COVID-19

Vaccine hesitancy in healthcare workers during COVID-19 pandemic: Draw on experience

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Keywords

Healthcare workers • Vaccine hesitancy • COVID-19 • Psychological wellbeing

Summary

Objectives. *The present study aimed to identify factors that affect healthcare workers' (HCWs) vaccine hesitancy and the subsequent changes in psychological well-being.*
Study design. *800 employees (207 M; 14 aged ≤ 25; 145 aged 26-35; 381 aged 36-55; 260 aged > 55 years) were recruited from the San Martino Hospital during the first months 2021.*
Methods. *HCWs were asked to fill in an online survey assessing (a) demographics, (b) having contracted COVID-19 infection, (c) vaccination history (against COVID-19 and influenza), (d) expected changes in psychological well-being, (e) vaccine hesitancy and (f) factors leading to a decision about the vaccine (Information Trust, Information Seeking, Fear for the Self, and Sense of Responsibility).*
Results. *We found that, in vaccinated HCW, years of employment and adherence to the influenza vaccine indirectly affected vaccine hesitancy. These effects were mediated by HCWs' sense of responsibility and information trust. Moreover, while information trust promoted positive changes in psychological well-being, vaccine hesitancy negatively affected it.*
Conclusions. *The present study consistently points to the crucial role of trusting information and having a sense of responsibility on vaccine hesitancy and, consequently, on psychological well-being. We discuss the practical implications for public health of these findings. In the conclusions, we suggest short-term and long-term strategies for improving vaccine adherence.*

Introduction

Vaccine hesitancy is the delay, reluctance, or refusal to get vaccinated despite vaccine availability and involves both vaccinated and non-vaccinated people [1, 2]. Hesitancy was highly affected by vaccine representation as being unsafe and ineffective as well as by negative beliefs regarding the untrustworthiness of the healthcare system [3]. In Italy, vaccine hesitancy is still a topic of interest since it is a major issue that could determine the failure of a vaccination program [4]. The COVID-19 pandemic has highlighted once more the importance of understanding the drivers of vaccine hesitancy. As the virus spread globally, the urgent need for a vaccine to fight against the disease led to a rapid development and approval process. This urgency and concern about the vaccine's safety and efficacy resulted in lower vaccine confidence and uptake rates in the general population [5]. Among others, healthcare workers (HCWs) were not immune to vaccine hesitancy [6-8] and displayed considerable hesitancy toward the COVID-19 vaccine [9]. HCWs' vaccine hesitancy raises significant concerns due to their increased risk of contracting and transmitting the virus leading to increased infections among vulnerable patients and colleagues and due to a possible increase of staff absences when there was a great need [10-12]. Moreover, HCWs' recommendations significantly impact vaccine acceptance in the general population and hesitant professionals were more likely not to recommend vaccination [13-15]. HCWs' attitudes toward COVID-19 vaccination were different from those of the general population that are most investigated [16-19]. Indeed, HCWs are more skillful in seeking healthcare information and can better understand the medical lexicon. An umbrella review synthesized the evidence about barriers and facilitators of HCWs' vaccine hesitancy toward the COVID-19 vaccine spotting several factors affecting vaccine hesitancy, such as sociodemographic, health, social, belief, and information factors [9]. The few empirical investigations on Italian HCWs agreed that their main reasons for accepting vaccination were protecting others and themselves from infection, and the main reasons for opposing vaccination were little or conflicting information and mistrust [20-22]. Moreover, Italian studies suggest a role of several demographic and personal-history-related factors such as age, receiving the influenza vaccination, and receiving a diagnosis of COVID-19 [13, 21-24].

However, these studies did not put all the factors affecting vaccine decisions together to identify the major predictors of COVID-19 vaccine hesitancy and did not consider the emotional effects of vaccine hesitancy. This would be important since enhancing vaccine adherence would, not only, reduce the risk of infection and transmission, but also, allow people to regain a sense of relief and optimism about returning to normalcy [18, 25, 26]. The present study tries to fill these gaps by (a) assessing at the same time all factors affecting vaccine hesitancy and (b) exploring the effects of vaccine hesitancy and related factors on changes in psychological well-being. Thus, the main aim of the present study was to identify factors that affect vaccine hesitancy and the subsequent changes in psychological well-being. Understanding and identifying the key factors that influence hesitancy and psychological well-being changes, especially for newly developed vaccines, like the COVID-19 one, is crucial for developing effective communication strategies that may foster confidence and vaccine acceptance.

