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Original Article

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Abstract

Background. Vaccine hesitancy has become prevalent in society. Vulnerable populations, such as those with cancer, are susceptible to increased morbidity and mortality from diseases that may have been prevented through vaccination.

Objectives. Our objective was to determine patient perception of vaccine efficacy and safety and sources of information that influence decisions.

Methods. This study was a prospective cross-sectional survey trial conducted from March 10, 2022, to November 1, 2022, at a Supportive Care Clinic. Patients completed the survey with a research assistant or from a survey link. Vaccine hesitancy was defined as a response of 2 or more on the Parent Attitudes About Childhood Vaccines (PACV-4). Perception on vaccine safety and efficacy along with the importance of sources of information were determined by a questionnaire.

Results. Of the 72 patients who completed the PACV-4, 30 were considered vaccine-hesitant (42%). Of those who completed the survey alone (35), 23 (66%) were vaccine-hesitant; and of those who completed the survey with the help of a study coordinator (37), 7 (19%) were vaccine-hesitant. The most important source for decision-making was their doctor (82%, 95% CI 73–89), followed by family (42%, 95% CI 32–52), news/media (31%, 95% CI 22–41), and social media (9%, 95% CI 4–16). Clinical and demographic factors including age, gender, race/ethnicity, education level, and location of residence were not associated with vaccine hesitancy.

Significance of results. Vaccine hesitancy is present among patients with advanced cancer. The high value given to the doctor's recommendation suggests that universal precautions regarding vaccine recommendation may be an effective intervention.

Introduction

Public perception of vaccine risks and benefits has affected the adoption of immunizations around the world (Kricorian et al. 2022). This perception has been influenced by the now ubiquitous nature of opinions regarding the safety and efficacy of vaccines appearing as part of news reports and on social media platforms (Luthy et al. 2009; Mirdamadi and Einarson 2011; Opel et al. 2011a). In 2012, the World Health Organization Strategic Advisory Group of Experts set out to better understand and define this phenomenon (Lane et al. 2018). The group helped define vaccine hesitancy as “A behavior, influenced by several factors including issues of confidence [do not trust vaccine or provider], complacency [do not perceive a need for a vaccine, do not value the vaccine], and convenience [access]” (Schuster et al. 2015). This defines a growing attitude among individuals to either delay or decline vaccines for themselves or loved ones (Larson et al. 2014). The movement has even led to a dichotomy in the public view of those classified as pro-vaccine individuals or anti vaccine (Larson et al. 2014). Literature points to many reasons for non-vaccination including religion, political reasons, and lack in confidence in the scientific data published (Larson et al. 2014). Willingness to get vaccinated is positively related to their recognition of the collective importance of the vaccine itself and negatively related to mistrust toward the safety information regarding the vaccine (Freeman et al. 2022).

The global pandemic from COVID-19 has further brought the concept of vaccine hesitancy to the forefront of public attention, given the growing number of people deferring to get the vaccine for COVID-19 (Bogart et al. 2021; Dror et al. 2020; Lucia et al. 2021; Puri et al. 2020). Within the US population, different racial and ethnic groups have been disproportionately affected by COVID-19 (Bogart et al. 2021). For example, Black individuals account for 13.4% of the US population but account for more than 24% of COVID-19 deaths (Bogart et al. 2021). Literature has also shown that patients with certain diseases are at an increased risk of harm from COVID-19.

Hospitalized cancer patients with COVID-19 have been shown to have increased 30-day mortality compared to those without cancer (30% compared to 21%) (Desai *et al.* 2021).

A recent review of literature reported a wide range of vaccine hesitancy rates ranging from 3.9% to 76.7% among patients with cancer (Butow *et al.* 2023). However, it should be noted that a limitation of vaccine hesitancy research is that the term vaccine hesitancy can be used in a varied manner (Bussink-Voorend *et al.* 2022). For instance, Butow *et al.* (2023) in their review reported a vaccine hesitancy rate of 82.1% from another study conducted in Hong Kong by Chan *et al.* (2021). However, the authors solely define vaccine hesitancy on a response of “could not decide” or “reluctant” to a single question regarding if they would get vaccinated (Chan *et al.* 2021). Thus, this was not a validated measure of vaccine hesitancy and illustrates the complexity of reporting vaccine hesitancy rates. Understanding and defining the underlying sources of mistrust toward vaccinations should be a priority. Thus, our group set out to assess perception of vaccine efficacy and safety along with vaccine hesitancy rates using a validated measure among patients seen at the outpatient Supportive Care Center.

