Health Care Workers' Reluctance to Take the Covid-19 Vaccine: A Consumer-Marketing Approach to Identifying and Overcoming Hesitancy

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An anonymous survey of employees across the Yale Medicine and Yale New Haven Health system at the time of FDA approval of the Pfizer-BioNTech vaccine used sentiment analysis to estimate the prevalence of and underlying reasons for Covid-19 vaccine hesitancy. Overall, 1 in 6 health care workers expressed reluctance to getting the vaccine in the first wave. Yale identified 15 themes describing reasons for this reluctance and found positive and negative sentiments underlying many of them. They propose strategies for messaging to mitigate vaccine hesitancy among these groups.

Health care workers are defined as critical infrastructure workers[1] for whom early Covid-19 vaccination should be prioritized and offered[2] in the U.S. Centers for Disease Control and Prevention (CDC)'s initial Covid-19 Vaccination Program Operational Guidance.[3] Health care workers (HCWs) are broadly defined as those not only providing direct patient care, but also providing essential support and operational services.

While health care leaders may assume that HCWs would have little hesitancy to take a vaccine given the risks of personal illness, fear of transmitting SARS-CoV-2 to patients and families, the high stress of the pandemic, and direct observation of patient harm, in reality, many HCWs may balk for a host of reasons. They may fear the clinical uncertainty of a new therapeutic, be wary as a result of the politicization of vaccination, or altruistically believe that higher-risk populations such as those with chronic health conditions should be vaccinated first.

To wit, the CDC reported that only 63% of HCWs polled over several months would get a Covid-19 vaccine.[4] (These surveys were conducted before public release of data by the U.S. Food and Drug Administration [FDA] and the manufacturer, as well as prior to initiation of vaccination in the U.K.)

The risk of vaccine hesitancy was heightened by the State of Connecticut's Covid-19 Mass Vaccination Plan, which appropriately anticipated shortages and uncertainty of vaccine supply. Health systems charged with vaccinating all personnel would be provided with weekly allotments of vaccine that are dependent on the number of doses utilized the prior week. This created a major impetus to ensure complete vaccine administration each week in order to receive enough supply to vaccinate all health care personnel within approximately 8 weeks.

We administered an anonymous survey to employees across our health system contemporaneous with FDA approval of the Pfizer-BioNTech vaccine to estimate the prevalence of Covid-19 vaccine hesitancy, as well as to characterize underlying reasons for vaccine hesitancy and identify sentiments amenable to persuasion through messaging campaigns. The survey was sent to the approximately 33,000 employees and medical staff across our health care system, which comprises Yale Medicine and Yale New Haven Health. The survey included clinically facing staff and those who support the critical infrastructure of the health system without direct patient contact, such as food service staff.

We chose to administer a fully anonymous survey to increase survey participation. Our personal conversations with frontline staff indicated an unwillingness to express vaccine hesitancy in fear of being labeled an "anti-vaxxer" or outside of social norms. Prior research also indicates that employee response rates are likely to be lower and that those who respond are less truthful if they perceive that their answers would be identified.[5,6] These concerns might also be higher among minorities and marginalized groups.[7] To most respondents of electronic surveys, even the collection of limited attributes like work role and age or gender is feared as potentially identifiable.

The survey included eight items, the first of which asked, "Once the U.S. Centers for Disease Control and Prevention and Food and Drug Administration have deemed Covid-19 vaccines safe and effective, would you get the vaccine if it was readily available and no cost to you?" Response options were: Extremely Likely, Somewhat Likely, Neither Likely nor Unlikely, Somewhat Unlikely, and Extremely Unlikely. Those who responded Very Likely or Likely were asked how soon they would get the vaccine (when first available, in 6 months, or later in the year). All others were asked, "What would make you comfortable getting the vaccine?" and provided a free-text box for responses.

Results

We received a total of 3,523 responses (an estimated 11% response rate) within the first 30 hours of survey availability. Fully 85% of respondents stated they were Extremely Likely or Somewhat Likely to receive the Covid-19 vaccine. Of these, 87% of these respondents sought the vaccine as soon as it was available to them, while 12% expressed mild hesitancy by stating that they would get it in the next 6 months.

