



THE NATIONAL
RESEARCH INSTITUTE
PAPUA NEW GUINEA

DISCUSSION PAPER

ESTIMATING WILLINGNESS
TO TAKE COVID-19 VACCINE
AMONG WHOLESALE AND RETAIL
SERVICE WORKERS IN PORT
MORESBY, PAPUA NEW GUINEA

Francis Odhuno
Dianah Ngui
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Table of Contents

Abstract	V
Introduction	1
Correlates of willingness to get COVID-19 vaccine	3
Data and methodology	5
Data analysis and discussion	7
Conclusion and policy implications	18
References	19
Appendix	21

List of Charts, Figures and Tables

List of Figures

Figure 1: Willingness to get vaccinated vs. those who have received first dose, both doses and no dose	7
Figure 2: Employees in the retail and wholesale sectors willing to get vaccinated	8
Figure 3: Residence/workplace and willingness to get vaccinated	8
Figure 4: Willingness to get vaccinated vs. level of threat respondents think COVID-19 poses to them and/or their family members.	9
Figure 5: Employees employment status vs. willingness to get vaccinated	9
Figure 6: Risk of exposure to COVID -19 infection at work place vs. willingness to vaccinated	10
Figure 7: Gender vs. willingness to vaccinated	11
Figure 8: Age groups vs. willingness to be vaccinated	12
Figure 9: Marital status vs. willingness to be vaccinated	12
Figure 10: Highest level of education completed vs. willingness to be vaccinated	13

List of Tables

Table 1: Access to information and willingness to get vaccinated	10
Table 2: Underlying medical conditions vs. willingness to get vaccinated	11
Table 3: Gross employment income/earnings per fortnight vs. willingness to get vaccinated	13
Table 3: Logistic regression results and marginal effects results	14

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Authors' Contribution

The first author conceived and designed the project and collected the data. The second author analysed the data and provided the econometric estimates. The third author wrote the literature review and methodology. All three authors contributed equally to drafting and revising all parts of the paper, including interpretation of the results.

Abbreviations and Acronyms

COVID-19	Coronavirus disease 2019
DFAT	Department for Foreign Affairs and Trade
NRI	National Research Institute
PNG	Papua New Guinea
TVET	Technical and Vocational Education and Training
UK	United Kingdom
UNRCO	United Nations Resident Coordinator Office

Abstract

“No jab, no job” has become hallmark of many a Papua New Guinea (PNG) employers’ whip to enforce COVID-19 vaccine passport policy in the workplace. Showing proof of vaccination at workplaces is therefore, gradually becoming indispensable for continuing employment, which is putting many formal sector workers under pressure to choose whether to vaccinate or not. We use data from a survey of wholesale and retail service sector workers in Port Moresby to assess some medical and socio-economic factors that possibly influence the workers’ willingness to get vaccinated against the coronavirus disease. Descriptive and qualitative analysis of the survey responses suggest possibility that some wholesale and retail service workers were/are decisively not willing to get vaccinated, even if they have to lose their jobs. Results of a logistic model estimated on the dichotomous variable willing/not willing to vaccinate show that access to sufficient information, level of education, threat of COVID-19 infection, income, underlying medical conditions, and living and working place were key in influencing willingness to get vaccinated. The government should concentrate on educating the population and ensuring right information regarding COVID-19 vaccine, is shared with the public regardless of their residence on time before the vaccine becomes available. Additionally, the government ought to build public confidence in the vaccine for the willingness to accept the COVID-19 vaccine to be improved.

Key Words: COVID-19, vaccine, employment, retail, wholesale, Port Moresby.

Introduction

The novel coronavirus disease (COVID-19) first appeared in Wuhan, China, in November 2019 and was subsequently declared by the World Health Organisation (WHO) as a public health emergency on 30 January 2020 and a global pandemic on 11 March 2020 (Zhu, Wei and Niu, 2020). Following the declaration of the coronavirus disease as a global pandemic by the WHO, the Prime Minister of Papua New Guinea announced the first positive COVID-19 case in the country on 20 March 2020 (Donovan and PNG UNRCO, 2020). The government, not only announced a state of emergency on 24 March 2020 which lasted for 14 days, but also established a Joint Agency Task Force at its National Operation Centre (Donovan and PNG UNRCO, 2020). As of 13 September (12:00 pm), there were 511 COVID-19 confirmed cases and six COVID-19 deaths reported in PNG (Department of Health, 2021). The confirmed COVID-19 cases and deaths were respectively 780 and nine as at 31 December 2020¹. The reported low numbers could have been due to critically inadequate testing in all provinces and under-reporting of influenza-like illnesses and severe acute respiratory illness.

