HUMAN VACCINES & IMMUNOTHERAPEUTICS
2019, VOL. 15, NO. 12, 2927–2932
https://doi.org/10.1080/21645515.2019.1625645

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RESEARCH PAPER

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Influenza vaccination in health-care workers: an evaluation of an on-site vaccination strategy to increase vaccination uptake in HCWs of a South Italy Hospital

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ABSTRACT

Despite the international recommendation and specific programs, and although the vaccination of health-care workers (HCWs) is considered the main measure to prevent nosocomial influenza, vaccination coverage (VC) among HCWs remains low. One of the most important barriers to vaccination uptake is the time required to attend a vaccination clinic. Centers for Disease Control and Prevention (CDC) recommends on-site influenza vaccination as a proven and cost-effective strategy that increases productivity, reduces overall absenteeism and prevents direct health-care costs. In order to increase vaccine compliance in the HCWs, the Hygiene and the Occupational Medicine departments of Bari Policlinico General University-Hospital, in the 2017/18 influenza season, promoted an on-site vaccination program in eight Operative Units (OUs). We investigated the influenza VC among HCWs of Bari Policlinico (n = 3,397), comparing VC after implementation of the on-site strategy by the Hygiene department during the 2017/18 influenza season to VC in 2016/17 season. For 2017/18 season, we also compared VC in OUs target of on-site strategy with data from in eight "control" Units (choose by simple random sampling) not included in the on-site offer. In the 2016/17 influenza season, 295/3,397 HCWs were vaccinated (VC: 8.7%) while in the 2017/18 season 482 HCWs (VC: 14.2%) received the vaccination. In OUs target of on-site vaccination, 71 HCWs (VC: 10.0%) were vaccinated in the 2016/17 season and 126 (18.0%) in the 2017/18 season, of which 101/126 (80.2%) were vaccinated in an on-site clinic. VC in OUs target of on-site vaccination increased between 2016/17 and 2017/18 seasons of 16.8 ± 10.4% (range: 5.5–37.1), while the coverage in OUs of the control group increased of 1.6 ± 2.2% (range: −1.7–4.5), with a significant difference ($p < .05$). Our study suggests that the offer of on-site vaccination during the 2017/18 season led to an increase of VC in HCWs compared to the classical vaccination clinic approach. The determinants of adhesion and not-adhesion must be analyzed in dept, to experiment, in the future, new good clinical practices to increase the vaccination coverage in HCWs.

ARTICLE HISTORY
Received 25 February 2019
Revised 7 May 2019
Accepted 22 May 2019

KEYWORDS
Healthcare workers vaccination; influenza; on-site offer

Introduction

The vaccination of the health-care workers (HCWs) is an effective measure of individual and collective protection; it helps to protect the HCW from the infectious professional risk and patients from the hazard of infection in the nosocomial environment. High vaccination coverage among HCWs avoids the discontinuation and guarantees the quality of the services offered.[1]

In Italy, the regulation of HCWs vaccination is provided by Legislative Decree 9 April 2008 n. 81 [2] that recommends the active offer of influenza vaccine to health-care professionals every year in the influenza season, from October to December; official recommendations for health personals' immunization are also reported in the National Immunization Plan and in annual influenza prevention guidelines provided by Italian Ministry of Health, [3,4] that include HCWs among the risk categories for which influenza vaccination is strongly recommended.

HCWs, involved in the care of patients, are constantly in contact with a large number of people (family members, sick people, other HCWs) and they are at major risk of exposition to influenza viruses, higher than the risk for general population. Finally, if infected (ill o in incubation) they are potential vectors of contagion.[5]

In Italy, many studies have been carried out to evaluate the adhesion of HCWs to the influenza vaccination, since no current coverage data are available because a national system for the collection of the coverage achieved is not planned by the Ministry of Health. According to a 2014 review of Prato R et al.[6] the vaccination coverage among Italian HCWs ranged from 12% to 37% in period 1999–2007. A 2015 study, [7] involving 2,198 HCWs (65.2% nurses, 22.6% physicians and 12.2% other hospital staff) of 51/69 (73.9%) Apulian hospitals, showed an influenza vaccination coverage in the 2013/14 season of 24.5% among the operators of the medical units, 26.0% of the surgical units and 24.3% for the intensive care onset. Higher adhesion to influenza vaccination was associated with being physicians in comparison to other categories, a longer professional career and having received the

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recommendation to perform vaccination by the occupational physician or General Practitioner (GP). A 2016 survey[8] interviewed via web 84 HCWs who worked in a hospital; 64.3% of enrolled subjects recognized influenza disease as a major professional risk for HCWs and almost 56% received the influenza vaccination in the season previous the interview.

