



Monitoring influenza vaccination coverage among healthcare workers during the COVID-19 pandemic: a three-year survey in a large university hospital in North-Western Italy

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Keywords

Influenza vaccination • Healthcare workers • Vaccination coverage • COVID-19 pandemic • Vaccination strategies

Summary

Introduction. Healthcare workers (HCWs) are one of the highest priority groups recommended for seasonal influenza vaccination (SIV). Greater awareness of the importance of influenza vaccination was observed among HCWs after the start of the COVID-19 pandemic. The aim of this study was to analyze SIV coverage rates in the 2019-2020, 2020-2021 and 2021-2022 seasons among HCWs employed at the IRCCS Ospedale Policlinico San Martino in Genoa, in order to observe how coverage has changed since the COVID-19 pandemic began.

Methods. A retrospective, single-center study was conducted among HCWs working at the IRCCS Ospedale Policlinico San Martino in Genoa. The vaccinated population was stratified by gender, age, qualification and area of activity, and the characteristics of vaccinated HCWs were analyzed.

Results. While SIV coverage was below the recommended target in

all seasons, a sharp increase was observed in 2020/2021 (12.8%; 40.9% and 23% in 2019/2020, 2020/2021 and 2021/2022, respectively). The mean and median age of vaccinees also increased during the 2020/2021 vaccination campaign (46.7 and 49 years, respectively) in comparison with the 2019/2020 season (43.5 and 45, respectively). In the 2019/2020 and 2021/2022 seasons, a higher proportion of vaccinees were physicians. Vaccinated females outnumbered males, but the coverage rate resulted greater in males than females in all three seasons. While a higher proportion of vaccinated subjects worked in medical areas, the most evident increase over the three years was seen among subjects working in the services area.

Conclusions. This survey highlights the importance of studying the determinants that influence vaccination adherence and how the COVID-19 pandemic has affected SIV coverage.

Introduction

Influenza is a viral respiratory disease of global importance. Indeed, a study published in 2018 reported that around 1 billion influenza cases worldwide occur each year, 3-5 million of which are severe cases and 290,000-650,000 lead to influenza-related respiratory deaths [1]. Healthcare workers (HCWs) are considered one of the highest priority groups recommended for annual influenza vaccination. After the start of the COVID-19 pandemic, owing to the possible concomitant circulation of influenza viruses and SARS-CoV2, awareness of the importance of influenza vaccination increased among HCWs [2, 3].

The 2009 Council of the EU encouraged Member States to implement national, regional and local plans and policies to improve the seasonal influenza vaccination (SIV) coverage rate among at-risk categories, including HCWs, and also to measure coverage rates. Although almost all European jurisdictions recommend free influenza vaccination for HCWs, less than half of the

Member States are able to report on vaccination coverage among HCWs [4].

As HCWs are often in contact with many people, they run a greater risk of exposure to influenza viruses than the general population. In addition, once infected, they are potential vectors of contagion to their patients [5]. Not only is influenza vaccination among HCWs important in terms of saving financial resources and preventing mortality among patients (6), it also aims to avoid the interruption of essential services for the community [7]. SIV coverage goals have been set at a minimum of 75% and an optimal value of 95% for populations at risk, including HCWs. In Italy, there is no systematic surveillance system for collecting coverage data among HCWs; however, single local studies have reported coverage rates ranging from 5% to 34% in different Regions and hospitals [8, 9]. The mean prevalence of SIV is lower in Italy than in other European countries [10]. HCWs' perception of the risks engendered by influenza varies according to the working setting; for example, differences between tertiary hospitals and community

hospitals have been reported [11, 12]. Moreover, physicians display higher SIV coverage rates than nurses, midwives, nursing assistants and nursing aides [11, 13]. In the 2020/2021 season, the Italian Ministry of Health recommended introducing initiatives to promote SIV of health personnel “on all possible occasions” [14].

Official recommendations for the 2020-2021 season suggest influenza vaccination starting with all children aged six and above who have no known contraindications. The recommendations identified health care workers and the elderly as highly recommended vaccination groups. Other categories covered by the recommendations are: pregnant women, patients with an underlying disorder that can affect the immune response and children mainly those in the 6 months to two years age range.

Several recent studies have shown that the COVID-19 pandemic has improved influenza vaccination rates among HCWs [15, 16]. Among the factors responsible for this more proactive attitude towards influenza vaccination, increased awareness of the severity of symptoms associated with airway infections has been hypothesized [17]. Furthermore, according to some studies, SIV coverage has also been found to have improved in professionals not directly involved in patient care (administrative staff, etc.), suggesting a link between increased SIV coverage and the fear of SARS-CoV-2 infection [18].