Methods

Participants

HCWs were recruited from the San Martino Hospital through the work intranet. In detail, all HCWs were invited through an email in which the nature and consequences of the study were fully explained. The recruitment occurred during the first months of 2021 when the COVID-19 vaccine had just been made available only for HCWs and was not yet mandatory for them. A total of 800 employees (207 M; 14 aged ≤ 25; 145 aged 26-35; 381 aged 36-55; 260 aged > 55 years) agreed to participate and fill in the informed consent and the online survey.

Procedure

Through an online survey, HCWs were asked to answer if they made the COVID-19 vaccine. The survey ended if they can't adhere to the vaccine having contracted COVID-19 90 days before the vaccination, since the Italian ministerial circular drove their decision about the vaccine. All the other participants had to answer further questions assessing (a) demographics, (b) control variables (*i.e.*, having contracted COVID-19 infection, and vaccination history), (c) Changes in psychological well-being, and (d) factors leading to vaccine reluctance/refusal. Finally, for vaccinated HCWs, we also measured vaccine hesitancy and factors leading to COVID-19 vaccine acceptance.

Measures

Changes in psychological well-being

Quality of Life and Work changes. All HCWs were asked to rate on a 3-point Likert scale how they think their Quality of Life (QoL) and Quality of Work (QoW) would change after the vaccination campaign. We derived a QoL index and a QoW index that go from -1 (will get worse) to +1 (will get better).

Changes in positive and negative emotions. All HCWs were asked to think about pandemics and rate on a 3-point Likert scale how their emotions changed after the vaccination campaign. Participants can answer that the written emotion did not belong to them. In this case, the answer was considered as a missing value. We calculated a changes-in-positive-emotions and a changes-in-negative-emotions index from the mean of positive (*i.e.*, calmness and confidence) and negative (*i.e.*, stress, anxiety, anger, helplessness, worry, and fear) emotions items that could range from -1 (Less than before) to +1 (More than before).

Factors leading to a decision about the vaccine

Factors leading to COVID-19 vaccine reluctance/refusal. All HCWs were asked to rate how much information and mistrust in the vaccine affected their decision about the vaccine on a 6-point Likert scale from 0 ("at all") to 5 ("a lot"). We derived an Information-Trust (IT) index and an Information-Seeking (IS) index (see Supplementary).

Factors leading to COVID-19 vaccine acceptance. Vaccinated HCWs were asked to rate how much their sense of responsibility and concerns for their health affected their decision about vaccine adherence on a 5-point Likert scale from 0 (at all) to 5 (a lot). We derived a Fear-for-the-Self (FS) index and a Sense-of-Responsibility (SR) index (see Supplementary).

Vaccine hesitancy

Vaccine hesitancy was measured, like in previous studies, with a single item assessing how many doubts vaccinated HCWs had about vaccine adherence when they knew the vaccine would be available to them [27]. We asked them to rate this index on a 3-point Likert scale from 0 ("no doubts") to 2 ("many doubts").

Statistical analyses

Before testing our main hypothesis, we conducted descriptive statistics, and group comparisons (vaccinated *vs* non-vaccinated HCWs) using χ^2 tests for ordinal and categorical dependent variables, and independent sample t-tests for continuous dependent variables.

We then examined the associations between aspects leading to a decision, vaccine hesitancy, and well-being changes in vaccinated HCWs, adopting a path model where factors leading to decisions (*i.e.*, IT, IS, SF, SR) predict vaccine hesitancy and psychological well-being changes. The model also included the effect of vaccine hesitancy on psychological well-being changes and controlled for age, gender, years of employment, having contracted COVID-19 infection, and vaccination history letting them regress on factors leading to a decision and vaccine hesitancy. Finally, we let error terms covary within constructs (*i.e.*, aspects leading to decision, and changes in wellbeing) to allow for potential residual associations among variables.

