-one respondents who did not recall whether they had been vaccinated are excluded. Northwestern Italy includes the regions of Piedmont, Aosta Valley, Lombardy, and Liguria; Northeastern Italy includes the regions of Trentino-South Tyrol, Veneto, Friuli-Venezia Giulia, and Emilia-Romagna; Central Italy includes the regions of Tuscany, Umbria, Marche, and Lazio; Southern Italy includes the regions of Abruzzo, Molise, Campania, Apulia, Basilicata, and Calabria; Insular Italy includes the regions of Sicily and Sardinia.
Table 4. General information about vaccines among respondents who provided information about their youngest child’s seasonal influenza vaccine uptake, overall and by NUTS statistical region.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Italy (n = 562)</th>
<th>Northwestern Italy (n = 162)</th>
<th>Northeastern Italy (n = 76)</th>
<th>Central Italy (n = 117)</th>
<th>Southern Italy (n = 142)</th>
<th>Insular Italy (n = 65)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place where you most likely got vaccines</td>
<td>Vaccine Hub</td>
<td>367 (65.3%)</td>
<td>107 (66.0%)</td>
<td>39 (51.3%)</td>
<td>75 (64.1%)</td>
<td>107 (75.4%)</td>
</tr>
<tr>
<td>Hospital</td>
<td>116 (20.6%)</td>
<td>34 (21.0%)</td>
<td>27 (35.5%)</td>
<td>20 (17.1%)</td>
<td>19 (13.4%)</td>
<td>16 (24.6%)</td>
</tr>
<tr>
<td>Family doctor</td>
<td>65 (11.6%)</td>
<td>18 (11.1%)</td>
<td>7 (9.2%)</td>
<td>20 (17.1%)</td>
<td>11 (7.7%)</td>
<td>9 (13.8%)</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>11 (2.0%)</td>
<td>2 (1.2%)</td>
<td>2 (2.6%)</td>
<td>2 (1.7%)</td>
<td>4 (2.8%)</td>
<td>1 (1.5%)</td>
</tr>
<tr>
<td>Home</td>
<td>2 (0.4%)</td>
<td>1 (0.6%)</td>
<td>1 (1.3%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Workplace</td>
<td>1 (0.2%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>1 (0.7%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Favorite place to get vaccines</td>
<td>Vaccine Hub</td>
<td>214 (38.1%)</td>
<td>71 (43.8%)</td>
<td>26 (34.2%)</td>
<td>36 (30.8%)</td>
<td>60 (42.3%)</td>
</tr>
<tr>
<td>Family doctor</td>
<td>133 (23.7%)</td>
<td>32 (19.8%)</td>
<td>14 (18.4%)</td>
<td>40 (34.2%)</td>
<td>25 (17.6%)</td>
<td>22 (33.8%)</td>
</tr>
<tr>
<td>Hospital</td>
<td>132 (23.5%)</td>
<td>36 (22.2%)</td>
<td>28 (36.8%)</td>
<td>27 (23.1%)</td>
<td>23 (16.2%)</td>
<td>18 (27.7%)</td>
</tr>
<tr>
<td>Home</td>
<td>38 (6.8%)</td>
<td>9 (5.6%)</td>
<td>4 (5.3%)</td>
<td>8 (6.8%)</td>
<td>16 (11.3%)</td>
<td>1 (1.5%)</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>27 (4.8%)</td>
<td>10 (6.2%)</td>
<td>0 (0.0%)</td>
<td>3 (2.6%)</td>
<td>11 (7.7%)</td>
<td>3 (4.6%)</td>
</tr>
<tr>
<td>Workplace</td>
<td>18 (3.2%)</td>
<td>4 (2.5%)</td>
<td>4 (5.3%)</td>
<td>3 (2.6%)</td>
<td>7 (4.9%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Friends and family’s views on vaccination</td>
<td>Very unfavorable</td>
<td>13 (2.3%)</td>
<td>2 (1.2%)</td>
<td>4 (5.3%)</td>
<td>2 (1.7%)</td>
<td>3 (2.1%)</td>
</tr>
<tr>
<td>Unfavorable</td>
<td>15 (2.7%)</td>
<td>7 (4.3%)</td>
<td>2 (2.6%)</td>
<td>2 (1.7%)</td>
<td>3 (2.1%)</td>
<td>1 (1.5%)</td>
</tr>
<tr>
<td>Quite unfavorable</td>
<td>40 (7.1%)</td>
<td>13 (8.0%)</td>
<td>2 (2.6%)</td>
<td>10 (8.5%)</td>
<td>8 (5.6%)</td>
<td>7 (10.8%)</td>
</tr>
<tr>
<td>Quite favorable</td>
<td>201 (35.8%)</td>
<td>54 (33.3%)</td>
<td>27 (35.5%)</td>
<td>42 (35.9%)</td>
<td>47 (33.1%)</td>
<td>31 (47.7%)</td>
</tr>
<tr>
<td>Favorable</td>
<td>163 (29.0%)</td>
<td>43 (26.5%)</td>
<td>24 (31.6%)</td>
<td>30 (25.6%)</td>
<td>49 (34.5%)</td>
<td>17 (26.2%)</td>
</tr>
<tr>
<td>Very favorable</td>
<td>130 (23.1%)</td>
<td>43 (26.5%)</td>
<td>17 (22.4%)</td>
<td>31 (25.6%)</td>
<td>32 (22.5%)</td>
<td>7 (10.8%)</td>
</tr>
</tbody>
</table>

