


Intention to Receive COVID-19 Vaccine by U.S. Health Sciences University Employees

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Travis S. Dowdle¹ , Jeff Dennis¹ , Kenneth M. Nugent¹ ,
and Theresa Byrd¹

Abstract

Objectives: Understanding vaccine intentions and attitudes of health professionals is critical as the Pfizer-BioNTech and the Moderna COVID19 vaccines are being administered throughout the United States. This study estimates the level of vaccine hesitancy at a health sciences center in West Texas prior to the distribution of the vaccines. **Methods:** An analytical cross-sectional study was performed via anonymous Qualtrics survey administered to approximately 4500 faculty, staff, postdoctoral research associates/medical residents, and employees at a multi-campus health sciences university in the United States. Respondents were asked demographic questions and intention to receive the vaccine. Factors associated with the intention to receive a vaccine were determined using logistic regression analysis. **Results:** A total sample of 2258 subjects were evaluated (50.0% response rate). Among all respondents, 64.6% reported that they would probably or definitely receive the COVID-19 vaccine. Men had higher levels of intention to receive the vaccine (OR=2.11, 95% CI 1.64-2.71); respondents who indicated yearly influenza vaccines are necessary were also more likely to receive the vaccine (OR=6.04, 95% CI 4.70-7.75). Eighty-three percent of faculty and 56% of the staff reported intention to receive the vaccine. Respondents who had previously tested positive for COVID-19 reported more interest in receiving the vaccine (58.5% yes vs 41.5% no). **Conclusion:** In this study, the intention to receive the COVID-19 vaccination at a United States health sciences center falls below the necessary herd immunity estimates. Public health initiatives must be developed to decrease vaccine hesitancy, especially among health professionals.

Keywords

COVID-19, vaccination, vaccine hesitancy, health care workers, herd immunity

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Introduction

The release of 2 COVID-19 vaccines in December 2020 marks the most rapid development, testing, and emergency approval of a vaccine in modern history and presents a critical milestone in the global response to the pandemic.^{1,2} Front line health care workers (HCWs) received priority for vaccination in December 2020, followed by high-risk individuals, such as those over 65 years of age and those with health conditions that put them at higher risk. By May 2021, all U.S. residents age 12 years and older were eligible to receive a COVID-19 vaccine. Unfortunately, vaccine development and availability are not the only limiting factors from a public health perspective. After a vaccine is developed, a relatively high percentage of the population must be vaccinated to reach herd immunity and reduce continued spread in the

community.³ However, public confidence in vaccines has declined in recent years.⁴ This well documented vaccine hesitancy coupled with the fact that the newly approved mRNA vaccines are novel, emergency use modalities, has led to an estimated global acceptance rate of the vaccine of 68.4%, as per a 30 paper meta-analysis.⁵

Misinformation, conspiracy theories, and fears about the safety of the vaccine combined with the accelerated pace of vaccine development have further increased public anxieties.

¹Texas Tech University Health Sciences Center, Lubbock, TX, USA

Corresponding Author:

Travis S. Dowdle, Texas Tech University Health Sciences Center, 3601 Fourth Street, Stop 9400, Lubbock, TX 79430-0002, USA.
Email: travis.dowdle@ttuhsc.edu



The question still remains as to how many in the United States will agree to vaccination.⁶ To reach herd immunity, sources estimate that 67% to 85% of the population will need vaccination,^{2,3,7-10} and public health professionals are concerned that not enough people will take the vaccine to reach this critical level. Health care workers are a critical group to study in the overall population as they are expected to understand the risks and benefits of vaccination and communicate this information effectively.¹¹ The medical literature reports that healthcare professionals who have an unfavorable attitude or hesitation toward vaccination may transfer these attitudes to patients and tend to recommend vaccination less frequently.⁴

Vaccine uptake is important for HCWs and others who work in medical centers due to their increased exposure to infection, their role in supporting critical healthcare functions, and their educational role for patients.² Our study explored intentions for vaccine uptake among clinical and non-clinical employees of a large United States health sciences university using a survey administered from December 7 to 14, 2020, closing the day before the COVID-19 vaccine was first available in the area. The first aim is to provide a snapshot of U.S. health sciences university employees vaccine intentions prior to implementation of the vaccine. Second, the survey explores the association, if any, between routine vaccination in children and adults and the intention to have COVID vaccination, and the association between the perceived risk for COVID-19 infection and the intention to receive the COVID-19 vaccine. This study provides a useful description of vaccine intentions and beliefs immediately prior to the release of an entirely new vaccine. This basic information is essential to develop educational programs to reduce hesitancy when possible and design more focused surveys.

