

# Determinants of COVID-19 Vaccine Hesitancy Among Senior Citizens in Dauis, Bohol

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**Background:** Vaccine hesitancy among senior citizens remains common in many countries. This was significantly observed during the COVID-19 pandemic in Dauis, Bohol, Philippines. However, there is limited research on the factors influencing this hesitancy.

**Objective:** This study aimed to identify the determinants associated with COVID-19 vaccine hesitancy among senior citizens in the municipality of Dauis, Bohol.

**Methods:** This case-control study employed a modified survey questionnaire adapted from relevant literatures. A total of 497 registered senior citizens participated, of whom 331 were vaccinated against COVID-19 and 166 were unvaccinated. The study determined the socio-demographic factors, health status, and perceptions of COVID-19 vaccine safety. Bivariate and multivariable logistic regression analyses were used to identify factors associated with vaccine hesitancy.

**Results:** The study found that respondents aged 84 and older were significantly more likely to exhibit vaccine hesitancy ( $p = 0.018$ ,  $OR = 7.817$ ). In contrast, factors associated with a reduced likelihood of hesitancy included having tertiary education ( $p = 0.012$ ,  $OR = 0.239$ ), a low income ( $p = 0.042$ ,  $OR = 0.138$ ), receiving an annual flu vaccine ( $p = 0.020$ ,  $OR = 0.328$ ), and perceiving the COVID-19 vaccine as safe ( $p = 0.000$ ,  $OR = 0.032$ ).

**Conclusion:** Age is a significant determinant of COVID-19 vaccine hesitancy. Educational attainment, monthly income, receipt of annual influenza vaccine and perception on vaccine safety were found to be influential determinants. These findings offer valuable insights for evidence-based interventions to enhance vaccine acceptance to this vulnerable population.

**Key words:** Vaccine hesitancy, COVID-19 pandemic, vaccination

## INTRODUCTION

The Coronavirus Disease 2019 (COVID-19) has emerged as a pandemic outbreak and continues to threaten public health worldwide affecting over hundred million people around the world. In an effort to end this pandemic, health authorities around the world have encouraged people to receive vaccination against COVID-19 as an effective way in providing protection against COVID-19 infection and severe outcomes.<sup>1</sup> However, COVID-19 vaccine uptake is challenged by anti-vaccination sentiments especially among low- and middle-income countries including the Philippines.<sup>2</sup>

Globally, about 77% of older adults have been vaccinated, but that average does not apply across all countries. In low-income countries,

only about 34% of older adults have been vaccinated.<sup>3</sup> According to WHO Philippines 2021, only about 25% of these senior citizens have been fully vaccinated, leaving 6.4 million of the elderly at increased risk of severe illness and death. In the province of Bohol, there is still a need to achieve a 70-percent vaccination rate for senior citizens for the entire province to be classified under Alert Level 1. Only 15 (31%) of the 48 municipalities were placed under Alert Level 1 wherein establishments are allowed to operate at full capacity with minimum public health standards. According to the Bohol Provincial Health Office (2023), the province remains under Alert Level 2 since June, 2022. Although 84% of the general population were inoculated, only 43% of the senior citizens in Bohol were fully vaccinated despite the Local Health Centers' effort of conducting daily vaccination in the community.<sup>4</sup>

The municipality of Dauis, the adopted community of Governor Celestino Gallares Memorial Medical Center is one of the top ten municipalities in Bohol with high prevalence of vaccine hesitancy, with a total of 15 mortalities on COVID-19 Infection. Thus, it was chosen as

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the subject of this study. Currently, only 1939 (39%) out of 4949 senior citizens in Dausi, Bohol were vaccinated with both primary series and had booster doses despite per barangay vaccination drive. With this, the municipality of Dausi remained under Alert Level 2 which may affect the municipality's economic recovery with the pandemic-induced restrictions.<sup>5</sup>

Locally, there are only few studies conducted on determining the factors affecting COVID-19 vaccine hesitancy specific among senior citizens despite availability of vaccine services. To address this gap, this study aims to investigate the potential determinants of COVID-19 vaccine hesitancy among senior citizens in Dausi, Bohol, focusing on sociodemographic profile, health status and perceptions of vaccine safety. This study is expected to offer important insights for promoting vaccination acceptance among elderly and to provide guidance for developing interventions, regulations and policies for the upcoming COVID-19 vaccination plan in this large population.

