

# Perceptions of Seasonal Influenza Vaccine Among U.S. Army Civilians and Dependents in the Kaiserslautern Military Community: A Mixed-Methods Survey

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## ABSTRACT

### Introduction:

Influenza is a globally occurring viral respiratory infection that can lead to hospitalizations and death. An influenza outbreak can interfere with combat readiness in a military setting, as the infection can incapacitate soldiers. Vaccination remains the most effective tool to prevent and mitigate seasonal influenza. Although influenza vaccinations for U.S. Army soldiers can be monitored through military health systems, those systems cannot capture DoD civilians and Army dependents who may not use military health services. This study aims to gauge flu vaccine uptake and perceptions in U.S. Army civilians and dependents.

### Materials and Methods:

An online survey was e-mailed to civilian and dependent enrollees of Landstuhl Regional Medical Center. The survey contained 24 questions pertaining to demographics, vaccine history, history of the flu, and beliefs toward vaccines. Chi-square tests, *t*-tests, and logistic regressions were performed to investigate the association between demographic, behavior, and belief factors with vaccine uptake. Free-text answers were coded and categorized by themes.

### Results:

Over 70% of respondents were vaccinated for the flu. There were differences between vaccinated and unvaccinated respondents regarding their perceptions of barriers to vaccination, benefits of the flu vaccine, severity of flu symptoms, and personal risk of getting ill with the flu. After controlling for confounders, flu vaccination in the previous season and healthcare worker status were associated with increased vaccine uptake, while perceived barriers to influenza vaccination were associated with decreased vaccine uptake.

### Conclusions:

Flu vaccine uptake may be increased by increasing access to vaccination, promoting vaccination and addressing concerns at the provider level, and engaging positively framed public messaging. Increasing flu vaccine uptake is of particular importance as the flu season approaches during the COVID-19 (Coronavirus disease 2019) pandemic.

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## INTRODUCTION

Seasonal influenza, or “the flu,” is a globally occurring viral respiratory infection which typically spreads during the winter in temperate climates. Influenza infection can cause serious complications and mortality in high-risk groups, namely: young children, the elderly, pregnant women, and the immunocompromised.<sup>1</sup> Flu infection in those populations can lead to pneumonia, pericarditis, and myocarditis and

exacerbate existing pulmonary and cardiac illness<sup>2</sup> as well as neurological conditions in children.<sup>3</sup> In Germany alone, seasonal flu was responsible for 18,000 hospitalizations during the 2018-2019 flu season<sup>4</sup> and 45,000 hospitalizations during the 2017-2018 flu season.<sup>5</sup> For healthy adults, flu infection poses an economic risk. One study estimates that 20 million productive days are lost to flu in the USA each year, resulting in an average annual cost of \$8.0 billion.<sup>6</sup>

In military settings, influenza can reduce combat readiness. The 1918 Spanish influenza pandemic spread within crowded military camps and traveled with soldiers, affecting 20% to 40% of U.S. Army and Navy personnel, disrupting training schedules and diverting resources away from combat support.<sup>7</sup> Because influenza can spread quickly in the military, where soldiers are in close contact and mobile, the U.S. Army requires soldiers to receive an annual flu vaccine.<sup>8</sup>

The flu vaccine is the most effective form of prevention against seasonal influenza.<sup>1</sup> A meta-analysis of randomized controlled trials assessing the trivalent flu vaccine over 12 influenza seasons found a pooled vaccine efficacy of 59%.<sup>9</sup>

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In the 2000s, the U.S. Centers for Disease Control and Prevention (CDC) expanded their flu vaccine recommendations to include everyone over 6 months of age with few contraindications.<sup>10</sup> Although flu vaccination coverage in the USA continues to improve, the vaccination coverage of 45% for adults and 63% for children in the 2018-2019 season<sup>11</sup> still falls short of the Healthy People 2020 target of 70% of adults and children vaccinated for the flu.<sup>12</sup> Vaccine hesitancy is a major barrier.<sup>13-15</sup> Parents are more hesitant to vaccinate their children for flu than they are for other childhood diseases like measles, mumps, and rubella, which typically have coverage rates of 90% compared to less than 50% for influenza vaccine.<sup>13</sup> Although flu vaccination is mandatory for service members and monitored closely, less is known about vaccination rates for U.S. Army civilians and dependents. This mixed-methods study aims to gauge flu vaccine uptake in U.S. Army civilians and dependents in the Kaiserslautern Military Community (KMC) and investigate attitudes toward the seasonal flu vaccine.

