Taylor & Francis
Taylor & Francis Group

Human Vaccines & Immunotherapeutics

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/khvi20

Attitudes toward influenza vaccination in healthcare workers in Italy: A systematic review and meta-analysis

Francesco Paolo Bianchi, Pasquale Stefanizzi, Antonio Di Lorenzo, Chiara De Waure, Stefania Boccia, Antonio Daleno, Giovanni Migliore & Silvio Tafuri

To cite this article: Francesco Paolo Bianchi, Pasquale Stefanizzi, Antonio Di Lorenzo, Chiara De Waure, Stefania Boccia, Antonio Daleno, Giovanni Migliore & Silvio Tafuri (2023) Attitudes toward influenza vaccination in healthcare workers in Italy: A systematic review and meta-analysis, Human Vaccines & Immunotherapeutics, 19:3, 2265587, DOI: 10.1080/21645515.2023.2265587

To link to this article: https://doi.org/10.1080/21645515.2023.2265587

HUMAN VACCINES & IMMUNOTHERAPEUTICS
2023, VOL. 19, NO. 3, 2265587
https://doi.org/10.1080/21645515.2023.2265587

Taylor & Francis
Taylor & Francis Group

REVIEW ARTICLE

OPEN ACCESS Check for updates

Attitudes toward influenza vaccination in healthcare workers in Italy: A systematic review and meta-analysis

Francesco Paolo Bianchi[a,b], Pasquale Stefanizzi[a], Antonio Di Lorenzo[a], Chiara De Waure[c], Stefania Boccia[d,e], Antonio Daleno[b], Giovanni Migliore[b], and Silvio Tafuri[a,b]

[a]Department of Interdisciplinary Medicine, Aldo Moro University of Bari, Bari, Italy; [b]Health Direction, University-General Hospital Policlinico, Bari, Italy; [c]Department of Medicine and Surgery, University of Perugia, Perugia, Italy; [d]Section of Hygiene, University Department of Life Sciences and Public Health, University Cattolica of Sacred Hearth, Rome, Italy; [e]Department of Woman and Child Health and Public Health - Public Health Area, Fondazione Policlinico Universitario A. Gemelli IRCCS, Rome, Italy

ABSTRACT

Healthcare workers (HCWs) are among the at-risk groups for whom influenza vaccination is strongly recommended. To assess the proportion of Italian HCWs with positive attitudes toward influenza vaccination, we conducted a systematic review of relevant literature and a meta-analysis. Our focus was on the influenza seasons from 2017/18 to 2021/22. The prevalence of favorable attitudes toward vaccination varied, ranging from 12% during the 2017/18 influenza season to 59% in the 2020/21 season. The significant increase in the 2020/21 season can be attributed to adaptations necessitated by the COVID-19 pandemic. During the 2021/22 influenza season, there was a decline in vaccination coverage (37%), likely due to the absence of a robust preventive culture. Various strategies have been employed to enhance HCWs' attitudes to achieve higher vaccination rates, but none of them have demonstrated satisfactory results. Policymakers should consider implementing a policy of mandatory vaccination to ensure elevated vaccination coverage among HCWs.

ARTICLE HISTORY
Received 15 June 2023
Revised 5 September 2023
Accepted 27 September 2023

KEYWORDS
Healthcare workers; management of susceptible; nosocomial infection; COVID-19; public health

Introduction

Vaccination for Healthcare Workers (HCWs) serves a dual purpose: safeguarding HCWs themselves from occupational infectious diseases and shielding patients from potential nosocomial infections. Moreover, it effectively curtails absenteeism, thereby ensuring the continuity of high-quality healthcare services.[1] Among the array of recommended vaccinations, special emphasis is placed on the annual administration of the influenza vaccine ahead of the influenza season.[2]

The immunization of HCWs aligns with the directives outlined in the National Immunization Plan, as well as the yearly guidelines for preventing influenza established by the Italian Ministry of Health.[3,4] Within this framework, HCWs stand out as a vulnerable demographic for whom influenza vaccination is strongly endorsed. Consequently, a proactive approach is advocated, involving the annual provision of influenza vaccines to healthcare staff in the lead-up to the influenza season (spanning from October to December). Notably, a minimum vaccination coverage (VC) goal of 75% has been established for this group.[4]

In Italy, numerous studies have been conducted to assess the adherence of HCWs to influenza vaccination due to the absence of a national system for Italian Ministry of Health to collect comprehensive coverage data. As highlighted in a review conducted by Prato R et al. in 2014,[5] the vaccination coverage among Italian HCWs varied from 12% to 37% within the timeframe of 1999 to 2007. Notably, a study conducted in 2015[6] revealed an influenza vaccination coverage of nearly 25% during the 2013/14 season. Enhanced compliance with influenza vaccination was observed among physicians when compared to other professional categories. Factors contributing to this higher adherence included possessing an extended professional tenure, receiving vaccination recommendations from the occupational physician or General Practitioner (GP).

Just like with other vaccines, individuals' attitudes toward vaccination play a pivotal role in determining the efficacy of an influenza immunization campaign. Notably, the success of such campaigns hinges on these perceptions. An illustrative case is the recognition by the World Health Organization (WHO) in 2019 of vaccination hesitancy as a substantial health concern for that year.[7] In the early months of 2020, the global landscape shifted as COVID-19, the contagious disease precipitated by the emergent SARS-CoV-2 coronavirus, was officially declared a pandemic.[8,9] This paradigm shift underscores the heightened importance of influenza vaccination for HCWs in Italy. The rationale is rooted in the similarities between symptoms exhibited by both respiratory viral infections, which share common high-risk groups – HCWs among them. By fortifying these frontline personnel against influenza, the nation's healthcare capacity is bolstered during a time when it is most critical.

CONTACT Silvio Tafuri silvio.tafuri@uniba.it Department of Interdisciplinary Medicine, Aldo Moro University of Bari, Piazza Giulio Cesare 11, Bari 70124, Italy.
The manuscript has not been presented at a meeting.
Supplemental data for this article can be accessed on the publisher's website at https://doi.org/10.1080/21645515.2023.2265587.

In light of this scenario, we undertook a comprehensive systematic review of pertinent literature along with a meticulous meta-analysis. Our aim was to ascertain the extent to which Italian HCWs hold favorable attitudes toward influenza vaccination. The scope of our investigation encompassed the influenza seasons spanning from 2017/18 to 2021/22, facilitating a comparative assessment involving three pre-pandemic flu seasons and two post-pandemic flu seasons. This approach allowed us to present an updated overview of the phenomenon and its evolutionary trajectory across these five distinct vaccination campaigns. Our inquiry extended beyond mere observation, delving into the factors influencing vaccine compliance while also scrutinizing strategies tailored to address vaccine hesitancy. This multi-faceted analysis serves to deepen our understanding of the landscape and the dynamics surrounding HCWs' attitudes and actions toward influenza vaccination.

Material and methods

The systematic review protocol was meticulously established in adherence to the guidelines stipulated by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist.[10] Our commitment to transparency and rigor led us to formally register the protocol within the International Prospective Register of Systematic Reviews (PROSPERO), where it is cataloged under the reference acknowledgment number CRD42022358187. To structure our investigation, we relied upon the Population, Intervention, Comparison, and Outcome (PICO) framework, a recognized methodology for framing review questions. Thus, the focal inquiry emerged as follows: "What are the prevailing attitudes held by Healthcare Workers (HCWs) toward influenza vaccination in the context of Italy?"

Search strategy, selection criteria, and data extraction

Comprehensive searches were executed across prominent academic databases including Scopus, MEDLINE/PubMed, and ISI Web of Knowledge. The study inclusion criteria encompassed research articles, brief reports, letters, and editorials published within the timeframe of January 1, 2018, to December 1, 2022. Our search parameters were designed to encapsulate the terms: (adherence OR hesitan* OR compliance OR attitude OR willingness) AND (influenza OR flu) AND (vaccin* OR immun*) AND (healthcare worker* OR health personnel OR physician* OR nurse* OR doctor* OR resident* OR student*) AND (Ital*).