The causes of poor vaccine compliance by HCWs have been investigated in many studies, according that vaccine hesitancy is associated to lack or inadequate awareness campaigns, insufficient health education regarding vaccine effectiveness and adverse reactions, perceiving of not being included in the at-risk category, not having been previously vaccinated against influenza, lack of influenza experience in the past, lack of access to vaccination facilities and socio-demographic variables.[9–12] One of the most important determinants of not adhesion is not having the time to attend the vaccination clinic.[9–12]

Among the policies recommended by international Public Health organizations to improve vaccination coverage among HCWs, on-site influenza vaccination (as described by the Centers for Disease Control and Prevention – CDC), is a proven and cost-effective strategy that increases productivity, reduces overall absenteeism and prevents direct health-care costs.[13] This strategy requires that physicians attend, in well-defined days and time slots, directly to the Operational Units (OUs) of a hospital in which the HCWs wishing to join the vaccination campaign, with the aim of covering as many Departments as possible.

In order to increase vaccine compliance in the HCWs and to ensure high influenza vaccine coverage in the nosocomial environment, the Hygiene and the Occupational Medicine departments of Bari Policlinico General University-Hospital (Apulia, South Italy, ˜4,000,000 inhabitants), in the 2017/18 influenza season, implemented a new operative procedure that included on-site vaccination in some OUs.

The aim of our study is to investigate the influenza vaccination coverage among HCWs of Bari Policlinico General University-Hospital, comparing the effect of the on-site strategy set by Hygiene department in 2017/18 influenza season to the results of previous influenza season, in which the classical model (invitation to the vaccination clinic) was carried out.

Results

In the 2016/17 influenza season, 295 HCWs were vaccinated (VC: 8.7%) and in the 2017/18 season 482 HCWs (VC: 14.2%). The vaccination coverage per clinical specialty is described in Figure 1; VC of the medical specialties in the 2017/18 influenza season doubles that one of the 2016/17 season.

Characteristics (gender, age, professional category, chronic diseases) of vaccinated HCWs in both seasons are described in Table 1.

Regarding the safety of the vaccination, in the 2 weeks of follow-up we did not find any serious and/or long-term adverse reaction. The most common reactions reported were pain at the injection site and rarely (<1/100) mild fever (<38°C). All the adverse events were resolved without sequelae.

In the 2016/2017 influenza season, the HCWs in the OUs target of on-site vaccination were 707, while in the following season they were 700 units ;[14] 71/707 HCWs (VC: 10.0%) were vaccinated in 2016/17 season and 126/700 HCWs (18.0%) in the 2017/18 season, of which 101/126 (80.2%) in the context of on-site offer. We observed an increase of people vaccinated in all professional categories in the 2017/2018 season: 26.0% in physicians, 5.2% in nurses and 10.8% in HCWs with another task (Table 2).

The vaccine coverage achieved in each Operative Units target of on-site offer is described in Figure 2.

VC in OUs target of on-site vaccination increased between 2016/17 and 2017/18 seasons of 16.8 ± 10.4% (range: 5.5–37.1), while the coverage in control group OUs (in which HCWs only received the invitation to perform the vaccine in the Hygiene