The fit of the model tested was evaluated following the

Tab. I. Descriptive statistics among demographic and control variables for each group (vaccinated *vs* non-vaccinated).

	Whole	Vaccinated	Non-vaccinated		
	N	N (%)	N (%)	χ^2	p
Gender				3.23	.072
Male	188	185 (98%)	3 (2%)		
Female	559	534 (96%)	25 (4%)		
Age				4.93	.177
< 25	14	14 (100%)	0 (0%)		
26-35	135	134 (99%)	1 (1%)		
36-55	362	346 (96%)	16 (4%)		
> 55	236	225 (95%)	11 (5%)		
Profession				8.20	.085
Healthcare executive	207	204 (99%)	3 (1%)		
Healthcare professionals	397	375 (94%)	22 (6%)		
Healthcare assistants	28	28 (100%)	0 (0%)		
Residents	52	51 (98%)	1 (2%)		
Amministrative personnel	63	61 (97%)	2 (3%)		
Years of employment				6.61	.037
0-5	123	122 (99%)	1 (1%)		
6-15	123	121 (98%)	2 (2%)		
> 15	501	476 (95%)	25 (5%)		
COVID-19 infection				5.64	.018
Yes	101	93 (92%)	8 (8%)		
No	646	626 (97%)	20 (3%)		
Influenza vaccine				30.92	<.001
Yes	516	510 (99%)	6 (1%)		
No	231	209 (90%)	22 (10%)		

Tab. II. Descriptive statistics among variables of interest for each group (vaccinated *vs* non-vaccinated).

	Vaccinated		Non-vaccinated				
	N	Mean + SD	N	Mean + SD	t	p	g
Changes in QoL	719	0.50 +.51	28	0.18 +.48	3.46	.002	0.63
Changes in QoW	719	0.48 +.51	28	0.18 +.48	3.23	.003	0.59
Changes in PE	699	0.37 +.54	26	-0.52 +.50	8.23	<.001	1.65
Changes in NE	635	-0,42 +.44	25	0.15 +.54	-6.36	<.001	1.28
Information-Seeking	719	1.42 +.93	28	0.36 +.64	8.46	<.001	1.15
Information-Trust	719	2.94 +.75	28	2.46 +.62	3.36	.001	0.64
Fear-for-the-Self	719	1.65 + 1.00	-	-	-	-	
Sense-of-Responsibility	719	2.89 +.95	-	-	-	-	
Vaccine hesitancy	719	0.34 +.56	-	-	-	-	

QoL: Quality of Life; QoW: Quality of Work; PE: Positive Emotions; NE: Negative Emotions.

criteria recommended by Brown [28]: nonsignificant chi-square (χ^2) test, root mean square error of approximation (RMSEA) ≤.08, a comparative fit index (CFI), and a Tucker-Lewis index (TLI) ≥.90.

Results

Preliminary descriptive analyses

Among all participants, 89.9% (N = 719) have made the COVID-19 vaccine, 3.5% (N = 28) actively refuse to get vaccinated, and 6.6% (N = 53) can't adhere to the vaccine since have contracted COVID-19 90 days before the vaccine. In subsequent analyses, we focused only on a subsample of 747 HCWs of which 96% adhere to the vaccine and 4% actively refuse to get vaccinated. Descriptive statistics of the two samples among all study variables are reported in Tables I and II.

Groups comparison

Regarding ordinal and categorical variables, we found differences between groups in years of employment, having adhered to the influenza vaccine, and having contracted COVID-19 before the vaccine (Tab. I). In detail, the percentage of COVID-19 vaccine adherence decreased for HCWs with more years of employment. Moreover, HCWs who contracted a COVID-19 infection showed a lower percentage of vaccination against COVID-19 compared to HCWs who did not contract COVID-19

yet. Finally, HCWs not vaccinated against influenza, compared to vaccinated ones, showed a lower percentage of vaccination against COVID-19. No differences were found for gender, age, and profession (Tab. I).
Regarding variables of interest, results showed a significant difference in IS, and IT (Tab. II). In detail, we found that non-vaccinated HCWs were more alarmed by the availability of the vaccine for them and reported a lower influence of IS and IT on their decision about the vaccine. Moreover, we found a significant difference in changes in QoL, QoW, positive, and negative emotions (Tab. II). In detail, non-vaccinated HCWs referred to expect a lower increase in QoL and QoW as well as an increase in negative emotions, and a decrease in positive emotions.