Northwestern Italy includes the regions of Piedmont, Aosta Valley, Lombardy, and Liguria; Northeastern Italy includes the regions of Trentino-South Tyrol, Veneto, Friuli-Venezia Giulia, and Emilia-Romagna; Central Italy includes the regions of Tuscany, Umbria, Marche, and Latium; Southern Italy includes the regions of Abruzzo, Molise, Campania, Apulia, Basilicata, and Calabria; Insular Italy includes the regions of Sicily and Sardinia.

All variables were summarized as counts and percentages and were stratified by first-level NUTS statistical region of residence and by target group based on age, gender, clinical status, and profession (male vs. female adults, ages ≥60 years, children, pregnant women, individuals with certain chronic conditions [respiratory diseases, cardiovascular, diabetes, BMI ≥30 kg/m²], Medical Doctors (MDs), other Healthcare Workers (HCWs) [nurses, pharmacists, optometrists, etc.], teachers, and law enforcement members (LEM)).

Multivariable multinomial logistic regression analysis was performed to examine the drivers of a three-category nominal outcome consisting of three mutually-exclusive response options: “I did get the vaccine,” “I did not get the vaccine, but I would,” “I do not want to get vaccinated.” In keeping with the increasing vaccination model proposed by the BeSD Expert Working Group,10 the covariates included in the regression model as potential drivers of vaccine uptake,8 delay, and refusal were the following: attitudes and beliefs about seasonal influenza infection and vaccination (perceived worry and safety concerns); social processes (friends and family’s views on vaccination, gender); practical issues (awareness of having higher priority for vaccination, perceived ease of access to healthcare to get the vaccine). Other relevant sociodemographic determinants considered were: age group, statistical region of residence, level of urbanization, educational level, and clinical/professional factors that lead to a higher priority for vaccination.

All analyses were conducted using Stata 17,16 and were performed separately on individuals answering on their own behalf vs. individuals answering on their children’s behalf.

Results

Sociodemographics

The sociodemographic characteristics of the respondents who answered on their own behalf are summarized in Table 1. Out of the 10,000 respondents to the full questionnaire, 4,694 (46.9%) were eligible for the influenza vaccine. Since 81 of these respondents (1.7%) did not recall their vaccination status, further analyses were conducted solely on the remaining 4,613 (46.1%). The sample comprised slightly more males (51.2%) than females (48.6%), with a majority of individuals aged 65 years or older (39.9%). Most respondents resided in towns or suburbs (45.3%), and a large proportion (60.4%) faced moderate or great difficulties in providing necessities with their economic means. The clinical characteristics of the 4,613 study respondents, overall and by NUTS region, are presented in Table 2.

