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Understanding Vaccine Hesitancy Dynamics: Insights from Northern Mindanao, Philippines

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Abstract

Background & Aim: Amidst the ongoing COVID-19 pandemic, vaccine hesitancy persists, especially within specific demographics. This study delved into vaccine hesitancy among Northern Mindanao, Philippines, residents aged 20 to 64, aiming to understand factors shaping vaccination decisions. Employing the Health Belief Model, the research sought to dispel misconceptions and bolster vaccine uptake through evidence-based public health education and improved communication strategies. By examining socio-demographic variables like age, gender, education, religion, and vaccination status, the study informed targeted interventions for enhancing vaccine acceptance and bolstering community health outcomes. **Methods:** This study employed a quantitative, descriptive-correlational design and analyzed vaccine hesitancy factors among Northern Mindanao, Philippines residents aged 20 to 64. Stratified sampling ensured representative inclusion across age groups, with a sample size of 372 respondents. Statistical analyses, including F-tests and ANOVA, assessed hesitancy differences, while stringent adherence to data privacy regulations safeguarded participant confidentiality. **Results:** Among respondents, those aged 51 to 69 exhibited the highest vaccine hesitancy levels, particularly regarding uncertainty and knowledge about COVID-19 vaccines. However, no significant relationship was found between hesitancy levels and age or gender. Conversely, significant disparities in hesitancy were observed concerning educational attainment, religion, and vaccination status. **Conclusion:** While age, gender, education, and religion are associated with varying levels of COVID-19 vaccine hesitancy, none singularly determine hesitancy. Enhanced education and knowledge about vaccines correlate with decreased hesitancy, emphasizing the necessity of targeted education initiatives. However, significant hesitancy disparities based on vaccination status underscore the ongoing challenge of addressing hesitancy despite reassurances about vaccine safety. **Recommendation:** Implementing tailored educational programs that address specific concerns related to demographic factors is recommended as a crucial strategy for reducing COVID-19 vaccine hesitancy.

Keywords: vaccine hesitancy, covid-19, health belief model, public health

INTRODUCTION

The global impact of the COVID-19 pandemic has been pervasive, affecting people across various dimensions—physically, economically, socially, and mentally—over several years. In response to the escalating cases of COVID-19, beyond the implementation of minimum health standards, the development of COVID-19 vaccines aimed to mitigate the daily rise in infections. Understanding the perceptions and factors influencing vaccine hesitancy among residents in a barangay in Northern Mindanao is crucial for more effective vaccination program rollouts. This process involves improved information dissemination to address misconceptions.

As of September 16, 2022, the Philippines has reported 3,913,536 confirmed cases of COVID-19, with 62,447 fatalities (1). Despite administering 162,844,138 vaccine doses as of August 31, 2022, many people still express reluctance to get vaccinated. This reluctance persists even with the numerous health teachings provided. "Vaccine hesitancy," the unwillingness of individuals to receive available and recommended vaccines, was already a significant concern before the COVID-19 pandemic (2). The campaign against vaccine hesitancy became even more critical during the COVID-19 pandemic (3).

The reasons behind vaccine resistance remain vague and complex, necessitating a comprehensive, objective, and research-based understanding of COVID-19 vaccines. This understanding is crucial as new virus mutations emerge and new vaccines enter the market. Consequently, the factors influencing vaccine hesitancy among individuals are still not fully understood and require further exploration.

The primary objective of this study was to identify and determine the perception of residents aged 20 to 64 years old in a barangay in Northern Mindanao regarding the major factors influencing the acquisition of COVID-19 vaccines. Additionally, evidence and research-based health teachings were provided to the residents to supplement their knowledge, rectify misconceptions about COVID-19 vaccines, and encourage vaccination. Proper and appropriate health education was expected to advance and motivate the residents to get vaccinated, ultimately reducing the entire population's susceptibility to acquiring COVID-19 and improving their holistic well-being.

The research was founded on the Health Belief Model (HBM), which was developed by Irwin Rosenstock, Godfrey M. Hochbaum, S. Stephen Kegeles, and Howard Leventhal (4). This model provided the theoretical framework for examining the influence of HBM constructs on COVID-19 vaccination hesitancy. Theoretical frameworks such as health belief models and risk perception models are essential for comprehending the factors that impact decision-making concerning health-related behaviors. The HBM consists of six constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy.

Communication strategies were enhanced, focusing on the merits of vaccination, particularly among younger individuals. Message framing was expanded to include altruistic considerations to improve government transparency regarding vaccine effectiveness and side effects (5). Notably, perceived social norms emerged as this population's most significant potential predictor and behavioral driver of COVID-19 vaccine acceptance (6). The model guided the understanding of how perceived vaccine effects played a crucial role in vaccine decision-making.