## METHODS

### **Sample and Data Collection**

Participants were recruited from a list of enrolled non-active duty patients at Landstuhl Regional Medical Center (LRMC) by e-mail through multistage random sampling. Those under 18 years of age and those who were not DoD Army civilians or Army dependents were excluded from the survey. The number of participants e-mailed was based on a power calculation, assuming 20% of people would complete the survey. Each participant received an invitation e-mail with the Max.gov survey link and a reminder e-mail 2 weeks later. Survey responses were anonymized and stored in Max.gov surveys.

The survey contained 28 questions relating to demographic factors, flu vaccination history, previous illness with influenza, and attitudes toward influenza and influenza vaccination. The survey was classified a public health activity by Public Health Command Europe and approved by the appropriate army survey approval authority.

### **Data Analyses**

Microsoft Excel and Epi Info 7 were used to clean the survey data. Reliability tests were performed using Microsoft Excel. All other data analyses were conducted using Epi Info 7. Missing data were excluded from the analysis via pairwise deletion.

The outcome variable of interest, flu vaccine uptake, was measured by those who received or were planning to receive the flu vaccine for the 2019-2020 flu season. All others were recorded as unvaccinated.

The characteristics of participants were tabulated. To determine differences in flu vaccine uptake by demographic factors, a Pearson's chi-square test was performed.

Attitudes toward influenza vaccination were measured on a Likert scale ranging from 1 = strongly disagree to 5 = strongly agree. The belief statements were grouped into belief categories: (1) Perceived benefits of the influenza vaccine, (2) perceived risk of seasonal influenza, (3) perceived severity of seasonal influenza, (4) perceived barriers to flu vaccination, and (5) external influence for influenza vaccination decision. Each belief statement was dichotomized: patients were categorized as "agreed" if they either agreed or strongly agreed with a statement and all other responses were categorized as "disagreed." Three statements were reverse coded to indicate a similar type of response as the other statements in their belief grouping. The percentage of respondents who agreed with each statement was tabulated and ranked to determine the most popular views among the unvaccinated and vaccinated respondents. The internal consistency of belief statements within a group was measured by calculating the Cronbach's alpha for categories with more than two statements and a Pearson's correlation coefficient for categories with two statements. Belief categories with a Cronbach's alpha or correlation coefficient of 0.6 or greater were measured as a group, with the mean Likert score of the statements serving as the composite Likert score. A *t*-test was performed to identify differences in composite Likert scores for beliefs between the vaccinated and the unvaccinated groups. For belief statements that could not be measured in a composite score, a Pearson's chi-square test measured the difference in prevalence of agreement among the vaccinated and unvaccinated groups.

A bivariate analysis was completed using a simple logistic regression model to determine the odds of vaccine uptake based on demographic and grouped belief factors. A multivariate logistic regression was performed to determine the adjusted odds ratio (OR) for the demographic and belief factors, adjusting for age, sex, and healthcare worker (HCW) status.

Qualitative responses for one open-ended question were read and grouped using thematic analysis. Patterns and frequency of themes were noted within the vaccinated and unvaccinated groups.