Associations between aspects leading to a decision, vaccine hesitancy, and well-being changes in vaccinated HCWs

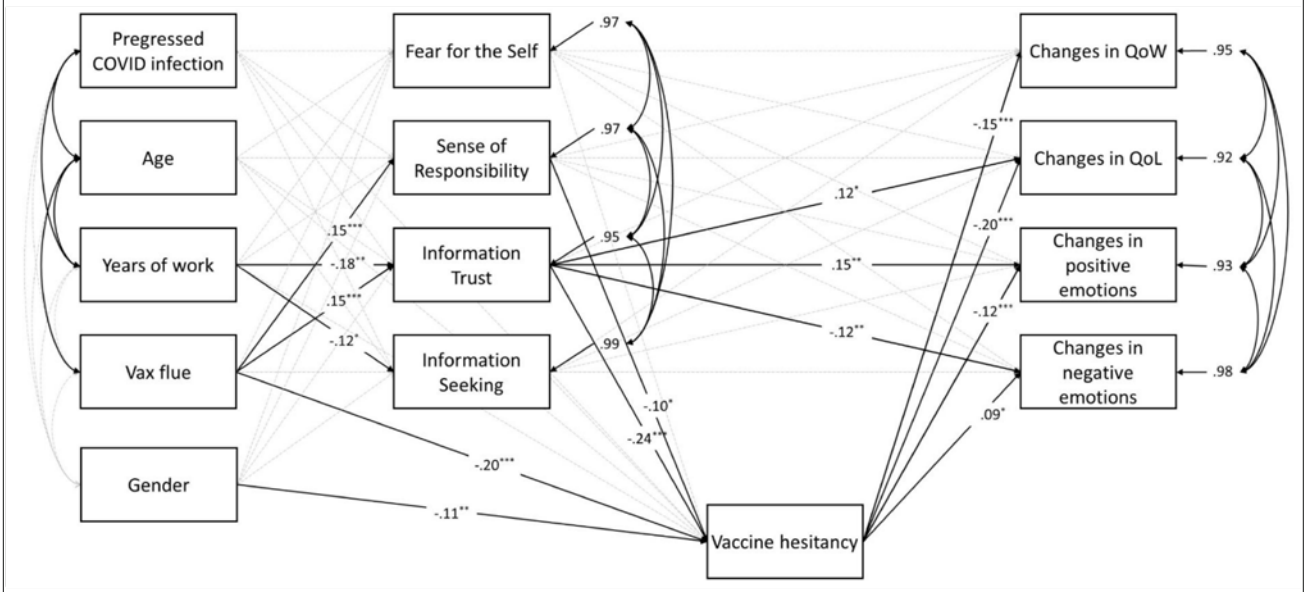
We investigated the effects of aspects leading to a decision on vaccine hesitancy and psychological well-being changes in vaccinated HCWs using the path model previously described. The resulting model exhibited a good fit to the data, $\chi^2(20) = 30.54$, $p = .062$, RMSEA = .03, CFI = .99, TLI = .96. Results are reported in Figure 1 and showed that years of employment affected IT, and IS in the direction that higher HCWs with more years of employment reported less IT and IS. Adherence to the influenza vaccine predicted SR, IT, and vaccine hesitancy. In detail, we found that HCWs who adhere to the influenza vaccine reported more SR and IT, and less vaccine hesitancy. Being male, SR, and IT exerted a negative effect on vaccine hesitancy. IT also predicts changes in negative emotions, QoL, and positive emotions in the direction that HCWs with more IT expect a decrease in negative emotions and an increase in positive emotions and QoL after the vaccine campaign. Finally, we found an effect of vaccine hesitancy on changes in negative emotions, QoW, QoL, and positive emotions. In detail, HCWs with more vaccine hesitancy expect an increase in negative emotions and a decrease in positive emotions and QoL after the vaccine campaign.