Relaxation of movement restrictions within the national capital, Port Moresby, and country, coupled with low compliance in wearing masks, social distancing and frequent hand sanitation were possible factors in the continuing rise in COVID-19 cases (Department of Health, 2021). Importation from bordering Papua Province in Indonesia and incoming travellers from other countries reporting COVID-19 cases also remains a threat. It is presumed, therefore, that PNG has widespread community transmission of COVID-19. While there is broad agreement among public health experts that widespread vaccination coverage is the best way to end this pandemic, only 1.2 percent of people in PNG, as at October 2021, had been fully vaccinated². Although improving vaccination rates require addressing gaps in supply, last-mile delivery problems given the rugged terrain and remoteness of majority of PNG's villages, vaccine hesitancy is also a concern. Indeed, vaccine hesitancy amongst the PNG population has been a major challenge (Choudhury, 2021). Vaccine rollout started in May 2021 and by July, only about 30,000 people had been vaccinated – raising fears that thousands of vaccine doses may expire due to low uptake despite widespread publicity and free vaccination campaign.

In order to boost vaccine uptake, businesses began to actively encourage vaccine rollout by promoting its safety and information. The business community may be playing a major role to spread the message that 'no one is safe until everyone is safe', but their current "no jab, no job" policy may at the same time, be putting their workers between a rock and a hard place. Workers have therefore, to choose between getting vaccinated and continue to work or lose their jobs if they are not vaccinated. An online poll conducted by The National newspaper in June 2021 indicated that 78 percent of 2,657 who voted were not willing to take the COVID-19 vaccine if it is made available³. At the time it was believed that vaccine acceptance in workplaces was between 15 to 22 percent. An earlier online survey of undergraduate students at the University of Papua New Guinea also indicated that 48 percent would not want to get vaccinated while 46 percent had not made up their minds (Fox, 2021). These polls were taken at times (May – July 2021) when the general sentiment among Papua New Guineans were either that COVID-19 is not real, or it is not life threatening, suggesting that people did not believe that COVID-19 can affect them. Even if COVID-19 is real and may have been spreading throughout the country, it seemed (at that time) like it was not causing vast illness as not many people were getting sick or dying while hospitals did not appear to be overwhelmed with COVID-related admissions (Ewart, 2021).

Even then, crisis began unfolding in October 2021 with the Delta strain of virus surging fast in the Western and Sepik provinces along the border with Indonesia, but it now continues to spread to nearly all parts of the country

¹ Papua New Guinea COVID: 35,538 Cases and 550 Deaths - Worldometer ([worldometers.info](https://www.worldometers.info))

² www.Covid19.info.gov.pg

³ <https://www.businessadvantage.com/covid-19-vaccination-rollout-in-papua-new-guinea-needs-a-boost/>

with most hospitals under strain due to COVID-19. As at 3 December 2021, there were 35,390 COVID-19 confirmed cases and 550 COVID-19 deaths reported in PNG since the first case was reported in March 2020 and about 1.7 percent of the 8.9 million PNG's population were fully-vaccinated^{4,5}. This is despite the fact that PNG is recording hundreds of new cases every day. With the current spike in cases and deaths – newspaper reports are indicating that the country's largest hospital in the capital city, Port Moresby, is, for example, recording 30 to 50 COVID-19-related deaths on arrival⁶. This latest coronavirus scare, along with the business community's push for mandatory vaccination through “no jab, no job” policy are raising questions whether Papua New Guineans are still reluctant to vaccinate against COVID-19.

In light of the above, the purpose of this study is to analyse data collected from a recent survey of wholesale and retail service sector workers based in Port Moresby, with a view to better understand PNG workers' willingness to get a COVID-19 vaccine. We aim to identify the correlates of vaccine hesitancy, that is, the factors that influence retail and wholesale workers' willingness to get a COVID-19 vaccine when it becomes available. We also empirically measure and interpret the policy significance of what determines retail and wholesale workers' willingness to get a COVID-19 vaccine.

The rest of the paper is organised as follows: Section 2 presents a brief review of the literature to inform the choice of the correlates of willingness to get a COVID-19 vaccine; Section 3 is a description of the sample, data and methodology used to model willingness to get vaccinated as an endogenous decision by retail and wholesale workers in Port Moresby; Section 4 presents data analysis and discussion; and Section 5 presents conclusion and policy implications.

