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Seasonal influenza vaccination among health-care workers: the impact of different tailored programs in four University hospitals in Rome

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ABSTRACT

Seasonal influenza vaccination (SIV) of health-care workers (HCWs) is recommended in most countries to protect them and their patients from infection. Although SIV can reduce the risk of influenza complications among vulnerable patients, vaccination uptake is generally unsatisfactory. The present study aimed to assess the impact of different programs in promoting SIV uptake among HCWs during the season 2017/2018 in four teaching hospitals in Rome. A multicentric cross-sectional study was carried out, in order to describe the four different campaigns and to assess their impact by identifying and developing a set of indicators that provide information about the vaccination services, the percentage of invited HCWs, the vaccinators' workforce and the vaccination coverage rates.

The hospitals organized different strategies: Hospital 1, 3 and 4 organized educational courses for HCWs and actively invited every single HCW through e-mail. All the hospitals organized a dedicated unit for influenza vaccination, and Hospital 1 added on-site vaccination sessions that required a large number of staff. Hospital 1 and hospital 4 registered a comparable vaccination coverage rate, 12.97% and 12.76%, respectively, while it was 6.88% in Hospital 2 and 4.23% in Hospital 3. Our indicators demonstrated to be effective and useful for analyzing the different SIV campaigns. The results suggest that the best practice to promote SIV among HCWs should include multiple approaches. Among those, an easy access to the vaccination site seems to play a key role in determining a higher vaccination coverage.

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Introduction

Seasonal influenza is an infectious disease that, despite being common, may cause severe complications, especially in specific groups of subjects, such as pregnant women, children aged between 6 months to 5 years, elderly people (aged more than 65 years) and patients with chronic medical conditions. The influenza vaccine efficacy is lower in old and immunocompromised people than in healthy, younger adults that, if vaccinated, can reduce the spread of virus and confer indirect protection to vulnerable people.[1] In the context of health-care facilities, the World Health Organization (WHO), US Centers for Disease Control and Prevention (CDC), European Center for Disease Control (ECDC) and the immunization guidelines of many countries recognize health-care workers (HCWs) as a key target of seasonal influenza vaccination (SIV).[2–4] Specific SIV programs for HCWs have demonstrated to reduce morbidity and mortality due to nosocomial infections among patients[5] and the risk of occupational exposure, as well as to decrease absenteeism, presenteeism[6-8] and the costs related to influenza.[9]

The vaccination coverage goals are established at 75% as the minimum and 95% as the optimal targets for populations at risk, including HCWs. Vaccination rates among HCWs vary widely among countries, depending on different reasons, but reaching the recommended target is challenging for the local health authorities.[10] The reasons depend both on the organizational difficulties in implementing the campaigns, but also on the personal beliefs, perceptions, and attitudes of the HCWs towards influenza disease and vaccination.[11,12]

In the USA, where in many settings influenza vaccination is required by the employer, coverage rates were reported to be 78.6% during the 2016/2017 season, with 92.3% for those HCWs working in hospitals.[13] In Europe, vaccination is not mandatory, though many European countries recommend it for risk groups, such as HCWs. In 2017, the ECDC reported the data (coming from 17 EU/EEA Member States) providing the coverage ratio for HCWs for the influenza seasons from 2007/2008 to 2014/2015. The report showed that the median coverage rate decreased in time, from 26% in 2007/2008 to 25.7% in 2014–15 with a wide range from 5% in Poland to 53% in the United Kingdom.[14]

In Italy, according to the National Immunization Plan, the categories for which SIV is recommended and offered for free include HCWs, with 75% and 95% coverage targets.[15] This is confirmed in the annual influenza vaccination program issued by the Ministry of Health.[16] In Italy, a systematic surveillance system collecting coverage data for HCWs is absent and single local studies report coverage rates ranging from 5% to 34% in different Regions and hospitals.[17–21]

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In order to provide alternatives to mandatory vaccination, new approaches are needed aimed at overcoming the low compliance of HCWs, taking into account barriers and facilitators of influenza vaccine uptake.[22,23] The WHO Regional Office for Europe proposed to tailor immunization programs to increase SIV coverage among HCWs, through evidence-based tools tailored to specific contexts.[24] In Italy, campaigns programs are very heterogeneous among regions and single institutions. The aim of the present study was to develop a set of specific indicators to assess the impact of different programs for promoting SIV uptake among HCWs implemented during the season 2017/2018 in four teaching hospitals in Rome.