Discussion

Preliminary results

We first discuss preliminary results about the percentage of vaccine adherence and the difference between vaccinated and non-vaccinated HCWs.
Results about the percentage of vaccine adherence showed that even if the majority of HCWs adhere to the COVID-19 vaccine a percentage of professionals actively refuse vaccination, in line with national data before the vaccine became compulsory [29].
Regarding differences between vaccinated and non-vaccinated HCWs, we found that HCWs who contracted a COVID-19 infection showed a lower percentage of vaccination against COVID-19 compared to HCWs who had not contracted COVID-19 yet. This fits with evidence showing that HCWs who contracted COVID-19 considered themselves already immune from infection [20]. In addition, we found that the percentage of the COVID-19 vaccine decreased for HCWs not vaccinated against influenza.

Fig. 1. Path diagram depicting relations between control variables, factors leading to a decision about the vaccine, vaccine hesitancy, and changes in psychological well-being.



Paths with p >.05 are shown in grey dotted lines. * p <.05. ** p <.01. ***p <.001. Vax flue: Influenza vaccine; QoL: Quality of Life; QoW: Quality of Work.

This result fits with the literature reporting refusal of the influenza vaccine as a predictor of vaccine hesitancy [13, 17, 21, 24]. Interestingly, regarding the influenza vaccine, we found that the number of HCWs that adhere to the influenza vaccine was very high in line with the increasing trend of influenza vaccination rates following the start of the COVID-19 pandemic [30, 31]. We found that the percentage of the COVID-19 vaccine increased for HCWs with higher years of employment, *i.e.*, those who are more experienced. Thus, they may preferably base their decisions on the intuitive system (*i.e.*, automatic, associative, and fast way of thought) rather than on the analytical system (*i.e.*, logical, reason-based, and relatively slow way of thought) [32]. Being more subjective to heuristics could result in decision cognitive biases [33] that were negatively related to risk perception, information-seeking, and preventive behavior like vaccine adherence [34]. Moreover, we also found that IT and IS are higher in HCWs vaccinated against COVID-19, in line with the higher trust induced by COVID-19 [35] and its role in vaccine acceptance [17-36]. Finally, we found that vaccinated HCWs expect an increase in their QoL, QoW, and positive emotions, and a decrease in their negative emotions. Thus, people who adhere to the vaccine feel it is the ultimate answer to the pandemic that would allow them to return to life as it was and to regain freedom, and normality in social relationships positively impacting emotional well-being [37].

Main results

The main aim of the present study was to identify factors that affect vaccine hesitancy and the subsequent changes in psychological well-being.

We found that higher years of employment predict lower IS and IT which, in turn, predicts vaccine hesitancy. The indirect effect on vaccine hesitancy mediated by IT is in line with the hypothesis that the higher formation about vaccines received during newer healthcare professionals' degree programs leads to a higher trust in vaccines. Thus, HCWs with fewer years of employment are those who have been educated more recently. In the last few decades, healthcare degree programs increased their attention to vaccines' safety and value. Interestingly, studies performed among younger HCWs have shown higher rates of adverse reactions, mild and transient, following the COVID-19 vaccines, further highlighting the need to improve the knowledge concerning these items among this subcategory. These findings could be useful in informing all HCWs to set evidence-based expectations and possibly improving adherence to vaccination campaigns [38-40]. Thus, improving self-rated knowledge about the COVID-19 vaccine was found to be significantly protective against COVID-19 and vaccine hesitancy [23-40].