Table 1. Primary Themes Stated by Participants Unlikely to Get the Vaccine That Would Make Them Comfortable Getting the Vaccine

Theme	Description	N	Percent
Long term	Wanted long-term follow-up (>1 year)	197	29.19%
Medium term	Wanted medium-term follow-up (1 year)	82	12.15%
Nothing	Nothing would make them comfortable	74	10.96%
Pregnant	Currently pregnant, breastfeeding, or planning pregnancy	53	7.85%
Safety	Concerned about safety or side effects	40	5.93%
Others getting	Wanted to see others get the vaccine	39	5.78%
More study	Wanted more clinical research and study	39	5.78%
Data transparency	Wanted to see the study results themselves	36	5.33%
Rushed process	Felt studies were rushed	32	4.74%
Health condition	Had an underlying condition that was not studied	15	2.22%
Technology	Worried about mRNA technology	14	2.07%
Allergies	Have severe allergies or prior reactions to vaccines	11	1.63%
Incentive	Requested incentive or mitigation of risks (e.g., not using sick days or pay loss for side effects)	8	1.19%
Had Covid-19	Had Covid-19 already and relying on natural immunity	8	1.19%
Religious	Religious objection	7	1.04%
Political	Concern about political influence	6	0.89%
Antibody	Requested antibody testing	5	0.74%
Length of immunity	Asked about length of immunity from vaccine	4	0.74%
Anti-vaccine	Generally anti-vaccine	2	0.30%
Misinformation	Misinformation about Covid-19 mortality risk	2	0.30%

Source: The authors

Another 523 (14.7%) responses from staff expressed reluctance to take the vaccine when readily available (Neither Likely nor Unlikely, Somewhat Unlikely, and Extremely Unlikely). These respondents indicated a wide variety of reasons for reluctance. Response themes and the frequency at which they were reported are shown in Table 1.

The top reasons for reluctance were long- and medium-term safety concerns, although some participants indicated that "Nothing" would make them comfortable. A few indicated concerns stemming from the clinical trial's exclusion of specific groups (e.g., pregnant women) or uncertainty about whether minorities were included in the trial.

While theme frequencies may provide a summary-level characterization regarding vaccine hesitancy, we also examined the complete free-text responses to better understand the underlying strengths and emotions of respondents' hesitancy in order to lead to more effective interventions.

We developed word clouds (Figure 1 also see Appendix) using subsets of data limited to the top 15 themes. Word clouds allow visualization of the raw text of responses, focusing the reader's attention on terms that are most common. The "R" statistical software and word cloud package were used for this purpose. The word clouds reveal unknown factors within the themes. For example, in the Others Getting theme, we saw that while watching others' experience would make most respondents comfortable, a minority had an altruistic motive. In the Nothing theme, respondents expressed concern about a mandate from the employer and spoke in strong terms about being uncomfortable with taking the vaccine.