To ensure the thoroughness of our study, we considered works published in either English or Italian with full-text availability. Exclusions were made for abstracts without accompanying full-text, reviews, meta-analyses, papers lacking epidemiological data, clinical trials, and studies that veered away from the core purpose of our review (pertaining to vaccine knowledge, seroprevalence, etc.). Additionally, studies not set within the Italian context were excluded from our analysis. We also reached out to the authors of relevant studies for supplementary information when necessary. Rigorous screening of article titles and/or abstracts was undertaken independently by two reviewers, both of whom adhered to the predefined inclusion and exclusion criteria. Instances of discrepancies were duly recorded and subsequently resolved through consensus-based discussions. Additionally, a comprehensive examination of the references within the identified articles was performed to uncover further relevant studies.

Data extracted included year, sample size, number of vaccinated HCWs, or the number of subjects who expressed a willingness to receive the vaccine in the subsequent influenza season, professional category, Italian region, potential determinants of vaccine hesitancy, and options for managing hesitant HCWs.

Quality assessment

The methodological quality of the chosen quantitative studies was evaluated utilizing the Newcastle – Ottawa Scale (NOS), which was suitably adapted for appraising cross-sectional studies.[11] Two independent researchers systematically assessed the potential risk of bias associated with each study. Instances of variance in their evaluations were diligently recorded and subsequently harmonized through mutual consensus.

Main outcomes and pooled analysis

As the primary endpoint, we evaluated the attitudes of HCWs during each influenza season under analysis; we defined "vaccine good attitude" as the synthesis between those studies that estimated a vaccination coverage, those studies that estimated vaccine willingness in the following influenza season, and those studies that investigated self-report vaccine uptake in the previous influenza season(s). As secondary endpoints, we evaluated the role of sex, age, and professional category. For comparisons by sex, age, and professional category, the Odds Ratios (ORs) and 95% confidence intervals (95%CIs) were estimated.

In the meta-analysis, the aggregated proportion was computed using the Freeman-Tukey double arcsine transformation, which served to stabilize variances. Random effects models were employed, utilizing the DerSimonian-Laird weights, while the estimated heterogeneity was derived from the inverse-variance random-effects model. The resultant pooled prevalence, accompanied by its corresponding 95% Wald confidence interval, was visually presented through a forest plot. To quantify heterogeneity, the I^2 statistic was computed, offering insight into the proportion of the overall variance that stems from heterogeneity between studies rather than chance. Moreover, an assessment of heterogeneity across distinct study groups was conducted. For the purpose of determining statistical significance of heterogeneity, a p-value of less than 0.05 was considered indicative.

Three different sensitivity analyses were conducted to evaluate stability, as follows

- Sub-analysis exclusively incorporating high-quality studies
- Sub-analysis segregated by study sample size, distinguishing between those with a sample size of 1,000 or more HCWs and those with a smaller sample size.

- Iterative exclusion of individual studies, followed by the reassessment of conclusions based on the remaining studies, aimed at averting any undue distortions.

Funnel plots were used to assess publication bias for evaluations that included more than two studies. The distribution of studies with a asymmetrical funnel shape indicated publication bias.

Statistical analysis was conducted using STATA MP17.

Strategies to increase vaccination compliance among HCWs, suggested strategies to address vaccine hesitancy, and determinants of good vaccination attitude were collected from all available studies. The respective findings were compared, with particular attention to the evidence presented in several of the included papers.

Results

Identification of relevant studies

The flowchart, meticulously crafted in accordance with the PRISMA guidelines[10] (Figure 1), provides a visual representation of the process employed for article selection. Following the established inclusion criteria, a total of 55 articles were initially identified within ISI Web of Knowledge, 39 within Scopus, and 51 within MEDLINE/PubMed. Additionally, one study was sourced through a bibliographic search. Subsequent to the exclusion of duplicated articles across the three databases, a final tally of 67 qualifying studies emerged. From this pool, a sum of 47 studies met the stipulated eligibility criteria,[12–58] of which 42 were subsequently included in the quantitative analysis,[12–53] as detailed in Table 1; the five studies excluded from the quantitative analysis lacked original data reporting. Consequently, a total of 135 studies were deemed ineligible and consequently excluded based on the predefined criteria.

Quality assessment

The NOS was suitably administered to the included studies, yielding a determination of high quality for 95.2% of them (Table 1).

Pooled analysis

Considering the 2017/18 influenza season, the pooled prevalence of vaccine good attitude, estimated on 39,493 HCWs, was 16.8% (95%CI = 13.8–19.9%), in accordance with an I^2 of

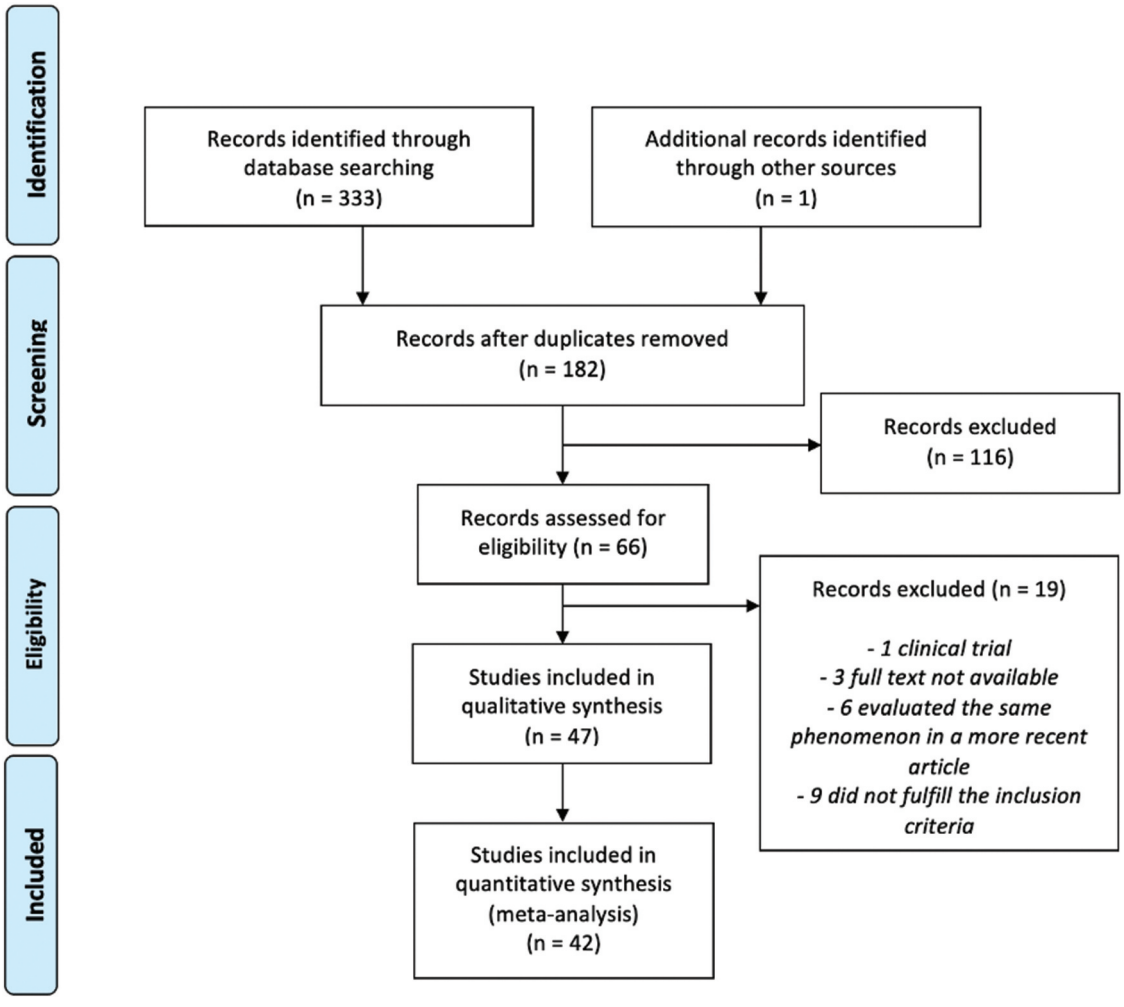

Figure 1. Flow-chart of bibliographic research.