The sociodemographics of the 562 respondents who provided information about their youngest child’s seasonal influenza vaccination status are presented in Supplemental Table S2, while children’s demographics are provided in Supplemental Table S3. Of note, nearly half of the respondents (45.7%) reported that decision-making about child vaccination was equally shared between partners.

Seasonal influenza vaccination status

In order to explore geographical differences in seasonal influenza vaccination status, data about uptake, delay, and refusal were disaggregated by NUTS statistical region. As depicted in Figure 1, 45.7% of the respondents who answered on their own behalf were vaccinated, 21.1% were not vaccinated but would, and 33.2% were not vaccinated and would not. Northeastern Italy had the highest vaccine uptake (54.6%), while Insular Italy had the lowest (39.5%). Central Italy exhibited the highest reluctance to the influenza vaccine (36.7%), while Northeastern had the lowest (28.1%). Data stratified by high-risk target group based on age, clinical status, or profession are illustrated in Figure 2. Among individuals aged 60 years or older, 16.2% did not receive the
vaccine but would have if informed, and 29.8% reported not getting the vaccine and having no intention to. Among all the target groups, children had the lowest vaccine uptake (31.5%). Among occupation categories, vaccine uptake ranged from 41.9% for law enforcement members to 62.2% for medical doctors, while among clinical categories, vaccine uptake ranged from 36.6% for people with BMI $\geq 30$ kg/m$^2$ to 65.1% for people with diabetes. Further stratification of each target group by gender is provided in Supplemental Table S4.

Information about vaccination-priority awareness, worry about getting sick with influenza, and perceived safety of influenza vaccines are shown in Supplemental Figures S1–S6. More specifically, data stratified by statistical region are presented in Supplemental Figures S1–S3, while data stratified by high-risk target group are presented in Supplemental Figures S4–S6. Further stratification of each target group by gender is provided in Supplemental Tables S5–S7.

**Experience with vaccines in general**

As shown in Table 3, 63.0% of the study participants who answered on their own behalf received their influenza vaccine in dedicated hubs, 16.7% in hospitals, and 13.3% from their primary care physician. When asked about their preferred vaccination locations, respondents chose dedicated vaccine hubs in 34.9% of cases, primary care physicians in 29.9%, and hospitals in 17.6%.

![Figure 3. Perception of how easy it is to access healthcare facilities to get a seasonal influenza vaccine among respondents who answered on their own behalf ($n = 4613$), overall and by NUTS statistical region. Notes: Northwestern Italy includes the regions of Piedmont, Aosta Valley, Lombardy, and Liguria; Northeastern Italy includes the regions of Trentino-South Tyrol, Veneto, Friuli-Venezia Giulia, and Emilia-Romagna; Central Italy includes the regions of Tuscany, Umbria, Marche, and Lazio; Southern Italy includes the regions of Abruzzo, Molise, Campania, Apulia, Basilicata, and Calabria; Insular Italy includes the regions of Sicily and Sardinia.](image-url)
As shown in Table 4, among the 562 participants who answered on their children’s vaccination status, vaccine hubs emerged as the preferred vaccination location for children (38.1%), closely followed by family doctors (23.7%).

Figures 3 and 4 summarize respondents’ perceptions of ease of access to vaccination services, with Northeastern Italy (5.1%) and pregnant women (14.3%) reporting the most difficult access to vaccination services. Further stratification of each target group by gender is provided in Supplemental Table S8.

Multivariable regression analysis

The lack of awareness of being in the target groups for seasonal influenza vaccination was significantly associated with an increased probability of both refusal and delay in acceptance (Table 5). Moreover, being female, being between 45 and 54 years of age, living in rural areas, not having an academic education, being unworried about catching the flu, perceiving seasonal influenza vaccination as unsafe, and having friends or relatives against vaccination were significantly associated with a higher probability of refusing vaccination, while significant predictors of delay in acceptance were self-reported difficulty in access to healthcare and living in Southern or Insular Italy. Furthermore, being ≥65 years old, living in Northeastern Italy, being a teacher or HCW, and suffering from cardiac disease or diabetes significantly increased the probability of vaccine uptake. All these significant associations between a predictor and the study outcome were obtained controlled for all the other covariates included in the regressions model, which means that, for instance, the higher probability of vaccine uptake in the Northeast was confirmed even after adjusting for differences in the percentage distribution of other significant covariates such as educational attainment, rural area, gender, teacher, and diabetes.