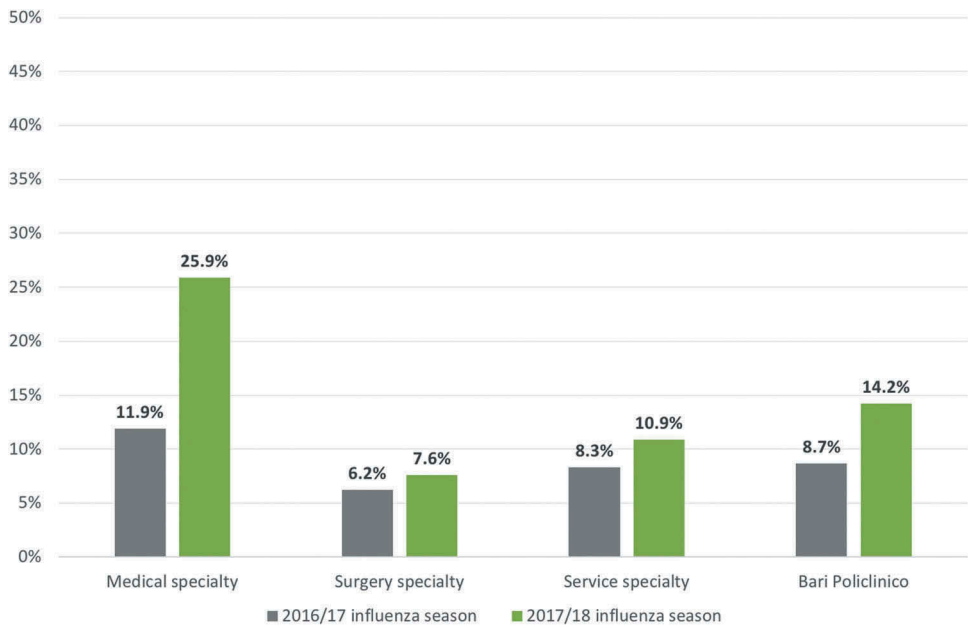

Figure 1. Vaccination coverage (%) of Bari Policlinico HCWs, per clinical specialty. Influenza seasons 2016/17 and 2017/18.

Table 1. Characteristics of vaccinated HCWs, per influenza season (2016/17 vs. 2017/18).

Characteristic	2016/17 season (n = 295)	2017/18 season (n = 482)
Age; mean±SD (range)	43.4 ± 13.5 (26.0–70.0)	45.5 ± 13.2 (25.0–70.0)
Female gender; n (%)	149 (50.5%)	254 (50.8%)
Professional category; n (%)		
• physician	223 (75.6%)	295 (61.3%)
• nurse	17 (5.8%)	48 (10.0%)
• other	55 (18.6%)	139 (28.7%)
At least one chronic disease*; n (%)	147 (49.8%)	237 (49.2%)
• allergy	87 (29.5%)	102 (21.2%)
• cardiopathy	38 (12.9%)	60 (12.4%)
• endocrinopathy	29 (9.8%)	59 (11.8%)
• respiratory disease	7 (2.4%)	14 (2.9%)
• gastrointestinal disease	9 (3.1%)	14 (2.9%)
• tumor	4 (1.4%)	7 (1.5%)
• nephropathy	1 (0.3%)	2 (0.4%)
• other	11 (3.7%)	26 (5.4%)

*finding multiple diseases in many HCWs.

Table 2. Vaccination coverage in the 8 OUs target of the on-site vaccination, 2016/17 and 2017/2018 influenza seasons, per professional category.

	2016/17 influenza season			2017/18 influenza season		
Professional category	n	n. vaccinated	CV (%)	n	n. vaccinated	CV (%)
Nurse	290	5	1.7%	290	20	6.9%
Physician	309	62	22.3%	302	90	45.6%
Other	108	4	2.7%	108	16	13.5%
Overall HCWs	707	71	10.0%	700	126	18.0%

Department) increased of 1.6 ± 2.2% (range: −1.7–4.5), with a significant difference (t = 4.0; p = .004; Figure 3).

Discussion

Although the vaccination coverage reached in both seasons is insufficient and unsatisfactory, our study suggests that on-site offer in 2017/18 season leads to an increase in vaccinated HCWs compared to the vaccinated ones in the previous season and almost 80% of HCWs preferred to be vaccinated in the working setting instead of attending the vaccination clinic. The comparison with the control OUs, not target of on-site vaccination, seems to confirm these data; indeed, we observed an increasing of VC between the two seasons in OUs target of the on-site offer (+17%), higher than that one in control OUs (+1.5%). Although in the 2017/18 season new further strategies (in addition to on-site) have been implemented, we did not observe a significant increase of VC in Surgery and Service Units (+1.4% and +2.6%, respectively), but only in Medical Units (+14%), among which we selected the OUs target of the on-site. Furthermore, the 2016/17 season has been in line with the previous ones for the intensity of influenza circulation, while in the 2017/8 season, Apulia and Italy suffered a severe influenza epidemic.[14] Although the increase of VC could not be attributed to HCWs' perceived severity of influenza illness, because in Italy, the vaccination campaign starts in November and ends in December, before the onset of the circulation of influenza viruses. Then, HCWs, at the time of the vaccination, are not able to perceive the different severity of influenza illness. However, our data strongly suggest that the active offer of on-site vaccination proposed in the Bari Policlinico seems to be able to increase the vaccination compliance.