⁴ Papua New Guinea COVID: 35,538 Cases and 550 Deaths - Worldometer ([worldometers.info](https://www.worldometers.info/))

⁵ Papua New Guinea Covid: Why only 1.7 per cent are fully vaccinated - NZ Herald

⁶ <https://asiapacificreport.nz/2021/10/22/pngs-capital-port-moresby-reaches-crisis-point-over-covid-surge/>

Correlates of willingness to get COVID-19 vaccine

Several studies on willingness to take COVID-19 vaccine have been carried out in various countries. A study by Kelly et al. (2021) found that while most Americans were willing to get a COVID-19 vaccine, the vulnerable populations were reporting low willingness. The willingness varied across the various groups. Notably, black, females and younger age group respondents were respectively less willing to get vaccinated than the white, males and those aged 65 and higher respondents (see also Neumann-Böhme et al., 2020). Solís et al. (2021) also found that women tended to be somewhat less willing to be vaccinated than men with younger respondents marginally more willing to get vaccinated in low- and middle-income countries.

Respondents with increased risk because of underlying medical conditions or morbid obesity were less willing to get vaccinated than their lower risk counterparts (Kelly et al., 2021). Similarly, a study carried out in Italy indicated that 67 percent of the health workers intended to be vaccinated (Di Gennaro, et al., 2021). Apparently Handebo et al. (2021) found that although respondents with a university degree had a decreased intention to receive the vaccine compared to those who received college diploma. This was despite the fact that they were aware of the health benefit of vaccines. Inadequate health literacy and lower education levels were also found to be determinants of reluctance to be vaccinated (Dodd et al., 2021).

Hoy et al. (2021) used data collected through a broadly representative phone survey with 2,533 respondents and an online randomised survey experiment with 2,392 participants in Papua New Guinea to examine the drivers of COVID-19 vaccine hesitancy and tests various means of increasing people's willingness to receive a COVID-19 vaccine. The study found that less than 20 percent of the respondents who were aware a vaccine existed were willing to be vaccinated with the concern about the vaccine's side effects being the main reason for the respondent's hesitancy to get the vaccine. Furthermore, the level of trust in the vaccine and beliefs about the behaviour of others were strongly associated with their intention to get a COVID-19 vaccine.

Pogo et al. (2021) surveyed 402 healthcare workers and 555 people from the general PNG community in attempt to understand why not many people in PNG are willing to get vaccinated against COVID-19. The study noted that in comparison, healthcare workers were more willing to get vaccinated than the general community. While the general PNG community tend to rely on healthcare workers regarding the safety of COVID-19 vaccines, a number of healthcare workers were also hesitant to take the vaccine. Their concern is the many conspiracy theories about the vaccines circulating in social media, suggesting that misinformation can largely be blamed for the widespread vaccine hesitancy among Papua New Guineans.

Public perceptions and rumours on the vaccines in as far as side effects is concerned may lead to vaccine hesitancy hence decline in vaccine coverage (Dubé et al., 2013). Using a total of 301 school teachers in Ethiopia, Handebo, et al. (2021) found that intention to receive the COVID-19 vaccine was affected by socio-demographic and health beliefs. Unlike respondents affiliated with the Orthodox religion, those affiliated with Catholic and Protestant religions had increased intention to accept the vaccine, which the study concluded was attributed to religious values or lack of trust in the health system. The study used both descriptive analysis and linear regression analysis to identify factors associated with intention to receive COVID-19 vaccine. Handebo et al. (2021) indicated that propaganda and indecisiveness resulted to an insufficient uptake of the COVID-19 vaccine.

A global survey by Lazarus et al. (2020) indicated a difference in the 19 countries surveyed in as far as potential acceptance of a COVID-19 vaccine is concerned (see also Solís et al., 2021). The acceptance rates ranged between 90 percent (in China) and 55 percent (in Russia) with the acceptance of the vaccine being highly correlated with the trust the respondents had in the information provided by the government. Similar results were found by Neumann-Böhme et al. (2020) revealing that willingness to get vaccinated varied from 62 percent in France to about 80 percent in Denmark and UK. Solís et al. (2021) found out that willingness to take the COVID-19 vaccine was higher (over 80 percent) in the low, and lower-middle income countries, than in either Russia or the United States.