The analysis of possible interactions effects across covariates revealed that the impact of safety concerns on vaccine refusal was much stronger among the eldest (very safe: 16.7%; quite/very unsafe: 72.2%; Δ = +55.5; 95% CI = 47.2 to 63.8) than among the young (very safe: 23.6%; quite/very unsafe: 37.4%; Δ = +13.7; 95% CI = 4.5 to 23.0) (LR test = 101.0, p-value <.0001). There was also evidence of a significant interaction (LR test = 74.2, p-value <.0001) between age and relatives and friends’ opinions, suggesting that the impact of having friends or relatives against vaccination on refusal was null in individuals aged <45 years (very favorable: 29.4%; unfavorable/very unfavorable: 25.4%; Δ = −4.0; 95% CI = −11.8 to 3.8), strong among those aged ≥65 years (very favorable: 25.6%; unfavorable/very unfavorable: 43.7%; Δ = +18.1; 95% CI = 10.5 to 25.7), and even stronger in those aged 45–64 years (very favorable: 27.9%; unfavorable/very unfavorable: 54.4%; Δ = +26.5; 95% CI = 11.7 to 41.2).
When the analysis was performed on vaccine uptake among children (Table 6), we found that a significant predictor of both refusal and delay in acceptance was not being aware that children had higher priority for seasonal influenza vaccination. Moreover, mothers, ages ≥35 years, living in Northeastern Italy, living in towns, suburbs, or rural areas, not being worried about catching the flu, having safety concerns, and having friends or relatives against vaccination were significantly
Table 6. Results of multivariable multinomial logistic regression analysis: determinants of seasonal influenza vaccine uptake, delay, and refusal among respondents who answered on their children’s behalf (n = 562).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Did get the vaccine</th>
<th>Would get the vaccine</th>
<th>Would not get the vaccine</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Predicted probability</td>
<td>Discrete difference (Δ)</td>
<td>Predicted probability</td>
</tr>
<tr>
<td>Parent’s gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>38.3%</td>
<td>Ref.</td>
<td>24.7%</td>
</tr>
<tr>
<td>Female</td>
<td>26.9%</td>
<td>Ref.</td>
<td>22.9%</td>
</tr>
<tr>
<td>Parent’s age group, y</td>
<td>37.8%</td>
<td>Ref.</td>
<td>25.7%</td>
</tr>
<tr>
<td>18–34</td>
<td>27.8%</td>
<td>−10.0*</td>
<td>24.8%</td>
</tr>
<tr>
<td>35–44</td>
<td>32.2%</td>
<td>−5.6</td>
<td>15.9%</td>
</tr>
<tr>
<td>NUTS statistical region</td>
<td>35.6%</td>
<td>Ref.</td>
<td>23.9%</td>
</tr>
<tr>
<td>Northwestern Italy</td>
<td>35.6%</td>
<td>Ref.</td>
<td>23.9%</td>
</tr>
<tr>
<td>Northeastern Italy</td>
<td>27.5%</td>
<td>−8.0</td>
<td>19.7%</td>
</tr>
<tr>
<td>Central Italy</td>
<td>22.1%</td>
<td>−13.4*</td>
<td>29.8%</td>
</tr>
<tr>
<td>Southern Italy</td>
<td>36.8%</td>
<td>1.2</td>
<td>20.9%</td>