Materials and methods

Setting

In this multicentric cross-sectional study, we analyzed the SIV programs for HCWs implemented in four hospitals in Rome from November to January. All of them are University teaching hospitals (Hospital 2 and 3 affiliated to the same University), provided with all the medical and surgical specialties, but they differ in terms of hospital beds number. Hospital 1 and Hospital 3 have, respectively, about 1550 and 1250 beds, and Hospital 2 and 4 have both about 450 beds, with about 12,200 employees in the four hospitals.[25] The vaccine used in all the settings was quadrivalent, including two influenza A viruses (H1N1 and H3N2) and two influenza B viruses (B/Victoria and B/Yamagata).

Seasonal Influenza Vaccination (SIV) campaigns

In the four considered settings, the hospital Medical Directorate, in collaboration with the University Hygiene and Public Health Units, were the leading project managers of the SIV campaigns. In order to implement the 2017–18 SIV campaigns and to assess their impact, a multi-step approach was adopted:

(1) Planning phase, aimed at defining the main objective, sub-objectives and the actions part of the SIV campaigns by the leading project managers.
(2) Implementation phase, aimed at carrying out the actions of the program, grouped into "Education", "Promotion", and "Access to vaccination" (Table 1) with the collaboration of the Hygiene Unit and the Occupational Medicine Unit.
(3) Monitoring phase, aimed at controlling the actions of the implementation phase, with the collaboration of two residents in Hygiene and Public Health from each of the three Universities. By taking part in the different vaccination campaigns, the residents collected the following data: type and number of educational activities organized by the academic Hygiene Unit, type of promotional activities implemented by the Medical Directorate, and ease of access to vaccination.
(4) Evaluation phase, starting once the vaccination campaign was over, aimed at analyzing the data collected during the implementation and monitoring phases, along with a set of indicators.

Table 1. Campaigns actions implemented in each hospital.

Hospital	Education	Promotion	Access to Vaccination
Hospital 1	Academic detailing for nurses' coordinators	Posters E-mail invitations Campaign presentation event Banner in the Intranet web page	Dedicated unit On-site vaccination
Hospital 2	-	Posters Banner in the Intranet web page	Dedicated unit
Hospital 3	CME course for HCWs	E-mail invitations	Dedicated unit
Hospital 4	CME course for HCWs	Posters E-mail invitations Campaign presentation event Banner in the Intranet web page	Dedicated service in the Occupational Medicine unit located in the center of the Hospital

Input, output, outcome indicators

In order to analyze the efficacy of the SIV campaigns of the four hospitals, we developed an evaluation grid, made of a set of indicators classified according to the WHO definition,[26] as reported in Table 2. As for the setting characteristics, we collected data on the target population of HCWs to be reached and the number of HCWs assigned to the vaccination staff.

To quantify the effort and results of the SIV campaign, we developed the following indicators:

Opening hours of each Vaccination Unit per week

Vaccinators/Target population (per 100)

Vaccinators/Vaccinated (per 100)

Proportion of actively invited HCWs/total HCWs

Vaccination Coverage (%).

The first three are defined as input indicators that provide a complete reading from the quantitative point of view of the resources needed for the implementation of the campaigns, in terms of potential work to be carried out, and of the workload of the immunization service staff. The proportion of actively invited HCWs/total HCWs is defined as output indicator, since it gives information about the implementation of promotion activities of the campaigns.

The last outcome indicator explores the efficacy of the SIV campaign, providing the overall percentage of vaccinated HCWs.

Statistical analysis

Excel 2013 software was used to build databases and analyze data.