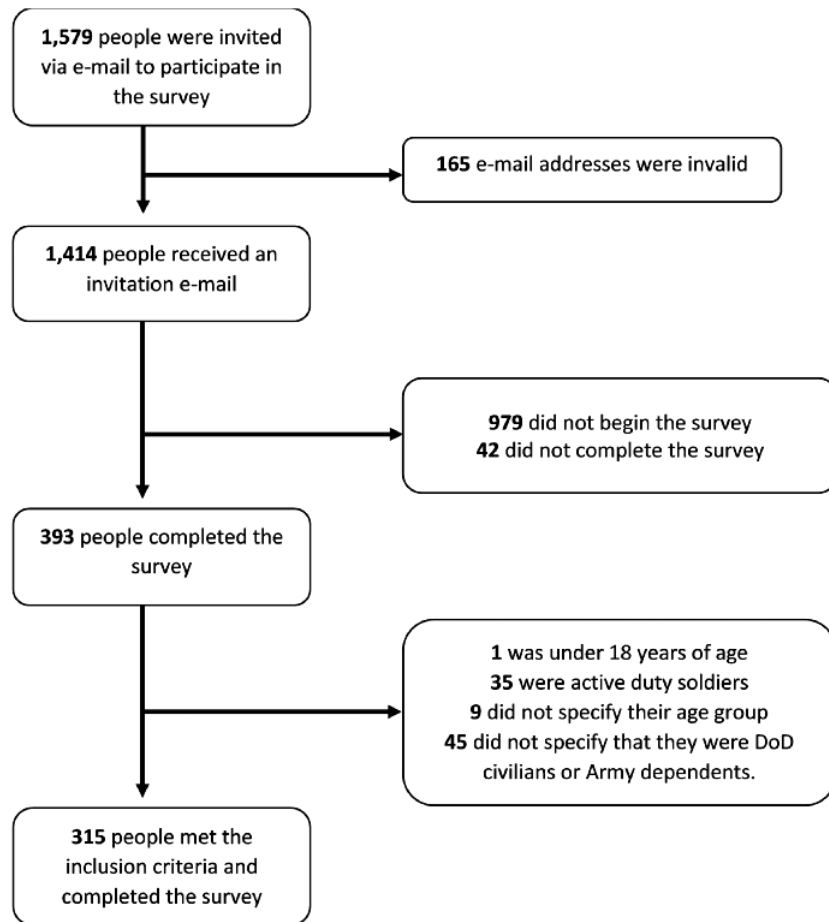
## RESULTS

This survey was sent to 1,579 e-mail addresses in March 2020, 5 months into the 2019-2020 flu season. One hundred and sixty-five e-mail addresses were invalid. Of the 435 people who began the survey, 393 completed it. Finally, 315 people met the inclusion criteria, and their responses were analyzed (Fig. 1), resulting in a response rate of 22.3%.

### **Quantitative Findings**

#### **Characteristics of participants**

Most respondents were: non-HCWs (86%), DoD civilians (71.4%), and under 60 years of age (65.3%). There were slightly more male (57.0%) than female participants.



**FIGURE 1.** Selection of participants.

Two hundred and fifty-one respondents (79.7%) had been vaccinated or were planning on being vaccinated for the 2019-2020 flu season. In the previous flu season, 229 (72.9%) of respondents were vaccinated and 29 (9.2%) respondents became ill with the flu (Table I).

A large majority (96.9%) of those who were vaccinated in the previous flu season were vaccinated or planning to be vaccinated for the 2019-2020 flu season. Comparatively, flu vaccine uptake was three times lower in those who were unvaccinated in the previous flu season (34.1%,  $P < .001$ ). Flu vaccine uptake was higher in participants 60 years of age or older (85.5%) than in participants under 60 years of age (76.6%,  $P = .062$ ). Healthcare workers had a higher percentage of flu vaccine uptake (93.2%) than non-HCWs (77.4%,  $P < .001$ ) (Table I).

### Influenza vaccine beliefs

The most agreed-upon statements among participants were related to perceived severity of influenza: most participants agreed the flu is a very serious disease (87.6%) and getting the flu may lead to other serious health problems (79.4%). Other popular statements related to the perceived benefits

of the flu vaccine: most participants agreed the flu vaccine is safe for them (75.2%) and the flu vaccine is effective in preventing the flu (71.4%). The composite Likert score was highest [2.68, standard deviation (SD): 0.888] for statements that expressed perceived personal risk for getting influenza, followed by statements relating to external influence on vaccination decision-making (2.00, SD: 0.929). The lowest composite Likert score was for statements that expressed perceived barriers to influenza vaccination (1.90, SD: 0.686). Of vaccinated respondents, 76.1% said they received the flu vaccine because it will protect others around them from getting sick (Table II).