It was essential to comprehend the factors influencing Filipinos' health-seeking habits and the motivations behind their refusal of medical care, especially concerning the risks associated with COVID-19 vaccination. The campaign against vaccine hesitancy gained increased importance during the COVID-19 pandemic (3).

The existing research on the effects of COVID-19 vaccine hesitancy in a barangay in Northern Mindanao had not identified the residents' views and perceptions regarding COVID-19 vaccines and the factors influencing their decision-making in getting vaccinated. The study aimed to fill this gap by investigating the socio-demographic profile of residents and its relationship with their hesitancy in acquiring the COVID-19 vaccine. It specifically focused on determining the most prevalent factor influencing residents' perception in a barangay in Northern Mindanao toward COVID-19 vaccination. The primary goal was to answer whether there was a significant relationship in the perceptions of factors affecting vaccine hesitancy among respondents in the barangay,

categorized by age, gender, educational attainment, religion, and vaccination status.

METHODS

Design

A quantitative, descriptive-correlational research design was utilized to analyze and evaluate the research questions. According to Williams (7), descriptive research is a type of research design employed to understand a phenomenon's situation. Nassaji (8) also stated that the objective of a quantitative descriptive research design was to delineate a phenomenon and the factors influencing it.

According to Williams (7), descriptive research design could be employed to determine the respondent's stance and beliefs about a social phenomenon. Additionally, contrary to straightforward cause-and-effect correlations, correlational designs systematically explored the nature of relationships or associations between and among variables. The variables and the correlations that emerged spontaneously between and among them were described in descriptive correlational research (9).

Sample, sample size & sampling technique

The research study presented was conducted in Misamis Oriental, one of the provinces in Northern Mindanao, with its independent city, Cagayan de Oro, comprising eighty (80) barangays. One of them was a specific barangay in Northern Mindanao, which was part of the Geographically Isolated and Disadvantaged Areas (GIDA). The research data was collected in a barangay in Northern Mindanao with fifteen (15) zones. The mentioned research setting was chosen as it was one of the many barangays in Cagayan de Oro that were significantly vulnerable due to the coexistence of socio-economic and physical variables, particularly during the COVID-19 crisis.

The researchers utilized the stratified sampling technique to identify clusters of individuals participating in the study, emphasizing the importance of providing each age group with adequate samples for comprehensive representation. This approach, subdividing the sample size into strata based on respondents' age groups, was chosen for its ability to produce solid statistical conclusions about the entire population.

For participant inclusion, individuals needed to be vaccinated and unvaccinated residents of a specific barangay in Northern Mindanao, aged 20 to 64 years old, literate, and mentally and physically able to function. Exclusions encompassed those below 18 years old, individuals with physical impairments, unsigned informed consent, and implied consent. Participants in the vulnerable category, including those under 18 years old and individuals with mental and physical disabilities, were not considered.

The sample size computation employed the Cochran formula, determining an approximate size of 372 respondents (n) based on a population size (N) of 10,758, a 95% confidence level, and a variability of 0.5. Participants willing to meet the study's criteria could withdraw anytime and for any reason.

Data collection process

Statistical data on vaccinated and unvaccinated residents were obtained from city health officers via email, serving as the sampling frame. Questionnaires were disseminated with the help of barangay zone leaders, collected after completion, and returned to the researchers.

The instrument of data collection

A survey questionnaire was formulated and used as the primary tool in the study. The questionnaire was based on a research article entitled "Factors Influencing COVID-19 Vaccine Acceptance in Indonesia: An Adoption of the Technology Acceptance Model [version 2; peer review: 2 approved]" (10). The self-made survey questionnaire underwent a validation process for face and content validity with the advice and assistance of the consulted validators and the Xavier University Research Ethics Board (XU REB) department to assess and measure its intended purposes in this study. According to Martinez (11), face validity was used to assess how relevant the content of a specific test appeared on the surface, while content validity was used to assess whether a test could accurately represent the various components of a specific construct.

Data analysis

In evaluating the questionnaire's validity and reliability, Cronbach's alpha coefficient was computed for each domain, focusing on the degree of COVID-19 vaccine hesitancy and understanding of the COVID-19 vaccine. As explained by Frost (12), Cronbach's alpha

assesses the internal consistency or reliability of a set of items within the questionnaire. This statistical method helped ascertain whether the items devised by the researchers consistently measured the same characteristics. Furthermore, Cronbach's alpha provided a standardized measure of agreement on a scale ranging from 0 to 1, with higher scores indicating stronger consensus among the items.