</tr>
<tr>
<td>Insular Italy</td>
<td>31.6%</td>
<td>−4.0</td>
<td>23.7%</td>
</tr>
<tr>
<td>Degree of urbanization†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City</td>
<td>36.5%</td>
<td>Ref.</td>
<td>25.0%</td>
</tr>
<tr>
<td>Town or suburb</td>
<td>29.4%</td>
<td>−7.1*</td>
<td>23.1%</td>
</tr>
<tr>
<td>Rural area</td>
<td>24.8%</td>
<td>−11.7*</td>
<td>23.8%</td>
</tr>
<tr>
<td>Parent’s educational attainment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic/Post-graduate degree</td>
<td>32.1%</td>
<td>Ref.</td>
<td>19.0%</td>
</tr>
<tr>
<td>Up to high school diploma</td>
<td>31.2%</td>
<td>−0.9</td>
<td>25.9%</td>
</tr>
<tr>
<td>Child’s gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>30.8%</td>
<td>Ref.</td>
<td>23.6%</td>
</tr>
<tr>
<td>Female</td>
<td>32.2%</td>
<td>1.4</td>
<td>23.7%</td>
</tr>
<tr>
<td>Child’s age group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 months to 3 years</td>
<td>30.1%</td>
<td>Ref.</td>
<td>24.7%</td>
</tr>
<tr>
<td>4 to 5 years</td>
<td>34.1%</td>
<td>4.0</td>
<td>21.7%</td>
</tr>
<tr>
<td>Worry about catching the flu</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very/Quite worried</td>
<td>34.3%</td>
<td>Ref.</td>
<td>35.5%</td>
</tr>
<tr>
<td>A little worried</td>
<td>29.3%</td>
<td>−5.0</td>
<td>21.4%</td>
</tr>
<tr>
<td>Not worried</td>
<td>34.8%</td>
<td>0.5</td>
<td>7.7%</td>
</tr>
<tr>
<td>Perception of vaccine safety for the child</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very safe</td>
<td>54.5%</td>
<td>Ref.</td>
<td>32.2%</td>
</tr>
<tr>
<td>Quite safe</td>
<td>30.0%</td>
<td>−24.5*</td>
<td>29.9%</td>
</tr>
<tr>
<td>Quite/Very unsafe</td>
<td>17.7%</td>
<td>−36.8*</td>
<td>5.0%</td>
</tr>
<tr>
<td>Dear ones’ views on vaccination in general</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very favorable</td>
<td>33.0%</td>
<td>Ref.</td>
<td>30.2%</td>
</tr>
<tr>
<td>Favorable</td>
<td>29.9%</td>
<td>−3.1</td>
<td>25.0%</td>
</tr>
<tr>
<td>Quite favorable</td>
<td>35.1%</td>
<td>2.1</td>
<td>19.3%</td>
</tr>
<tr>
<td>Quite to very unfavorable</td>
<td>23.2%</td>
<td>−9.8</td>
<td>18.0%</td>
</tr>
<tr>
<td>Awareness that the child has priority for vaccination</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>49.2%</td>
<td>Ref.</td>
<td>20.3%</td>
</tr>
<tr>
<td>No</td>
<td>10.5%</td>
<td>−38.7*</td>
<td>30.1%</td>
</tr>
<tr>
<td>Don’t know</td>
<td>14.1%</td>
<td>−35.1*</td>
<td>30.9%</td>
</tr>
<tr>
<td>Perceived ease of access for the child to get the vaccine</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very easy</td>
<td>27.4%</td>
<td>Ref.</td>
<td>21.7%</td>
</tr>
<tr>
<td>Quite easy</td>
<td>31.4%</td>
<td>4.0</td>
<td>23.6%</td>
</tr>
<tr>
<td>Quite/Very difficult</td>
<td>41.3%</td>
<td>14.0*</td>
<td>25.1%</td>
</tr>
</tbody>
</table>