Cerda and García (2021) used a multinomial logistic regression that suggested that the probability of vaccine

rejection or indecision in Chile were associated with the severity of COVID-19. In this study, only 49 percent of the respondents were willing to be vaccinated, with 28 percent undecided suggesting that 77 percent of individuals would potentially be willing to be inoculated. A number of factors such as the side effects and effectiveness of the vaccine; perceived benefits, including immunity; decreased fear of contagion, and the protection of oneself and the environment; action signals, such as, responses from ones' family and the government; available information and specialists' recommendations; and susceptibility, including the contagion rate per 1,000 inhabitants and relatives with COVID-19, are some of the factors that played a role in Chileans' decision to get inoculated or not.

Data and methodology

Data and sample

The study used Port Moresby wholesale and retail sector employment – COVID-19 survey October 2021 data with 1,265 respondents. For the data collection instrument, we used a questionnaire adapted from Alekseev et al. (2020) and Kelly et al. (2021). The first part of the questionnaire focused on eliciting measures related to the risk and exposure of the employees / workers to COVID-19 infection and willingness to get vaccinated when COVID-19 vaccine becomes available. The second part of the questionnaire comprised specific demographic factors of the survey participants including; age, income, gender, marital status, nationality, occupation and education. (See Appendix Table A1 for details.) The survey also allowed participants to make any comments in relation to the effect of COVID-19 pandemic on their work. The survey instrument was pilot tested using online Microsoft Forms questionnaire distributed by email and posted on Twitter, Facebook and LinkedIn social media⁷. A group of 25 individuals working in wholesale and retail businesses responded to the online pilot survey, which was useful in informing and refining the survey methodology and questionnaire content.

Given the limited response to the online survey, primary data was collected using survey enumerators and personal (face-to-face) delivery/distribution of questionnaire paper. The survey was independently administered by a contracted private consulting firm between 18 to 31 October 2021. Sample selection was in two stages. Introductory letters were presented to chief executives of the selected businesses seeking their consent to allow our survey team to approach their employees who would be asked to voluntarily take part in the survey. The choice of businesses to approach was made on grounds of practical convenience. Since we were not going to reach every employee in each wholesale and/or retail outlet where access was permitted within that time, we did not set a minimum or maximum cap on the number of questionnaires to be distributed each day in each company. We therefore, assigned a survey team of eight people who canvassed the wholesale and retail sector employers and continued to attempt to contact their employees to complete the survey⁸.

We continued to give out as many questionnaires as possible (approximately 100 per day) until we reached the end of the predetermined field work period. We ended up hand-delivering 1,400 questionnaires directly to consenting employees across 86 wholesale and retail business outlets in nine commercial centres across Port Moresby. Some of the consenting employees chose to complete the survey questionnaires later. Therefore, to increase the response rate, the survey enumerators made phone calls and personal visits to remind these potential respondents to return the completed questionnaires. We also made at least two further attempts to get more completed questionnaires returned to us during the week after the end of the predetermined field work period. As a result of these efforts, we achieved a final convenient sample of $n=1,265$ (response rate 90 percent), comprising of 59 percent males and 41 percent females.

Empirical specification

To assess the determinants of willingness to get vaccinated when COVID-19 vaccine becomes available (dichotomized as willing vs. not willing), a logistic regression was employed since our response variable is binary. A logistic regression does not assume multivariate normality and equal covariance matrixes.

Let y_j^* be a latent variable determined by:

$$y_j^* = \beta_1 x_{1j} + \dots + \beta_k x_{kj} + \varepsilon_j = x_j \beta + \varepsilon_j$$

⁷ Initially we had approached four relatively large private wholesale and retail businesses in Port Moresby that were likely to have a large number of employees in different but clearly distinguishable occupations and job grades. We sent introductory letters to the chief executives of the selected companies seeking their consent to allow our survey team to approach their employees who would be asked to voluntarily take part in the survey. Unfortunately, none of the chief executives responded to our request.

⁸ The data collection was informed by a comprehensive approach to research ethics that ensured participants were able to voluntarily participate with informed consent, while managing risk of COVID-19 transmission and protecting their identities.

Where ε_j is a residual having a logistic distribution and assumed to be uncorrelated with the independent variables. y_j^* is a latent/unobservable variable of reported responses of willing to get vaccinated when COVID-19 vaccine becomes available. Since y_j^* is unobservable, we observe the binary choice made by the individual. Thus:

$$y_j=1 \text{ if } y_j^* > 0$$
$$y_j=0 \text{ if } y_j^* \leq 0$$

x_j is a vector of explanatory variables which includes employment status, access to information, underlying medical conditions, perceived threat of the virus, gender, marital status, age, education, income and residence. β is a vector of the unknown parameters to be estimated. Detailed definition of the variables in the model is given in Appendix Table A1. After fitting the logit model, marginal effects were computed to obtain the simulated probabilities for each willingness to get vaccinated response.

