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Demographic factors associated with COVID-19 vaccine perceptions amongst healthcare and law enforcement workers

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ABSTRACT

Introduction: The emergence of COVID-19 and the development of subsequent vaccines have both significantly impacted the lives and work of essential workers such as those who are healthcare, first responders, and law enforcement. Data has shown that these groups are all at a higher occupational risk for COVID-19 exposure, and therefore public health policy has prioritized the vaccination of this group, including mandating vaccines in this population. However, the perceptions of COVID-19 vaccines in this group are not clear and require examination.

Methods: A cross-sectional analysis was conducted to examine the psychosocial factors associated with vaccine perceptions amongst healthcare and law enforcement professionals. An online survey was distributed to (n=216) between May 5, 2021, and August 25, 2021, and analyzed using a Chi-squared test for independence and Spearman correlation coefficient test.

Results: It was found that race was significantly associated with four statements regarding COVID-19 vaccine attitudes and perceptions, gender identity was not associated with any statements, ethnicity was associated with two statements, and education level was associated with nine statements. Further analysis using a Spearman correlation coefficient found education to be associated with one statement regarding perceived safety (p=0.006) and another statement regarding perceived benefits (p=0.001).

Conclusion: These findings are largely preliminary, but they provide insight into psychosocial factors associated with COVID-19 vaccine perception. It was found that all factors except for gender identity were associated with COVID-19 vaccine attitudes among healthcare and law enforcement professionals. Additional analysis found that higher education level was associated with higher perceived benefits and lower perceived barriers regarding COVID-19 vaccines.

Keywords: COVID-19, vaccinations, healthcare, law enforcement, Hispanic

INTRODUCTION

The emergence of COVID-19 and the development of subsequent vaccines have both significantly impacted the lives and work of essential workers such as those who are healthcare, first responders, and law enforcement. Data has shown that these groups are all at a higher occupational risk for COVID-19 exposure, and therefore public health policy has prioritized the vaccination of this group, including mandating vaccines in this population. However, the perceptions of COVID-19 vaccines in this group are not clear and require examination. Therefore, this study aims to provide evidence about COVID-19 vaccine perceptions in this population.

Current literature primarily measures vaccine hesitancy and acceptance by asking study participants whether they intend to receive their COVID-19 vaccine or not. Prior studies have shown that racial and ethnic minorities such as those who identify as Black/African American or Hispanic/Latino are more likely to refuse or delay getting their COVID-19 vaccine compared to those who identify as White/Caucasian. Similar trends have been observed among those who identify as women and those without a college-level degree [1]. These results were found in studies conducted utilizing representative samples of the United States. However, similar trends can also be observed among samples of exclusively healthcare workers. It was also found in these studies that racial/ethnic minorities, women, and those without a college degree are more likely to refuse or delay COVID-19 vaccination [2].

While these studies offer insight into vaccine intentions among healthcare workers, they do not elaborate on potential COVID-19 vaccine attitudes and perceptions that may play a role in the decision to get vaccinated against COVID-19. This study aims to use a cross-sectional approach based on the health belief model (HBM) to identify the effect of various psychosocial factors and their association with COVID-19 vaccine attitudes and perceptions. The HBM is a theoretical model that uses factors such as perceived susceptibility, severity, benefits, barriers, and cues to action, to predict health behaviors [3]. By identifying associations between psychosocial variables and COVID-19 vaccine attitudes and

Table 1. Sample demographics

Variable	Frequency (n)	Percentage (%)
Race		
White	143	66.2
Asian	2	0.9
Native American/American Indian or Alaska Native	19	8.8
Black/African American	40	18.5
Mixed race or other	12	5.6
Education		
Did not complete high school	10	4.6
Grade 12 (high school diploma or GED)	62	28.7
Some college, associate, or technical degree	90	41.7
Bachelor's degree or higher	54	25.0
Ethnicity		
Not Hispanic or Latino/a	85	39.4
Hispanic or Latino/a	131	60.6
Gender identity		
Male/man	107	49.5
Female/woman	99	45.9
Transgender male	5	2.3
Transgender female	5	2.3

perceptions, this study may potentially offer some insight into factors that could be contributing to vaccine intake among this population.