*P-value ≤.05, that is, Δ significantly ≠ 0.
†According to the Eurostat Degree of Urbanization (DEGRUBA) classification system based on 2011 population grids and 2018 administrative boundaries.

associated with a higher probability of refusing vaccination while reporting difficulties in access to healthcare was significantly associated with a higher probability of vaccination.

Discussion

This cross-sectional study sheds light on the vaccination uptake among various target groups recommended for the influenza vaccine in Italy, supplementing what is already mapped by the Italian Ministry of Health, which focuses solely on the general public and the ≥ 65 age group. The findings from the OBVIOUS project offer valuable insights into the possible reasons for low vaccination uptake among these groups.

One key finding is that HCW, teachers, and LEMs often lacked awareness of the recommendation for influenza vaccination or even doubted its safety. As a result, HCWs, other than medical doctors, and LEMs, were the ones with the highest percentages of influenza vaccine refusal. Alas, both professional groups also had non-negligible percentages of people who would have gotten the vaccine should they had known they could. This knowledge gap presents an opportunity for Italian decision-makers and public health professionals to develop tailored information campaigns.

Since vaccine uptake can be
influenced by practical factors, such as the convenience of health services, this study also explored people’s preferences for vaccination locations. Although the data was collected shortly after the massive COVID-19 vaccine campaign, the preference for dedicated hubs suggests that an annual opening of flu-dedicated hubs could help increase vaccine uptake. Additionally, the primary care physician’s clinic was the second preferred location, emphasizing their crucial role in promoting vaccination uptake.\textsuperscript{19,20}

To effectively enhance uptake, strategies should address people’s perceptions of vaccine safety.\textsuperscript{21} Our findings reveal that one in five respondents with respiratory diseases, LEM, or HCWs (excluding MDs) did not consider the vaccine safe. Targeting these demographics with campaigns that stress the vaccine’s safety profile could be beneficial. Furthermore, multivariable analyses showed that individuals aged 65 years or older often did not receive the vaccine due to safety concerns and were strongly influenced by close friends’ and relatives’ opinions. Policymakers could prioritize efforts to improve coverage among these demographics by launching targeted awareness campaigns that provide accurate information about vaccine safety and address people’s concerns.\textsuperscript{22,23} Such campaigns might lead to social and economic gains for the national health service, as the elderly are most susceptible to life-threatening consequences related to influenza.\textsuperscript{24,25}

Interestingly, our data also revealed that mothers aged 35 or older with difficulty accessing healthcare facilities, and living in northeastern Italy, were more likely to get vaccinated. This phenomenon warrants further investigation, as identifying the specific causes of increased uptake could inform strategies to enhance vaccine coverage. Finally, the Northeast regions of Italy showed the highest vaccine uptake rates, as confirmed by our regression analysis. Consequently, regions with comparatively lower vaccine coverage could consider emulating the vaccination policies implemented in Northeast Italy to enhance their own vaccine coverage rates.

Limitations and strengths

This study has several limitations. First, the cross-sectional design precludes causal inferences. Second, the online survey relies on self-reported data, which may be subject to reporting biases. Third, the over-representation of lower socioeconomic classes in the sample (60.4% reporting economic struggles) could limit generalizability. Fourth, economic status was assessed through perceived income adequacy rather than actual family income, as the latter is a sensitive topic that may compromise survey completion. Fifth, the survey did not consider the gestational age of pregnant women or all immunocompromised individuals, despite their prioritization by the Italian Ministry of Health. Lastly, the decision to prioritize brevity in the survey design may have introduced selection bias, particularly when interpreting children’s data, and removing questions investigating transportation, which may be a barrier to getting the vaccine for some.

Despite these limitations, this is the first study to provide comprehensive data from a large national sample of individuals recommended and offered seasonal influenza vaccination in Italy.

Conclusions

As low influenza vaccine uptake contributes to population morbidity and mortality, this study offers valuable insights to inform program planning and guide policymakers’ decisions. The nationwide disaggregated analysis of influenza vaccine uptake by sex, age, geographic area, and risk category (health or occupational), as well as the focus on behavioral and social determinants of uptake, highlights key areas for intervention to improve influenza vaccination coverage in Italy.