The availability of the health personnel of the Operative Unities involved in the study, the collaboration of the Medical residents and the extensive influenza vaccination campaign (explanatory posters in the departments of the Bari Policlinico) have been successful strategies in bringing HCWs closer to vaccination practice.

Some professional categories, such as nurses, and older subjects are less inclined to get the influenza shot, while physicians (especially Medical residents) are more compliant; these evidence are confirmed in literature and many studies confirmed that the determinants above described are fundamental in vaccination compliance.[9–12]

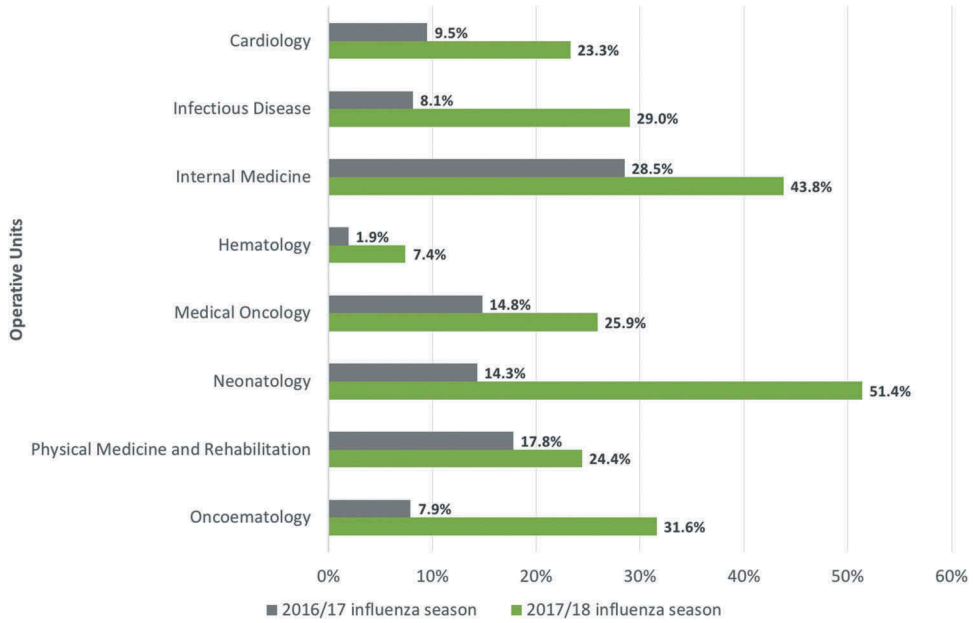

Figure 2. Vaccine coverage (%) of Operative Units target of the on-site vaccination, influenza seasons 2016/17 and 2017/18.

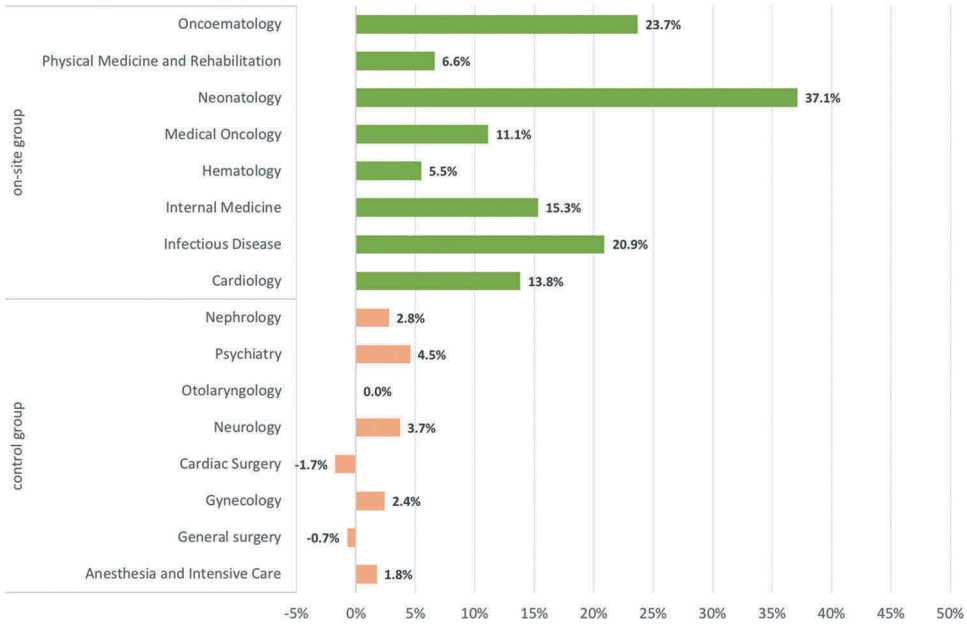

Figure 3. Difference of vaccine coverage (%) between influenza seasons 2016/17 and 2017/18, per Operative Units and typology of vaccination strategy.