Before administering the questionnaires, the researchers carried out a pilot test to evaluate the viability of the study and the reliability of the survey questionnaire. As described by Simkus (13), a pilot test is a preliminary investigation conducted on a small scale to assess the potential of a research study before conducting it on a larger scale. The main objective was to evaluate the feasibility of the intended main study. The researchers selected pilot participants from the residents of a barangay in Northern Mindanao, who were subsequently excluded from the main study.

To determine the significant relationship between the factors affecting the hesitancy of acquiring COVID-19 vaccines among the respondents of a barangay in Northern Mindanao in terms of age, gender, educational attainment, religion, and knowledge of COVID-19 vaccines, the F-test and ANOVA (analysis of variance) were used to understand their differences. ANOVA utilized the F-test to determine the variability between the factors, allowing the researchers to analyze the variation to make judgments about means.

Ethical consideration

The researchers got ethical clearance from the XU REB (XU REC Package No. NSG-2023001281). Informed consent was obtained from eligible participants, ensuring voluntary participation and understanding of the study's purpose. Strict compliance with the Data Privacy Act was observed to maintain confidentiality and privacy, with data access restricted to the research team. Personal data was retained only for the study's duration and then irretrievably disposed of.

RESULTS

Table 1 analyzed the levels of vaccine hesitancy among respondents when grouped by age. The results indicated that respondents aged 51 to 69 exhibited the highest hesitancy levels, particularly regarding uncertainty about acquiring the COVID-19 vaccine and knowledge of the vaccine, with mean values of 2.16 and 2.21, respectively. This finding suggested that the oldest respondents were most affected by factors against vaccination, leading to the highest overall vaccine hesitancy. The statistical analysis using an F-test or ANOVA generated p-values of 0.109 for uncertainty about getting the COVID-19 vaccine and 0.171 for knowledge about the vaccine. Since both p-values were more significant than 0.05, the hypothesis was accepted, indicating no significant relationship in vaccine hesitancy among respondents when grouped by age. However, it is crucial to note that age alone is not a definitive predictor of vaccine hesitancy, emphasizing the need to consider various factors beyond age when addressing this issue.

Table 1. ANOVA Results of Respondent's Level of Vaccine Hesitancy When Grouped According to AGE

Profile	Level of Vaccine Hesitancy of the Respondents			
	Uncertainty towards Acquiring COVID-19 Vaccine		Knowledge of the COVID-19 Vaccine	
Age	Mean	p-value	Mean	p-value
20-34	1.98	0.109 ns	2.06	0.171 ns
35-50	2.10		2.06	
51-69	2.16		2.21	

Legend: ns = Not Significant *=Significant
**=Highly Significant

Table 2 presented the levels of vaccine hesitancy among respondents when grouped by gender. Female respondents consistently exhibited higher hesitancy levels regarding uncertainty about acquiring the COVID-19 vaccine and knowledge of the vaccine, with mean values of 2.10 and 2.13, respectively. Consequently, they displayed a higher overall level of vaccine hesitancy. A t-test was employed, yielding p-values of 0.388 for uncertainty about getting the COVID-19 vaccine and 0.392 for knowledge about the vaccine. Since both p-values were more significant than 0.05, the hypothesis was accepted, indicating no significant relationship in vaccine hesitancy among respondents when grouped by gender. This result underscores that gender alone is not a significant determining factor in predicting the

likelihood of vaccine hesitancy within the surveyed population.

Table 2. T-test Results of Respondent's Level of Vaccine Hesitancy When Grouped According to GENDER

Profile	Level of Vaccine Hesitancy of the Respondents			
	Uncertainty towards Acquiring COVID-19 Vaccine		Knowledge of the COVID-19 Vaccine	
Gender	Mean	p-value	Mean	p-value
Male	2.04	0.388 ns	2.07	0.392 ns
Female	2.10		2.13	

Legend: ns = Not Significant *=Significant **=Highly Significant

Table 3 describes the levels of vaccine hesitancy among respondents when grouped by their educational attainment. Those who were elementary graduates but did not pursue high school displayed the highest mean of 2.36 regarding uncertainty about acquiring the COVID-19 vaccine. Conversely, the group with no educational attainment exhibited the lowest level of vaccine hesitancy due to a lack of knowledge, with a mean of 2.70. Overall, elementary graduates had the highest level of vaccine hesitancy. The F-test or ANOVA analysis revealed that all the p-values were less than 0.01, indicating a highly significant relationship in the level of vaccine hesitancy among respondents when grouped according to educational attainment.