Methods

The institutional review board approved this prospective cross-sectional survey trial at MD Anderson Cancer Center, a comprehensive cancer center, in Houston, Texas. To illustrate the Supportive Care Center clinic environment, our department has previously published recent data reporting number of clinic visits and patients seen from 2018 to 2021 (25,767 and 6,631, respectively) along with most common cancer diagnosis, average age, gender, and race (Hui *et al.* 2023). This study was conducted from March 10 to November 01, 2022. Inclusion criteria included patients who were part of a clinic visit either in person or through telemedicine, 18 years of age or older, and able to speak English. The exclusion criteria included patients who could not sign written consent and patients who were considered delirious at the time of the clinic encounter as defined by a Memorial Delirium Assessment Scale score of 7 or greater (Bramati and Bruera 2021). As a part of the patient intake process and routine care, the clinic nursing staff performs the delirium assessment for all patients.

The research staff helped identify eligible patients for the study and obtained written informed consent either in per-

son, or over the phone, via the electronic health record (EHR), or using any Health Insurance Portability and Accountability Act (HIPAA) compliant platform. Afterward, the research staff collected patient demographics, including age, gender, ethnicity, cancer diagnosis, highest level of education, and region where the patient lives (urban, suburban, rural), by phone and recoded this information in an intuitional review board approved database.

The research staff administered the survey using any of the methods mentioned above. If the patient preferred to complete the survey independently, the survey link was sent to the patient through the EHR or email to complete the questionnaires. To reach the desired response rate of up to 100 participants who completed the survey, we planned to enroll up to 120 patients over 6 months. The study size of 100 was determined based on perceived time of recruitment and the desire to attempt to complete the study in 6 months due to concerns about possible emergence of COVID-19 variants. The primary objective was to determine patient perception of the efficacy and safety of vaccinations. The secondary objectives included the following: to assess demographic predictors of those who would be considered as vaccine-hesitant, to assess the patient preferred source of recommendations for or against vaccination, to assess the role previous side effects or allergic reactions play on patient perception of future vaccines, to assess patient perception of vaccination before COVID-19, to assess patient willingness to get the COVID-19 vaccine, and to determine the patient desire to get the influenza vaccine.

Vaccine hesitancy was defined as a hesitant response to greater than or equal to 2 items on a modified version of the validated 4-item Parent Attitudes About Childhood Vaccines (PACV-4) (Opel *et al.* 2019), Vaccine hesitancy was not solely define to the COVID-19 vaccine but to vaccines in general. The PACV-4 is a copyrighted tool; the owner Dr. Douglas Opel has permitted us to use this for research purposes, although he does not have an active role in this study. It has been validated to determine vaccine hesitancy that was adapted by Dr. Douglas Opel from a 15-item survey (Opel *et al.* 2011b).

The survey questions were developed by the study team. All questions were reviewed by the investigators for face validity and discussed in a blueprint meeting with members of the research and statistics team. The questions were comprised of responses in the form of a 5-point Likert scale from completely agree to completely disagree along with questions that had a yes and no response.

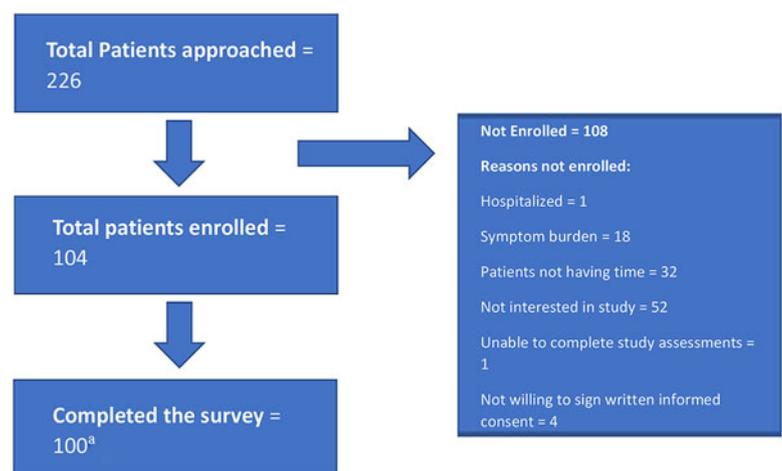


Figure 1. Consort diagram.