## METHODS

This research utilized a case-control study using quantitative data analysis from the survey questionnaire. Research questionnaires were distributed to the selected elderly respondents ( $\geq 60$  years old) in the municipality of Dausi, Bohol. This study utilized data from Dausi Rural Health Unit to identify the vaccination status of the elderly in the studied area. This study used stratified random sampling technique to identify the eligible respondents based on the inclusion criteria: respondents are individuals who were (1) at least 60 years old; (2) able to read and complete the self-administered questionnaire independently; and (3) voluntarily agreed to participate in this survey. For the exclusion criteria, this study excluded senior citizens who have (1) existing psychiatric or mental illness; (2) impaired ability to think or make decisions and (3) poor health condition. Respondents who received partially or fully the primary series of COVID-19 vaccines were identified as "Vaccinated" (coded as 0) and respondents who refused to receive COVID-19 vaccine were identified as "Unvaccinated" (coded as 1). The identified "vaccinated senior citizens" serve as the controls and the identified "unvaccinated senior citizens" were the cases of the study.

There was a total of 4949 registered senior citizens in Dausi, Bohol. In this study, the sample size was calculated using OpenEpi version 3 ([www.openepi.com](http://www.openepi.com)). The following assumptions were made during the calculation of the sample size: 95% confidence level, 80% power, 10.2% controls exposed and 20% cases exposed of senior citizens with low education level and case to control ratio of 1:2.<sup>6</sup> The minimum sample size is 497 senior citizens (166 cases and 331 controls) in the municipality of Dausi, Bohol.

Data were analyzed using IBM SPSS Statistics Trial Version. Frequency and percent were used to describe the distribution of the respondents according to their profile, socio-demographic and medical health status. The perception of COVID-19 vaccine safety was analyzed according to responses on a five-point Likert scale. The frequency distribution of these of these responses were used to describe the overall perception of vaccine safety. Furthermore, bivariate logistic regression analyses were used to observe the association between each of the sociodemographic, medical health status and perception

on COVID-19 vaccine's safety to their vaccination status. Statistical significance is  $p\text{-value} < 0.05$  or within 95% Confidence Interval (CI). All variables associated with vaccination status in bivariate logistic regression analyses were subjected to multivariate logistic regression analyses, specifically goodness-of-fit for the model using Hosmer and Lemeshow tests.

This study was approved by the Ethics Committee of Gov. Celestino Gallares Memorial Medical Center last May 15, 2023. Informed consent form was signed after thorough discussion with the respondents.

## RESULTS

A total of 497 senior citizen respondents participated in this study. They were all registered residents of Dausi, Bohol (vaccinated = 331 unvaccinated = 166). In this comprehensive study, the socio-demographic profile and medical health status of the selected senior citizens from Dausi, Bohol were identified to discern various key factors as indicated in Table 1.

The table showed that a substantial majority of the respondents in both the unvaccinated (68.7%) and vaccinated groups (70.7%) were females. The age distribution showcased a prevalence within the 60-74 years old category for both groups, with 68.1% in the unvaccinated group and a higher proportion of 79.8% in the vaccinated group. Sixty three percent (63%) of unvaccinated respondents had primary education compared to 44.7% in the vaccinated group. Employment status delineated notable distinctions, as 47% of unvaccinated respondents were unemployed, while retirees constituted the majority (37.5%) in the vaccinated group. Marital status exhibited a balanced distribution, with 51.2% of unvaccinated and 54.7% of vaccinated respondents being married. Economic considerations reflected a higher prevalence of respondents in the lowest income category in both the unvaccinated (61.4%) and vaccinated (68.6%) groups. Social security assistance was received by the majority in both groups, the unvaccinated (54.8%) and vaccinated (60.4%). The presence of family caregivers was consistently high, with 82.5% of unvaccinated and 82.8% of vaccinated respondents benefitting from familial support. The vast majority in both groups resided in self-owned houses (unvaccinated=89.9%, vaccinated=89.7%). Lastly, the respondents hailed from various barangays in Dausi, Bohol, showcasing a diverse representation. Notable barangays with high respondent percentages included Biking, Bingag, Catarman, Mariveles, Mayacabac, Poblacion, Songculan, Tabalong, and Totolan, each contributing to the overall richness and diversity of the study population.