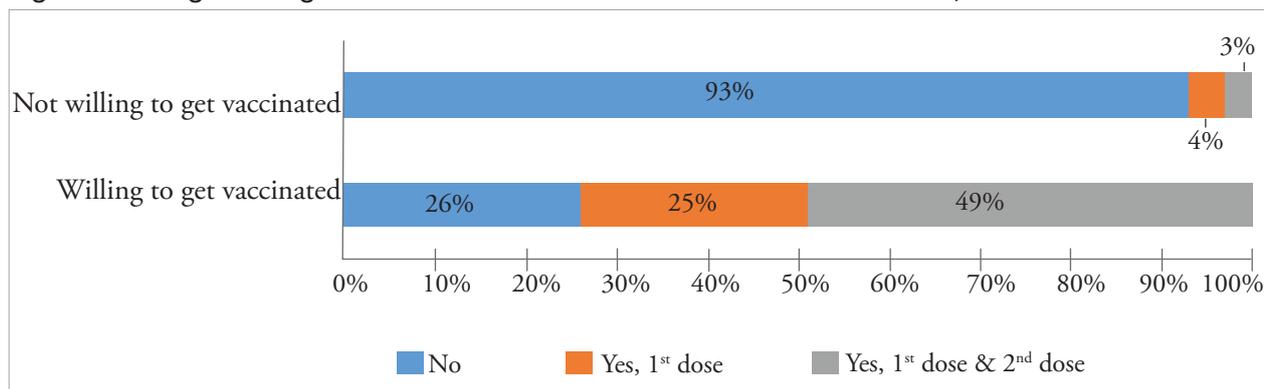
Data analysis and discussion

Exploring data relationships

To explore the relationship between willingness of wholesale and retail service workers in Port Moresby to get vaccinated when the vaccine becomes available and other attributes of the respondents, descriptive statistics were used. Frequency analysis of the data indicate that 1 percent (n=15) of the respondents (n=1265) chose not to answer the question: When a vaccine for COVID-19 become available, will you be willing to get vaccinated? The remaining 39 percent (n=498) of the respondents were willing to get vaccinated while 61 percent (n=752) were not willing to get vaccinated. The rest of the analysis focusses on the sample obtained after excluding respondents who had not respond to at least one of the key questions.

Frequency analysis of the usable survey data indicates that only 40 percent of the respondents working in the retail and wholesale service sector were willing to get vaccinated when a vaccine for COVID-19 became available. The rest, 60 percent, were not willing to get vaccinated against COVID-19. Figure 1 suggests that out of those willing to get vaccinated, 26 percent had not received any of the doses while 25 percent and 49 percent had received the first or first and second doses respectively. It is unsurprising that 93 percent of those not willing to get vaccinated had not received the vaccine doses. Nearly all the respondents (99 percent) were PNG nationals with only 37 percent of them willing to get vaccinated despite the fact that 66 percent of the PNG nationals having not received either the first or both doses.