Results

The need for increasing SIV coverage among HCWs was defined as the common main objective in all hospitals. Raising HCWs awareness about benefits and risks of influenza

Table 2. Setting characteristics and input, output and outcome indicators.

	SETTING CHARACTERISTICS		INPUT			OUTPUT	OUTCOME
SETTING	Target population (n)	Vaccinators of HCWs (n)	Vaccination Unit opening time	Vaccinators/Target population (per 100)	Vaccinators/ Vaccinated (per 100)	Actively invited HCWs	Vaccination Coverage %
Hospital 1	4111	11	6 hrs/week	0.27	2.06	100%	12.97% (n = 533)
Hospital 2	1452	2	10 hrs/week	0.13	2.00	0%	6.88% (n = 100)
Hospital 3	4703	1	20 hrs/week	0.02	0.50	100%	4.23% (n = 199)
Hospital 4	1960	2	10 hrs/week	0.10	0.80	100%	12.76% (n = 250)

vaccination and making SIV more accessible for HCWs were stated as common sub-objectives. The specific actions implemented in each hospital to achieve the common objective and sub-objectives are displayed in Table 1.

As to the "Education" field, Hospital 3 and 4 organized "Continuing Medical Education" (CME) courses targeted at HCWs about all the recommended vaccinations for HCWs. Differently, the Hospital 1 addressed the nurses' coordinators as key target for an educational initiative on influenza vaccination. Only Hospital 2 did not organize any courses.

As to the "Promotion" field, Hospital 1 and 4 had the most complete set of promotional activities: active invitation (personal e-mails sent to all hospital staff), use of promotional material including advertising posters hanged up in the wards, banners in the hospital Intranet page and a campaign presentation event. This was targeted at all health-care professionals to explain how the vaccination was offered and to present the results about vaccination coverage of the previous campaign. Hospital 2 spread the information about the campaign through posters and banners in the Intranet page. Hospital 3 used only the e-mail invitation.

Finally, as to the "Access to vaccination" field, Hospitals 1, 2 and 3 organized a dedicated service for influenza vaccination at the Preventive Medicine service, while Hospital 4 promoted a specific service within the activities of the Occupational Medicine unit, located at the center of the hospital. Hospital 1 proposed also an on-site vaccination service in 42 wards. The on-site vaccination consists of groups of physicians and/or nurses that, after performing immunization counseling to HCWs and collecting the informed consent, vaccinate HCWs who want to be vaccinated directly in wards and outpatient clinics. The units that are usually mainly interested in this initiative are those where patients, because of their conditions, can suffer from influenza complications, such as hematological and oncological wards, intensive care units, geriatric, and pneumological wards.[27]

Input, output, outcome indicators

Data regarding the indicators are summarized in Table 2. They highlighted a wide variability in the organization of the SIV campaigns in the four hospitals, without any qualitative correlations between the number of target HCWs and the number of vaccinator HCWs nor the number of opening hours of the Vaccination Unit. The output indicator showed that only in Hospital 2 an active invitation of target HCWs to vaccination was not adopted (n = 1452), while in the other Hospitals 100% of HCWs were actively invited by e-mail (n = 4111, n = 4703, n = 1960, respectively, in Hospital 1, 3 and 4).

In Hospital 1 the vaccination coverage recorded was 12.97% (n = 533); the ratio of vaccinator personnel (n = 11) to target population was 0.27/100; the ratio of vaccinator personnel to vaccinated HCWs was 2.06/100.

In Hospital 2 the coverage was 6.88% (n = 100); the ratio of vaccinator personnel (n = 2) to target population was 0.13/100; the ratio of vaccinator personnel to vaccinated HCWs was 2.00/100.

In Hospital 3 the vaccination coverage was 4.23% (n = 199); the ratio of vaccinator personnel (n = 1) to target population was 0.02/100; the ratio of vaccinator personnel to vaccinated HCWs was 0.50/100.

In Hospital 4 the coverage was 12.76% (n = 250). The ratio of vaccinator personnel (n = 2) to target population was 0.10/100. The ratio of vaccinator personnel to vaccinated HCWs was 0.80/100.