The strong point of our study is the relevant population (˜4,000 HCWs), the on-site offer is a strategy poor studied in the literature and the comparison between two influenza seasons; furthermore, the issue of vaccinations in HCWs is extremely topical in future decisions on Public Health strategies. The major limitation is related to the impossibility to analyze the reasons for the refusal to vaccinate; in addition, it was not possible to evaluate if the HCWs not immunized in the Hospital have been vaccinated by the General Practitioner (GP) or if they purchased the vaccine in the Pharmacy. This lack of information could regard both studied seasons. Furthermore, the on-site offer was activated only for a small number of Units and, indeed, in the 2018/19 influenza season the offer has been extended to all the Units of the Bari Policlinico; the results are not yet available at the time of writing this paper, but from a primordial analysis very good results have been achieved which will be described in a subsequent study. A major limitation of this study is the before-after comparison design; without a parallel control, the data are biased in supporting any conclusions beyond the purely descriptive, even if the study strongly seems to suggest a main role on on-site offer in the increase of VC.

An important lesson learned by our experience is that the increase of vaccination coverage among HCWs is not free of charge. To increase the vaccination coverage, we spent several hours of work of high-qualified physicians, expert in vaccinology. It is impossible to increase VC without appropriate human resource. Although there are no specific studies on the cost-effectiveness of the on-site clinic, HCWs immunization programs in the hospital environment are recognized as effective in reducing the costs related to the disease, especially regarding the costs associated to work absenteeism.[15] For these reasons, future studies have to examine the question of the benefit/cost of the on-site offer.

On our knowledge, few studies investigated the effects of on-site offer on vaccine coverage in HCWs; our data agree with what has already been highlighted in a 2018 Italian study conducted at the "Bambino Gesù" Rome Pediatric Hospital, which showed that the on-site vaccination strategy has led to a significant increase in vaccination coverage among HCWs in two consecutive influenza seasons.[16]

HCWs have an important responsibility towards the patients, that is to guarantee the maintenance of the health status of subjects requesting medical assistance. Nonetheless, vaccination coverage among HCWs remains low and it is therefore essential to continue to implement strategies to increase vaccination compliance and increase the sense of responsibility towards their patients, as provided by national and international recommendations.[1,3,4]

Indeed, the active immunization of health personnel is an effective and safe strategy to prevent nosocomial transmission, in particularly to vulnerable patients, and also to reduce the work absenteeism caused by the disease.[5] Despite these evidences, consequences of influenza are underestimated among HCWs: a Canadian study conducted in a Neonatal Intensive Care Unit evaluated the consequence of influenza disease on patients and health-care personnel during an influenza season; at the end of the season were recorded 19 patients (one death) and 86 HCWs affected by influenza; of these, 85% resulted unvaccinated and 86% continued their work notwithstanding the disease.[17] A 2009 review estimates that almost a quarter of unvaccinated HCWs are affected by the influenza during the winter; of these, at least one third did not stop to work, representing a potential source of infection for other colleagues and patients. This behavior could cause several clusters every year in the nosocomial environment with consequent direct (increased morbidity and mortality, high socio-health costs) and indirect (interruption of work and absenteeism with consequent malfunctioning of essential welfare services) damage for patients and other HCWs.[18]

Despite the numerous recommendations and campaigns to promote influenza vaccine among HCWs, achieving high

rates of immunization among health workers is still a challenge as showed in our study, because >80% of HCWs of Bari Policlinico General Hospital remained unvaccinated at the end of vaccination campaign and this scenario is consistent with the Italian general figure.[6,7] To increase the vaccination compliance, in 2018 Apulian Regional Authority approved a Regional Law that makes vaccinations mandatory for health personnel, representing the second Italian region, after Emilia Romagna, to promote this kind of strategy; however, the vaccine-skeptical Italian Government contested the Law to the Constitutional Court, so it has never been applied.[19]

For the future, it would therefore be advisable to repeat the on-site vaccination strategy, expanding the offer to the largest possible number of departments and trying to involve mainly the professional categories at greatest contact with the patients. Furthermore, the on-site offer should not only be used for administering the vaccine, but should also be an occasion to educate the HCWs on the meaning of prevention prophylaxis and on the individual and patients' health risks associated to the influenza disease.