A higher percentage of vaccinated respondents compared to unvaccinated respondents agreed with statements ( $P < .05$ ) relating to the severity of influenza. Statements relating to perceived benefits of flu vaccine were ranked higher in vaccinated respondents than in unvaccinated respondents ( $P < .001$ ). The composite Likert score for perceived risk of influenza was higher in the vaccinated respondents (2.74, SD: 0.884) than in the unvaccinated respondents (2.43, SD: 0.874,  $P = .023$ ). The composite Likert score for perceived barriers to flu vaccination was higher in unvaccinated respondents (2.94, SD: 0.686) than in vaccinated

**TABLE I.** Demographic Characteristics of Unvaccinated and Vaccinated Participants for the 2019-2020 Flu Season

	Total <i>n</i>	Unvaccinated <i>n</i> (%)	Vaccinated or planning to receive vaccination <i>n</i> (%)	<i>P</i> -value <sup>b</sup>
Total	315 <sup>a</sup>	64 (20.3) <sup>a</sup>	251 (79.7) <sup>a</sup>	
Vaccinated in the previous flu season				
Yes	229	7 (3.1)	222 (96.9)	<.001
No	85	56 (65.9)	29 (34.1)	
Ill with flu in the previous flu season				
Yes	29	5 (17.2)	24 (82.8)	.691
No	285	58 (20.4)	227 (79.6)	
Gender				
Male	179	34 (19.0)	145 (81.0)	.482
Female	135	30 (22.2)	105 (77.8)	
Age				
21-59 years	205	48 (23.4)	157 (76.6)	.062
60 years or older	110	16 (14.5)	94 (85.5)	
Status				
DoD civilian	225	44 (19.6)	181 (80.4)	.596
U.S. Army dependent	90	20 (22.2)	70 (77.8)	
Healthcare worker				
Yes	44	3 (6.8)	41 (93.2)	.016
No	270	61 (22.6)	209 (77.4)	

<sup>a</sup>Includes data that may have missing demographic factors.

<sup>b</sup>*P*-values were determined by chi-square test.

respondents (1.63, SD: 0.666, *P* < .001). There was no evidence of a difference between vaccinated and unvaccinated groups in external influence on vaccination decision (*P* = .431) (Table II).

**Multivariate regression model**

The factors associated with receiving or planning to receive the 2019-2020 flu vaccine before and after controlling for gender, age, and HCW status were: previous season vaccination [adjusted OR (Adj. OR): 57.16, 95% confidence interval (CI): 25.48-146.83, *P* < .001], HCW status (Adj. OR: 4.75, 95% CI: 1.39-16.18, *P* = .013), and perceived barriers to flu vaccination (Adj. OR: 0.10, 95% CI: 0.6-0.18, *P* < .001). Although perceived risk of seasonal influenza was associated with receiving the flu influenza in the unadjusted model (OR: 1.46, 95% CI: 1.05-2.02, *P* = .024), the evidence for the association weakened after adjusting for gender, age, and HCW status (Adj. OR: 1.38, 95% CI: 0.99-1.94, *P* = .057) (Table III).

**Qualitative Findings**

Thirty four (53.2%) of unvaccinated respondents answered the open-ended question asking why they chose not to get vaccinated. Thirty eight (15.1%) of vaccinated respondents left a comment in the free-text section. Responses indicated the following latent themes: barriers to influenza vaccination, perceived risk of influenza, perceived symptoms following influenza vaccination, efficacy of influenza vaccination, and severity of the flu. Most of the responses (29) reflected people’s personal experience with the flu vaccine.

**Barriers to flu vaccine**

Sixteen people commented on barriers to receiving the flu vaccine. Most (11) had received their flu vaccine. Those respondents either cited cost, availability, and/or convenience as reasons why they receive their flu vaccine, or stated that changes in cost, availability, and convenience could lead them to forgo the flu vaccine in the future. Barriers mentioned by those who were unvaccinated were: cost, distance to healthcare facility, and time. Respondents described long wait times, distance to a clinic, and taking time off work as barriers to receiving their flu vaccine. The most common comments were from U.S. Army retirees who stated that they must drive to LRMC to receive their flu vaccine.

- “As a retiree, the Wiesbaden MTF will not vaccinate me. Since LRMC is an hour drive away, it discourages consistent vaccination.”
- “Ease of access. Not sure if they were available on each Kaserne or not but would be nice if they were and I did not have to leave for an extended time to get shot.”
- “Shift worker and not driving in for it while off work.”