Table 1. Characteristics of the selected studies included in the meta-analysis and systematic review.

			2017/18 season		2018/19 season		2019/20 season		2020/21 season		2021/22 season				
Author	Year	Quality	sample	vaccinated	sample	vaccinated	sample	vaccinated	sample	vaccinated	sample	vaccinated	Region	Study population	Outcome
Quantitative studies															
Bertoni et al.*[12]	2022	h			437	109	451	151	579	307			Emilia-Romagna	HCWs	VC
Bianchi et al.[13]	2022	h			3.867	789							Apulia	HCWs	VC
Costantino et al.[14]	2022	h							1.450	841			Sicily	Pharmacists	VW
Lecce et al.[15]	2022	h									3541	2381	Lombardy	HCWs and students	VC
Marziali et al.[16]	2022	h							1521	1156			Latium	Physicians and dentists	VU
Monami et al.[17]	2022	h							7707	5702			Multicenter	HCWs	VU
Ogliastro et al.[18]	2022	h					6194	794	6194	2356	6194	1423	Liguria	HCWs	VC
Papini et al.[19]	2022	h			2016	726	2012	817	2048	1221			Multicenter	HCWs	VU
Pascucci et al.[20]	2022	h									8221	1979	Latium	HCWs	VC
Regazzi et al.[21]	2022	h							2142	1497			Multicenter	Public Health HCWs	VU
Riccò et al.[22]	2022	h	161	45	161	42							Emilia-Romagna	HCWs	VU
Sani et al.*[23]	2022	m							2021	1084			Marche	HCWs	VC
Bellingheri et al.[24]	2021	h							421	171			Lombardy	HCWs	VU
Chitanno Congedo et al.[25]	2021	h			352	48							Lombardy	Students	VU
Della Polla et al.[26]	2021	h					613	295					Campania	HCWs	VU
Dettori et al.[27]	2021	h					2271	629	3044	1793			Sardinia	HCWs	VC
Di Gennaro et al.[28]	2021	h					1841	810	1841	1364			Multicenter	HCWs	VU and VW
Di Giuseppe et al.[29]	2021	h	490	21	490	152	490	200	490	333			Campania	HCWs	VW
Di Lorenzo et al.**[30]	2021	m					1360	324	2383	1849			Apulia	HCWs	VC
Di Pumpo et al.*[31]	2021	m					10207	2755	11857	6579			Latium	HCWs	VC
Gallè et al.[32]	2021	h					1.203	225	1.194	753			Multicenter	Students	VU
Lecce et al.[33]	2021	h			5.234	759	5.363	1.153	4.879	2.103			Lombardy	HCWs	VC
Ledda et al.[34]	2021	h	2.764	233	2.764	425							Sicily	HCWs	VU
Scardina et al.[35]	2021	h			5.721	663	5.936	847	6.323	2.505			Tuscany	HCWs	VC
Antinolfi et al.[36]	2020	h	4.419	641									Friuli Venezia Giulia	HCWs	VC
Arghittu et al.[37]	2020	h	457	132	457	140							Sardinia	HCWs	VU
Barbara et al.[38]	2020	h	3664	514	4248	933							Latium	HCWs	VC
Bellingheri et al.[39]	2020	h	3.520	429	3.520	750	3.520	817					Lombardy	HCWs	VC
Bert et al.[40]	2020	h	5.584	593	5.584	812							Piemonte	HCWs	VC
Brunelli et al.[41]	2020	h					12.627	3.264					Friuli Venezia Giulia	HCWs	VC
Costantino et al.[42]	2020	h					1.480	412					Sicily	HCWs	VC
Di Martino et al.[43]	2020	h			347	122							Abruzzo	HCWs	VU
Maffeo et al.[44]	2020	h			3417	495	3.405	733					Lombardy	HCWs	VC
Mellucci et al.[45]	2020	h	61	27	61	35	61	51					Latium	Students	VU
Montagna et al.[46]	2020	h			1.050	698							Multicenter	Public Health HCWs	VU
Pelullo et al.[47]	2020	h			715	89							Campania	HCWs	VU
Santangelo et al.[48]	2020	h			403	85	403	188					Sicily	Students	VW
Tognetto et al.[49]	2020	h	12.226	1.082									Latium	HCWs	VC
Paoli et al.[50]	2019	h	108	21									Tuscany	HCWs	VU
Pinto et al.[51]	2019	h	514	216									Multicenter	HCWs	VU
Vimercati et al.[52]	2019	h	3.394	482									Apulia	HCWs	VC
Gilardi et al.[53]	2018	h	2.131	369									Latium	HCWs	VC
Qualitative studies															
Colaprico et al.[54]	2022	-													
Mansour et al.[55]	2022	-													
Voglino et al.[56]	2022	-													
Moretti et al.[57]	2020	-													
Tamburrano et al.[58]	2019	-													

*Short report.
**Letter.
HCW s= healthcare workers; VC: Vaccine Coverage; VW: Vaccine Willingness; VU: self-reported Vaccine Good attitude.

98.2% and a *p*-value for the heterogeneity test of < .0001 (Figure S1). Sub-analysis by quality was not performed, considering that all included studies were high quality. The exclusion of one study at a time showed no severe distortions from any specific paper. Non-significant distortion was evidenced when considering sub-analysis by sample size with a pooled prevalence of 12.4% (95%CI = 10.3–14.5%; I^2 = 97.4%; *p*-value < .0001) in studies with a sample size of 1.000+ subjects and 26.0% (95%CI = 12.0–43.1%; I^2 = 98.2%; *p*-value < .0001) in studies with sample size < 1.000, with an inter-group heterogeneity *p*-value of .057.

Considering the 2018/19 influenza season, the pooled prevalence of vaccine good attitude, estimated on 35,260 HCWs, was 24.4% (95%CI = 19.9–29.2%), in accordance with an I^2 of 99.1% and a *p*-value for the heterogeneity test of < .0001 (Figure S2). Sub-analysis by quality was not performed, considering that all included studies were high quality. The exclusion of one study at a time showed that the paper by Montagna et al.[46] significantly overestimated the pooled prevalence because the study population was Public Health workers, a population with higher knowledge of influenza vaccine and therefore higher intake compared to other colleagues. Thus, the pooled prevalence excluding that study was 22.0% (95%CI = 18.8–25.3%; I^2 = 98.3%; *p*-value < .0001). A significative distortion was evidenced considering sub-analyses by sample size (excluding Montagna et al.[46]) with a pooled prevalence of 18.5% (95%CI = 14.8–22.5%; I^2 = 98.9%; *p*-value < .0001) in studies with a sample size of 1.000+ subjects and 26.6% (95% CI = 20.0–33.8%; I^2 = 95.1%; *p*-value < .0001) in studies with a sample size < 1.000, with between-group heterogeneity *p*-value = .037.

Considering the 2019/20 influenza season, the pooled prevalence of vaccine good attitude, estimated on 59,437 HCWs, was 30.7% (95%CI = 26.5–35.1%), in accordance with an I^2 of 99.2% and a *p*-value for the heterogeneity test of < .0001 (Figure S3). Sub-analysis by quality showed a pooled prevalence equal to 31.6% (95%CI = 26.6–36.8%; I^2 = 99.3%; *p*-value < .0001). The exclusion of one study at a time showed no severe distortions from any specific paper. Significant distortion was evidenced when considering sub-analysis by sample size with a pooled prevalence of 24.8% (95%CI = 20.7–29.2%; I^2 = 99.3%; *p*-value < .0001) in studies with a sample size of 1.000+ subjects and of 49.3% (95%CI = 39.6–58.9%; I^2 = 94.4%; *p*-value < .0001) in studies with sample size < 1.000, with between-group heterogeneity *p*-value < .0001.