To increase the SIV coverage of HCWs, in particular those working in hospitals, a number of initiatives have been implemented and evaluated. According to the Centre for Disease Control and Prevention (CDC), a proven and cost-effective strategy is to administer influenza vaccination on site [19].

The purpose of the present study was to analyze and compare SIV coverage rate in the 2019-2020, 2020-2021 and 2021-2022 seasons in the IRCCS Ospedale Policlinico San Martino in Genoa, in order to observe how HCWs' compliance has changed since the start of the COVID-19 pandemic. The characteristics of vaccinated HCWs were also studied.

Methods

A retrospective, single-center study was conducted among HCWs working at the IRCCS Ospedale Policlinico San Martino in Genoa. This hospital has always been a reference point for the health needs of the citizens of the metropolitan area of Genoa, the regional capital of Liguria, North-Western Italy, which has a population of about 650,000. San Martino is a research and clinical institute officially recognized by the Italian Ministry of Health and specializes in oncology (Istituto di Ricovero e Cura a Carattere Scientifico or IRCCS). Besides these activities, the duties of the hospital also include teaching and academic research in all major fields of medicine, in collaboration with the University of Genoa. Indeed, the centre handles the teaching of clinical medicine for the Medical School and post-graduate training to qualify in all medical specialties and sub-specialties [20].

Most recent studies in the literature suggest that combined interventions can moderately increase SIV coverage among HCWs [11, 21]. For these reasons, the strategies implemented in our hospital in all three years considered in our study were: the offer of on-site vaccination during working hours, the distribution of vaccines provided by the hospital pharmacy, and the publication of ministerial recommendations on the hospital network (hospital Intranet platform). In the 2019/2020 season, the SIV campaign began in the first week of November, while in the following seasons it started one month earlier (first week of October) [22].

This study adopted a retrospective cohort design. When vaccinations were carried out, HCWs' consent forms were collected by the Hygiene and Preventive Medicine Unit. Our dataset included all the consent forms collected in the period 2019-2022, which included three flu seasons: 2019-2020, 2020-2021 and 2021-2022. The administrative databases of the hospital were queried in order to retrieve the data of the HCWs currently employed in the hospital.

The vaccinated population was stratified by gender, age, qualification and area of activity. In terms of qualification, three groups were created: physicians (including resident doctors), nurses and others. The “Others” category included: medical assistants, administrative staff, technicians, pharmacists, biologists, engineers, psychologists, veterinarians and rehabilitation staff. With regard to the area of activity, three categories were identified: medical, surgical and services.

Descriptive statistics were reported for the collected variables: quantitative variables were summarized with median and interquartile range, while for describing qualitative variables, absolute and relative (percentage) frequencies were reported.

Associations between vaccination status and other characteristics were tested by mean of chi-square tests.

As this was a non-interventional study involving the analysis of routinely collected data, no ethical approval was required.

Results

The study considered a total of 6194 HCWs employed at the IRCCS Ospedale Policlinico San Martino in Genoa for whom records were available for all three seasons. Table 1 shows the characteristics of the vaccinated HCWs and the vaccination coverage rates in the three-year period. Data on the last three flu seasons (2019/2020, 2020/2021 and 2021/2022) are reported.

A total of 4753 influenza vaccinations were carried out during the entire three-year period: 794 in the 2019/2020 season, 2536 in 2020/2021 and 1423 in 2021/2022. Vaccination coverage rose from 12.8% in 2019/2020 to 40.9% during the 2020/2021 season. The rate subsequently fell to 23.0% in the 2021/2022 season. Both the increase between the 2019/2020 and 2020/2021 vaccination coverage rates and the decrease

Tab. I. Characteristics of vaccinated HCWs: 2019/2020, 2020/2021 and 2021/2022 seasons.

	2019/2020 season	2020/2021 season	2021/2022 season
Total HCWs vaccinated (n)	794	2536	1423
Total hospital HCWs (n)	6194	6194	6194
Vaccination coverage rate (%)	12.8	40.9	23.0
Gender (n, %)			
Total male vaccinated (n)	277	924	512
Total hospital male (n)	2120	2120	2120
Vaccination coverage rate in male (%)	13.1	43.6	24.2
Total female vaccinated (n)	517	1606	911
Total hospital female (n)	4074	4074	4074
Vaccination coverage rate in female (%)	12.7	39.4	22.4
Age of vaccinated HCWs			
Mean, SD	43.6	12.34	46.7
Median, IQR	45	31-54	49
18-39 (n, %)	311	39.1	755
40-59 (n, %)	392	49.4	1420
>60 (n, %)	91	11.5	345
Missing	-	-	16
Qualification of vaccinated HCWs (n, %)			
Physicians	447	56.3	854
Nurses	249	31.4	886
Other	97	12.2	634
Missing	1	0.1	162
Area of activity of vaccinated HCWs (n, %)			
Medical area	478	60.2	1117
Surgical area	209	24.2	614
Services area	107	13.5	664
Missing	-	-	141

observed during the following year resulted statistically significant ($P < 0.01$).