**Personal risk of influenza**

Fifteen people commented on their perceived personal risk of influenza. Seven of the people who mentioned personal risk did receive or were planning to receive their 2019-2020 flu vaccine. Vaccinated respondents mentioned age and underlying health conditions such as COPD (chronic obstructive pulmonary disease) or asthma that put them at greater risk of complications from the flu. Unvaccinated respondents stated that they felt they were healthy and did not get sick. Some

**TABLE II.** Prevalence and Ranking of Agreement With Belief Statements and Composite Likert Scores for Belief Categories of Unvaccinated and Vaccinated Participants for the 2019–2020 Flu Season

Belief categories	Overall			Unvaccinated			Vaccinated or planning to receive vaccination			P-value <sup>c</sup>	
	n	(% Agree) <sup>a</sup>	Rank	n	(% Agree) <sup>a</sup>	Rank	n	(% Agree) <sup>a</sup>	Rank		
Perceived benefits	Individual belief statements										
	I believe the flu vaccine is effective in preventing the flu <sup>b</sup>	225	(71.4%)	4	18	(28.1%)	7	207	(82.5%)	3	<.001
Perceived severity of influenza	I get the flu vaccine because it will protect others around me from getting sick	201	(63.8%)	5	10	(15.6%)	8	191	(76.1%)	5	-
	The flu vaccine is safe for me	237	(75.2%)	3	22	(35.4%)	6	215	(85.6%)	2	<.001
	The flu is a very serious disease and can make you very sick	276	(87.6%)	1	49	(76.6%)	1	227	(90.4%)	1	.003
	Getting the flu may lead to other serious health problems	250	(79.4%)	2	45	(70.3%)	2	205	(81.7%)	4	.045
Perceived personal risk of influenza	I believe I am not healthy and at risk of getting sick <sup>b</sup>	96	(30.5%)	6	10	(15.6%)	9	86	(35.1%)	6	.023
	I have an increased risk of getting the flu	92	(29.2%)	7	10	(15.6%)	8	82	(32.7%)	7	
	I believe I get sick more often because of my age	52	(16.5%)	11	9	(14.1%)	10	43	(17.1%)	9	
My decision to receive or not receive the flu vaccine was influenced by ...	Reliability: 0.65	Mean: 2.68 SD: 0.888		Mean: 2.43 SD: 0.874		Mean: 2.74 SD: 0.884					
	...a discussion with my healthcare provider	81	(25.7%)	8	7	(10.9%)	11	74	(29.5%)	8	.431
	...a recent newspaper article	25	(7.9%)	13	3	(4.7%)	13	22	(8.8%)	11	
	...a recent TV segment on AFN about the flu	21	(6.7%)	14	2	(3.1%)	14	19	(7.6%)	12	
	...a recent social media post/article	19	(6.0%)	15	2	(3.1%)	15	17	(6.8%)	13	
Perceived barriers	Reliability: 0.86	Mean: 2.00 SD: 0.939		Mean: 1.92 SD: 0.840		Mean: 2.02 SD: 0.962					
	I do not get the flu vaccine because of its cost and convenience in the military community <sup>b</sup>	55	(17.6%)	10	23	(37.1%)	4	32	(12.8%)	10	<.001
	The flu vaccine will make me sick	35	(11.2%)	12	23	(35.9%)	5	12	(4.8%)	14	
Perceived barriers	I do not want to get the flu vaccine	59	(18.8%)	9	40	(62.5%)	3	19	(7.6%)	12	
	I do not get the flu vaccine because I have a fear of needles	11	(3.5%)	16	5	(7.8%)	12	6	(2.4%)	15	
	Reliability: 0.67	Mean: 1.90 SD: 0.686		Mean: 2.94 SD: 0.686		Mean: 1.63 SD: 0.666					

<sup>a</sup>Unless otherwise noted, statements are coded on a Likert scale from 1 = Strongly Disagree to 5 = Strongly Agree and percentage of respondents who agreed with the statements are shown.

<sup>b</sup>These statements are changed to be the opposite of the original statement, which was reverse-coded. Percentages displayed are the percentage of participants who disagreed or strongly disagreed with the original statement.

<sup>c</sup>P-values are determined from a chi-square test for individual statements, and a t-test for composite Likert scores.