The vaccination coverage rates ranged from 4.23% of Hospital 3 to 12.97% of Hospital 1.

Discussion

In the present study, we collected and analyzed data regarding the SIV campaigns for HCWs in four teaching hospitals in Rome through the identification of a set of "ad hoc" indicators, with the ultimate goal of identifying the best practices for future campaigns.

While the vaccination coverage rate is an intuitive indicator of a vaccination campaign efficacy, we developed additional specific indicators, as a tool for comparing different organizational models applied to the different settings from the administrative and institutional point of view. To our knowledge, our set of indicators constitute the first attempt to standardize the evaluation of SIV campaigns in the specific setting.

The input indicators focused on those that are referred to as relevant barriers to access to vaccination by the operators themselves, namely the ease of access to the vaccination service and the organizational infrastructure of the hospitals.[10,28–31] The size of the target population, the number of staff dedicated to vaccinate the HCWs and the number of hours in which the Vaccination Units were actually usable are intended as an indirect proxy of the investment, in policy and economics terms, that each hospital dedicated to this initiative. These indicators contributed to provide an overview of the effort needed to implement an influenza vaccination campaign. Our study has deliberately excluded the aspects inherent to the beliefs and perceptions of the staff regarding the ethical sphere of vaccination,[22] which would have required specific questionnaires and the setting up of a parallel study.

The coverage indicator highlighted a low adherence to SIV campaigns in the four studied hospitals (ranging from 4.23% to 12.97%). Our results are in line with other studies

performed in Italy, that reported vaccination coverage rates ranging from about 5% to 34%.[17–21,32] Although the campaigns could be considered unsuccessful in absolute terms, our project will be useful for starting a common approach among the participating teaching hospitals for developing positive trends. There is evidence that the combination of different interventions is the most effective strategy in increasing the influenza vaccination coverage among HCWs, with the effect of doubling the vaccination coverage for each season.[33] According to our multicentric experience, the programs comprehensive of multiple actions in all the three fields (Education, Promotion, and Access to vaccination) organized by Hospital 1 and Hospital 4 determined the highest coverage rates. In particular, the easy access to vaccination of these two hospitals (i.e., the on-site vaccination for the Hospital 1, and the vaccination units located in the center of the Hospital 4) along with the pro-active promotion of the campaign may have contributed to a better outcome.

On the other hand, the indicators referred to vaccinators (i.e., vaccinators/target population, and vaccinators/vaccinated) could be interpreted to plan a valuable service, avoiding excessive workload or an unnecessary use of resources. In fact, while the lowest results for these indicators are associated to the lowest coverage rate (Hospital 3), in Hospital 1 and Hospital 4 the coverage is comparable (12.97% and 12.76%, respectively) despite the ratio of vaccinator staff to target population in Hospital 1 (0.27/100) being double that in Hospital 4 (0.10/100). The planning of the necessary personnel is related to the type of vaccination campaign (dedicated unit or on-site vaccination) and to the opening hours of the unit. For instance, the high number of opening hours of the Vaccination Unit in Hospital 3 demonstrated to be poorly effective on the outcome, probably because of the insufficient number of vaccinators (only 1) and the lack of a broader promotion approach. On the contrary, in Hospital 1 the reduced opening time (6 hours/week) was counterbalanced by the effort spent on the high number of vaccinators (n = 11), requested by the organization of the on-site vaccination. These findings suggest that the availability of a high number of vaccinators may not always be necessary in itself, unless it is balanced with other resources.

The profound differences between structures, in terms of bed capacity, facilities and commitment to the SIV campaign, were the rationale for the choice to keep the indicators particularly general, then analyzing strong outcomes. Unfortunately, this strategy does not allow a more detailed analysis stratified for professional categories, and this is one of the main limitations of the study, since significant differences in vaccination rates have been reported among different professional categories.[21,34–36] Nevertheless, our indicators made different hospital facilities comparable and provided a useful overview on the potential strengths and weaknesses of the individual SIV campaigns. Moreover, another limitation of the study is due to its design: this is a descriptive study comparing data of different settings during only one influenza season, since data regarding previous SIV campaigns were not available for all the considered hospitals. This study may be considered as the starting point for a standardized collection of data, providing a set of indicators that will help in analyzing the coverage trends over the incoming seasons.