Considering the 2020/21 influenza season, the pooled prevalence of vaccine good attitude, estimated on 56,094 HCWs, was 59.3% (95%CI = 52.4–66.0%), in accordance with an I^2 of 99.6% and a *p*-value for the heterogeneity test of < .0001 (Figure S4). Sub-analysis by quality showed a pooled prevalence equal to 58.6% (95%CI = 50.0–66.9%; I^2 = 99.7%; *p*-value < .0001). The exclusion of one study at a time showed that the paper by Regazzi L et al.[21] overestimated the pooled prevalence because the study population was Public Health workers, as per Montagna et al.[46] Thus, the pooled prevalence excluding that study was 58.6% (95%CI = 51.4–65.6%; I^2 = 99.6%; *p*-value < .0001). No significant distortion was evidenced when considering sub-analysis by sample size with a pooled prevalence of 59.6% (95%CI = 51.6–67.4%; I^2 = 99.7%; *p*-value < .0001) in studies with a sample size of 1.000+ subjects and 54.0% (95% CI = 38.9–68.7%; I^2=-; *p*-value=-) in studies with sample size < 1.000, with between groups heterogeneity *p*-value = .515.

Considering the 2021/22 influenza season, the pooled prevalence of vaccine good attitude, estimated on 17,956 HCWs, was 37.4% (95%CI = 15.2–62.8%), in accordance with an I^2 of 99.9% and a *p*-value for the heterogeneity test of < .0001. A sensitivity analysis was not performed since only three studies investigated this season.

Therefore, based on the above analyses, we have chosen the most reliable pooled prevalence estimate for each influenza season under analysis, the one reported in Figure 2.

Comparing attitudes toward the vaccine among male and female HCWs, the OR was 1.67 (95%CI = 1.45–1.92; I^2 = 85.0%; *p* < .0001; Figure S5). Sensitivity analyses showed no specific distortion (not shown). In the publication bias analysis, a non-relevant asymmetry in funnel plots may be shown (Figure S6).

Comparing attitudes toward the vaccine between nurses and physicians, the OR was 0.38 (95%CI = 0.31–0.47; I^2 = 94.0%; *p* < .0001; Figure S7). Sensitivity analyses showed no specific distortion (not shown). The publication bias analysis shows an irrelevant asymmetry in the funnel plots (Figure S8).

Comparing attitudes toward the vaccine among nurses and other HCWs, the OR was 1.13 (95%CI = 0.99–1.28; I^2 = 82.0%; *p* < .0001; Figure S9). Sensitivity analyses showed no specific distortion (not shown). In the publication bias analysis, an irrelevant asymmetry in the funnel plots may be evidenced (Figure S10).

Comparing the vaccine attitude of subjects younger than 40 years and those older than 40 years, the OR was 0.92 (95%CI = 0.71–1.20; I^2 = 93.0%; *p* < .0001; Figure S11). Sensitivity analyses showed no specific distortion (not shown). In the publication bias analysis, a slight asymmetry in the funnel plots may be evidenced (Figure S12).

Determinants of vaccination compliance and suggested strategies to address vaccination hesitation

Most studies have reported that the main reasons are lack of information about vaccination, the opinion that the vaccine is unsafe/useless, and fear of adverse events.[23,25,26,42–44,46,48,50,54,55,57] Other factors of a negative attitude toward the vaccine were the opinion that influenza is not a threatening disease,[14,25,26,42,50] the role of pharmaceutical companies in influencing vaccine policy decisions,[23,44] lack of time and/or forgetting to vaccinate,[25,48,56] and not considering themselves a high-risk group for spreading influenza to patients.[42,45,47,48,50,56] Nevertheless, HCWs reported that the safety and protection of themselves and their patients is a significant reason for vaccination good attitude;[14,15,20,22,25,29,42,45,47,50] it is significant for individuals with comorbidities.[18] HCWs with higher education and knowledge and who obtained information from scientific sources were associated with better acceptance.[22,26,29,36,47,50,54,56,58] Anyway, educating HCWs about seasonal influenza vaccination has been advocated by many authors[14,15,19,23,25,26,34,37,38,44–48,54,56,57] and should begin while they are still students in order to consolidate

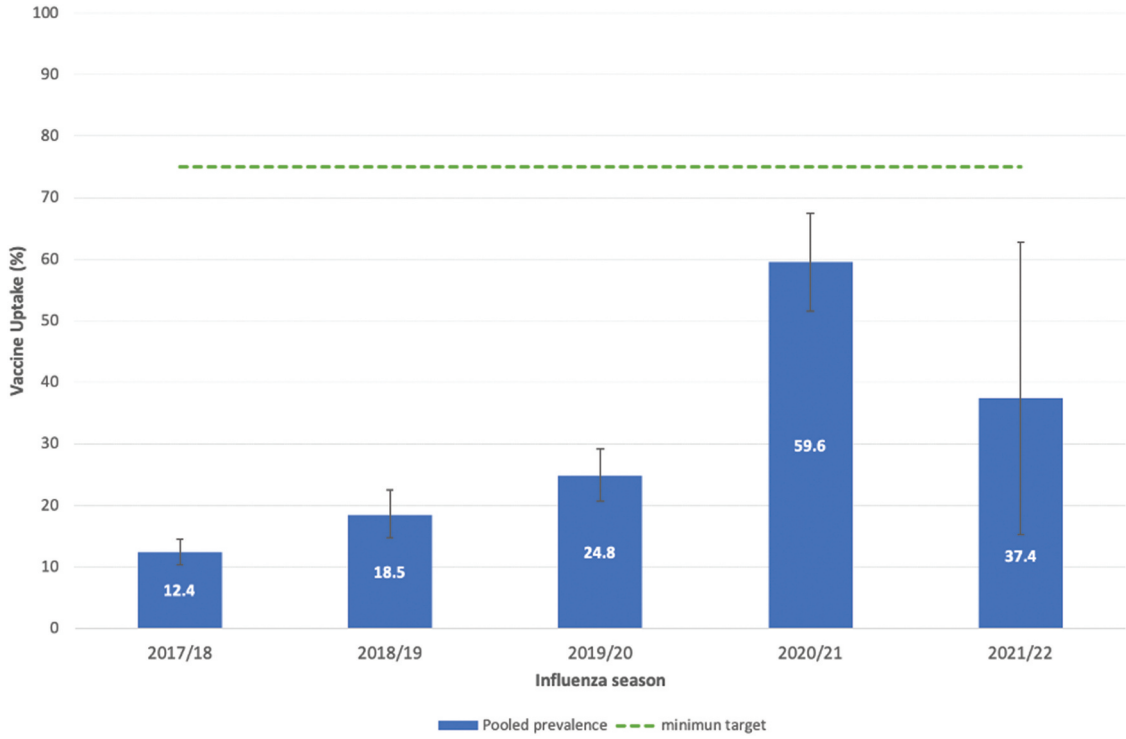

Figure 2. Estimated pooled prevalence trend of vaccination good attitude by influenza vaccination season.

this habit. Better communication on social networks provided by health institutions has also been hoped for.[43]

One of the main determinants of vaccination's good attitude was being vaccinated in previous influenza seasons,[25,29,35,42,46] just as good attitude with the 2020/21 influenza vaccination campaign was associated with better readiness for COVID-19 vaccination.[24,28] Regarding age, higher levels of compliance have been reported in younger HCWs,[23,26,27,33,35,41,44,52,53] even though three studies[12,38,46] reported lower hesitation in older subjects. The different approach to immunization between the sexes is more discussed, with eight studies[12,18,29,35,36,38,44,50] reporting better compliance in males and two[33,48] in females. Physicians seem to report less hesitation than other healthcare professionals;[13,15,18,19,26,28,31,35-38,43,44,50–52,54] as reported by Melucci et al.[45] the involvement of Medical School students in vaccination activities during the flu season improved their attitude toward immunization.