METHODS

For this study, a dataset that was previously collected and funded in part by the American Lung Association was utilized. The data comes from the second wave of the air quality surveys conducted by Central Washington University between April's side effect 2021 and August 2021. Any individual who was living in Yakima County during this period and over the age of 18 was eligible to participate in the survey.

All participant's responses were stored virtually through the Qualtrics survey tool. After the survey closed, the data was exported from Qualtrics servers as a CSV file. Upon conclusion of the study, there were (n=2,137) recorded survey responses in total. All responses were further evaluated for both completion and accuracy. Responses were also double-checked to ensure that all participants were within the target region of adults living in Yakima County. Afterward, responses were sorted by occupational category. In the survey, participants were able to indicate whether they or someone living in their household worked in one of the following industries: agriculture food and farming production, factory or manufacturing, healthcare or law enforcement, retail food or hospitality, and other. Only those who indicated that they worked in healthcare or law enforcement were included in the study. All other responses were excluded from further analysis. In total, (n=216) healthcare and law enforcement workers were included in the final sample.

The final dataset was analyzed using STATA/BE version 17.0. The psychosocial and socio-demographic variables that were assessed include race, ethnicity, education level, and gender identity. These variables were then tested against 12 different statements regarding COVID-19 vaccination attitudes and perceptions (**Appendix A**). All participants were asked to respond to these statements using a Likert scale with responses to include strongly disagree, disagree, neither agree nor disagree, agree, and strongly agree. Before performing any statistical analysis, all responses were recoded to a numerical value between 1 and 5 with 1 being strongly disagree and 5

being strongly agree. After all the responses were re-coded, a series of Pearson's Chi-squared tests were performed to identify significant associations between the different variables and statements regarding COVID-19 vaccination attitudes and perceptions. Pearson's Chi-squared tests were chosen for this analysis as it was most suitable for identifying factors that were significantly associated with COVID-19 vaccine attitudes and perceptions using categorical data. As education was the only ranked variable used in this study, further analysis was performed using a Spearman correlation coefficient.

RESULTS

The Qualtrics survey was made available from May 5, 2021, through August 25, 2021, and all responses were voluntary and self-reported. Overall, a total of (n=216) healthcare workers, first responders, and law enforcement workers participated in this survey. The variables analyzed in this cross-sectional analysis include race, ethnicity, education, and gender identity. In this sample a majority of the participants identified as white (n=143) and over half of the respondents identified as Hispanic or Latino/a (n=131). Additionally, (n=107) participants identified as males, and (n=99) identified as females. A total of (n=5) respondents identified as transgender males and (n=5) identified as transgender females (**Table 1**).

It was found that race was significantly associated with four statements within the questionnaire. The first statement to have a significant association with race was, "The COVID-19 vaccine is safe for most people" (χ^2=27.5179, p=0.036). 73.6% of Native American/American Indian/Alaska Native respondents agreed with this statement followed by 67.5% of Black/African American respondents, 63.6% of white respondents, 50% of Asian respondents, and 8.3% of those who identified as mixed-race/other. The next statement was, "I have some concerns about the side effects of the COVID-19 vaccine" (χ^2=31.5041, p=0.012). 47.3% of Native American/American Indian/Alaska Native respondents agreed with this statement followed by 43.3% of white respondents, and 25% of Black/African American respondents. None of the respondents who identified as mixed-race/other or Asian expressed that they were concerned about the side effects of the COVID-19 vaccine.

The third statement was, "I think the COVID-19 vaccine has not been tested enough" (χ^2=34.1443, p=0.005). All respondents who identified as Asian agreed or strongly agreed with this statement followed by 47.3% of Native American/American Indian/Alaska Native respondents, 39.1% of white respondents, and 27.5% of black/African American respondents. The fourth and final statement was "In general, there's not much that would change my decision about whether or not I would get a COVID-19 vaccine" (χ^2=26.5529, p=0.047). 78.9% of Native American/American Indian/Alaska Native respondents agreed or strongly agreed with this statement, followed by 70% of black/African American respondents, 68.5% of white respondents, 50% of Asian respondents, and 8.3% of those who identified as mixed-race/other.