Table 3 also revealed the levels of vaccine hesitancy among respondents when grouped by their religion. Followers of Islam exhibited the highest hesitancy regarding uncertainty towards acquiring the COVID-19 vaccine, with a mean value of 2.13, indicating the highest overall vaccine hesitancy. Conversely, Protestant respondents had the highest hesitancy level due to their knowledge, with a mean of 2.37. An F-test or ANOVA was applied, yielding p-values all greater than 0.05. Consequently, the null hypothesis was accepted, suggesting no significant relationship in the level of vaccine hesitancy among respondents when grouped by religion.

Table 3. ANOVA Results of Respondent's Level of vaccine hesitancy when grouped according to educational attainment and religion

		Level of Vaccine Hesitancy of the Respondents			
		Uncertainty towards Acquiring COVID-19 Vaccine		Knowledge of the COVID-19 Vaccine	
Variable		Mean	p-value	Mean	p-value
Educational Attainment	Elementary Level	2.24	0.002**	2.41	<0.01**
	Elementary Graduate	2.36		2.60	
	High School Level	2.16		2.25	
	High School Graduate	2.14		2.14	
	College Level	1.86		1.88	
	College Graduate	1.91		1.76	
	Postgraduate	1.63		1.83	
	No Educational Attainment	2.23		2.70	
Religion	Roman Catholic	2.07	0.988 ns	2.09	0.590 ns
	Protestant	2.02		2.37	
	Islam	2.13		2.13	
	Others	2.07		2.08	

Legend: ns = Not Significant *=Significant **=Highly Significant

Table 4 demonstrates the levels of vaccine hesitancy among respondents when grouped by vaccination status. The data indicated that unvaccinated respondents consistently exhibited higher vaccine hesitancy than those already vaccinated. Their hesitancy, influenced by uncertainty about getting the COVID-19 vaccine and their knowledge, significantly impacted their decision to refrain from acquiring it. The F-test or ANOVA analysis revealed that all the p-values were more significant than 0.01, indicating that the observed differences in vaccine hesitancy levels among the respondents were highly unlikely to have occurred by chance. Therefore, there was a highly significant difference in vaccine hesitancy among respondents when grouped by vaccination status.

Table 4. T-test results of Respondent's Level of vaccine hesitancy when grouped according to vaccination status

Profile	Level of Vaccine Hesitancy of the Respondents			
	Uncertainty towards Acquiring COVID-19 Vaccine		Knowledge of the COVID-19 Vaccine	
Vaccination Status	Mean	p-value	Mean	p-value
Vaccinated	2.02	<0.01*	2.06	<0.01**
Unvaccinated	2.89	*	2.75	

Legend: ns = Not Significant *=Significant
**=Highly Significant

DISCUSSIONS

In line with findings indicating that the oldest individuals, aged between 51 and 69 years, exhibited the most reluctance towards obtaining the COVID-19 vaccine, research by Zhang et al. (14) uncovered that the highest levels of vaccine hesitancy were observed among those aged 65 years and older during the vaccination program's rollout among Hong Kong residents. Their data illustrated that resistance or hesitancy towards vaccination primarily stemmed from concerns about potential health risks and complications arising from vaccine side effects. Despite older individuals with pre-existing health conditions urgently requiring vaccination, multivariate regression analysis indicated that vaccine resistance and hesitancy were notably associated with factors such as advanced age, a higher prevalence of chronic illnesses, lower self-rated health status, living alone, and limited use of various social media platforms. Furthermore, older adults who had previous hospitalizations expressed reluctance to receive the vaccine. Additionally, a study conducted by Siu et al. (15) revealed that older adults had the lowest rate of COVID-19 vaccination, with only 26% of individuals aged 60 years and older having received their first dose of the COVID-19 vaccine by July 2021.

As mentioned, there was no significant correlation in vaccine hesitancy levels among respondents when categorized by age. Similar findings were implied by the study conducted by Syan et al. (16), which found no significant differences in safety perceptions regarding general vaccines or COVID-19 vaccines between individuals under 30 and those in the 30-49 age group.