Regarding strategies to increase vaccination adherence, many authors have suggested that an on-site vaccination clinic is an effective strategy to increase compliance among HCWs,[13,19,27,31,34,35,38,40–42,44,47,48,50,52,53] although not sufficient to achieve VCs above the minimum goal of 75%. Proactive one-to-one invitations of HCWs in a personal e-mail, an advertising campaign, and competition among hospital departments (gaming strategy) seem to confer a greater spread of campaign information.[31,33,49] Finally, easy access to vaccination and overcoming logistical barriers for HCWs in undergoing vaccination seems to play a crucial role in determining a better outcome regarding vaccination coverage.[25,37,44,49] It should be considered that a relationship between influenza vaccination coverage of HCWs and absenteeism has been reported.[20,36] Improving vaccine acceptance and information by HCWs can be doubly effective in policies against seasonal influenza, as they are employed on the front lines and can be decisive in influencing the general population.[25,37,56]

Numerous contemporary studies have suggested the implementation of mandatory vaccination as a necessary response to an urgent societal demand for the safeguarding of personal and public health. Furthermore, such advocacy underscores the paramount importance of defending susceptible individuals and patients.[13,34,42,43,45,51,52,55] Di Lorenzo et al.[30] evidenced that after implementing the Apulian Regional Law n. June 27 June 19, 2018, which provided for the mandatory influenza vaccination for HCWs, the VC reached in health personnel working in High Infectious Risk Operational Units was 77.8%, higher than the previous seasons' figure (24% and 28%, respectively). The same health personnel expressed adequate support for mandatory vaccination for health care professionals, as well as the use of Personal Protective Equipment (PPE) for the unvaccinated;[25,36,54,56] HCWs who disagreed with the mandatory strategy appealed for freedom of choice.[50,57]

The co-administration of flu and COVID-19 vaccines has been investigated by two authors;[15,19] Lecce et al.[15] reported that co-administration might act as a facilitator toward flu vaccine good attitude for health personnel who had access to vaccination services during the 2021/22 influenza season but did not receive the flu vaccine in the 2020–2021 season, while Pascucci et al.[19] noted that health personnel prioritized vaccination against SARS-CoV-2, thus avoiding influenza vaccination, mainly because of the potential consequences of

concurrent administration that could overload the immune system or be more reactogenic, despite the availability of evidence-based recommendations demonstrating its safety and immunogenicity. Finally, two authors focused on the propensity for dual vaccination in later years, emphasizing that Public Health Institutions need to improve strategies to ensure the immunization of health personnel for influenza and COVID-19 vaccinations.[12,29]

Discussion

Our meta-analysis revealed that the vaccination attitude among HCWs in Italy has not met the minimum target of 75% set by Italian Health Institutions. A 2011 systematic review[59] reported influenza vaccination adherence rates among nurses and ancillary workers at 13.5% (95%CI = 9.6–17.9%) and 12.5% (95%CI = 10.0–15.3%), respectively, underscoring that vaccination hesitancy among health personnel in Italy has persisted as a long-standing issue. The positive vaccine attitude ranged from 12% in the 2017/18 influenza season to 58% in the 2020/21 season. These data demonstrate that, from one season to the next, the strategies implemented by Italian Health Institutions have improved the vaccine attitude toward influenza vaccination. However, the significant increase in the 2020/21 season must be addressed to the adaptation necessitated by the COVID-19 pandemic. This observation is further substantiated by data from the World Health Organization (WHO), which indicated an overall increase in vaccination coverage during the 2020/21 season in specific EU/EEA countries. Notably, these countries encompass Hungary, Ireland, Lithuania, Norway, Romania, Slovenia, Spain, Croatia, and the UK.[60] Further analysis is required regarding the 2021/22 influenza season, considering that only three studies have investigated this season. Our meta-analysis showed a decrease compared to the previous season, but the wide 95%CI necessitates further investigation. Nevertheless, it is possible that once the acute phase of the emergency subsides, health personnel may exhibit hesitancy toward flu vaccination due to the lack of a robust preventive culture.[19]

Both the meta-analysis and the systematic review showed that physicians appear to be less hesitant than nurses (OR = 0.38; 95%CI = 0.31–0.47), while when comparing nurses with other HCWs, they seem to be more prone to vaccination (OR = 1.13; 95%CI = 0.99–1.28); this evidence agrees with the literature.[61] As indicated by the findings of our systematic review, it becomes apparent that elevated education levels and reliance on scientific sources hold a pivotal influence on the attitudes of HCWs. This is particularly pertinent given that a considerable proportion of older Italian HCWs, including nurses and auxiliary staff, lack advanced academic qualifications such as a master's degree.[62] Our meta-analysis did not highlight the influenza vaccination aptitude of HCWs in Italy considering age groups (OR = 0.92; 95%CI = 0.71–1.20), although most of the experiences reported in the included studies showed better attitude in younger HCWs.[26,33,35,41,44,52,53]

The systematic review highlighted the main determinants of vaccination hesitancy; lack of information about vaccination, the opinion that the vaccine is unsafe or useless, fear of adverse events, and the opinion that influenza is not a threatening disease are known determinants of vaccination refusal in the scientific literature.[61] The influence of pharmaceutical companies on vaccination policy decisions has been identified as a factor contributing to vaccine hesitancy. While this assertion may be contentious, a review conducted in 2022 provided evidence that among both nurses and physicians, a certain degree of hesitancy can be attributed to their attitudes toward pharmaceutical companies. Specifically, nurses believed that physicians were swayed by pharmaceutical companies to endorse vaccination through concealed affiliations and financial incentives, while physicians cited the financial motivations of pharmaceutical companies as a source of concern.[62] Severe is the widespread opinion that health personnel do not consider themselves potential vectors of influenza transmission to patients; indeed, the use of influenza vaccine to prevent illness and transmission should be part of the "duty of care."[63]

The influence of information sources, particularly social media, warrants careful consideration. Italy has encountered the peril of vaccine campaign setbacks due to the unregulated spread of inaccurate information by the media on separate occasions (Fluad 2014, Vaxveria 2021).[64,65] The considerable impact of media communication on vaccine hesitancy is apparent, even within the community of Healthcare Workers (HCWs). Thus, it becomes imperative for public health organizations to take proactive measures to ensure accurate and science-based communication, particularly within the realm of social networks.

On the other hand, an awareness of safety and the protection of oneself and patients appears to increase willingness to vaccinate. Trust in the scientific community has already been identified as one of the significant determinants of vaccine compliance in the general population and therefore also plays a crucial role for HCWs. Another main determinant of vaccination adherence was having received a previous anti-influenza vaccination. Nonetheless, most authors and the scientific literature concur that only a multifactorial approach, including pro-active invitations, advertising campaigns, and competition among hospital departments, as well as easy access to vaccination (i.e., on-site vaccination), and improved vaccine acceptance and information among HCWs, has the potential to effectively increase influenza vaccination compliance among health personnel.[66]

The COVID-19 pandemic marked the 2020/21 influenza season; in this context, the highest VC values were recorded among HCWs in Italy. However, our systematic review revealed that both study authors and the interviewed HCWs themselves found mandatory anti-influenza desirable.[13,34,42,43,45,51,52]

The primary limitation of this meta-analysis was the high heterogeneity observed across studies, as evidenced by the I^2 values. Several factors may account for this high heterogeneity. One factor is the variation in the geographical locations within Italy where the phenomenon was studied among HCWs. Moreover, the authors employed different methods to assess "vaccine attitude," including evaluating vaccination coverage, gauging willingness to receive the vaccine in the upcoming flu season, or conducting retrospective interviews

with HCWs. Additionally, the sensitivity analyses conducted did not yield a notable enhancement in heterogeneity values across the various studies. Nevertheless, the implementation of a random-effects analysis within the statistical framework effectively mitigated this potential bias. Furthermore, it is important to acknowledge that certain surveys were disseminated through online platforms or social media, potentially leading to instances where HCWs responded to multiple questionnaires. Regrettably, this particular bias remains inherently challenging to identify or rectify. Nevertheless, a strength of our review and meta-analysis lay in the large sample size achieved by compiling selected papers. This bolstered the statistical analysis and offered a more comprehensive perspective on influenza vaccine hesitancy among Italian HCWs. Moreover, this study offers a comprehensive assessment of vaccination behaviors in a critical demographic. The multi-seasonal analysis provides a nuanced understanding of how these attitudes may evolve over time, considering the varying challenges posed by different influenza seasons. Furthermore, the sheer volume of data collected and analyzed underscores the study's robustness. Lastly, the originality of this research lies in its exploration of vaccination attitudes in a specific and vital segment of the healthcare workforce, shedding light on crucial insights for public health policy and intervention strategies. Finally, we computed OR for several determinants (such as sex, age class, professional category) that had not been previously documented in the literature.