Methods

Participants were recruited via an online anonymous survey at a multi-campus health sciences university in the United States. A total of 2328 employees responded to the survey, including faculty, staff, postdoctoral research associates/medical residents, and employees who classified themselves as something other than the above categories. The survey was disseminated by university administration to each school with request to send to employees in each division. Although we cannot guarantee that every employee received the survey, the total number of employees of the university is approximately 4500, giving a response rate of 50.0%. The survey was distributed from December 7 to 14, 2020, and was closed 1 day before the first vaccines were administered to HCWs in this location.

The survey was conducted in Qualtrics software, and minimal demographic information was collected to preserve participant anonymity. The study was approved via exempt review by the Institutional Review Board (Protocol

L21-053). The names of the respective schools in the university and campus locations are not reported here, as they were collected primarily for internal purposes of estimating survey distribution.

A short survey was adapted from publications of the WHO Strategic Advisory Group on Experts (SAGE) on Immunization.^{12,13} It included limited demographics (age, sex, campus site, school, faculty, or staff) and items about beliefs about vaccines, COVID-19 restrictions, and perceived susceptibility to COVID-19. Finally, respondents were asked about whether they had previously had a positive COVID-19 test and about their intention to accept the vaccine. Except for the demographic items, the survey items were presented as statements with 5-item Likert scale for answers (“Strongly agree” to “Strongly disagree” and “I definitely plan to get the vaccine” to “I will definitely not get the vaccine”).

The dependent variable of interest was intention to get the vaccine, coded as a binary variable from the 5 possible responses (1—definitely or probably will get the vaccine vs 0—not sure, probably will not, and definitely will not). Seventy individuals did not answer this key question and were dropped from analysis, leaving a primary analysis sample of $N=2258$. We dichotomize this variable for analysis to focus on the most likely individuals to receive the vaccine versus all others, but we report the full breakdown of the Likert scale for reference in the Results section. Age group (in 10-year increments), sex, and job role were coded as categorical variables for descriptive tables. The same variables were converted to dummy variables for logistic regression analysis on the dichotomous dependent variable. Other Likert scale questions asking attitudes toward vaccines and COVID-19 restrictions were coded as dichotomous variables to better present the data and to provide more straightforward comparisons in multivariate analysis. Analysis was conducted using Stata Stata/MP 16.1. Statistical significance was set at $\alpha=.05$.

Results

For the full sample of health sciences university employees prior to vaccine availability, 64.57% reported that they would probably or definitely receive the COVID-19 vaccine (46.24% definitely will, 18.33% probably will, 17.94% not sure, 7.26% probably will not, 10.23% definitely will not). About 14% of respondents in the sample indicated that they had had a positive COVID-19 test. Bivariate results in Table 1 demonstrate that men and individuals over age 60 years are significantly more likely to say they will get the vaccine than their counterparts. About 83% of faculty reported intention to receive the vaccine compared to 56% of staff. Individuals who had previously tested positive for COVID-19 were more likely to report intention to receive the vaccine.

Figure 1 shows intention to receive the vaccine by sex and age to explore whether sex differences are driven by

Table 1. Bivariate Row Percentages Intentions Regarding the COVID-19 Vaccine, by Demographics and Prior COVID-19 Status.

	Not sure, probably/definitely will not get vaccine	Probably/ definitely will get vaccine	Significance
	N (%)	N (%)	
Overall	800 (35.43)	1458 (64.57)	
Gender			
Female (ref)	625 (39.86)	943 (60.14)	
Male	152 (23.35)	499 (76.65)	*
Prefer not to disclose	23 (65.71)	12 (34.29)	*
Age			
18-29 (ref)	116 (38.67)	184 (61.33)	
30-39	225 (38.07)	366 (61.93)	
40-49	189 (37.28)	318 (62.72)	
50-59	171 (35.77)	307 (64.23)	
60-69	91 (27.58)	239 (72.42)	*
70+	7 (13.73)	44 (86.27)	*
Role			
Staff (ref)	633 (44.36)	794 (55.64)	
Faculty	85 (16.67)	425 (83.33)	*
Resident/fellow/postdoc	52 (23.32)	171 (76.68)	*
Other	26 (28.57)	65 (71.43)	*
Prior COVID-19 positive			
Yes (ref)	135 (41.54)	190 (58.46)	
No	647 (34.05)	1253 (65.95)	*
Prefer not to disclose	16 (57.14)	12 (42.86)	

*Significantly different from above noted reference group, respectively—Wald test ($P < .05$).