Gender identity was found to have no significant statements with any of 12 statements within the questionnaire. However, ethnicity was found to be significantly associated with two statements. The first statement was, "I think the COVID-19 vaccine has not been tested enough (χ^2=10.9259, p=0.027). 42.7% of respondents who identified as Hispanic, or Latino/a agreed or strongly agreed with this statement compared to 30.5% of those who identified as not Hispanic or Latino/a. The second statement was, "In general, I think vaccines could be harmful to people (χ^2=17.6715, p=0.001). It was found that 71.7% of respondents who did identify as Hispanic, or Latino/a agreed with this statement followed by 67.1% of those who did not identify as Hispanic or Latino/a.

Education level was found to be associated with the most statements and was significantly associated with nine statements in the questionnaire. The first statement was, "I think the COVID-19 vaccine was developed on good science and data" (χ^2=30.7075, p=0.002). 77.7% of those with a bachelor's degree or higher agreed or strongly agreed with this statement, followed by 75.8% of those with a high school diploma or GED, 66.6 of those with some college, associate degree, or technical degree, and 20% of those who did not complete high school. The next statement was, "The COVID-19 vaccine is safe for most people" (χ^2=40.7215, p=0.0001). 75.9% of those with a bachelor's degree or higher agreed or strongly with this statement, followed by 64.5% of those with a high school diploma or GED, 64.4% of those with some college, an associate degree, or technical degree, and 20% of those who did not complete high school. The next statement was, "The COVID-19 vaccine is effective at protecting most people from COVID-19 disease" (χ^2=24.6950, p=0.016). 70.9% of those with a high school diploma or GED agreed with this statement, followed by 66.6% of those with a bachelor's degree or higher, 63.3% of those with some college, an associate degree, or technical degree, and 40% of those who did not complete high school. The next statement was, "The benefits of COVID-19 vaccine outweigh the potential risks" (χ^2=29.4319, p=0.003). 75.9% of those with a bachelor's degree of higher agreed or strongly agreed with this statement followed by 45.5% of those with some college, an associate degree, or technical degree, 40% of those who did not complete high school, and 35.4% of those with a high school diploma or GED. The next statement was, "I have concerns that the COVID-19 vaccine could harm me" (χ^2=21.0140, p=0.050). 48.1% of those with a bachelor's degree or high agreed or strongly agreed with this statement followed by 42.2% of those with some college, an associate degree, or technical degree, 33.8% of those with a high school diploma or GED, and 30% of those who did not complete high

school. The next statement was, "When enough people get vaccinated with the COVID-19 vaccine, it will offer protection to the whole community" (χ^2=32.2800, p=0.001). 75.9% of those with a bachelor's degree or higher agreed or strongly agreed with this statement, followed by 69.3% of those with a high school diploma or GED, 61.1% of those with some college, an associate degree, or technical degree, and 10% of those who did not complete high school. The next statement was, "I know where to get a COVID-19 vaccine if I become eligible for it" (χ^2=23.0369, p=0.027). 80.6% of those with a high school diploma or GED agreed or strongly agreed with this statement followed by, 72.2% of those with a bachelor's degree or higher, 56.6% of those with some college, an associate degree, or technical degree, and 50% of those who did not complete high school. The next statement was, "In general, I think vaccines could be harmful to people" (χ^2=22.2403, p=0.035). 72.2% of those with a bachelor's degree or higher agree or strongly agreed with this statement followed by, 70.9% of those with a high school diploma or GED, 68.8% of those with some college, an associate degree, or technical degree, and 30% of those who did not complete high school. The final statement was, "If there was a COVID-19 vaccine approved for children, I would make sure my child got vaccinated" (χ^2=25.4057, p=0.013). It was found that 77.4% of those with a high school diploma or GED agreed or strongly agreed with this statement followed by, 70.3% of those with a bachelor's degree of higher, 67.7% of those with some college, an associate degree, or technical degree, and 30 percent of those who did not complete high school.