SD = Standard Deviation

**TABLE III.** Odds Ratio (OR) of Flu Vaccine Uptake for 2019-2020 Flu Season by Demographic and Belief Factors, n = 313

	Unadj. OR	(95% CI)	P-value	Adj. OR <sup>a</sup>	(95% CI)	P-value	
Demographic factors	Vaccinated in previous season						
	Yes	61.17	(25.48–146.83)	<.001	57.16	(23.61–138.41)	<.001
	No	1			1		
	Ill with flu in previous season						
	Yes	1.23	(0.45–3.35)	.691	1.23	(0.43–3.49)	.700
	No	1			1		
	Gender						
	Male	1.22	(0.70–2.11)	.480	1.15	(0.61–2.16)	.672
	Female	1			1		
	Age						
	60 years or older	1.79	(0.96–3.34)	.065	1.88	(0.94–3.78)	.075
	21-49 years	1			1		
	Group						
	U.S. Army dependent	0.85	(0.47–1.54)	.595	1.15	(0.50–2.65)	.751
DoD civilian	1			1			
Healthcare worker							
Yes	3.98	(1.19–13.29)	.025	4.75	(1.39–16.18)	.013	
No	1			1			
Belief factors	Perceive barriers to influenza vaccination	0.11	(0.06–0.18)	<.001	0.10	(0.06–0.18)	<.001
	Perceive themselves to be at risk of seasonal influenza	1.46	(1.05–2.02)	.024	1.38	(0.99–1.94)	.057
	Self-reported influence of external factors on flu vaccine uptake	1.13	(0.83–1.53)	.430	1.09	(0.79–1.50)	.615

<sup>a</sup>Adjusted for healthcare worker status, age, and gender.

reported that they were at lower risk of flu or flu complications because of alternative flu prevention measures.

- “If we aren’t in the...groups that are most affected by the flu, and we have healthy immune systems, I don’t think we would really need to get the flu shot.”
- “I haven’t had the flu since I was a child, so I choose not to get the vaccine.”
- “I do my due diligence to stay healthy and to avoid those who aren’t.”
- “When I did not take the shot and took increased amounts of Vitamin C, I did not become sick.”

**Efficacy of influenza vaccination**

Twenty-nine people commented on perceived efficacy of the flu vaccine. Eleven received the vaccine, choosing to vaccinate because of vulnerable groups they interact with, and the potential personal protection conferred from the vaccine. Unvaccinated respondents stated that they do not believe it helps because of experience contracting the flu while vaccinated or not contracting the flu while unvaccinated. People also commented on the flu vaccine efficacy’s dependence on the accuracy of the predictions of predominant flu strains. Some stated that although they do not believe the flu vaccine helps, work requirements prompted them to receive the flu vaccine for the 2019-2020 flu season.

- “I believe there are too many variables and differences in the flu seasons so the shot really would not make a difference in the kind that will go around for the year.”

- “I think its effectiveness is wildly overstated as there have been flu outbreaks here in the Europe AOR almost every year... so if you are gonna get the flu anyway, why put yourself through a shot that will likely give you 3-4 days of cold symptoms”

**Safety of flu vaccination**

Eighteen people commented on the safety of the flu vaccine. Less than half (6) of those respondents received the flu vaccine. Those who received and did not receive the vaccine mentioned unknown side effects, experience of cold and flu symptoms after receiving the vaccine, allergies, adverse reactions, and concerns over the contents of the flu vaccine.

- “I also do not want a live foreign virus in me when there are no guarantees that it will guard me against the flu.”
- “Following the flu mist, I realized that I had the same discomfort, lower right back pain after the shot and the mist, and correlated that I had been having the same reaction since about 2005....”
- “Lack of trust on what is actually being put into my body.”

**Severity of flu**

Three people commented on perceived severity of flu. These respondents did not receive the flu vaccine for the 2019-2020 season and commented that getting the flu was not a substantial concern of theirs.

- “My daughter brought home the flu from school and we were down for about a week then was business as usual.”
- “Getting the flu... is not a game breaker for me... ok... I will not feel well for a couple of days... and my immune system will be strengthened.”

## DISCUSSION

### Vaccine Uptake

Flu vaccine uptake is higher in the survey respondents than in adults in the USA, with over 70% of respondents across all subgroups receiving their vaccine in the past two flu seasons compared to 45.3% of adults in the USA vaccinated in 2018-2019.<sup>11</sup> Assuming the respondents are representative of the KMC civilian and dependent population, the vaccination coverage in this community meets Health Promotion's Healthy People 2020 target of 70% vaccination coverage.<sup>12</sup> Although the employers for HCWs surveyed were not specified, flu vaccine uptake tends to be higher in HCWs as health facilities often mandate employees to receive the flu vaccine. The higher vaccine uptake in HCWs and higher likelihood of HCWs to respond to health surveys may skew the overall vaccination rate of respondents to be higher than the general civilian population in the KMC area.