In terms of medical health status, majority of respondents, both in the unvaccinated (59%) and vaccinated (66.8%) groups had completed their childhood vaccination. Majority of the unvaccinated respondents with 58.4% did not receive the influenza vaccine in the past three years compared to a lower percentage of 36.9% among the vaccinated group. In the unvaccinated group with COVID-19, only 31.9% were vaccinated with pneumococcal and there is a notable lack of pneumococcal vaccination (68.1%). Conversely, in the vaccinated group, 51.4% have received pneumococcal vaccines and 48.6% did not received pneumococcal vaccines. Approximately half of the respondents in both groups

reported comorbidities or chronic illnesses (unvaccinated=54.2%, vaccinated=54.4%). Hypertension (unvaccinated= 38%, vaccinated= 43.2%) emerged as the most common chronic illness in both groups. Generally, neither the respondents nor their family members had previous COVID-19 infection in both groups (unvaccinated=97.6%, vaccinated=91.8%).

The research utilized a Five-Point Likert Scale to assess senior citizens' perception of COVID-19 vaccine safety in Dauis, Bohol. A majority of respondents (72 unvaccinated, 163 vaccinated) agreed that the COVID-19 vaccine is more important than other vaccines.

(Table 2) Additionally, both groups (69 unvaccinated, 189 vaccinated) expressed trust in pharmaceutical companies to provide a safe and effective COVID-19 vaccine. However, when asked about the statement, "If COVID-19 vaccine cases decline, vaccines are still needed," most unvaccinated respondents with a frequency of 83 disagreed, while a majority of the vaccinated (n= 142) group agreed. Regarding willingness to accept the vaccine regardless of others' choices, most unvaccinated respondents (n=136) disagreed. In contrast, 233 vaccinated individuals agreed to accept the vaccine regardless of others' decisions.

**Table 1.** Socio-demographic profile and medical health status of senior citizens in Dauis, Bohol.

Socio-Demographic Profile		Case (n = 166)		Control (n = 331)		N=497
		Frequency	%	Frequency	%	Total
Sex	Male	52	31.3	57	29.3	149
	Female	114	68.7	234	70.7	348
Age Group	60-74	113	68.1	264	79.8	377
	75-84	42	25.3	64	19.3	106
	>84	11	6.6	3	0.9	14
Educational Attainment	Primary	105	63.3	148	44.7	253
	Secondary	45	27.1	99	29.9	144
	Tertiary	11	6.6	69	20.8	80
	Postgraduate	3	1.8	13	3.9	16
	Vocational	2	1.2	2	0.6	4
Work Status	Employed	23	13.9	70	21.1	93
	Retired	49	29.5	124	37.5	173
	Part-time Job	16	9.6	46	13.9	62
	Unemployed	78	47	91	27.5	169
Marital Status	Single	15	9.0	45	13.6	60
	Married	85	51.2	181	54.7	266
	Widowed	61	36.7	97	29.3	158
	Separated/Divorced	4	2.4	7	2.1	11
	Common Law/Live-in	1	0.6	1	0.3	2
Monthly Income	Poor	102	61.4	227	68.6	329
	Low Income but Not Poor	5	3.0	28	8.5	33
	Lower Middle	0	0	6	1.8	6
	None/Supported by Family	59	35.5	70	21.1	129
Receiving Social Security Assistance	Yes	91	54.8	200	60.4	291
	No	75	45.2	131	39.6	206
Has Family Caregiver	Yes	137	82.5	274	82.8	411
	No	29	17.5	57	17.2	86
Housing Type	Self-owned	149	89.9	297	89.7	446
	Rented	1	0.6	3	0.9	4
	Others	16	9.6	31	9.4	47
Barangay of Residence	Biking	22	13.3	36	10.9	58
	Bingag	23	13.9	38	11.5	61
	Catarman	22	13.3	45	13.6	67
	Dao	3	1.8	5	1.5	8
	Mariveles	14	8.4	36	10.9	50
	Mayacabac	23	13.9	36	10.9	59
	Poblacion	14	8.4	36	10.9	50
	San Isidro	3	1.8	3	0.9	6
	Songculan	12	7.2	14	4.2	26
	Tabalong	14	8.4	51	15.4	65
	Tinago	3	1.8	3	0.9	6
	Totolan	13	7.8	28	8.5	41