FIGURE 1

Word Clouds for the Top 15 Themes for Vaccine Hesitancy

Wordclouds allow us to visualize the raw text of the responses, focusing the reader's attention on terms that are most common. The "R" statistical software and wordcloud package were used for this purpose.
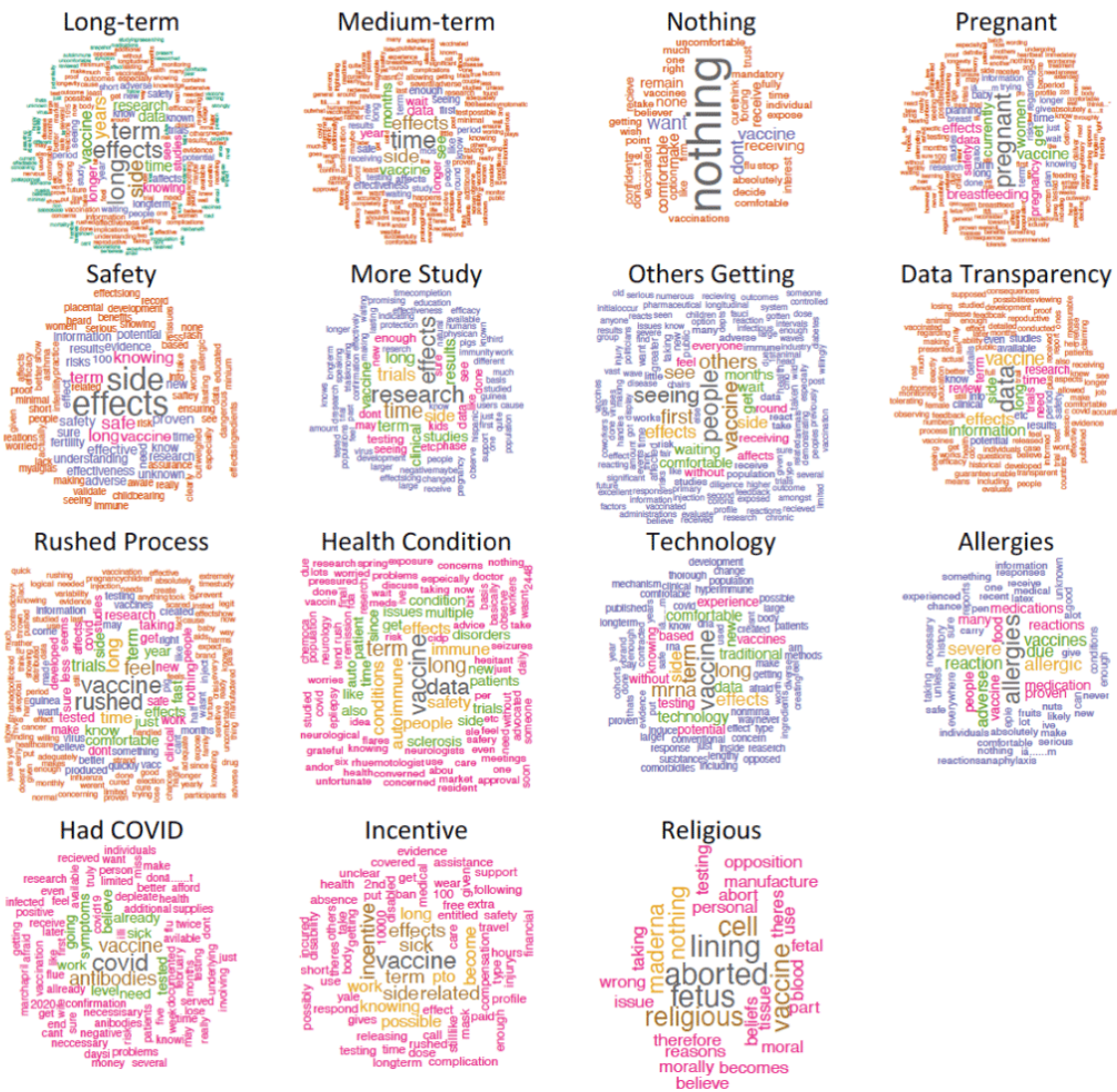
Source: The authors

Sentiment analysis has been used in prior research across a variety of medical settings, ranging from patients' social media to electronic health records,[8] as well as more broadly for brands[9] and even prediction of stock market returns.[10] We used a sentiment lexicon-based approach, by which we classified sentiments by the top 15 themes. This captured both positive and negative scores of all sentiments within each theme. A higher negative score indicates that respondents used words

and phrases that have highly negative meaning, or more vaccine hesitancy. Thus, an overall score assigned for each phrase is positive (+1), negative (-1), or neutral (0).

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Figure 2 shows the total positive, negative, and overall sentiment across each theme for vaccine reluctance (also see Appendix). We find that the sentiment scores for those with long-term concerns are a combination of positive (green bar) and negative (red bar) sentiments. In many categories, the majority of users did not express strong sentiments. However, within the theme of Allergies, respondents expressed very strong negative sentiments, indicating distrust of the vaccine based on prior negative reactions to other vaccines. Similarly, we find that those with underlying health conditions and religious concerns had very strong negative sentiment toward being forced to take the vaccine.