In conclusion, according to our descriptive multicentric experience, the coordinated work of the hospital Management, Vaccination Unit, and Occupational Medicine has demonstrated to be feasible and valuable, although vaccination coverage rates are unsatisfactory if compared to target rates. We suggest that the best strategy to promote SIV among HCWs should include multiple approaches in order to obtain an increasing coverage trend in all settings. The educational initiatives, whether CME courses or "academic detailing", should counteract the concerns about vaccine safety and efficacy, reported as personal barriers to HCWs' vaccine uptake.[37] These should also be the occasion for raising awareness about the importance of protecting vulnerable patients. As for "Promotion", a pro-active invitation of HCWs one by one in the form of personal e-mail, seems to confer a wider spread of the information concerning the campaign. Lastly, an easy access to vaccination (i.e., on-site vaccination offer or strategic and accessible location of the Vaccination Unit), overcoming logistic barriers for the HCWs to uptake vaccination, seems to play a key role in determining a better outcome in terms of vaccination coverage. In particular, our results suggest that the approach adopted by Hospital 4, focused on providing a dedicated Vaccination Unit, easily accessible in terms of location, was the most efficient, regardless the number of vaccinators. Although we developed specific indicators suitable to our settings, subsequent updates, and comparisons, even outside the Roman context, could lead to a more effective validation of these items.

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No potential conflicts of interest were disclosed.

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References

1. (WHO) WHO. Seasonal Influenza. Fact Sheets. [accessed 2019 Feb 19]. https://www.who.int/en/news-room/fact-sheets/detail/influenza-(seasonal).
2. World Health Organization (WHO). E. Influenza Vaccination. [accessed 2019 Feb 19]. http://www.euro.who.int/en/health-topics/communicable-diseases/influenza/vaccination.
3. (ECDC) EC for DC and P. Seasonal Influenza. Public health control measures. [accessed 2019 Feb 19]. https://ecdc.europa.eu/en/seasonal-influenza/prevention-and-control/public-health-control-measures.