Conclusions

HCWs are among the most trusted sources of vaccine information and have a direct impact on the vaccination decisions made by their patients and social contacts. A skeptical professional could potentially sway people's opinions or reinforce the belief that vaccinations are unsafe, especially among those who are already hesitant about vaccinations.[51] Indeed, the effectiveness of a vaccination campaign greatly relies on how well the message reaches and resonates with the general population.

Our study uncovered a significant proportion of HCWs expressing negative attitudes toward influenza vaccination and identified the primary determinants of this attitude. Mandatory vaccination, which has previously demonstrated success in other population groups, seems to be the sole effective measure for ensuring the protection of HCWs and the patients under their care. The only study reporting a vaccination coverage value > 75% is that of Di Lorenzo et al.;[30] VC achieved among health personnel after the implementation of mandatory vaccination reached 77.8% (+179% compared to the previous season).

In conclusion, policymakers should seriously contemplate the implementation of mandatory vaccination policies to attain high VC among health professionals, particularly those working in high-risk wards. The impacts of this mandatory approach should be subjected to evaluation, encompassing considerations of cost-effectiveness and addressing ethical and medico-legal aspects. Nonetheless, we believe it represents the quickest solution to address the issue of poor vaccination attitudes among healthcare personnel. Simultaneously, in the medium to long term, supplementary strategies for improving vaccination compliance should be developed to reassess HCWs' attitudes toward vaccination, with the potential to transition away from a mandatory approach if deemed appropriate.[66]

Acknowledgments

We acknowledge Mr. Nazario Brescia for the copy-editing of this paper.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

Research was funded by Puglia Region.

ORCID

Francesco Paolo Bianchi http://orcid.org/0000-0002-9659-0193
Silvio Tafuri http://orcid.org/0000-0003-4194-0210

References

1. CDC. Recommended vaccines for healthcare workers. [accessed 2022 Jun 4]. https://www.cdc.gov/vaccines/adults/rec-vac/hcw.html.
2. Black CL, Yue X, Ball SW, Fink RV, De Perio MA, Laney AS, Williams WW, Graitcer SB, Fiebelkorn AP, Lu PJ, et al. Influenza vaccination coverage among health care personnel - United States, 2017–18 influenza season. Morb Mortal Wkly Rep. 2018 Sept 28;67(38):1050–6. doi:10.15585/mmwr.mm6738a2.
3. Italian Government Legislative Decree No. 81/2008. Unique text on health and safety at work. [accessed 2022 Jun 2]. https://www.ispettorato.gov.it/it-it/Documenti-Norme/Documents/Testo-Unico-Dlgs-81-08-edizione-di-luglio-2018.pdf.
4. Italian Ministry of Health. National plan of vaccinal prevention (PNPV) 2017–2019. [accessed 2022 June 3]. http://www.salute.gov.it/imgs/C_17_pubblicazioni_2571_allegato.pdf.
5. Prato R, Tafuri S, Fortunato F, Martinelli D. Vaccination in healthcare workers: an Italian perspective. Expert Rev Vaccines. 2010;9(3):277–83. doi:10.1586/erv.10.11.
6. Fortunato F, Tafuri S, Cozza V, Martinelli D, Prato R. Low vaccination coverage among Italian healthcare workers in 2013. Hum Vaccin Immunother. 2015;11(1):133–9. doi:10.4161/hv.34415.
7. World Health Organization. Ten threats to global health in 2019. [accessed 2022 Jun 5]. https://www.who.int/news-room/spotlight/ten-threats-to-global-health-in-2019.
8. WHO. Q&A on coronaviruses (COVID-19). Updated 2021 May 13 [accessed 2022 Jun 4]. https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/q-a-coronaviruses.
9. Bianchi FP, Germinario CA, Migliore G, Vimercati L, Martinelli A, Lobifaro A, Tafuri S, Stefanizzi P, Amoruso F, Capodiferro L, et al. BNT162b2 mRNA COVID-19 vaccine effectiveness in the prevention of SARS-CoV-2 infection: a preliminary report. J Infect Dis. 2021 Aug 2;224(3):431–4. doi:10.1093/infdis/jiab262.
10. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, Shamseer L, Tetzlaff JM, Akl EA, Brennan SE, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021 Mar 29;372:n71. doi:10.1136/bmj.n71.

11. Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Losos M, Tugwell P. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Ottawa (Canada): Ottawa Health Research Institute; 2014.
12. Bertoni L, Roncadori A, Gentili N, Danesi V, Massa I, Nanni O, Altini M, Gabutti G, Montella MT. How has COVID-19 pandemic changed flu vaccination attitudes among an Italian cancer center healthcare workers? Hum Vaccin Immunother. 2022 Dec 31;18 (1):1978795. doi:10.1080/21645515.2021.1978795.
13. Bianchi FP, Tafuri S, Spinelli G, Carlucci M, Migliore G, Calabrese G, Daleno A, Melpignano L, Vimercati L, Stefanizzi P. Two years of on-site influenza vaccination strategy in an Italian university hospital: main results and lessons learned. Hum Vaccin Immunother. 2022 Dec 31;18(1):1993039. doi:10.1080/21645515.2021.1993039.
14. Costantino C, Graziano G, Bonaccorso N, Conforto A, Cimino L, Sciortino M, Scarpitta F, Giuffrè C, Mannino S, Bilardo M, et al. Knowledge, attitudes, perceptions and vaccination acceptance/hesitancy among the community pharmacists of Palermo's province, Italy: from influenza to COVID-19. Vaccines (Basel). 2022 Mar 18;10(3):475. doi:10.3390/vaccines10030475.
15. Lecce M, Biganzoli G, Agnello L, Belisario I, Cicconi G, D'Amico M, De Giorgi F, Ferilli A, Ferraguzzi G, Guzzardi F, et al. COVID-19 and influenza vaccination campaign in a research and University hospital in Milan, Italy. Int J Environ Res Public Health. 2022 May 26;19(11):6500. doi:10.3390/ijerph19116500.
16. Marziali E, Lontano A, Regazzi L, Paladini A, Villani L, Calabrò GE, Damiani G, Laurenti P, Ricciardi W, Cadeddu C. Factors influencing the choice to advise for or against COVID-19 vaccination in the physicians and dentists of an Italian region. Vaccines (Basel). 2022 Oct 25;10(11):1793. doi:10.3390/vaccines10111793.
17. Monami M, Gori D, Guaraldi F, Montalti M, Nreu B, Burioni R, Mannucci E. COVID-19 vaccine hesitancy and early adverse events reported in a cohort of 7,881 Italian physicians. Ann Ig. 2022 Jul–Aug;34(4):344–57. doi:10.7416/ai.2021.2491.
18. Ogliastro M, Borghesi R, Costa E, Fiorano A, Massaro E, Sticchi L, Domnich A, Tisa V, Durando P, Icardi G, et al. 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. J Prev Med Hyg. 2022 Oct 27;63 (3):E405–E14. doi:10.15167/2421-4248/jpmh2022.63.3.2700.
19. Papini F, Mazzilli S, Paganini D, Rago L, Arzilli G, Pan A, Goglio A, Tuvo B, Privitera G, Casini B. Healthcare workers attitudes, practices and sources of information for COVID-19 vaccination: an Italian national survey. Int J Environ Res Public Health. 2022 Jan 10;19(2):733. doi:10.3390/ijerph19020733.
20. Pascucci D, Nurchis MC, Lontano A, Marziali E, Vetrugno G, Cambieri A, Moscato U, Di Pilla A, Damiani G, Laurenti P. Flu and COVID-19 vaccination: what happens to the flu shot when the campaigns overlap? Experience from a large Italian research hospital. Vaccines (Basel). 2022 Jun 19;10(6):976. doi:10.3390/vaccines10060976.
21. Regazzi L, Marziali E, Lontano A, Villani L, Paladini A, Calabrò GE, Laurenti P, Ricciardi W, Cadeddu C. Knowledge, attitudes, and behaviors toward COVID-19 vaccination in a sample of Italian healthcare workers. Hum Vaccin Immunother. 2022 Oct;18(6):2116206. doi:10.1080/21645515.2022.2116206.
22. Riccò M, Vezzosi L, Marchesi F. Vaccinating front-line healthcare workers: results of a pre-pandemic cross-sectional study from North-Eastern Italy on first responders. Vaccines (Basel). 2022 Sep 7;10(9):1492. doi:10.3390/vaccines10091492.
23. Sani T, Morelli I, Sarti D, Tassinari G, Capalbo M, Espinosa E, Gasperini B, Prospero E. Attitudes of healthcare workers toward influenza vaccination in the COVID-19 era. Vaccines (Basel). 2022 May 31;10(6):883. doi:10.3390/vaccines10060883.
24. Belingheri M, Roncalli M, Riva MA, Paladino ME, Teruzzi CM. COVID-19 vaccine hesitancy and reasons for or against adherence among dentists. J Am Dent Assoc. 2021 Sep;152(9):740–6. doi:10.1016/j.adaj.2021.04.020.
25. Chittano Congedo E, Paladino ME, Riva MA, Belingheri M. Adherence, perception of, and attitude toward influenza and flu vaccination: a cross-sectional study among a population of future healthcare workers. Int J Environ Res Public Health. 2021 Dec 11;18(24):13086. doi:10.3390/ijerph182413086.
26. Della Polla G, Licata F, Angelillo S, Pelullo CP, Bianco A, Angelillo IF. Characteristics of healthcare workers vaccinated against influenza in the era of COVID-19. Vaccines (Basel). 2021 Jun 24;9(7):695. doi:10.3390/vaccines9070695.
27. Dettori M, Arghittu A, Deiana G, Azara A, Masia MD, Palmieri A, Spano AL, Serra A, Castiglia P. Influenza vaccination strategies in healthcare workers: a cohort study (2018–2021) in an Italian University hospital. Vaccines (Basel). 2021 Aug 30;9(9):971. doi:10.3390/vaccines9090971.
28. Di Gennaro F, Murri R, Segala FV, Cerruti L, Abdulle A, Saracino A, Bavaro DF, Fantoni M. Attitudes towards anti-SARS-CoV2 vaccination among healthcare workers: results from a national survey in Italy. Viruses. 2021 Feb 26;13(3):371. doi:10.3390/v13030371.
29. Di Giuseppe G, Pelullo CP, Paolantonio A, Della Polla G, Pavia M. Healthcare workers' willingness to receive influenza vaccination in the context of the COVID-19 pandemic: a survey in Southern Italy. Vaccines (Basel). 2021 Jul 9;9(7):766. doi:10.3390/vaccines9070766.
30. Di Lorenzo A, Tafuri S, Martinelli A, Diella G, Vimercati L, Stefanizzi P. Could mandatory vaccination increase coverage in health-care workers? The experience of Bari Policlinico general hospital. Hum Vaccin Immunother. 2021 Dec 2;17(12):5388–9. doi:10.1080/21645515.2021.1999712.
31. Di Pumpo M, Vetrugno G, Pascucci D, Carini E, Beccia V, Sguera A, Zega M, Pani M, Cambieri A, Nurchis MC, et al. Is COVID-19 a real incentive for flu vaccination? Let the numbers speak for themselves. Vaccines (Basel). 2021 Mar 18;9(3):276. doi:10.3390/vaccines9030276.
32. Gallè F, Sabella EA, Roma P, De Giglio O, Caggiano G, Tafuri S, Da Molin G, Ferracuti S, Montagna MT, Liguori G, et al. Knowledge and acceptance of COVID-19 vaccination among undergraduate students from Central and Southern Italy. Vaccines (Basel). 2021 Jun 10;9(6):638. doi:10.3390/vaccines9060638.
33. Lecce M, Perrone PM, Bonalumi F, Castaldi S, Cremonesi M. 2020-21 influenza vaccination campaign strategy as a model for the third COVID-19 vaccine dose? Acta Biomed. 2021 Oct 19;92 (S6):e2021447. doi:10.23750/abm.v92iS6.12230.
34. Ledda C, Rapisarda V, Maltezou HC, Contrino E, Conforto A, Maida CM, Tramuto F, Vitale F, Costantino C. Coverage rates against vaccine-preventable diseases among healthcare workers in Sicily (Italy). Eur J Public Health. 2021 Feb 1;31(1):56. doi:10.1093/eurpub/ckaa179.
35. Scardina G, Ceccarelli L, Casigliani V, Mazzilli S, Napoletano M, Padovan M, Petillo A, Sironi D, Brilli C, Gattini V, et al. Evaluation of flu vaccination coverage among healthcare workers during a 3 years' study period and attitude towards influenza and potential COVID-19 vaccination in the context of the pandemic. Vaccines (Basel). 2021 Jul 9;9(7):769. doi:10.3390/vaccines9070769.
36. Antinolfi F, Battistella C, Brunelli L, Malacarne F, Bucci FG, Celotto D, Cocconi R, Brusaferro S. Absences from work among healthcare workers: are they related to influenza shot adherence? BMC Health Serv Res. 2020 Aug 18;20(1):763. doi:10.1186/s12913-020-05585-9.
37. Arghittu A, Dettori M, Azara A, Gentili D, Serra A, Contu B, Castiglia P. Flu vaccination attitudes, behaviours, and knowledge among health workers. Int J Environ Res Public Health. 2020 May 3;17(9):3185. doi:10.3390/ijerph17093185.
38. Barbara A, La Milia DI, Di Pumpo M, Tognetto A, Tamburrano A, Vallone D, Viora C, Cavalieri S, Cambieri A, Moscato U, et al. Strategies to increase flu vaccination coverage among healthcare workers: a 4 years study in a large Italian teaching hospital.