^aFour patients signed up for the study but never completed the survey by the end of the 3-week period permitted by the study protocol.

For responses, please see Table 4. Summary statistics were used to describe the clinical and demographic characteristics of the study population. All survey items were summarized individually with frequencies and percentages for categorical variables and means, standard deviations, and ranges for continuous variables. Demographic factors were summarized by survey items and compared using *t*-test or ranks-sum test for continuous variables and chi-squared or Fisher's exact test for categorical variables. With a sample size of 100, a 2-sided 95% confidence interval for a single proportion of responding "vaccine hesitant" will extend 0.098 (0.09) from the observed proportion for an expected proportion of 0.50 (0.30). Vaccine hesitancy was defined using the PACV-4. All statistical analysis was performed using Stata/M.P. v17.0 (College Station, TX).

Results

A total of 104 patients were enrolled, and the desired completion of 100 patient surveys was obtained. Figure 1 shows the consort diagram. Four patients agreed to participate in the survey and signed consent but did not complete the surveys. Patient demographics are provided in Table 1. Associations were assessed between vaccine hesitancy and patient demographics, including age, gender, location of residence, and whether the patient completed the survey independently versus with the aid of a study coordinator. There were no significant associations between vaccine hesitancy and age, gender, and location of residence.

Table 2 describes vaccine hesitancy in the study population. Of the 72 patients who completed the PACV-4 subsection, 30 were considered vaccine hesitant (42%, 95% CI: 30–54%). Of the patients who completed the survey independently, 23 of 35 (66%) were vaccine hesitant. Of the 37 patients for whom the coordinator assisted with administering the survey, 7 (19%) were found to be vaccine hesitant. The median PACV-4 scores were 0 and 2 for whom the survey was administered to them by a study coordinator versus those who completed the survey independently respectively ($p < 0.001$). This difference appears to be driven by the question "How concerned are you that a shot might not prevent the disease?" where 51% of patients who completed the survey alone had concern versus 11% in the group who completed the survey with a coordinator.

Table 3 shows the importance placed on specific sources of information by all patients in the study. This information was obtained by asking patients to rank from very important to not important on a 5-point Likert scale each source of information when deciding to get vaccination. Moreover, 82% (95% CI: 73–89%) of patients ranked "very important or important" when asked how important your own medical provider's recommendation is, whereas only 9% (95% CI: 4–16%) would rank personal stories in social media as "very important or important" in their decision-making.

Table 4 shows the participants' responses to the survey questions. The first part of the table represents their response to vaccines other than the COVID-19 vaccine. A majority of participants (63%) agreed with the statement "I am concerned to the side effects of vaccines." However, most (80%) also agreed with the statement "I have confidence in the effectiveness of vaccines" and 77% also agreed with the statement "I have an overall positive view towards vaccines." The second half of the table represents thoughts and perceptions regarding the COVID-19 vaccination. A majority (66%) of the participants agreed with the statement, "I feel overall that the [COVID-19] vaccine is beneficial for me."

Table 1. Patient demographics ($n = 100$)

Characteristic	N	%
Age (years)		
18–30	8	8
30–40	19	19
40–50	24	24
50–60	27	27
60–70	19	19
70+	3	3
Gender		
Female	80	8
Male	20	2
Race		
White	78	79
Black	17	17
Asian/Pacific Islander	2	2
Other	2	2
Ethnicity		
Non-Hispanic or Latino	94	94
Latino	6	6
Highest level of education		
Some high school but no diploma	1	1
High school graduate, or equivalent (GED)	16	16
Trade school	4	4
Some college, no degree	22	22
College degree	34	34
Postgraduate	22	22
Prefer not to answer	1	1
Location of residence		
Rural	23	23
Urban	35	35
Suburban	42	42
Survey completed by patients or study coordinators		
Coordinator	51	51
Patient	49	49

GED = General Educational Development.

Discussion

Among patients with a very high risk of complications or death from COVID infection, our study found that almost 42% were vaccine hesitant. Our findings are consistent with previous studies seen when evaluating vaccine hesitancy in patients with cancer (Butow et al. 2023). This study also used a validate measure for vaccine hesitancy (Opel et al. 2019, 2011a, 2011b). The patients who are seen at the Supportive Care Clinic are those who have advanced illnesses and are more likely to require inpatient hospitalizations for illnesses along with intensive care unit admissions (Hui et al. 2020, 2014).