Disclosure statement

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ORCID

Giorgia Soldà \( \text{http://orcid.org/0000-0002-5951-1062} \)

Author contributions


References

Appendix

Questionnaire

1. **Sex**
   - Male
   - Female

2. **Year of birth**
   Free text: YYYY
   - (i) over 60 (since 1961) [Influenza target]
   - (ii) over 64 (since 1957) [Influenza target]
   - (iii) 18-27 (2003 to 1990)

3. **Education level**
   - A. Elementary/middle school
   - B. High school
   - C. University
   - D. Postgraduate education

4. **What is the postcode of the area you live in?**
   Free field: postcode (e.g. 40126)

5. **Occupation**
   - A. Student
   - B. Doctor [Influenza target]
   - C. Other health worker [Influenza target]
   - D. Law enforcement [Influenza target]
   - E. Teacher [Influenza target]
   - F. Employed (other category than above)
   - G. Unemployed
   - H. Retired

6. **Who do you live with?**
   - A. I live alone
   - B. I live as a couple
   - C. I live with my family of origin
   - D. Other

7. **With the financial resources available to you (from your own or your family’s income) can you meet the needs of your current living situation?**
   - A. grade 1 (with many difficulties)
   - B. grade 2
   - C. grade 3
   - D. grade 4
   - E. grade 5 (with no difficulties)

8. **Do you have any children?**
   - A. Yes [Children]
   - B. No

9. **[Children] What is the sex of your youngest child?**
   - A. M
   - B. F

10. **[Children] Date of birth of the youngest child:**
    Free field: DD/MM/YYYY
    - (i) 2 - 2.5 months
    - (ii) 2.5 - 6 months
    - (iii) 6 months - 4 years [Influenza target]
    - (iv) 4 years - 6 years [Influenza target]
    - (v) 6 years to 9 years
    - (vi) 9 to 32 years (born from 1990 onwards)

11. **[Children] Who makes decisions about vaccination of your children?**
    - A. Mainly me
    - B. Mainly my partner
    - C. Evenly divided

12. **[Pregnancy] Were you pregnant at the beginning of the influenza epidemic season (October/November 2021)?**
    - A. Yes [Influenza target]
    - B. No

13. **Due to a physical/psychological/sensory disability, do you have difficulties completing daily tasks such as going to the doctor or buying groceries?**
    - A. Yes
    - B. No

14. **Weight**
    - Free range: kg (e.g. 77)

15. **Height**
    - Free range: cm (e.g. 130) - BMI[(kg/(m^2))] > 30 [Influenza target]

16. **Do you have chronic respiratory diseases (i.e.: severe asthma, bronchopulmonary dysplasia, cystic fibrosis and chronic obstructive pulmonary disease-BPCO)?**
    - A. Yes [Influenza target]
    - B. No

17. **Do you have any cardiovascular chronic diseases (i.e.: congenital and acquired heart disease)?**
    - A. Yes [Influenza target]
    - B. No

18. **Are you diabetic?**
    - A. Yes [Influenza target]
    - B. No

19. **In which of the following facilities did you have most of your vaccinations?**
    - A. in a hospital
    - B. in a pharmacy
    - C. at your family doctor’s
    - D. in a vaccination hub
    - E. at home
    - F. at work

20. **If you could choose, in which facility/place would you prefer to receive a vaccination?**
    - A. in a hospital
    - B. in a pharmacy
    - C. at your family doctor’s
    - D. in a vaccination hub
    - E. at home
    - F. at work

21. **How do your family and friends feel about vaccinations?**
    - A. grade 1 (strongly disagree)
    - B. grade 2
    - C. grade 3
    - D. grade 4
    - E. grade 5 (strongly agree)

22. **Have you had a flu vaccine during the vaccination season 2021?**
    - A. Yes
    - B. No [NoFlu]
    - I don’t know what it is — close section

23. **[NoFlu] Would you get a flu shot?**
    - A. Yes
    - B. No

24. **How worried are you about getting the flu?**
    - A. grade 1 (very little)
    - B. grade 2
    - C. grade 3
    - D. grade 4
    - E. grade 5 (very much)

25. **How safe do you think the flu vaccine is?**
    - A. grade 1 (not very safe)
    - B. grade 2
    - C. grade 3
    - D. grade 4
    - E. grade 5 (very safe)

26. **Do you think you are entitled to receive a free flu shot?**
    - A. Yes
    - B. No

27. **How easy do you think it is for you to access facilities to get the flu shot?**
    - A. grade 1 (with many difficulties)
    - B. grade 2
    - C. grade 3
    - D. grade 4
    - E. grade 5 (with no difficulties)