Regarding the gender of the vaccinated HCWs, more females than males were vaccinated in all three seasons. For both gender, vaccination coverage rose from 2019/2020 to 2020/2021 and then decline from 2020/2021 to 2021/2022. Vaccination coverage in males was greater than in females for all the three seasons. A statistically significant difference in vaccine coverage rates between males and females was observed in the 2020/2021 season.

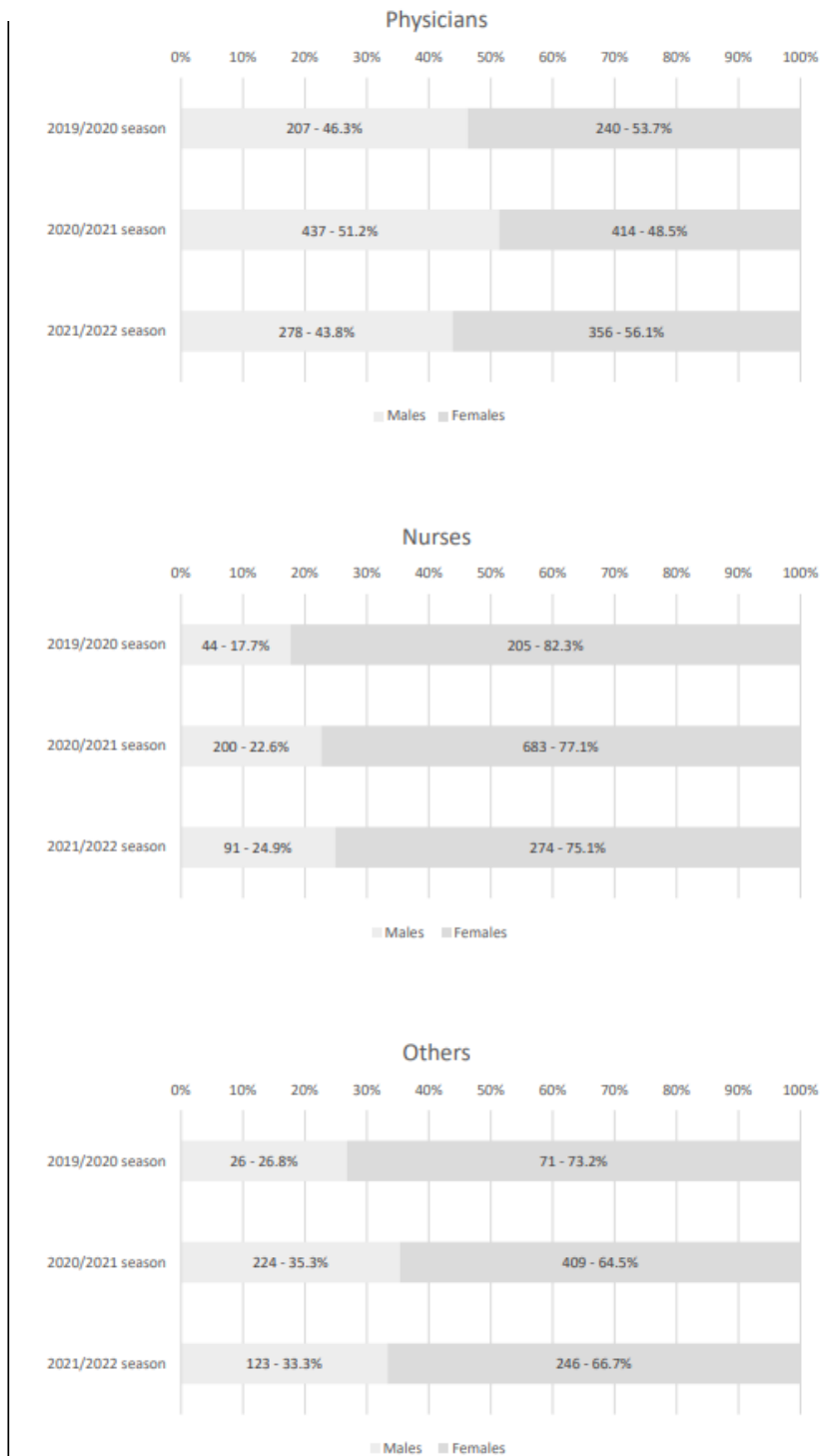
Both the mean and median ages were higher in the 2020/2021 season (46.7 and 49, respectively) than in the 2019/2020 season (43.6 and 45 respectively). In the 2021/2022 season, however, the mean (44.9) and median (47) ages declined. Both the increase in mean age from 2019/2020 to 2020/2021 and its decrease from 2020/2021 to 2021/2022 were statistically significant ($P < 0.01$).