4. Centres for Disease Control and Prevention (CDC). Influenza Vaccination Information for Health Care Workers. [accessed 2019 Feb 19]. https://www.cdc.gov/flu/healthcareworkers.htm#should-vaccinate.
5. WHO. Weekly epidemiological record: vaccines against influenza WHO position paper – november 2012. Wkly Epidemiol Rec. 2016;III(7):73–81. doi:10.1016/j.actatropica.2012.04.013.
6. Salgado CD, Giannetta ET, Hayden FG, Farr BM. Preventing Nosocomial Influenza by Improving the Vaccine Acceptance Rate of Clinicians. Infect Control Hosp Epidemiol. 2004;25(11):923–28. doi:10.1086/502321.
7. Carman WF, Elder AG, Wallace LA, McAulay K, Walker A, Murray GD, Stott DJ. Effects of influenza vaccination of health-care workers on mortality of elderly people in long-term care: A randomised controlled trial. Lancet. 2000;355(9198):93–97. doi:10.1016/S0140-6736(99)05190-9.
8. Potter MB, Somkin CP, Ackerson LM, Gomez V, Dao T, Horberg MA, Walsh J ME. The FLU-FIT program: an effective colorectal cancer screening program for high volume flu shot clinics. Am J Manag Care. 2011;17:577–83.
9. Szucs T. The socio-economic burden of influenza. J Antimicrob Chemother. 2002;44(90002):11–15. doi:10.1093/jac/44.suppl_2.11.
10. Lorenc T, Marshall D, Wright K, Sutcliffe K, Sowden A. Seasonal influenza vaccination of healthcare workers: systematic review of qualitative evidence. BMC Health Serv Res. 2017;17:1. doi:10.1186/s12913-017-2703-4.
11. Weber DJ, Orenstein W, Rutala WA. How to improve influenza vaccine coverage of healthcare personnel. Isr J Health Policy Res. 2016;5:1. doi:10.1186/s13584-016-0122-3.
12. Ozisik L, Tanriover MD, Altınel S, Unal S. Vaccinating healthcare workers: level of implementation, barriers and proposal for evidence-based policies in Turkey. Hum Vaccines Immunother. 2017;13(5):1198–206. doi:10.1080/21645515.2016.1269992.
13. Black CL, Yue X, Ball SW, Donahue SMA, Izrael D, de Perio MA, Laney AS, Williams WW, Lindley MC, Graitcer SB, et al. Influenza Vaccination Coverage Among Health Care Personnel — united States, 2014–15 Influenza Season. MMWR Morb Mortal Wkly Rep. 2015;64(36):993–99. doi:10.15585/mmwr.mm6436a1.
14. Mereckiene J *Seasonal Influenza Vaccination in Europe. Vaccination* Recommendations *and* Coverage Rates in the EU Member States for Eight Influenza Seasons; 2017. doi:10.2900/153616.
15. Italian Ministry of Health. National Preventive Vaccination Plan 2017–2019. Italian Official Gazette. [accessed 2019 Feb 19]. http://www.salute.gov.it/imgs/C_17_pubblicazioni_2571_allegato.pdf.
16. Italian Ministry of Health. Prevention and control of influenza: recommendations for the 2018-2019 season. [accessed 2019 Feb 19]. http://www.trovanorme.salute.gov.it/norme/renderNormsanPdf?anno=2018&codLeg=64381&parte=1%20&serie=null.
17. Campagna M, Argiolas F, Soggiu B, Mereu NM, Lai A, Galletta M, Coppola RC. Current preventive policies and practices against Vaccine-Preventable Diseases and tuberculosis targeted for workers from hospitals of the Sardinia Region, Italy. J Prev Med Hyg. 2016;57:E69–E74.
18. Esposito S, Bosis S, Pelucchi C, Tremolati E, Sabatini C, Semino M, Marchisio P, Della Croce F, Principi N. Influenza vaccination among healthcare workers in a multidisciplinary University hospital in Italy. BMC Public Health. 2008:8. doi:10.1186/1471-2458-8-422.
19. Fortunato F, Tafuri S, Cozza V, Martinelli D, Prato R. Low vaccination coverage among Italian healthcare workers in 2013: contributing to the voluntary vs. mandatory vaccination debate. Hum Vaccines Immunother. 2015;11(1):133–39. doi:10.4161/hv.34415.
20. Bonaccorsi G, Lorini C, Santomauro F, Guarducci S, Pellegrino E, Puggelli F, Balli M, Bonanni P. Predictive factors associated with the acceptance of pandemic and seasonal influenza vaccination in health care workers and students in Tuscany, Central Italy. Hum Vaccines Immunother. 2013;9(12):2603–12. doi:10.4161/hv.26036.