Vaccines (Basel). 2020 Feb 13;8(1):85. doi:10.3390/vaccines8010085.
39. Belingheri M, Paladino ME, Latocca R, De Vito G, Riva MA. Association between seasonal flu vaccination and COVID-19 among healthcare workers. Occup Med (Lond). 2020 Dec 30;70(9):665–71. doi:10.1093/occmed/kqaa197.
40. Bert F, Thomas R, Lo Moro G, Scarmozzino A, Silvestre C, Zotti CM, Siliquini R. A new strategy to promote flu vaccination among health care workers: Molinette hospital's experience. J Eval Clin Pract. 2020 Aug;26(4):1205–11. doi:10.1111/jep.13295.
41. Brunelli L, Antinolfi F, Malacarne F, Cocconi R, Brusaferro S. A wide range of strategies to cope with healthcare workers' vaccine hesitancy in a North-Eastern Italian Region: are they enough? Healthcare (Basel). 2020 Dec 23;9(1):4. doi:10.3390/healthcare9010004.
42. Costantino C, Ledda C, Squeri R, Restivo V, Casuccio A, Rapisarda V, Graziano G, Alba D, Cimino L, Conforto A, et al. Attitudes and perception of healthcare workers concerning influenza vaccination during the 2019/2020 season: a survey of Sicilian University hospitals. Vaccines (Basel). 2020 Nov 16;8(4):686. doi:10.3390/vaccines8040686.
43. Di Martino G, Di Giovanni P, Di Girolamo A, Scampoli P, Cedrone F, D'Addezio M, Meo F, Romano F, Di Sciascio MB, Staniscia T. Knowledge and attitude towards vaccination among healthcare workers: a multicenter cross-sectional study in a Southern Italian region. Vaccines (Basel). 2020 May 24;8(2):248. doi:10.3390/vaccines8020248.
44. Maffeo M, Luconi E, Castrofino A, Campagnoli EM, Cinnirella A, Fornaro F, Gallana C, Perrone PM, Shishmintseva V, Pariani E, et al. 2019 influenza vaccination campaign in an Italian research and teaching hospital: analysis of the reasons for its failure. Int J Environ Res Public Health. 2020 May 30;17(11):3881. doi:10.3390/ijerph17113881.
45. Mellucci C, Tamburrano A, Cassano F, Galletti C, Sguera A, Damiani G, Laurenti P. Vaccine hesitancy among Master's degree students in nursing and midwifery: attitude and knowledge about influenza vaccination. Int J Environ Res Public Health. 2020 Oct 1;17(19):7191. doi:10.3390/ijerph17197191.
46. Montagna MT, De Giglio O, Napoli C, Fasano F, Diella G, Donnoli R, Caggiano G, Tafuri S, Lopalco PL, Agodi A, et al. Adherence to vaccination policy among Public health professionals: results of a National survey in Italy. Vaccines (Basel). 2020 Jul 11;8(3):379. doi:10.3390/vaccines8030379.
47. Pelullo CP, Della Polla G, Napolitano F, Di Giuseppe G, Angelillo IF. Healthcare workers' Knowledge, attitudes, and practices about vaccinations: a cross-sectional study in Italy. Vaccines (Basel). 2020 Mar 26;8(2):148. doi:10.3390/vaccines8020148.
48. Santangelo OE, Provenzano S, Firenze A. Factors influencing flu vaccination in nursing students at Palermo University. J Prev Med Hyg. 2021 Jan 14;61(4):E563–E7. doi:10.15167/2421-4248/jpmh2020.61.4.1426.
49. Tognetto A, Zorzoli E, Franco E, Gervasi G, Paglione L, Di Ninno F, De Soccio P, Barbara A, Orsi GB, De Vito C, et al. Seasonal influenza vaccination among health-care workers: the impact of different tailored programs in four University hospitals in Rome. Hum Vaccin Immunother. 2020;16(1):81–5. doi:10.1080/21645515.2019.1632684.
50. Paoli S, Lorini C, Puggelli F, Sala A, Grazzini M, Paolini D, Bonanni P, Bonaccorsi G. Assessing vaccine hesitancy among healthcare workers: a cross-sectional study at an Italian paediatric hospital and the development of a healthcare worker's vaccination compliance index. Vaccines (Basel). 2019 Nov 29;7(4):201. doi:10.3390/vaccines7040201.
51. Pinto L, Falsaperla R, Villani A, Corsello G, Del Gado R, Mazzeo A, Lubrano R. Influenza vaccination: opinions of health care professionals working in pediatric emergency departments. Ital J Pediatr. 2019 Apr 11;45(1):47. doi:10.1186/s13052-019-0638-6.
52. Vimercati L, Bianchi FP, Mansi F, Ranieri B, Stefanizzi P, De Nitto S, Tafuri S. Influenza vaccination in health-care workers: an evaluation of an on-site vaccination strategy to increase vaccination good attitude in HCWs of a South Italy hospital. Hum Vaccin Immunother. 2019;15(12):2927–32. doi:10.1080/21645515.2019.1625645.
53. Gilardi F, Castelli Gattinara G, Vinci MR, Ciofi Degli Atti M, Santilli V, Brugaletta R, Santoro A, Montanaro R, Lavorato L, Raponi M, et al. Seasonal influenza vaccination in health care workers. A pre-post intervention study in an Italian paediatric hospital. Int J Environ Res Public Health. 2018 Apr 24;15(5):841. doi:10.3390/ijerph15050841.
54. Colaprico C, Ricci E, Bongiovanni A, Imeshtari V, Barletta VI, Manai MV, Shaholli D, Marte M, Serruto P, La Torre G. Flu vaccination among healthcare professionals in times of COVID-19: knowledge, attitudes, and behavior. Vaccines (Basel). 2022 Aug 18;10(8):1341. doi:10.3390/vaccines10081341.
55. Mansour I, Collatuzzo G, De Pasquale V, Mirra I, Ciocan C, Godono A, Pira E, Boffetta P. Vaccination confidence among healthcare workers: results from two anamnestic questionnaires adopted in the COVID-19 and influenza campaign. Vaccines (Basel). 2022 Oct 29;10(11):1835. doi:10.3390/vaccines10111835.
56. Voglino G, Barbara A, Dallagiacoma G, Santangelo OE, Provenzano S, Gianfredi V. Do degree programs affect health profession students' attitudes and opinions toward vaccinations? An Italian multicenter study. Saf Health Work. 2022 Mar;13(1):59–65. doi:10.1016/j.shaw.2021.10.005.
57. Moretti F, Visentin D, Bovolenta E, Rimondini M, Majori S, Mazzi M, Poli A, Tardivo S, Torri E. Attitudes of nursing home staff towards influenza vaccination: opinions and factors influencing hesitancy. Int J Environ Res Public Health. 2020 Mar 12;17(6):1851. doi:10.3390/ijerph17061851.
58. Tamburrano A, Mellucci C, Galletti C, Vitale D, Vallone D, Barbara A, Sguera A, Zega M, Damiani G, Laurenti P. Improving nursing staff attitudes toward vaccinations through academic detailing: the HProImmune questionnaire as a tool for medical management. Int J Environ Res Public Health. 2019 Jun 5;16(11):2006. doi:10.3390/ijerph16112006.
59. 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 Jul;7(7):728–33. doi:10.4161/hv.7.7.15413.
60. WHO. Influenza vaccination coverage. [accessed 2023 Sep 2]. https://immunizationdata.who.int/pages/coverage/flu.html.
61. Bianchi FP, Vimercati L, Mansi F, De Nitto S, Stefanizzi P, Rizzo LA, Fragnelli GR, Cannone ESS, De Maria L, Larocca AMV, et al. Compliance with immunization and a biological risk assessment of health care workers as part of an occupational health surveillance program: the experience of a university hospital in Southern Italy. Am J Infect Control. 2020 Apr;48(4):368–74. doi:10.1016/j.ajic.2019.09.024.
62. Ahmad M, Akande A, Majid U. Health care provider trust in vaccination: a systematic review and qualitative meta-synthesis. Eur J Public Health. 2022 Apr 1;32(2):207–13. doi:10.1093/eurpub/ckab209.
63. Orr P. Influenza vaccination for health care workers: a duty of care. Can J Infect Dis. 2000 Sep;11(5):225–6. doi:10.1155/2000/461308.
64. Signorelli C, Odone A, Conversano M, Bonanni P. Deaths after Fluad flu vaccine and the epidemic of panic in Italy. BMJ. 2015 Jan 14;350:h116. doi:10.1136/bmj.h116.
65. Bianchi FP, Tafuri S. A public health perspective on the responsibility of mass media for the outcome of the anti-COVID-19 vaccination campaign: the AstraZeneca case. Ann Ig. 2022 Nov-Dec;34(6):650–655.
66. Bianchi FP, Stefanizzi P, Cuscianna E, Di Lorenzo A, Martinelli A, Tafuri S. Effectiveness of on-site influenza vaccination strategy in Italian healthcare workers: a systematic review and statistical analysis. Expert Rev Vaccines. 2023 Jan–Dec;22(1):17–24. doi:10.1080/14760584.2023.2149500.