Table 2. Vaccine hesitancy by coordinator administering the survey to the patient versus the patient completing the survey independently

Characteristic	Total (n = 72)		Coordinator assisted		Patient independent		p-Value
	N	%	N	%	N	%	
Total PACV-4							<0.001
N			37		35		
Mean (SD)			0.89 (1.97)		2.43 (2.10)		
Median (Min–Max)			0.00 (0.00–8.00)		2.00 (0.00–6.00)		
Vaccine-hesitant patients^a	30	41.67	7	18.92	23	65.71	
PACV-4 Questions^b							
Have you ever delayed having your child get a shot for reasons other than illness or allergy?							0.509
No	62	86.11	33	89.19	29	82.86	
Yes	10	13.89	4	10.81	6	17.14	
How concerned are you that a shot might not prevent the disease?							<0.001
Not concerned	46	63.89	33	89.19	13	37.14	
Not sure	4	5.56	0	0.00	4	11.43	
Concerned	22	30.56	4	10.81	18	51.43	
Overall, how hesitant about the childhood shots would you consider yourself to be?							0.281
Not hesitant	57	79.92	32	86.49	25	71.43	
Not sure	4	5.56	1	2.70	3	8.57	
Hesitant	11	15.28	4	10.81	7	20.00	
I trust the information I receive about shots.							0.305
Agree	55	76.64	31	83.78	24	68.57	
Not sure	10	13.89	4	10.81	6	17.14	
Disagree	7	9.72	2	5.41	5	14.29	

^aVaccine hesitancy was defined as a PACV-4 score of 2 or greater.

^bThe PACV-4 questions were only administered to patients who have had children.

Table 3. Importance placed by patients on sources of information (n = 100)

Patient Response	Medical professional that is directly caring for the patient	Family member	Medical professional seen in the news/media but not one in direct care	Friends	Personal stories in social media
Important/Very Important (%; 95% CI)	82 (82, 73–89)	42 (42, 32–52)	31 (31, 22–41)	24 (24, 16–34)	9 (9, 4–16)

Despite reassurances of complete anonymity and safety when it came to the responses of our survey, the study showed that those who completed the survey independently reported greater vaccine hesitancy than those who completed the survey with the aid of a study coordinator. This was an unexpected finding and one that we did not originally set out to investigate. We feel that our data demonstrate that when speaking to the study coordinator patients are less likely to be candid with their responses and more likely to answer the questions in a manner, they feel the clinical team would want. This sentiment may have been further exacerbated several reasons. There have been reports not only in literature but also in news and media reporting specific medical care being denied to those who have been unvaccinated against COVID-19 (Klitzman 2022). Although there has been an increasingly positive sentiment

regarding COVID-19 vaccinations across the United States, there are many who have a negative view toward the vaccine and may want to avoid direct dialogue with those who they perceive are in support of the vaccine (Hu et al. 2021).

Another important finding of this paper is the importance patients placed on sources of information. When assessing risks toward vaccination, literature suggests that individuals may come to conclusions regarding safety and benefits relying more on personal narratives rather than scientific data (Karafillakis and Larson 2017). This may lead to mistrust and fear regarding vaccination (Karafillakis and Larson 2017). Hence with the rise of social media over the past few decades, there came a rise in mass distributed accessible personal narratives greatly influencing decisions of individuals (Basch et al. 2021; Hernandez et al. 2021;