According to data analysis, female respondents displayed greater reluctance to receive the COVID-19 vaccine compared to their male counterparts. Toshkov's research (17) revealed a substantial gender disparity in COVID-19 vaccine hesitancy, with women showing a higher inclination towards hesitancy and, to a lesser extent, refusal to be vaccinated against COVID-19. One plausible explanation, supported by the data, is that women were more likely to perceive COVID-19 vaccines as unsafe and ineffective. Consequently, they carefully weighed the perceived benefits of vaccination against the associated risks. Furthermore, women, overall, exhibited heightened levels of concern regarding the potential side effects of COVID-19 vaccination compared to men during the pandemic (18). Additionally, a study carried out by The Clayman Institute for Gender Research and Bellon 19) discovered that existing literature on vaccine hesitancy supports the findings indicating a pronounced tendency among women, compared to men, to express a preference for delaying or refusing the COVID-19 vaccine. Women were also more inclined to attribute their hesitancy to concerns about the novelty of the vaccine, fear of potential side effects, and the presence of medical contraindications. However, both genders were equally likely to cite philosophical or religious beliefs as reasons for not getting vaccinated.

Regarding findings suggesting no significant correlation between the level of vaccine hesitancy and respondents' gender, earlier research on COVID-19 vaccine hesitancy did not delve into gender perspectives, leading to uncertainty about whether gender interacts with socioeconomic status to contribute to disparities in vaccine acceptance. However, a more recent study conducted by Morales et al. (20) indicated that women in the United States exhibited a higher incidence of vaccine hesitancy than men. Moreover, women expressed greater concerns regarding vaccine safety, while men's hesitancy appeared to be rooted in lower perceptions of COVID-19 risks and belief in conspiracy theories.

The result indicated a strong relationship between educational attainment and the respondent's level of vaccine hesitancy. The analysis revealed varying levels of vaccine

hesitancy among respondents with different educational backgrounds. Notably, individuals with lower educational attainment, such as elementary graduates, were more likely to express vaccine hesitancy than those with higher education levels, such as college degrees.

According to Piltch-Loeb et al. (21), individuals with less education were more likely to be hesitant or undecided about getting the vaccine, with a higher risk of outright refusal. This situation suggests an association between lower educational attainment and hesitancy toward the COVID-19 vaccine. Furthermore, reasons for vaccination reluctance were linked to a lack of knowledge about potential side effects, benefits, effectiveness, and the adverse effects of not vaccinating. This study highlights persistent obstacles to accepting the COVID-19 vaccination, including gaps in vaccine knowledge and inadequate infrastructure (22). People's level of education significantly impacted various metrics related to vaccination experiences and attitudes, including trust in the vaccine approval process and the assessment of the risk of significant adverse effects (23).

Religion was noted to contribute to vaccine reluctance. According to Aechtner (24), religious affiliations were not significant reasons for hesitancy in obtaining COVID-19 vaccines. Among the respondents who had a negative attitude towards vaccines, some individuals identified themselves as religious. However, this did not imply that their religious affiliations directly affected their decisions in acquiring the COVID-19 vaccine.

A study by Fridman et al. (25) revealed that despite the vaccine's safety assurance by credible health organizations such as WHO, EMA, CDC, and USFDA, people were still hesitant to obtain vaccine injections, leading more people to become unvaccinated. Based on the statistical analysis, there was a highly significant difference in vaccine hesitancy among the respondents when they were grouped according to their vaccination status. This result suggested that the vaccination status of individuals had a significant impact on their level of vaccine hesitancy, indicating distinct differences in attitudes and behaviors toward vaccines based on whether or not someone had been vaccinated.

CONCLUSION

The study revealed that age was not the sole determinant of COVID-19 vaccine hesitancy, as attitudes varied widely even within similar age brackets. Factors such as education, access to information, trust in healthcare systems, socioeconomic status, and cultural beliefs had a more pronounced impact on vaccine hesitancy than age alone. Similarly, gender played a role in hesitancy levels, with females showing higher reluctance overall, although this trend varied depending on the social and cultural context. Education level emerged as a significant factor, with lower-educated individuals exhibiting more hesitancy, likely due to limited access to information and lower health literacy. Moreover, religious affiliation correlated with higher levels of hesitancy, although it's essential to note that religious beliefs did not directly dictate vaccine decision-making.

On the other hand, knowledge about COVID-19 vaccines was linked to reduced hesitancy, underscoring the critical role of education and awareness campaigns in promoting vaccine acceptance. Notably, vaccination status strongly influenced hesitancy levels, indicating distinct attitudes and behaviors between vaccinated and unvaccinated individuals. Further research could delve deeper into these factors to inform targeted strategies for addressing vaccine hesitancy in clinical practice, emphasizing the need for tailored interventions that consider education, access to information, cultural beliefs, and religious affiliations to enhance vaccine acceptance rates and public health outcomes.

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