There were 15 flu-related hospitalizations among non-active duty members reported in the Army Disease Reporting System during the 2019-2020 flu season in Germany. Of those admitted, 53% were vaccinated compared to 80% of survey respondents. Assuming that (1) none of the survey respondents were hospitalized for the flu, (2) Army Disease Reporting System captured all flu-related hospitalization among U.S. Army dependents and civilians in Germany, and (3) that the 80% vaccination uptake in respondents is representative of the vaccine uptake in the Army civilian and dependent population in all of Germany, the odds of hospitalization for flu-related illness is roughly estimated to be three times greater in those who were unvaccinated compared to those who were vaccinated.

### The Influence of Personal Experience

Personal experience with the flu vaccine has been well documented as a contributing factor toward a person's decision to vaccinate.<sup>16,17</sup> In fact, a majority of the survey respondents described previous experiences with the flu and the flu vaccine to justify their decision not to vaccinate.

Experimental setups exploring how experiences and descriptions of risks influence decision-making have found that once people have experienced a risk, descriptions of risks will have less influence on their decisions.<sup>18</sup> That would imply that once people have experienced what they feel is an adverse event from the flu vaccine, they are less likely to be influenced by descriptions from the media or healthcare providers on the probability of vaccine-related adverse

events. Overall, agreement that a media segment influenced one's decision to vaccinate was remarkably low in both vaccinated and unvaccinated respondents. This creates a challenge for flu vaccine campaigns, as these messages are less convincing to the public than their own experiences. One possibility would be to simulate experiences with interactive and immersive health communications. The use of visuals, interactive simulations, and virtual reality have been explored as means of public health education with success in increasing vaccine uptake.<sup>19,20</sup>

### Weighing the Benefits Against the Risks

People tend to make decisions by weighing the benefits against the risks.<sup>21</sup> Survey respondents who chose to vaccinate felt the possible benefit of protection would be greater and more likely than the risk of adverse effects from the vaccine. Respondents who chose not to vaccinate felt that the risk of adverse effects from the vaccine was greater and more likely than the possible benefit of protection against influenza.

A higher percentage of vaccinated respondents agreed: the flu vaccine is effective in preventing the flu, the flu vaccine is safe, the flu is a serious disease and can lead to other complications, and they are at risk of getting the flu compared to unvaccinated respondents. This is congruent with findings from other studies, which have described that perceived ineffectiveness of the flu vaccine is a major factor in vaccine hesitancy.<sup>22</sup> The perceived safety of flu vaccine, personal risk of the flu, and the severity of the flu have also been documented as large drivers for vaccination decisions.<sup>14,22-27</sup> Evaluations of flu vaccine messaging that addresses these misconceptions have had mixed results, often resulting in decreased flu vaccine uptake in those greatly concerned with side effects.<sup>28,29</sup> Perhaps the best approach would be to use gain-framed messaging in mass flu campaigns and address concerns at the provider level.<sup>25,27-30</sup>

### Vaccine Accessibility

After controlling for confounders, perceived barriers to flu vaccination were associated with lower vaccine uptake. It is important to note that in the model, this category included statements on: the convenience and accessibility of the vaccine, perception that the flu vaccine will make them sick, wanting to receive the flu vaccine, and a fear of needles. Difficulty accessing the flu vaccine was frequently mentioned in survey comments, particularly by U.S. Army retirees ineligible to receive their vaccines in military clinics outside of LRMC. Considering the older age of retirees, this barrier is particularly concerning. It may be beneficial to advertise alternative vaccination sites for retirees or offer flu vaccines during regular clinic visits in the flu season. Navigating the healthcare system on the economy can be challenging for army civilians and dependents living abroad. Increasing the accessibility of flu vaccine on military installations abroad can help bypass

this challenge, and examining policy changes to achieve this may be worth further investigation.