Table 4. Survey results

Characteristic	N	%
Thoughts and perceptions regarding vaccines other than COVID-19		
Have you ever decided not to get a vaccine or delayed getting a vaccine for a reason other than being sick?		
Yes	27	27
Have you ever become ill or have had unpleasant side effects following a vaccine?		
Yes	24	24
Have you ever had an allergic reaction to a vaccine?		
Yes	3	3
I am concerned about side effects of vaccines.		
Completely agree/Partially agree	63	64
Neither agree nor disagree	13	13
Completely disagree/Partially disagree	23	23
I have confidence in the safety of vaccines.		
Completely agree/Partially agree	73	74
Neither agree nor disagree	15	15
Completely disagree/Partially disagree	11	11
I have confidence in the effectiveness of vaccines.		
Completely agree/Partially agree	80	81
Neither agree nor disagree	11	11
Completely disagree/Partially disagree	8	8
I have an overall negative view toward vaccines.		
Completely agree/Partially agree	13	13
Neither agree nor disagree	14	14
Completely disagree/Partially disagree	73	73
I have an overall positive view toward vaccines.		
Completely agree/Partially agree	77	78
Neither agree nor disagree	14	14
Completely disagree/Partially disagree	8	8
Thoughts and perceptions regarding COVID-19 vaccination		
Before the COVID-19 pandemic, I felt that most illnesses in which a vaccine was available for were not serious enough for a vaccine.		
Completely agree/Partially agree	29	31
Neither agree nor disagree	13	14
Completely disagree/Partially disagree	53	56
I am eager to get the vaccine for COVID-19.		
Completely agree/Partially agree	56	57
Neither agree nor disagree	13	13

(Continued)

Table 4. (Continued.)

Characteristic	N	%
Completely disagree/Partially disagree	29	30
I find information that I see on social media helpful in making a decision on whether or not to get the COVID-19 vaccine.		
Completely agree/Partially agree	9	9
Neither agree nor disagree	18	18
Completely disagree/Partially disagree	71	72
I find information that is presented by the news media (television, internet, newspaper) helpful in making a decision on whether or not to get the COVID-19 vaccine.		
Completely agree/Partially agree	28	28
Neither agree nor disagree	19	19
Completely disagree/Partially disagree	52	53
I find information that is presented by my primary care physician or health professionals that I see helpful in making a decision on whether or not to get the COVID-19 vaccine.		
Completely agree/Partially agree	72	73
Neither agree nor disagree	13	13
Completely disagree/Partially disagree	13	13
I find information that is presented by national health experts helpful in making a decision on whether or not to get the COVID-19 vaccine.		
Completely agree/Partially agree	54	55
Neither agree nor disagree	22	22
Completely disagree/Partially disagree	22	22
I find the information that is presented by government press releases or presentations including those by the President of the United States helpful in making a decision on whether or not to get the COVID-19 vaccine.		
Completely agree/Partially agree	30	31
Neither agree nor disagree	29	30
Completely disagree/Partially disagree	39	40
Considering all the potential risks and benefits that have been mentioned about the COVID-19 vaccine, I feel overall that the vaccine is beneficial for me.		
Completely agree/Partially agree	66	67
Neither agree nor disagree	13	13
Completely disagree/Partially disagree	19	28
I have received the COVID-19 vaccine.		
Yes	76	78

Raghupathi et al. 2020). As an example, Raghupathi et al. (2020) evaluated sentiment on the social medical platform Twitter and its associations with the measles vaccine. Much of the negative sentiment was linked with misinformation that has been propagated

by its association with autism (Raghupathi *et al.* 2020). There also are several reports that public figures play a large role in impacting public opinion regarding vaccines (Hu *et al.* 2021; Kang *et al.* 2017).

Our study showed that participants in both groups (vaccine-hesitant and not) still place a greater importance on the recommendation from a medical professional who is actively involved in their care over the recommendation of family members, friends, news media, and social media. We feel that this information can be very helpful to the medical community in helping with patient decision-making and the value that patients place on the patient–physician relationship.

This study has several limitations. This study took place in a supportive care center – a cancer institute. While we hope that this would be representative of those who are facing serious illness, the results may not be generalizable. The sample size was small and thus our ability to detect hesitancy may have been affected. The PACV-4 score is a validated measure to determine vaccine hesitancy; however, it was validated as a tool to determine vaccine hesitancy in parents in a pediatric clinic setting (Opel *et al.* 2019). This may have affected our results because our patient population now has adult children and recall bias may have influenced the results. Other limitations of this study include an inability to establish causality, self-reporting biases, and an under-representation of minority races and ethnicity.

Conclusion

Our study initially set out to gain a better understanding of the factors associated with vaccine hesitancy in a setting in which patients are facing serious illness. Given the vulnerabilities of those with advanced cancer, it is important to gain a better understanding of not only the reasons behind vaccine hesitancy but also the importance placed on sources of information. This study calls to light that many may not feel completely safe in discussing their opinions regarding the matter, and perhaps further studies should use a completely anonymous method to survey patients. Further research is needed to help better understand vaccine hesitancy along with the factors that influence health-related decision-making from patients.

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