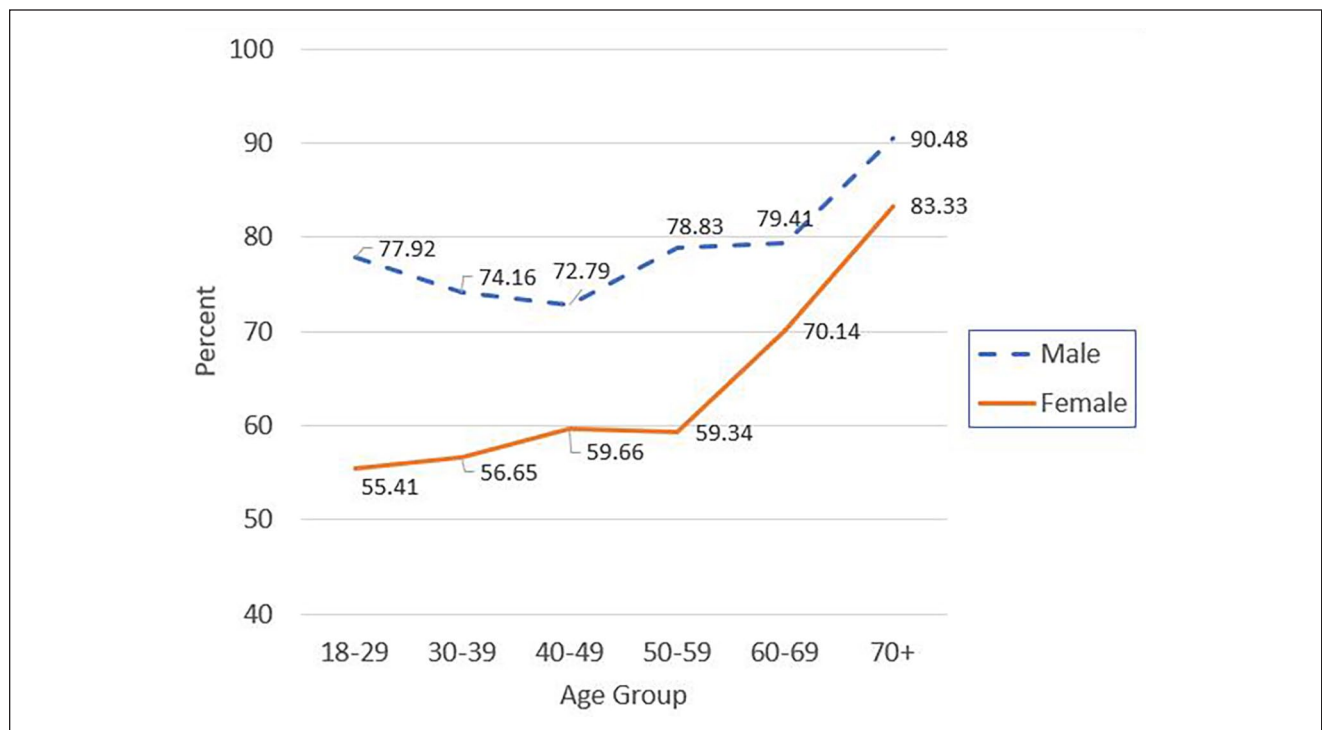
**Figure 1.** Percent reporting they definitely or probably will get the vaccine by sex and age group.

Table 2. Row Percentages Showing Intentions Regarding COVID-19 Vaccine by Self-Reported Attitudes and Risk Factors.

	Not sure, probably/definitely will not get vaccine	Probably/ definitely will get vaccine	Chi square	P-value
	N (%)	N (%)		
Children should get all childhood vaccinations				
Strongly/somewhat disagree, neutral	132 (64.71)	72 (35.29)	84.6	<.001
Strongly/somewhat agree	663 (32.42)	1382 (67.58)		
Both adults and children should receive yearly flu shot				
Strongly/somewhat disagree, neutral	356 (72.51)	135 (27.49)	378.75	<.001
Strongly/somewhat agree	439 (25.00)	1317 (75.00)		
Current COVID-19 restrictions are not strict enough				
Strongly/somewhat disagree, neutral	486 (51.81)	452 (48.19)	193.71	<.001
Strongly/somewhat agree	305 (23.35)	1001 (76.65)		
I consider myself high risk for COVID-19				
Strongly/somewhat disagree, neutral	558 (42.56)	753 (57.44)	70.38	<.001
Strongly/somewhat agree	238 (25.40)	699 (74.60)		

Table 3. Logistic Regression Odds Ratios Predicting Response of Probably or Definitely Will Get COVID-19 Vaccine Among Employees of a U.S. Health Sciences University.