FIGURE 2

Sentiment Analysis by Themes

Legend:
- Total number of responses (N)
- Number of words with negative sentiment (–)
- Number of words with positive sentiment (+)
- Total net of positive and negative sentiments (Total)
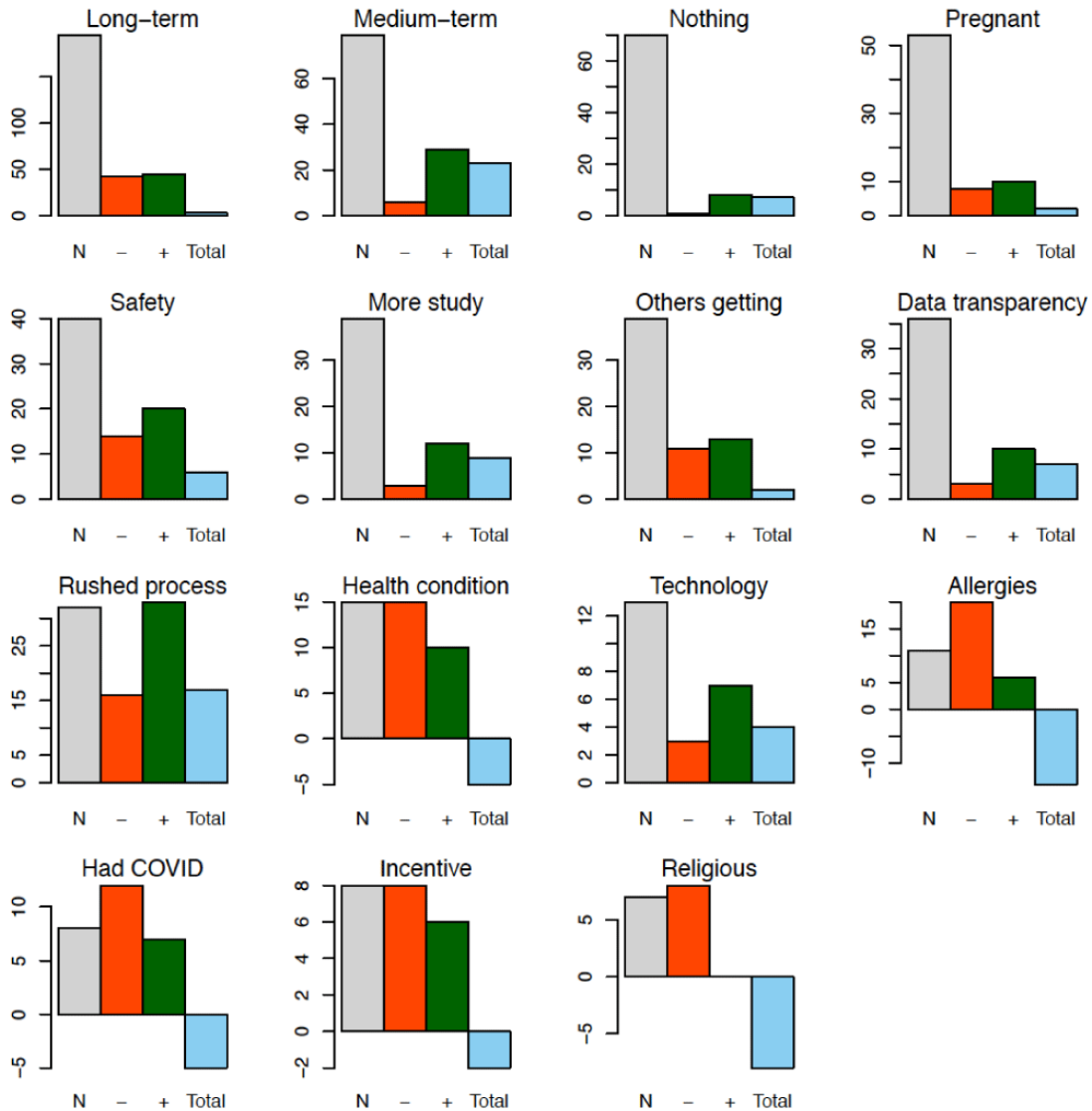
Source: The authors

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However, those who expressed reluctance due to the lack of data transparency don't seem to have strongly negative sentiment, indicating they might benefit from receiving more details and discussion around the vaccine development and trial process from a trusted source. Broadly, people expressing themes for which we see more positive sentiments might be persuadable, whereas those with highly negative sentiments might be less so.

Table 2. Recommended Interventions to Mitigate Reasons Stated Not to Get the Vaccine in the First Wave

#	Theme	Specific Reason	Recommended Intervention
1	Long term and medium term	Not convinced of longer-term safety of vaccine	Communicate the latest trial results with the audience. Promise and provide regular, future updates on vaccine safety.
2	Others getting	Want to wait for others to receive	Because majority want to wait to see how vaccine affects others, communicate and celebrate the experiences of other employees who received the vaccine.
3	Health condition	Patients with autoimmune and other conditions not included in trial; concerned about pressure	Determine if employees with such conditions have taken it and are willing to share their specific experience publicly or in an interactive session. This information may be difficult to obtain.
4	Pregnant	Pregnant women and concerns about breastfeeding	Provide interactive sessions specifically to answer questions about potential risks and benefits, both known and unknown, for getting and not getting the vaccine among both breastfeeding and pregnant women.
5	Religious	Very concerned about tissue taken from aborted fetus	Fact-check use of fetal tissue in vaccine research among available vaccines. Determine if influencers trusted by this group indicate it is morally acceptable.[T1] Historically, top-down pressure is unlikely to work in this scenario.
6	Had Covid-19	Not sure why vaccine is required if a person has antibodies	Need trusted sources to explain the specific reasoning for this subgroup about benefits and effectiveness of the vaccine after Covid-19 infection.