21. Alicino C, Iudici R, Barberis I, Paganino C, Cacciani R, Zacconi M, Battistini A, Bellina D, Di Bella AM, Talamini A, et al. Influenza vaccination among healthcare workers in Italy: the experience of a large tertiary acute-care teaching hospital. Hum Vaccines Immunother. 2015;11(1):95–100. doi:10.4161/hv.34362.
22. Hollmeyer HG, Hayden F, Poland G, Buchholz U. Influenza vaccination of health care workers in hospitals-A review of studies on attitudes and predictors. Vaccine. 2009;27(30):3935–44. doi:10.1016/j.vaccine.2009.03.056.
23. Galanakis E, Jansen A, Lopalco PL, Giesecke J. Ethics of mandatory vaccination for healthcare workers. Eurosurveillance. 2013;18:45. doi:10.2807/1560-7917.ES2013.18.45.20627.
24. WHO. Tailoring Immunization Programmes for Seasonal Influenza (TIP FLU). 2015.
25. Ministero della Salute. Dati dataset. [accessed 2017 May 6]. http://www.dati.salute.gov.it/dati/dettaglioDataset.jsp?menu=dati&idPag=18.
26. WHO EMRO. Research and evaluation, Indicators. [accessed 2019 May 15]. http://www.emro.who.int/child-health/research-and-evaluation/indicators/Type-of-indicators.html.
27. Advisory Committee on Immunization Practices; Centers for Disease Control and Prevention (CDC). Immunization of health-care personnel: recommendations of the Advisory Committee On Immunization Practices (ACIP). Morb Mortal Wkly Rep. 2011;60(RR–7):1–37.
28. Durando P, Alicino C, Dini G, Barberis I, Bagnasco AM, Iudici R, Zanini M, Martini M, Toletone A, Paganino C, et al. Determinants of adherence to seasonal influenza vaccination among healthcare workers from an Italian region: results from a cross-sectional study. BMJ Open. 2016;6(5):e010779. doi:10.1136/bmjopen-2015-010779.
29. Boey L, Bral C, Roelants M, De Schryver A, Godderis L, Hoppenbrouwers K, Vandermeulen C. Attitudes, believes, determinants and organisational barriers behind the low seasonal influenza vaccination uptake in healthcare workers – A cross-sectional survey. Vaccine. 2018;36(23):3351–58. doi:10.1016/j.vaccine.2018.04.044.
30. Prematunge C, Corace K, McCarthy A, Nair RC, Pugsley R, Garber G. Factors influencing pandemic influenza vaccination of healthcare workers-A systematic review. Vaccine. 2012;30(32):4733–43. doi:10.1016/j.vaccine.2012.05.018.
31. Garruto V, Scalingi S, Siclari M, Chiarini M, La Torre G, Mannocci A. Knowledge, Attitude and Behaviours towards Recommended Vaccinations among Healthcare Workers. Healthcare. 2017;5(1):13. doi:10.3390/healthcare5010013.
32. Gilardi F, Gattinara GC, Vinci MR, Shih M-J, Chen T-J, Chou L-F, Hwang S-J. Seasonal influenza vaccination in health care workers. A pre-post intervention study in an Italian paediatric hospital. Int J Environ Res Public Health. 2018;15(5). doi:10.3390/ijerph15050841.
33. Schmidt S, Saulle R, Di Thiene D, Boccia A, La Torre G. Do the quality of the trials and the year of publication affect the efficacy of intervention to improve seasonal influenza vaccination among healthcare workers? Results of a systematic review. Hum Vaccines Immunother. 2013;9:349–61. doi:10.4161/hv.22736.
34. La Torre G, Mannocci A, Ursillo P, Bontempi C, Firenze A, Panico MG, Sferrazza A, Ronga C, D'Anna A, Amodio E, et al. Prevalence of influenza vaccination among nurses and ancillary workers in Italy: systematic review and meta analysis. Hum Vaccin. 2011;7(7):728–33. doi:10.4161/hv.7.7.15413.
35. Costantino C, Mazzucco W, Azzolini E, Baldini C, Bergomi M, Biafiore AD, Bianco M, Borsari L, Cacciari P, Cadeddu C, et al. Influenza vaccination coverage among medical residents. Hum Vaccin Immunother. 2014;10(5):1204–10. doi:10.4161/hv.28081.
36. Barbara A, Mariani M, De Waure C, Anzelmo V, Piccoli B, Cambieri A, Damiani G, Ricciardi W, Laurenti P. A campaign aimed at increasing seasonal influenza vaccination coverage among post graduate medical residents in an Italian teaching hospital. Hum Vaccin Immunother. 2019;15:967–72. doi:10.1080/21645515.2018.1556076.
37. Dini G, Toletone A, Sticchi L, Orsi A, Bragazzi NL, Durando P. Influenza vaccination in healthcare workers: A comprehensive critical appraisal of the literature. Hum Vaccines Immunother. 2018;14(3):772–89. doi:10.1080/21645515.2017.1348442.