Data on age were missing in 16 subjects in the 2020/2021 season and in 85 subjects in the 2021/2022 season. In all three seasons, the percentage of vaccinated subjects was higher among those aged between 40 and 59 years. The

highest percentage of vaccinated subjects aged between 40 and 59 years was observed in the 2020/2021 season (56%), while the lowest percentage (43.6%) in this age-group was seen in the 2021/2022 season; in 2019/2020, the figure was 49.4%.

Concerning the occupational categories of the HCWs, physicians displayed the highest coverage rates in the 2019/2020 and 2021/2022 seasons. The difference between categories was greatest in the year before the start of the COVID-19 pandemic, the percentages being 56.3% in physicians, 31.4% in nurses and 12.2% in the category “others”. The 2020/2021 season saw a decrease in the differences between the occupational categories (33.7%, 34.9% and 25% among physicians, nurses and others, respectively). In the last season, however, the initial differences partially re-emerged (44.6%, 25.6% and 25.9% in physicians, nurses and others, respectively). In all three vaccination campaigns, a higher proportion of vaccinated subjects worked in medical areas (60.2, 44 and 52.1% in 2019/2020, 2020/2021 and 2021/2022, respectively). The most evident increase in the proportion of vaccinees was observed among subjects working in the service area: 13.5% in 2019/2020, 26.2% in 2020/2021

Fig. 1. Characteristics of vaccinated HCWs, stratified by occupational category and gender: 2019/2020, 2020/2021 and 2021/2022 seasons.