**Table 2.** Perception on COVID-19 vaccine safety among senior citizens in Dausi, Bohol in a Five Point-Likert Scale.

Variables	Case (n = 166)					Control (n = 331)				
	Frequency					Frequency				
	SA	A	N	D	SD	SA	A	N	D	SD
I believe COVID-19 vaccine is more important than other vaccines	6	72	43	41	4	135	163	27	6	0
I trust pharmaceutical companies in providing safe and effective COVID-19 vaccine	5	69	41	47	4	105	187	30	9	0
If COVID-19 vaccine cases decline, vaccines are still needed	2	36	42	83	3	64	142	41	82	2
I would accept the vaccine regardless of what other people do	0	8	18	136	4	73	233	17	5	3

Legend: **SA-** Strongly Agree **A-** Agree **N-** Neutral **D-** Disagree **SD-** Strongly Disagree

**Table 3.** Multivariate logistic regression results for significant predictors of COVID-19 vaccine hesitancy.

		B	S.E.	p	OR	95% CI for OR	
						Lower	Upper
Age	60 to 74 years ( <i>reference</i> )						
	75 to 84 years	.440	.389	.259	1.552	.724	3.327
	More than 84 years	2.056	.869	.018	7.817	1.423	42.940
Educational Attainment	Primary ( <i>reference</i> )						
	Secondary	-.339	.352	.335	.712	.357	1.420
	Vocational	-.096	1.294	.941	.909	.072	11.478
	Tertiary	-1.433	.573	.012	.239	.078	.734
	Postgraduate	.045	1.003	.964	1.046	.146	7.468
Work Status	Unemployed ( <i>reference</i> )						
	Parttime	.238	.526	.651	1.269	.452	3.559
	Employed	-.523	.480	.276	.593	.231	1.519
	Retired	-.247	.392	.529	.781	.362	1.685
Monthly Income	None or Supported by Family ( <i>reference</i> )						
	Poor	-.141	.368	.701	.868	.422	1.787
	Low-Income but Not Poor	-1.982	.975	.042	.138	.020	.932
	Lower-Middle	-19.281	14839.92	.999	.000	.000	.
		8					
Annual Influenza vaccine received in the past 3 years	Never ( <i>reference</i> )						
	Once	-.529	.563	.347	.589	.195	1.777
	Twice	-.184	.438	.675	.832	.352	1.964
	Annual	-1.114	.478	.020	.328	.129	.837
Received Pneumococcal vaccine within 5 years	No ( <i>reference</i> )						
	Yes	.612	.469	.192	1.844	.735	4.623
Perception on Safety of COVID-19 Vaccine		-3.440	.338	.000	.032	.017	.062

*n* = 497, *B* = regression coefficient *SE* = standard error of *B*, *OR* = odds ratio, *CI* = Confidence Interval

*Independent: Significant Predictors (Age, Educational Attainment, Work Status, Monthly Income, Receipt of Influenza vaccine in the past 3 years and Receipt of Pneumococcal vaccine within 5 years)*

*Dependent: Vaccination Status [1=Case (Unvaccinated), 0=Control (Vaccinated)]*

Variables associated with vaccination status in bivariate logistic regression analyses were subjected to multivariate logistic regression analyses. A multivariate logistic regression analysis was conducted to examine the significance of various socio-demographics, medical health factors and the perception on COVID-19 vaccine safety in relation to COVID-19 vaccine hesitancy. The results indicate that age, educational attainment, monthly income, influenza vaccine status, and

perception on COVID-19 vaccine safety were associated with COVID-19 vaccine hesitancy ( $p < 0.05$ ) as shown in Table 3.