As education was the only ranked variable, further analysis was performed using a Spearman correlation coefficient test. It was found that two variables were significantly associated with education. The first statement, "The COVID-19 vaccine is safe for most people" had a positive association with education level (ρ=0.187, p=0.006). As previously stated, 75.9% of those with a bachelor's degree or higher agreed or strongly with this statement, followed by 64.5% of those with a high school diploma or GED, 64.4% of those with some college, an associate degree, or technical degree, and 20% of those who did not complete high school. The second statement, "The benefits of COVID-19 vaccine outweigh the potential risks" also had a significant positive association with education level (ρ=0.265, p=0.001). 75.9% of those with a bachelor's degree or higher agreed or strongly agreed with this statement followed by 45.5% of those with some college, an associate degree, or technical degree, 40% of those who did not complete high school, and 35.4% of those with a high school diploma or GED (**Table 2**).

DISCUSSION

The findings from this study found race to be significantly associated with four statements regarding COVID-19 vaccine perceptions. The primary themes of the statements were regarding the safety and effectiveness of the COVID-19 vaccine. This data suggests that race has a significant association with COVID-19 vaccine attitudes and perceptions. Ethnicity was also found to be significantly associated with two statements primarily about COVID-19 vaccine safety and the safety of vaccines in general. Prior literature has shown that COVID-19 vaccine intake tends to be lower in those who identify as Black/African American or Hispanic/Latino [1]. With the HBM in mind, it is possible that variations in COVID-19 attitudes and

Table 2. Questionnaire results by those who agree or strongly agree

	Total	White	Asian	Native American/American Indian or Alaska Native	Black/African American	Mixed race of other	Bachelor's degree or higher	Some college, associate, or technical degree	Grade 12 (high school diploma or GED)	Did not complete high school	Hispanic or Latino/a	Not Hispanic or Latino/a	Male/man	Female/woman	Transgender male	Transgender female
1. I think COVID-19 vaccine was developed on good science & data.	151	101	0	15	30	5	42	60	47	2	91	60	71	75	2	3
2. The COVID-19 vaccine is safe for most people.	141	91	1	14	27	1	41	58	40	2	83	58	74	63	2	2
3. The COVID-19 vaccine is effective at protecting most people from COVID-19 disease.	141	101	0	15	30	5	36	57	44	4	84	57	72	62	4	3
4. I have some concerns about side effects of COVID-19 vaccine.	88	62	0	9	10	0	26	38	21	3	52	36	38	47	2	1
5. The benefits of the COVID-19 vaccine outweigh the potential risks.	108	77	2	13	12	0	41	41	22	4	68	40	47	53	4	4
6. I have concerns that the COVID-19 vaccine could harm me.	73	50	0	9	11	0	20	26	21	6	51	22	34	38	1	0
7. I think COVID-19 vaccine has not been tested enough (reverse coded).	82	56	2	9	11	0	23	34	22	3	56	26	36	44	1	1
8. When enough people get vaccinated with the COVID-19 vaccine, it will offer protection to the whole community.	140	91	1	15	28	1	41	55	43	1	84	56	74	61	2	3
9. I know where to get a COVID-19 vaccine if I become eligible for it.	145	94	2	17	27	1	39	51	50	5	85	60	74	66	1	4
10. In general, I think vaccines could be harmful to people.	71	51	0	8	5	0	20	28	20	3	50	21	31	38	1	1
11. If there was a COVID-19 vaccine approved for children, I would make sure my child got vaccinated.	150	97	1	17	30	0	38	61	48	3	91	59	71	71	4	4
12. In general, there's not much that would change my decision about whether or not I would get a COVID-19 vaccine.	149	98	1	15	28	1	39	62	44	4	88	61	76	67	2	5

perceptions among these populations could potentially lead to variations in COVID-19 vaccine intake among healthcare workers, first responders, and law enforcement professionals. However, further analysis would be necessary to identify relationships between race, ethnicity, and COVID-19 vaccine perceptions and how they could potentially affect COVID-19 vaccine intake.