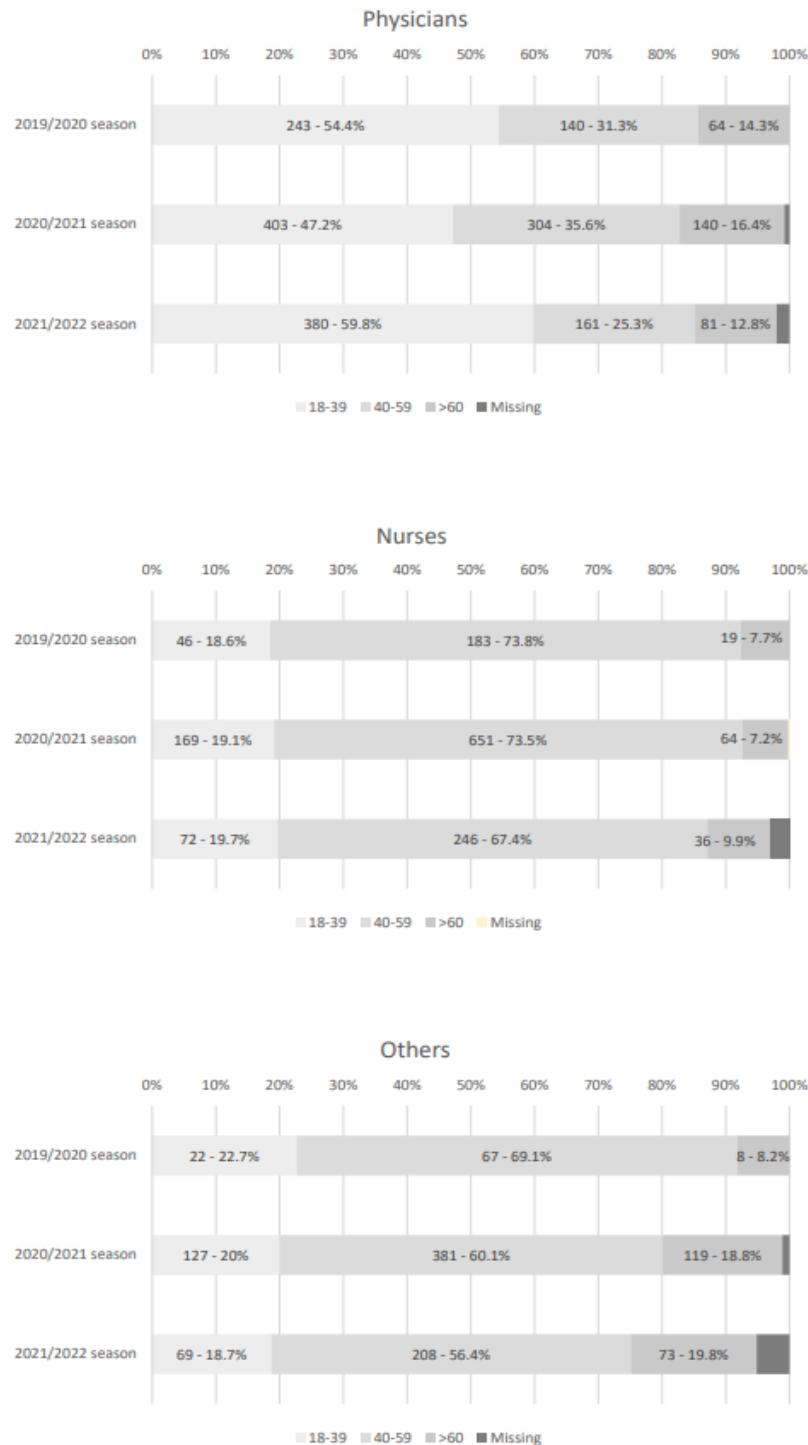


and 30.6% in 2021/2022. Conversely, a decrease was observed in the last two seasons among those working in the surgical area (24.2% in 2020/2021 and 17.2% in 2021/2022). Figure 1 shows the populations of physicians, nurses and “others” vaccinated in the three-year period, divided by gender.

Among physicians, males accounted for 46.3 and 51.2% of vaccinees in the 2019/2020 and 2020/2021 seasons,

respectively, and females for 53.7 and 48.5%. The greatest gender difference was seen in the last