T1. Asher J. Use of Pfizer, Moderna Covid-19 Vaccines Is Morally Acceptable, Say Bishops. National Catholic Reporter. November 25, 2020. Accessed December 15, 2020. https://www.ncronline.org/news/coronavirus/use-pfizer-moderna-covid-19-vaccines-morally-acceptable-say-bishops. Source: The authors

Recommended Interventions

While the prevalence of vaccine hesitancy among our employees was modest in comparison to several recent media reports, 1 in 6 personnel in our health system reported vaccine hesitancy after the first FDA approval of a Covid-19 vaccine for a myriad of reasons. Given the possibility of our employees responding favorably to an employer-administered survey due to social desirability bias, the risk of health care workers failing to meet community-wide standards for vaccination is possible and must be anticipated and mitigated.

Understanding the reasons underlying reluctance in this population of health care workers is essential to increasing the likelihood of successful intervention. Without these reasons documented in the free-text response, we might recommend the "wrong" intervention. Consider two responses within the theme Others Getting. Response A indicates "it should be given first to others who have greater health risks," whereas B response indicates "I would be more comfortable to see how everyone else handles it first." These would have entirely different interventions to reduce reluctance. For A, we would communicate that individuals at high risk have adequate supplies of vaccines, whereas for B, we would provide data indicating high efficacy and low risk of side effects in populations similar to them. If these interventions were reversed, they might not be effective. Unlike traditional quality improvement initiatives that may afford the time for iterative cycles of failure and re-intervention, the scarcity of vaccine supply and magnitude of the Covid-19 pandemic demand a higher probability of early success.

Based on experience in other industries and principles of consumer marketing, we propose several specific recommended interventions targeted to each specific reason for vaccine hesitancy in Table 2.

Limitations and Conclusions

Our study has limitations. First, as with any survey, participants who do not respond might be more reluctant to be vaccinated, which risks underestimating the true prevalence of vaccine hesitancy. Second, we anonymized the survey to improve response rate and reliability, but this limits our ability to use results to develop targeted messaging at specific types of health care personnel. Third, we only asked participants who are reluctant to receive the vaccine for text responses, so our sentiment analysis is likely to skew more negative than typical data. Fourth, intentions are not the same as behavior, so we don't know if those who indicated they would take the vaccine will actually follow through. Finally, the study population was in the state of Connecticut, which experienced very high rates of Covid-19 and health system strain in the spring of 2020 and again in the fall and may not be generalizable to other parts of the United States with different local Covid-19 burdens. Furthermore, Connecticut has historically the second-highest statewide flu vaccination rate nationally, which may imply a populace that is relatively more trustful of vaccination programs.

> "
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While this analysis may seem complicated to some on the surface, the design, administration, and analysis of this survey was completed within 1 week. Furthermore, the analytic tools and software necessary to replicate this approach in other health systems or by other employers are easily accessed through code we made publicly available and through openly accessible software, respectively. The rich insights provided by this approach demonstrate the potential for health systems to learn from consumer marketing firms that routinely apply such survey methods for customer service improvement, as well as unstructured text analysis to learn about performance issues in service industries.[11]

Overall, we found the vast majority of our health care workers who responded to this anonymous survey were willing to get the Covid-19 vaccine in the first wave. However, 1 in 6 health care personnel expressed reluctance to get vaccinated, primarily due to concerns about the lack of information regarding the vaccine's effectiveness and safety. We describe 15 major reasons for unwillingness and propose strategies for messaging to mitigate vaccine hesitancy among these groups. Subgroups of health care personnel with vaccine hesitancy who express positive sentiments should be targeted as the most persuadable under current circumstances.

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Covid-19 Vaccine Hesitancy Word Clouds and Sentiment Analysis

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