	OR	95% CI	P-value
Sex (ref=female)			
Male	2.11	1.64, 2.71	<.001
Prefer not to disclose	0.31	0.14, 0.70	.005
Age (ref= 18-29)			
30-39	0.90	0.64, 1.27	.545
40-49	1.08	0.75, 1.55	.675
50-59	1.20	0.83, 1.74	.340
60-69	1.75	1.15, 2.66	.009
70+	3.07	1.10, 8.54	.032
Role (ref=staff)			
Faculty	2.74	2.05, 3.66	<.001
Resident/fellow/postdoc	1.87	1.26, 2.77	.002
Other	2.54	1.43, 4.49	.001
Strongly/somewhat agree (ref=not sure, strongly/somewhat disagree)			
Adults and children should get flu shot	6.04	4.70, 7.75	<.001
COVID-19 restrictions not strict enough	1.45	1.17, 1.81	.001
I consider myself to be high risk	2.83	2.30, 3.50	<.001

N = 2219; Pseudo $r^2 = 0.224$

differences in childbearing ages. The gender gap is about 22% in the youngest (ages 18-29 years) age group compared to 7% in the oldest age group (age 70 years or more). Gender differences were statistically significant by age group for 18 to 29, 30 to 39, 40 to 49, and 50 to 59 (supplemental analysis, not shown).

Table 2 shows the relationship between self-reported attitudes and risk and likelihood of receiving the COVID-19 vaccine. Those who strongly or somewhat agreed that children should receive all childhood vaccinations, that adults and children should receive a yearly influenza vaccine, that current COVID-19 restrictions were not strict

enough, and that they were high risk for infection were more likely to report they would receive the vaccine than their counterparts.

Table 3 shows adjusted logistic regression odds ratios predicting respondents saying they probably or definitely will get the COVID-19 vaccine, when available. Past positive COVID-19 test was not a significant predictor and was dropped from the final model. Similarly, agreement with the need for childhood vaccinations and for adults and children to get a yearly influenza vaccine presented issues of multicollinearity when included in the model, and childhood vaccination attitudes were dropped from the model because

attitudes on yearly influenza vaccines better predicted the dependent variable.

Adjusted models found that males were about twice as likely (OR=2.11, 95% CI 1.64-2.71) to report they would get the COVID-19 vaccine. Persons who agreed adults and children should receive a yearly influenza vaccine were 6 times more likely (OR=6.04, 95% CI 4.70-7.75) to report they would get the vaccine than those who did not agree or were neutral on the topic. Relationships found at the bivariate level remained reasonably consistent in adjusted models other than the fact that prior positive COVID-19 status was no longer statistically significant.

Discussion

Similar to other studies on COVID-19 vaccine interest/hesitancy in HCWs, the percentage of faculty and staff in the health sciences university intending to be vaccinated is below the estimated level needed for herd immunity.^{2,4,7,11} The only other comparable study to our multi-center survey of clinical and non-clinical health sciences university employees is a study reported by Meyer et al.² from Geisinger Health in Pennsylvania in which 55% of the 9904 employees surveyed indicated that they would receive COVID-19 vaccination. Other surveys administered in the United States in the September-November 2020 timeframe, prior to FDA approval, have shown that HCWs have the same or greater COVID-19 vaccine hesitancy as the general population. One survey of 12939 United States nurses found that only 34% would choose to be vaccinated.¹⁴ Only 32% of 609 UCLA health system employees in California intended to receive the vaccine when available;¹⁵ another survey found that 31% of physicians and nurses would like to get the vaccine in the first wave.¹⁵ Five hundred twenty-eight emergency medical services (EMS) personnel were queried in another survey that found just 28% would choose to get the vaccine.¹⁶ This low level of participation could increase the risk for infection in HCWs and might persuade the general public that vaccination is a poor choice.