Specifically, individuals aged 84 years and above (*OR*: 7.817; 95% *CI*: 1.423 – 42.940), had eight times higher odds of COVID-19 vaccine hesitancy compared to the 60 to 74 years old age group. Moreover, lower educational attainment demonstrated greater hesitancy on COVID-19 vaccine. Similarly, respondents who reached tertiary level of

educational has 0.20 times higher odds of COVID-19 vaccine acceptance. (OR: 0.239; 95% CI: 0.078 – 0.734) compared to those with only a primary level of education.

Additionally, respondents with no monthly income and rely solely on family support are more hesitant to accept COVID-19 vaccine. Comparably, low-income but not poor have 0.13 times higher odds of COVID-19 vaccine acceptance (OR: 0.138; 95% CI: 0.020 – 0.932) compared to those without monthly income. Furthermore, elderly individuals revealed that those who did not receive the influenza vaccine were also hesitant to receive COVID-19 vaccine. In parallel, those with annual influenza vaccine in the past three years have 0.32 times higher odds of COVID-19 vaccine acceptance (OR: 0.328; 95% CI: 0.129 – 0.837). Lastly, individuals with low perception of COVID-19 vaccine safety are more hesitant to receive COVID-19 vaccine. Likewise, respondents who have higher perception on COVID-19 vaccine safety have 0.32 times higher odds of COVID-19 vaccine acceptance (OR: 0.032; 95% CI: 0.017 – 0.062).

### DISCUSSION

Vaccination, is a key tool in combating COVID-19<sup>7</sup>. Yet in Daus, Bohol, only 39% of senior citizens have embraced the COVID-19 vaccine, despite efforts from medical experts and authorities. In this study, involving 497 senior citizens, 33.4% were identified hesitant to receive the vaccine. Analyzing the factors influencing vaccine hesitancy, the multivariable logistic regression analysis unveils that age, educational attainment, monthly income, receipt of influenza vaccine in the past 3 years and the perception on COVID-19 vaccine safety emerged as significant determinants.

This study indicated that as individuals grow older, they exhibited greater vaccine hesitancy, despite the urgent need for vaccination among older demographics. These findings aligned with previous researches conducted by Zhang, et al (2022) and Utami, et al (2022), which observed that individuals aged 80 and above have significantly lower vaccine uptake as compared to younger seniors.<sup>8-9</sup> This reluctance may be attributed from a perceived lower risk due to staying home more, limited access to information, and concerns about side effects. In contrast, a study of Siu, et al (2022) found that recent government policies significantly increased vaccination rates among older adults during the pandemic's fifth wave.<sup>1</sup> Higher educational attainment was associated with lower vaccine hesitancy. A study conducted by Thanaplueti Wong, et al (2021)<sup>6</sup> and Al-Hanawi, et al (2021)<sup>10</sup> found that individuals who reached elementary school level or lower, were more hesitant to receive the COVID-19 vaccine compared to those who reached higher education levels. This is likely due to lower health literacy, which can lead to misunderstandings about COVID-19 vaccination messages.<sup>11</sup> Thus, the findings emphasized the need for tailored educational campaigns that will address these disparities and will be delivered by reliable sources.

Monthly income also played notable roles in vaccine hesitancy. Those with no income and reliant on family support were more hesitant, while higher-income individuals were less likely to be hesitant. A parallel study of Fisher, et al (2020) similarly identified lower income, lower educational level, and belonging to an ethnic minority group as factors associated

with a diminished likelihood of intending to be vaccinated once a vaccine becomes available.<sup>12</sup> Similar study of Abdul Karim, et al (2022) confirmed that lower socioeconomic status, along with factors like age and chronic health conditions, contributed to vaccine hesitancy.<sup>13</sup> Moreover, the annual influenza vaccine uptake significantly influenced the acceptance of COVID-19 vaccination. Studies of Omar, et al (2021) showed that elderly individuals who did not receive the flu vaccine<sup>14</sup> were more hesitant in getting the COVID-19 vaccine. Similarly, those who had never received the flu vaccine exhibited higher vaccine hesitancy.<sup>15</sup> In contrast, a study of Abdul (2022) found that those who had received the flu vaccine at least once were still hesitant, likely influenced by the attitudes of their social circle.<sup>13</sup> This highlighted the role of social influence and past vaccination behavior in shaping attitudes toward COVID-19 vaccination.