In this study, education level was significantly associated with the most statements about COVID-19 vaccine attitudes and perceptions when using a Chi-square test for independence. It was found that education level was significantly associated with nine statements about perceived safety, benefits, and risks of vaccination. Further evaluation using a Spearman correlation coefficient test, found two statements "The COVID-19 vaccine is safe for most people" ($\rho=0.187$, $p=0.006$) and "The benefits of COVID-19 vaccine outweigh the potential risks" ($\rho=0.265$, $p=0.001$) to have a significant association. Results from this study would suggest that education level is significantly associated with COVID-19 perceptions and attitudes. Furthermore, it would suggest that those with higher educational backgrounds have higher perceived benefits and lower perceived barriers toward COVID-19 vaccination. These results would be consistent with prior literature. Prior studies have shown that those without a college degree are less likely to receive their COVID-19 vaccine when compared to those with a college-level degree or higher [4-6]. Looking back to the HBM, vaccine intake may be higher among those with a higher educational level because the

perceived benefits of COVID-19 vaccination are higher and perceived barriers are lower. However, it is important to note that this study is not able to establish an association or relationship between COVID-19 vaccine perceptions and COVID-19 vaccine intake. Further investigation would be necessary to establish a relationship or association between the two variables among this population.

This study found that there were no COVID-19 vaccine attitudes or perceptions that were significantly associated with gender identity. This would suggest that gender identity does not have any significant impact on COVID-19 vaccine attitudes and perceptions. However, prior literature has shown that those who identify as women are more likely to refuse COVID-19 vaccination among samples of the general population and samples of only healthcare workers. One study done using a representative sample of the United States found that gender identity was significantly associated with vaccine intentions. It was found that women were 1.74 times more likely to report vaccine hesitancy, defined as not intending to receive their COVID-19 vaccine, compared to males [1]. Although this study does not suggest an association between gender identity and COVID-19 vaccine attitudes and perceptions, it is important to note that this study utilized a convenience sampling method containing (n=216) respondents. Furthermore, the study was limited by having occupations grouped in such a way that law-enforcement, healthcare workers, and first responders were in the same group, while technically they are all human services and essential workers, each sector likely has unique

demographics and psychosocial characteristics. It is possible that performing a follow-up study using random sampling and a larger sample size with more precise measures could lead to results more consistent with prior literature.

CONCLUSION

Although these findings are largely preliminary, they do provide some insight into various psychosocial factors and COVID-19 vaccine perception among healthcare workers, first responders, and law enforcement professionals. The implications of these findings can be best used to guide how public health professionals frame and promote education regarding the COVID-19 vaccine. The findings from this study suggest that race, ethnicity, and education, all play a role in COVID-19 vaccine attitudes and perceptions while gender identity does not. However, it is important to note that convenience-based sampling was used for this study and all responses were completely voluntary and self-reported. Additionally, this study does not offer any evidence to suggest potential relationships between COVID-19 vaccine perceptions and attitudes and how this may affect vaccine intake among this population. Further investigation would be necessary to fully understand the implications of psychosocial factors and COVID-19 vaccine perceptions and attitudes. Despite this, the results of this study can provide preliminary evidence for further investigations and studies regarding COVID-19 vaccination that may be conducted in the future.

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APPENDIX A

Portions of Questionnaire Included

1. The next set of questions will ask you to share how much you agree or disagree with certain statements about vaccines, including those that offer protection from the COVID-19 disease. There are no right, or wrong answers so please answer to the best of your knowledge and comfort:

   a. I think the COVID-19 vaccine was developed on good science and data.

   b. COVID-19 is safe for most people.

   c. The COVID-19 vaccine is effective at protecting most people from COVID-19 disease.

   d. I have some concerns about the side effects of the COVID-19 vaccine (reverse coded).

   e. The benefits of the COVID-19 vaccine outweigh the potential risks.

   f. I have concerns that the COVID-19 vaccine could harm me (reverse coded).

   g. I think the COVID-19 vaccine has not been tested enough (reverse coded).

   h. When enough people get vaccinated with the COVID-19 vaccine, it will offer protection to the whole community.

   i. I know where to get a COVID-19 vaccine if I become eligible for it.

   j. In general, I think vaccines could be harmful to people (reverse coded).

   k. I wish I had more information about the COVID-19 vaccine.

   l. If there was a COVID-19 vaccine approved for children, I would make sure my child got vaccinated.

   m. In general, there's not much that would change my decision about whether or not I would get a COVID-19 vaccine.