influenza season (43.8% males and 56% females in 2021/2022). Regarding the population of nurses and “others”, a higher proportion of vaccinees were females in all three influenza seasons. In the population of nurses, the proportion of vaccinated males steadily increased over the three-year period (from 17.7% in 2019/2020 to 24.9% in 2021/2022). In the

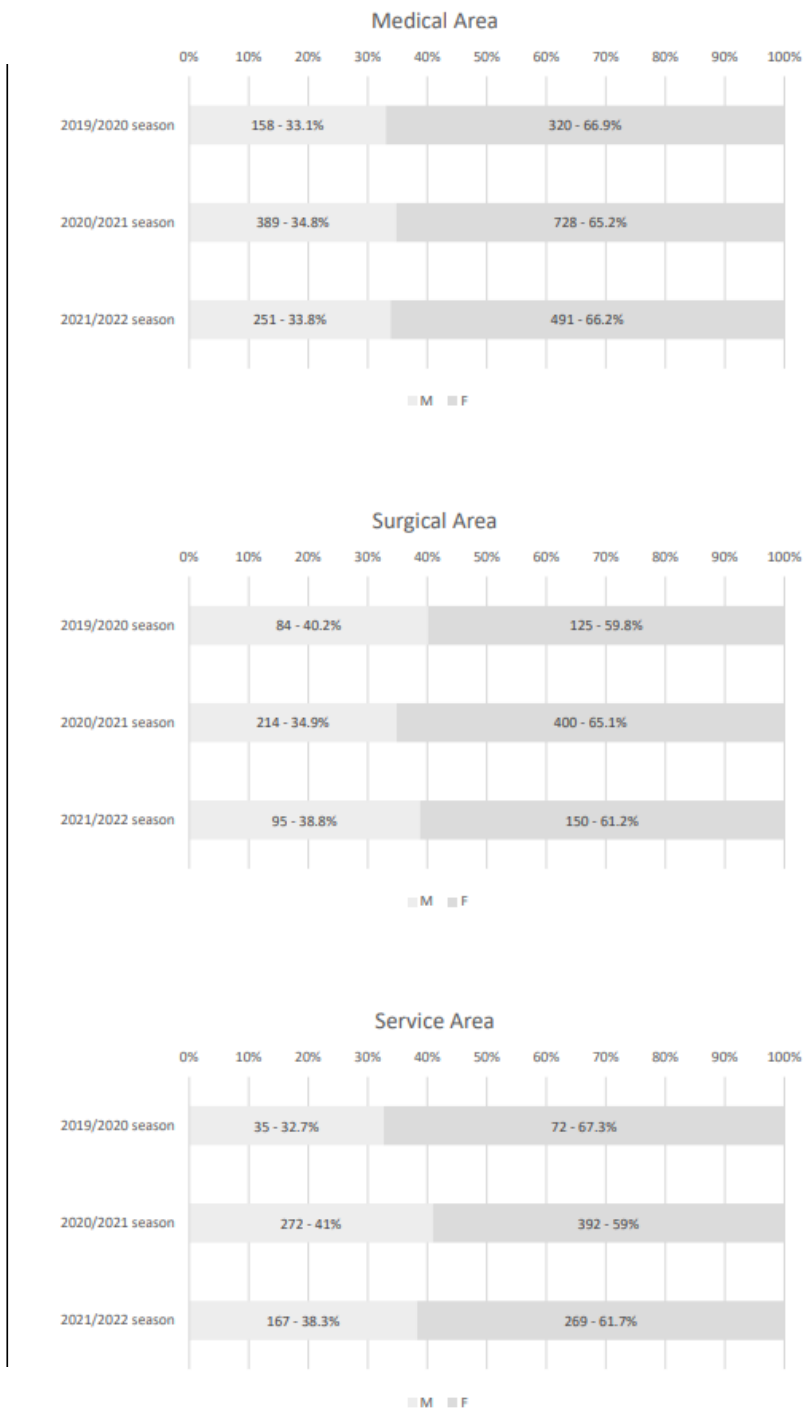
Fig. 2. Characteristics of vaccinated HCWs, stratified by occupational category and age-group: seasons 2019/2020, 2020/2021 and 2021/2022.