This COVID-19 vaccine apprehension has also occurred in other countries. Only 27.7% of 613 HCWs surveyed in the Democratic Republic of Congo said that they would be vaccinated.⁴ Fifty-two percent of 1006 government sector Maltese HCWs stated they would be willing to receive the COVID-19 vaccine.¹⁷ Grech and Gauci¹⁸ found 44.2% of health sciences university employees at the University of Malta reported they would be likely to receive the COVID-19 vaccine. In contrast, in France the willingness in HCWs was in the projected requisite herd immunity percentages (67-85%) with 81.5% of 1421 HCWs reporting they would be willing to be vaccinated.¹⁹

The staff in our survey had less intention to receive a vaccine than the faculty. This suggests that medical knowledge and patient care experiences might lead to a higher intention. Workplace initiatives to encourage vaccine

uptake should consider the diversity of perspectives among faculty and staff and work to extend information to all employees in a way that does not marginalize individuals by education/training level or difference of opinion. Women of child-bearing age were less likely than men and older women to express an intention to be vaccinated. Although the CDC has determined that pregnant women may “choose to be vaccinated,” the guidelines are not specific in January 2021.²⁰ At the time of survey administration, there were no special guidelines for women of childbearing age. A recent PEW research report also found that women are less likely to want the vaccine.²¹ Without supporting qualitative data, we can only assume that this might be due to fear of damage to a fetus or of reduced fertility. However, a study published in June 2021 on outcomes in 3958 participants in a vaccine safety pregnancy registry did not report any “obvious safety signals” among pregnant women who received mRNA COVID-19 vaccines.²² Pregnant women likely need more reassurance about the safety and the benefits of vaccination, and this information could be provided by public health announcements from obstetricians and primary care physicians at the community level.

The WHO Strategic Advisory Group on Experts (SAGE) on Immunization have reviewed the definitions and components of vaccine hesitancy and have developed a survey tool for its study.^{12,13} They offered the following definition: *Vaccine hesitancy refers to delay in acceptance or refusal of vaccination despite availability of vaccination services. Vaccine hesitancy is complex and context specific, varying across time, place, and vaccines. It is influenced by factors such as complacency, convenience, and confidence.*¹² Contextual influences include multiple factors, including historic and socio-cultural factors. Individual and group influences reflect personal perception of the vaccine and decisions related to the social and peer environment. There are also vaccine specific issues which reflect risks/benefit analysis and concerns related the introduction of new vaccines. The WHO analyzed global drivers for vaccine hesitancy based on joint reporting forms distributed to all members of the WHO/UNICEF member states annually.²³ The information was then categorized by the geographical region and income levels in particular countries. Religion/cultural/gender/socio-economic influences were 1 of the top 3 major reasons for vaccine hesitancy in 35% of the responses from member organizations. This category was particularly important in Africa and the Americas and was important in all income categories. The WHO vaccine survey includes questions about childhood vaccination reasons for choosing not to receive vaccination, and a 5-point Likert scale about vaccines and vaccination. The questions in our survey have a similar format and fall into 2 categories. One involves vaccination for children and vaccination against influenza infection similar to the SAGE survey. The second category is more specific to the risk of COVID-19 infections.

Limitations

This study was conducted at a single multi-site health sciences university and may not represent university employees more broadly. The survey was distributed to all employees and had a 50% response rate. However, it is unknown whether vaccine intentions influenced decisions to participate in the survey in any systematic fashion, or whether social desirability bias influenced some to answer more or less favorably than their true intentions. This concern is likely true for all surveys. In addition, this survey provides information from a single time point during an ongoing pandemic and was not collected in a manner that would allow linkage of future vaccine uptake data. This format limits causal interpretation and may not provide an accurate, stable estimate of vaccine hesitancy given the continuous distribution of new information about case numbers and mortality with this virus. Our survey did not ask about political affiliation, which has been shown to have substantial correlation with intentions regarding COVID-19 vaccine uptake.²¹ Future studies should explore political affiliation and/or ideology, chronic health disorders, prior experience with vaccination, and convenience to better understand intentions regarding vaccine uptake.

Conclusion

Although demand for the vaccine remains relatively high in the United States at the time of this writing (May 2021), our study and similar surveys find substantially less than 85% of adults, the projected herd immunity level, intend to receive the COVID-19 vaccine.^{2,4,17,18,24} There continues to be vaccine hesitancy in both HCWs and the general population, although perspectives on the vaccine may change relatively quickly as the vaccines continue to be administered and the public is able to observe the effects of vaccination. Interventions and education to increase vaccine uptake will need to be developed for different populations. Future research should also include qualitative data to understand the reasons behind vaccine hesitancy better and to help develop culturally appropriate interventions. Our study provides the background information necessary for measuring serial changes in adult participation in vaccination before and after the introduction of a comprehensive vaccination program in the United States.

Declaration of Conflicting Interests

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ORCID iDs

Travis S. Dowdle  <https://orcid.org/0000-0001-5782-2935>

Jeff Dennis  <https://orcid.org/0000-0003-0264-3635>

Kenneth M. Nugent  <https://orcid.org/0000-0003-2781-4816>

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