Moreover, adherence to the influenza vaccine exerted a significant direct and indirect negative effect on vaccine hesitancy. Indeed, during the COVID-19 pandemic, the importance of the influenza vaccine could have been boosted by the co-circulation of the two viruses during flu season. Thus, being vaccinated against influenza could help to disentangle the type of virus contracted [41]. Moreover, the higher perceived level of a health threat could lead people to adopt higher preventive behavior [41]. The indirect effects on vaccine hesitancy were mediated by SR and IT. The mediation of IT highlighted how trust would have reduced hesitancy about the COVID-19 vaccine. Indeed, several studies highlighted the role of trust in the COVID-19 vaccine and science on vaccine acceptance [17, 36, 42, 43]. The mediation of SR on vaccine hesitancy suggests that HCWs vaccinated against influenza are more prone to a sense of responsibility that affects their higher acceptance and lower hesitancy among vaccines in general. The role of responsibility in reducing vaccine hesitancy highlights the importance of getting vaccinated as a collective responsibility to protect the health of patients and family members [44].

Contrary to our expectations, we did not find an effect of IS on vaccine hesitancy and changes in well-being probably because no clear information was already available about SARS-CoV-2 and its vaccines, and people were highly exposed to conflicting or unclear information [9]. Thus, in this period, even HCWs face the challenge of seeking trusting information making IS not a valid strategy to decide about vaccine adherence.

Regarding the effect on changes in psychological well-being, we found that IT has a direct and indirect positive effect. This is consistent with studies showing that living a "common fate" in the face of mortal danger, can improve relationality and prosociality, which, in turn, impacts trust toward others and well-being [45]. Vaccine hesitancy mediates the indirect effects of IT and SR on psychological well-being. Accordingly, the literature showed that lower hesitancy reflects individuals' intention to actively contribute to protecting others (*e.g.*, patients and relatives) and promotes a sense of empowerment positively impacting their emotional well-being [18, 25, 26].

Conclusions

Altogether, our findings consistently point to the crucial effects of IT and SR on vaccine hesitancy and expected changes in psychological well-being. These results have several practical implications for public health pointing to the importance of promoting trust and responsibility among HCWs by using, for example, coherent communication campaigns emphasizing social norms and prosocial behavior [46].

In the short term, it could be useful to directly involve HCWs in small group meetings to explore their attitudes towards vaccines and their possible contradictory thoughts. These focus groups should contribute to (a) improving HCWs' decision-making by increasing their awareness of cognitive dissonances and bias based on heuristics (b) enhancing HCWs' trust by giving them evidence-based information about vaccines, and (c) fostering their sense of responsibility by engaging

them actively in promoting vaccine acceptance among HCWs and more broadly the general population. Future studies should move in this way, planning focus groups to identify HCWs' attitudes and cognitive dissonances towards vaccines.

In the long term, it could be useful to break down erroneous beliefs about vaccines starting from the basics of primary school and prosecuting with specialistic education. In line with this, evidence showed that promoting cognitive information processing alone was ineffective in contrasting the effects of fake news [47]. Indeed, it is necessary to increase the general level of instruction to promote a mature prior belief system that has a role in mistrusting fake news [47]. Accordingly, promoting a culture of critical thinking should be crucial to help people navigate a world full of information and distinguish true from fake information [48]. Moreover, since vaccine acceptance is also an emotional process, education programs should help people in the management of emotional responses to false news [49-50]. Educating about emotion regulation strategies in media literacy may reduce hesitancy by decreasing the reliance on heuristics in decisions about vaccines [51].

Limits

Despite the novelty of this study, it is not exempt from limitations. First, the measures used are not preliminarily validated. Second, the cross-sectional nature of the study prevents us from deriving certain conclusions about the direction of the relationships between factors leading to a decision about the vaccine, vaccine hesitancy, and changes in psychological well-being. Indeed, since changes in emotions are expected, we are not certain that our results replicated when emotional changes were assessed retrospectively.

Ethical approval

The local ethics committee approved the study protocol (N. Reg. 171/2021 - DB id 11335).

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Conflicts of interest statement

The authors have no conflicts of interest to disclose.

Author contributions

FR and ES: conceived the study. PDS: conducted the analysis. PDS, FR, and ES: drafted the first version of the article, and all the authors reviewed the article critically for important intellectual content. All the authors have approved the final version of the article.

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