category “others”, the proportion of vaccinated males increased in 2020/2021 and then decreased in 2021/2022, though remaining above the initial level (26.8%, 35.3%, 33.3% in the seasons 2019/2020, 2020/2021 and 2021/2022, respectively). Figure 2 shows the populations of vaccinated physicians, nurses and “others”, stratified into three age-groups: 18-39, 40-59 and > 60 years.

With regard to physicians, the largest proportion of vaccinees belonged to the youngest age-group in all three seasons, (54.4%, 47.2% and 59.8% in 2019/2020, 2020/2021 and 2021/2022, respectively). The difference in the distribution of proportions of the young and the middle age groups in the physician’s population over the past two seasons was statistically significant ($P < 0.01$).

Fig. 3. Characteristics of vaccinated HCWs, stratified by area of activity and gender: seasons 2019/2020, 2020/2021 and 2021/2022.

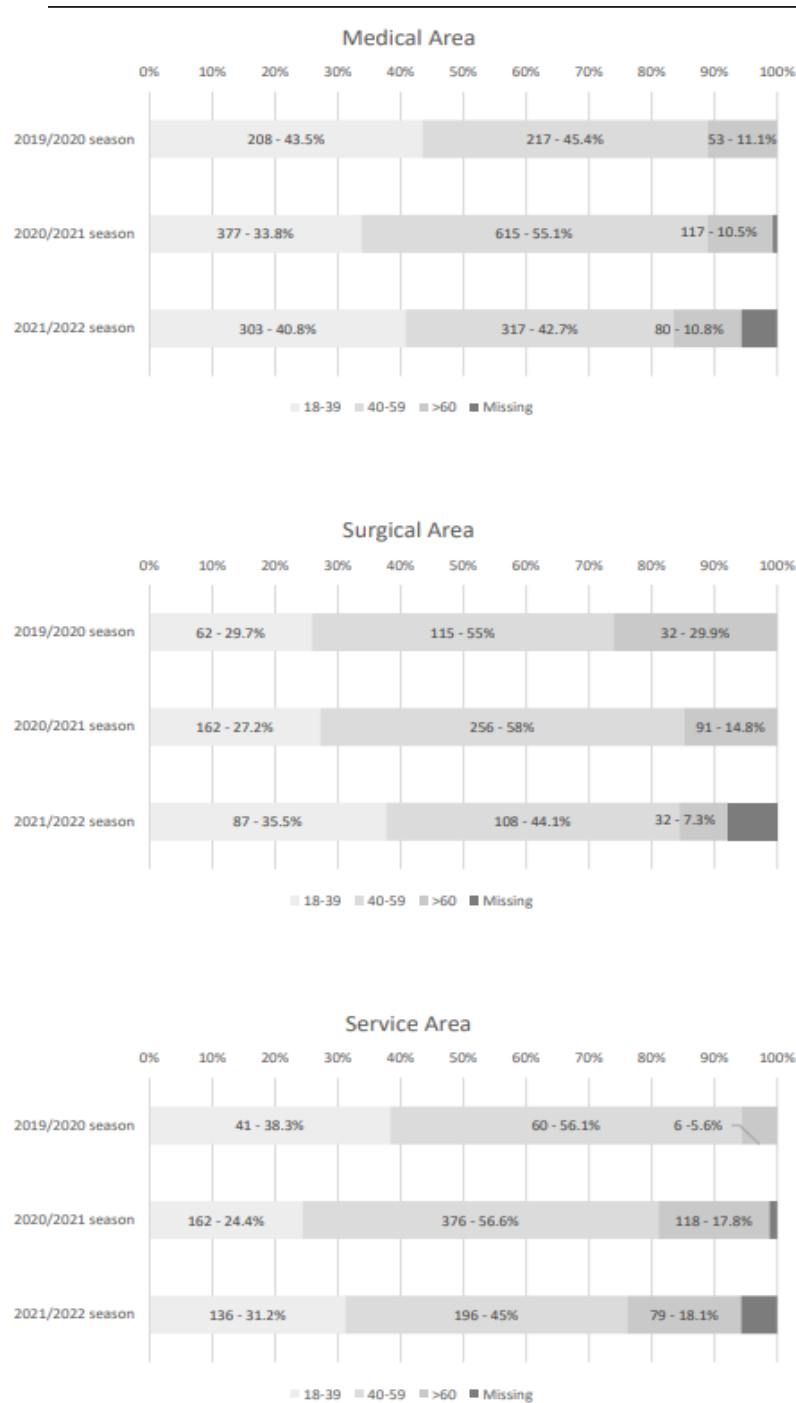


Regarding both nurses and “others”, the largest proportion of vaccinees was seen in the intermediate age-group (40-59 years): 73.8%, 73.5% and 67.4% of vaccinated nurses and 69.1%, 60.1% and 56.4% of “others” in the 2019/2020, 2020/2021 and 2021/2022 seasons, respectively. Among physicians, the oldest age-group (> 60 years) remained almost constant over the three years studied. Among nurses, the oldest group showed a slight increase (7.7%, 7.2% and 9.9% in the 2019/2020,

2020/2021 and 2021/2022 seasons, respectively). The greatest increase in this age-group 60 was seen in the category “others”: from 8.2% in 2019/2020 to 18.8% in 2020/2021 and 19.8% in 2021/2022.

The HCWs’ areas of activity were grouped into three categories: medical, surgical and services. Within these categories, vaccinees were divided according to gender, and the proportions of males and females vaccinated during the three years were observed (Fig. 3).

Fig. 4. Characteristics of vaccinated HCWs, stratified by areas of activity and age-group: seasons 2019/2020, 2020/2021 and 2021/2022.



In all areas, the proportion of vaccinated females exceeded 50% in all seasons surveyed. In the medical area, the male/female ratio remained fairly constant. In the surgical area, the percentage of vaccinated males decreased in the 2020/2021 season, but increased again in the following season (40.2%, 34.9% and 38.8% in the 2019/2020, 2020/2021 and 2021/2022 seasons, respectively). In the services area, males accounted

for 32.7%, 41% and 38.3% of vaccinees in 2019/2020, 2020/2021 and 2021/2022, respectively. The vaccinated population in each area of activity was also stratified by age-group (Fig. 4). In all three flu seasons, the proportion of vaccinees in the 40-59 age-group was the highest. The greatest increase (+9.7%) in the proportion of vaccinees in this age-group was seen in the medical area: from 45.4% in 2019/2020 to 55.1% in 2020/2021 ($P < 0.01$). In the services area,

the proportion of vaccinated subjects belonging to the > 60 age-group rose from 5.6% in 2019/2020, to 17.8% in 2020/2021 (+ 12.2%, $P < 0.01$) and 18.1% in 2021/2022. Instead, for the surgical area, the proportion of > 60 age group decreased from 29.9 to 14.8% and the decline of this proportion was statically significant ($P < 0.01$).

Discussion

This study evaluated SIV coverage rates among HCWs at the IRCCS Ospedale Policlinico San Martino in Genoa in the last three flu seasons (2019/2020, 2020/2021 and 2021/2022). The percentage of HCWs who underwent vaccination was unstable over the years.

The study confirmed the low compliance of Italian HCWs with the national and international recommendations for SIV. Indeed, the overall SIV coverage rates observed were below the recommended threshold in all seasons (12.8%; 40.9%; 23%). In Italy, current coverage data are not available, but these results agree with the findings of other Italian studies, which show that HCWs' knowledge and coverage of recommended vaccinations are often insufficient [9, 23]. Moreover, the results of our study agree with those of a 2010 review by Prato R et al. [24], which found that SIV coverage among Italian HCWs in the period 1999-2007 ranged between 12% and 37%.