Influenza vaccination in HCWs has cost-effectiveness benefits, as it reduces work absenteeism, as asserted by a 2018 metanalysis,[15] so Public Health decision makers should improve the annual vaccination campaign to obtain the dual objective of preventing the risk of infection for the HCWs and the patients and of saving funding reducing direct and indirect costs associated to the disease. Probably, in the Italian and Apulian context, governmental institutions should implement policies of strong recommendation of seasonal influenza vaccine for health professionals, especially for the ones in contact with patients at risk of complications. Our experience, as well as other evidence in Italian hospitals, suggests that, despite the strategies and human resources implemented, satisfactory VCs cannot be reached without apposite regulations.

Methods

The study model is cross-sectional, carried out in two influenza campaigns.

The Bari Policlinico General University-Hospital consists of 50 Operative Units, 1,000 beds and 3,397 HCWs, of which 1,423/3,397 (41.9%) in the Services specialties, 1,005/3,397 (29.6%) in the Surgical specialties and 969/3,397 (28.5%) in the Medical specialties.[20]

In the 2016/17 influenza season, Hygiene Department of Bari Policlinico offered influenza vaccination to the HCWs in the period from October to December; for this purpose, an ad hoc clinic was set up in Hygiene department, open for about 10 h a day from Monday to Friday, with direct access without reservation.

In the 2017/18 season, in addition to the ordinary 2016/2017 season activities, the Hygiene department, in collaboration with the Occupational Medicine department, experimented the on-site vaccination strategy in 8 OUs of Medical specialty (Cardiology, Hematology, Physical Medicine and Rehabilitation, Infectious Diseases, Internal Medicine, Neonatology, Pediatric Oncoematology, Medical Oncology), identified in relation to the presence of patients at high risk of complications in case of influenza.

Directors of each OU received a specific letter that explain the vaccination strategies, that was also communicated by Hospital website and intranet system. In the days before the vaccination campaign, specific posters were exposed in the OU, to communicate the schedule of vaccination offer. The on-site clinic in each OU was cared by Public Health physicians.

For both influenza seasons, the following variables were noted for each vaccinated HCW, using a specific form:

- surname and name
- age
- gender
- professional category (physician, nurse, other)
- OU
- specialty (Surgical/Medical/Services)
- site of vaccination (on-site/Hygiene department), only for 2017/18 season.

Informed consent was also collected at the time of vaccination. Data and informed consent collections were performed by Public Health physicians. In both seasons, vaccinated HCWs received a dose of inactivated tetravalent split vaccine, administered intramuscularly in deltoid; these subjects underwent two weeks follow-up in order to assess any adverse effects and the physicians requested them to contact the Hygiene department in case of any adverse reactions. Adverse reactions reported by HCWs were notified to the Pharmacovigilance Service of the Policlinico Bari General Hospital and put in the database of the Hygiene department.

To calculate the vaccination coverage in each Operative Unit, we used the official list of HCWs provided by the Hospital Director; this list reported name, surname, professional category, and OU.

Data were stored according to privacy law. Compiled forms were put in a database created by Excel spreadsheet and data analysis was performed by STATA MP15 software.

Continuous variables were expressed as mean±standard deviation and range, categorical variables as proportions. To calculate the vaccination coverage (%) the number of HCWs vaccinated was used as numerator and the number of employees of the Bari Policlinico (in each Operative Unit) was used as denominator.

The analysis was set by comparing the overall results of the 2017/18 season with those of the 2016/17 season and with a focus on the results of the on-site strategy for the 2017/18 season.

The difference of VC between the two influenza seasons reached in the Units target of on-site strategy was compared with the same value reached in 8 "control" Units (choose by simple random sampling) not included in the on-site offer (Anesthesia and Intensive Care, General surgery, Gynecology, Cardiac Surgery, Neurology, Otolaryngology, Psychiatry, Nephrology). The average value of the difference of VC was compared between the two groups of OUs (on-site group vs. control group) by t student's test (p-value<0.05 was considered significant).

The research was carried out in accordance with the Helsinki declaration. The protocol of the survey was approved by ethical committee of Apulian Regional Observatory for Epidemiology.

Abbreviations

OU	Operative Unit
ECDC	European Centre for Disease Prevention and Control
CDC	Centers for Disease Control and Prevention

Disclosure of potential conflicts of interest

The authors declare that they have no competing interests.

Funding

No funding was requested or obtained to carry out this survey.

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