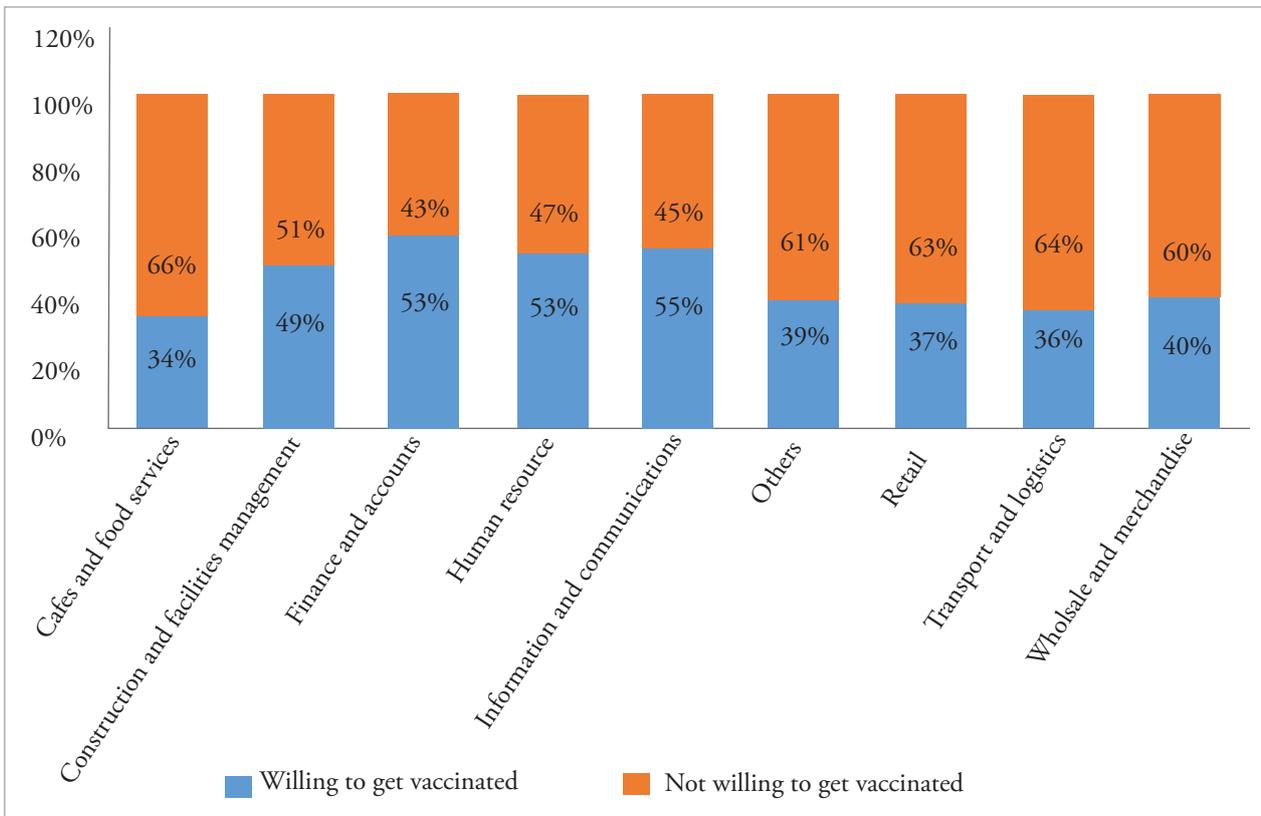
Figure 1: Willingness to get vaccinated vs. those who have received first dose, both doses and no dose.



Source: Authors' calculations based on Ports Moresby retail sector employment – COVID-19 survey, October 2021.

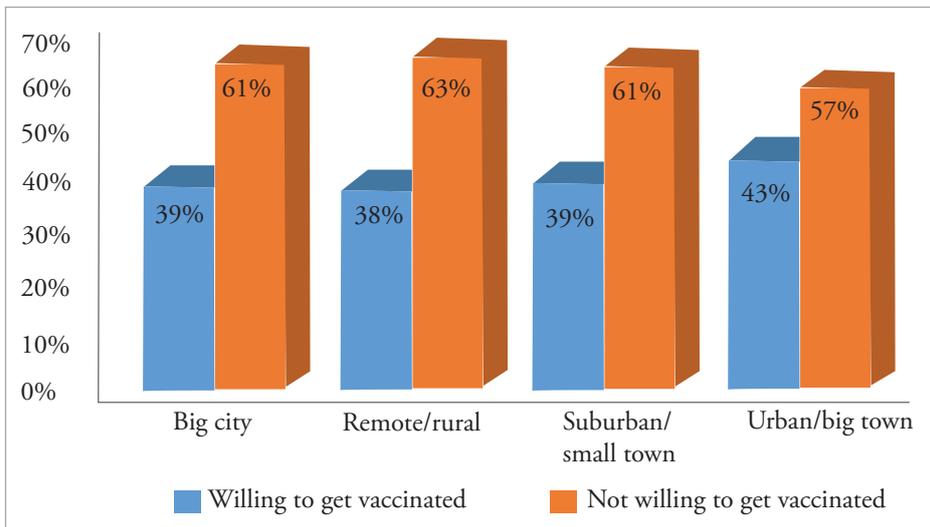
The percentage distribution between those willing and not willing to get vaccinated was similar among those working in the different sections of their employers' companies. As shown in Figure 2, less than 50 percent of those working in cafes and food services, construction and facilities management, retail, transport and logistics, wholesale and merchandise, and other sections of the company respectively were willing to get vaccinated. Out of those willing to get vaccinated, 40 percent worked in the retail section of the company while 16 percent worked in the wholesale section of the company.

Figure 2: Employees in the retail and wholesale sectors willing to get vaccinated



Source: Authors' calculations based on Port Moresby retail sector employment – COVID-19 survey, October 2021.