The perception of COVID-19 vaccine safety had also emerged as a significant factor influencing vaccine hesitancy. Seniors who expressed confidence in the vaccine's safety were more inclined to accept it, underscoring the substantial influence of individual attitudes. In contrast, a study of Siu, et al (2022) showed that some participants continued to harbor doubts about the vaccine's safety and effectiveness, despite the Hong Kong government's establishment of an expert committee to investigate adverse events following COVID-19 vaccination.<sup>1</sup> In parallel, a study of Narapureddy, et al (2021) indicated that the primary factors contributing to vaccine hesitancy included a lack of perception toward vaccine effectiveness and safety concerns.<sup>16</sup> Additionally, concerns over vaccine safety were frequently mentioned among the factors leading to hesitancy.<sup>17</sup> Only 38.1% of respondents thought that the time spent on developing a safe and effective COVID-19 vaccine was sufficient. There has been a fear that the rapid production of the COVID-19 vaccine, based on underpowered trials, might result in a weakly effective vaccine that could lead to catastrophic consequences.<sup>18</sup>

In Daus, Bohol, unvaccinated senior citizens cited existing health conditions as their main concern, aligning with broader research linking vaccine hesitancy in older individuals to chronic health conditions.<sup>8</sup> Additionally, COVID-19 vaccine may exacerbate health issues since multimorbidity is often present in most older persons.<sup>19</sup> Conversely, seniors with existing health conditions were three times more likely to accept the vaccine.<sup>20</sup> This is consistent with broader findings indicating that those with comorbidities were generally more receptive to COVID-19 immunization. Additionally, other reasons for hesitancy included fears of side effects, concerns about death, age, religious beliefs, fear of needles, disbelief in COVID-19, work commitments, and vaccine availability. These diverse reasons emphasized the need for targeted interventions that address specific concerns within the elderly population. Thus, effective communication and education on vaccine safety is necessary to alleviate concerns and enhance confidence among seniors.

This study also has limited number of respondents and included senior citizens registered in Daus, Bohol last March, 2023. Cultural and societal factors such as social norms and community dynamics that may contribute to vaccine hesitancy were not included in this study.

### CONCLUSION AND RECOMMENDATIONS

The COVID-19 vaccine hesitancy among the elderly population in the municipality of Daus, Bohol, was relatively high. Only 39% of the

elderly population were vaccinated, indicating that a significant portion of this demographic was hesitant to receive the vaccine despite the municipality's implementation of a barangay vaccination campaign. A noteworthy determinant of COVID-19 vaccine hesitancy was individual's age. Furthermore, socio-demographic factors such as educational attainment, monthly income and medical health factor specifically receipt of annual influenza vaccine and perception on vaccine's safety played pivotal roles as influential predictors of vaccine hesitancy within the elderly demographic. Concerns about the presence of comorbidity, fear of side effects, fear of death and old age were the main reasons for vaccine hesitancy among unvaccinated older adults in Dauis, Bohol. These provided invaluable insights for public health practitioners and policymakers, underscoring the importance of evidence-based interventions to bolster vaccine coverage, especially within this vulnerable population.

It is essential to provide comprehensive education on the COVID-19 influenza and pneumococcal vaccines and other necessary immunizations for the elderly population, particularly those with only primary education. Vaccination campaigns targeting the elderly must be strengthened, and vaccines should be made easily accessible at local health centers. Additionally, future research should conduct a more in-depth analysis of individuals' understanding of the COVID-19 vaccine, exploring how information, misinformation, and educational strategies influence perceptions and acceptance. Future researchers may also examine other cultural and societal factors that can contribute to vaccine hesitancy to gain a more nuanced understanding of the diverse elements that affect vaccine decisions.

### Conflict of Interest Statement

The author has no conflict of interest to declare. The co-author had seen and agreed with the contents of the manuscript and also has no financial interest to report.

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