Often people repeat behaviors. If one begins receiving their flu vaccine, they are likely to continue this behavior each year, forming a habit.<sup>17,31–33</sup> This is apparent in the results of this survey. Those who were vaccinated in the 2019-2020 had greater odds of being vaccinated the previous season than those who were unvaccinated. If accessibility and convenience of flu vaccine increases for the unvaccinated respondents, it may foster the habit of an annual flu vaccination. Successful programs that increase flu vaccine accessibility offer vaccines in workplaces, schools, or supermarkets.<sup>32–34</sup>

### **Vaccine Campaign Strategies**

Although external factors appear to have little influence on a person's vaccination decision, healthcare providers appeared to have more influence than social media or media segments. This finding is in line with other studies, which found that the professional medical opinion is a factor in individual vaccination decisions<sup>35</sup> and is associated with higher flu vaccine uptake.<sup>25,30</sup> This suggests that proper counseling by healthcare providers may be the more influential way to increase flu vaccine uptake. The CDC recommends healthcare providers use the "SHARE" method, which involves counseling patients on their vaccination decision, highlighting positive experiences with flu vaccines, addressing patient concerns, describing the protective effect of flu vaccine, and explaining the costs of forgoing the flu vaccine.<sup>36</sup>

For healthcare providers to effectively recommend the flu vaccine, they also need to be convinced of the value of the flu vaccine.<sup>37</sup> Clinic-level interventions, such as reminding physicians to vaccinate all patients, posters in clinics presenting vaccination rate, and encouraging competition between doctors may help increase vaccine uptake.<sup>30</sup>

Although flu vaccine uptake in respondents was high, results from this study suggest that flu vaccine uptake in this community can be improved by increasing access to the flu vaccine and proper counseling by healthcare professionals on the benefits of the flu vaccine. Discussing and offering flu vaccine during regular clinic visits may educate patients while increasing the convenience of vaccination.

Ultimately, increased vaccine uptake may lead to decreased flu-related morbidities.<sup>9</sup> Decreasing the burden flu-related illness places on healthcare systems is of particular importance during the COVID-19 pandemic, which has already strained health resources globally. Coinfection with SARS-CoV-2 (severe acute respiratory syndrome coronavirus-2) and influenza B virus may lead to more severe illness.<sup>38,39</sup> Flu vaccination may not only reduce severe flu illnesses, but preliminary findings from a study in Brazil suggests that the trivalent flu vaccine may also provide protection against COVID-19-related deaths,<sup>40</sup> highlighting the importance of flu vaccination as the 2020-2021 flu season approaches while the COVID-19 pandemic is ongoing.

### **Limitations**

There are limitations to consider while interpreting the results from this survey. Self-reporting of responses is prone to information bias, resulting in an overreporting of vaccine uptake. Additionally, the results are specific to U.S. Army dependents and civilians in the KMC area and may not be generalizable to all U.S. military dependents and civilians in Europe, particularly considering the response rate of less than 25%. Differences in healthcare practices and availability in the host nation may influence vaccination behaviors in army civilian population, so results may not be generalizable to all army civilians living abroad. Since participants were all registered with LRMC, they may display higher healthcare seeking behavior than the general U.S. military civilian population in Europe, resulting in an overestimate of vaccine uptake in this population. Participants who may not be registered with any healthcare facility or may instead seek care on the economy were not captured by this study. Furthermore, the belief statements were measured on a Likert scale, which is prone to its own biases as respondents may have different interpretations of the belief statements and the possible responses. There may be selection bias if those who chose to respond to the survey felt strongly about either receiving or not receiving the vaccine. A more in-depth questionnaire would better characterize people's beliefs about the flu vaccine.

Additionally, residual confounders not evaluated in this survey, such as education or religion, may affect beliefs surrounding vaccination or play a role in vaccine uptake.

### **CONCLUSION**

Although U.S. Army civilians and dependents participating in the survey had reportedly higher vaccine uptake than the U.S. national targets, there is still room for improvement. After controlling for confounders, flu vaccination in the previous season and HCW status were associated with increased vaccine uptake and perceived barriers to influenza vaccination were associated with decreased vaccine uptake. A higher percentage of vaccinated respondents compared to unvaccinated respondents agreed that they were more at risk of getting the flu, the flu was a serious illness, and the flu vaccine was effective and safe. Provider-level promotion of flu vaccine coupled with increased access to flu vaccines may increase flu vaccine uptake.

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### **CONFLICT OF INTEREST STATEMENT**

None declared.



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