Figure 3: Residence/workplace and willingness to get vaccinated

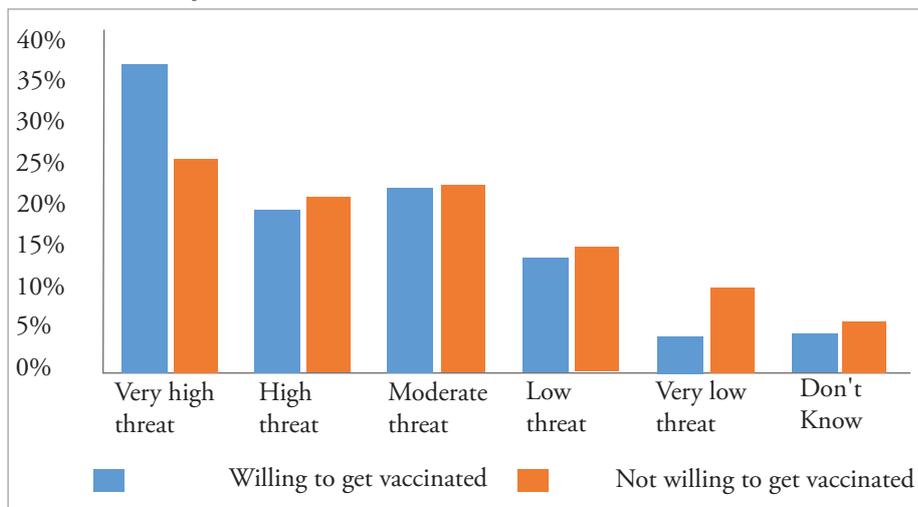


Source: Authors' calculations based on Port Moresby retail sector employment – COVID-19 survey, October 2021.

Figure 3 indicates that regardless of where the respondents lived or worked from, over 55 percent were not willing to get vaccinated. Willingness to get vaccinated was more or less the same across those living and working in the big city, rural/remote, suburban/small town and big town. In general, out of all those willing to get vaccinated, 34 percent lived and worked in a big city, 6 percent in the rural, 33 percent in suburban/small town and 27 percent in a big town. In fact, a further analysis of the data showed that 70 percent of the respondents living in the rural/remote areas had not received any dose compared to 61 percent of those living in big towns.

Figure 4 indicates willingness to get vaccinated declined with the level of threat the respondents thought COVID-19 posed to them and their family. For example, of the respondents willing to get vaccinated, 57 percent perceived the threat of COVID-19 infection as high/very high; 35 percent perceived the threat as moderate/low; while the remaining 9 percent assessed the threat of COVID-19 as very low or they don't know whether or not the virus poses a threat to them or their family members. Thus, the higher the level of threat, the more the respondents were willing to get vaccinated. Surprisingly, nearly 55 percent of the respondents who believe that COVID-19 poses a very high or high threat to them and their family were still not willing to get vaccinated against the virus.

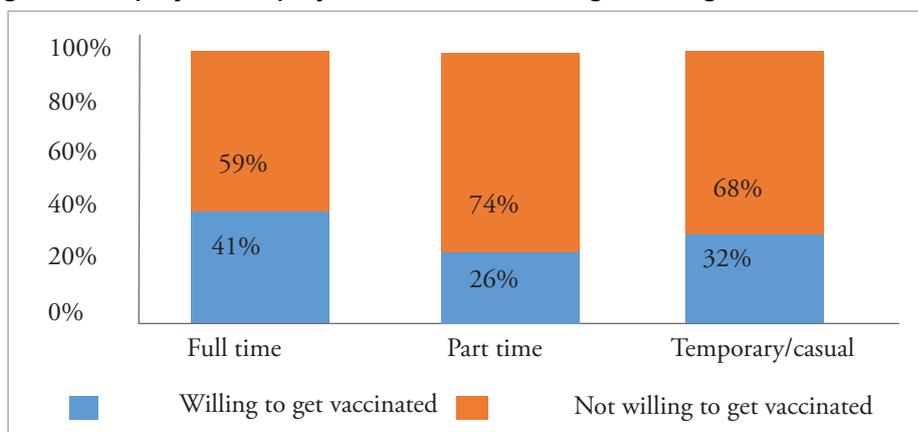
Figure 4: Willingness to get vaccinated vs. level of threat respondents think COVID-19 poses to them and/or their family members.



Source: Authors' calculations based on Port Moresby retail sector employment – COVID-19 survey, October 2021.