As revealed by the recent literature [18, 25, 26, 27], influenza vaccination rates showed an increasing trend in the first influenza season following the start of the COVID-19 pandemic.

In our hospital, a higher proportion of physicians than other professionals were vaccinated in the 2019/2020 and 2021/2022 seasons. This result agrees with literature reports that physicians are more inclined to accept seasonal influenza vaccination than other HCWs [28].

Among vaccinated HCWs, females outnumbered males in all categories studied, but the coverage rate resulted greater in males than females in all the three seasons.

Regarding gender, according to some studies, female HCWs are less likely to be vaccinated than male HCWs [29]. Indeed, in an Italian survey conducted during the 2009-2010 A/H1N1 influenza pandemic, males were more likely than females to be vaccinated and to perceive vaccination as more effective [30]. A statistically significant difference in vaccine coverage rates between males and females was observed in the first influenza season after the start of COVID-19 pandemic; this can be partly explained by the fact that the risks of COVID-19 disease have been indicated in the literature as being greater for males [31]; males may therefore feel at higher risk.

The increase in the mean and median ages of vaccinated subjects suggests that the COVID-19 pandemic may have had a greater influence on the older population, owing to their heightened perception of risk, as evidenced by other studies [32]. The vaccines in each occupational category and area of activity were stratified in three age-groups (18-39, 40-59 and > 60 years).

The category of nurses displayed less variation in the percentages of vaccinees in the various age-groups in the three seasons. By contrast, in the 2020/2021 season, physicians and "others" displayed an increase in the percentages of vaccinees in the 40-59 and > 60-year age-groups, respectively. This could mean that, after the start of the COVID-19 pandemic, older physicians and older "other" professionals were more compliant with influenza vaccination, while older nurses did not show a similarly sustained increase in SIV compliance. Our results confirm what was observed in a survey published in 2021 by Kwok et al. [33], which reported low compliance with influenza vaccination among older nurses.

Regarding the areas of activity, in both the medical and surgical areas, the proportion of vaccinees in the 40-59 age-group increased markedly from the 2019/2020 season to the 2020/2021 season. This finding, however, needs to be further investigated, as the distribution of age-groups in the different areas of activity may have been affected by the unequal representation of the various occupational categories.

The main limitation of this study is that the number of employees of the Polyclinic was considered constant throughout the three seasons. However, new employees in the years 2020 and 2021 accounted for less than 3% of the total. Moreover, as data were collected retrospectively, some information was missing. Despite this limitation, the data were processed by means of company software and, with regard to the latest anti-flu campaign, the regional internet platforms were used for the purpose of creating the database. Another limitation is that HCWs may have been vaccinated outside our hospital; thus, the SIV coverage data may be underestimated. Finally, as this was a single-center study, the data refer to a single hospital. However, our Polyclinic is representative of many national and international hospitals, since it is a university hospital, committed to research and training.

Conclusions

The study of adherence to influenza vaccination among HCWs has aroused increased interest in recent years. The goal of such studies is to evaluate the coverage and effectiveness of vaccination campaigns, and to identify new strategies to reduce vaccine hesitancy [34]. In the literature, SIV coverage among healthcare professionals continues to be unsatisfactory, a finding which was also confirmed in our study.

In agreement with the recent literature, we observed that the COVID-19 pandemic was an incentive for HCWs to undergo flu vaccination. However, in the years following the start of the pandemic, adherence to vaccination declined. It is important to study the determinants that influenced the increased compliance with influenza vaccination, in order to develop vaccination strategies. Our results confirm that being a physician increases the likelihood of adhering to flu vaccination. In addition, we observed that the average age of vaccinated subjects

increased after the start of the COVID-19 pandemic; this finding confirms the greater propensity for vaccination among older subjects.

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Conflicts of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Authors' contributions

M.O., A.D., A.O.: conceptualization; M.O., A.D., A.O.: methodology; M.O., R.B.: formal analysis; M.O., R.B., E.C., A.F., E.M., V.T.: investigation; G.I., A.O.: resources; L.S., A.D., P.D.: data analysis; M.O., A.O.: writing-original draft preparation; M.O., L.S., A.D., P.D., G.I., A.O.: writing-review and editing; M.O., R.B., E.C., A.F., E.M., L.S., A.D., V.T., P.D., G.I. and A.O.: visualization; A.O.: supervision.

All authors have read and agreed to the current version of the manuscript.

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