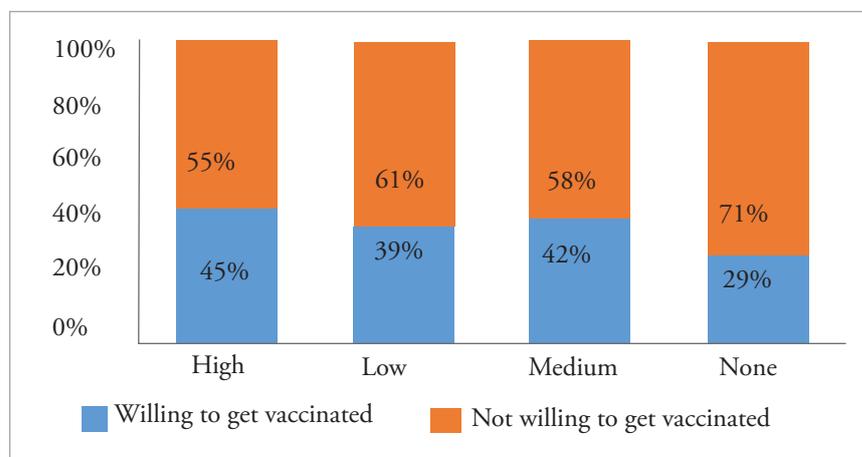
With reference to employment status, 41 percent employed on full time basis (at least 40 hours a week) were willing to get vaccinated compared to 16 percent and 32 percent of those employed on part time basis (less than 40 hours a week) and casual basis respectively (see Figure 5). Out of the total number not willing to get vaccinated, 88 percent were employed on full time basis (at least 40 hours a week), 7 percent and 5 percent of on part time basis (less than 40 hours a week) and casual basis respectively. The pattern was reflected among those willing to get vaccinated with 93 percent of those willing to get vaccinated employed on full time basis compared to 4 percent employed on part time and casual basis.

Figure 5: Employees employment status vs. willingness to get vaccinated



Source: Authors' calculations based on Port Moresby retail sector employment – COVID-19 survey, October 2021.

Figure 6: Risk of exposure to COVID -19 infection at work place vs. willingness to vaccinated



Source: Authors' calculations based on Port Moresby retail sector employment – COVID survey October 2021.

Figure 6 shows the retail and wholesale sector employees' assessment of their potential of their exposure to COVID -19 infection at their places of work and their corresponding willingness to get vaccinated. Fifty-five percent of respondents who believe that the risk of COVID-19 infection at their work place is high are still not willing to get vaccinated against the virus. On the other extreme, only 29 percent of respondents who believe that they are not exposed to COVID-19 infection at the workplace indicated that they are willing to get vaccinated.

Table 1 presents access to information in relation to willing to get vaccinated. Fifty-two percent of the respondents felt that they had access to enough information to make decisions about the vaccination against COVID -19 compared to 19 percent who indicated that they did not have any information. Of the 52 percent, only 52 percent were willing to get vaccinated while of the 19 percent with no information, 26 percent were willing to get vaccinated. A further analysis of the data shows that 34 percent of those having sufficient information and willing to get vaccinated got their information about vaccination against COVID-19 from the government/health authority with 26 percent getting their information from the social media. Hoy et al. (2021) found that people's most trusted source of information (including social media) was unrelated to their intention to get vaccinated.

Table 1: Access to information and willingness to get vaccinated

Information Adequacy	Willing to get vaccinated		Not willing to get vaccinated		Total	
	Freq.	%	Freq.	%	Freq.	%
Sufficient information	339	52%	311	48%	650	52%
Did not have all the information	40	24%	130	76%	170	14%
Did not have any information	75	32%	159	68%	234	19%
Not sure	40	22%	146	78%	186	15%
Total	494		746		1240	100%

Source: Authors' calculations based on Port Moresby retail sector employment – COVID-19 survey, October 2021.

Table 2 presents the breakdown of respondents' willingness to get vaccinated according to their underlying medical conditions. Sixty-six percent of those with underlying medical conditions were not willing to get vaccinated out of which 36 percent had a compromised immune system (immunosuppression). This notwithstanding however, of the 34 percent willing to get vaccinated, 47 percent of retail and wholesale workers had a compromised immune system compared to 3 percent with chronic lung disease. Out of the respondents with a serious heart disease and diabetes medical conditions respectively, 94 percent and 68 percent were not willing to get vaccinated. Only 34 percent of all those with underlying medical condition were willing to get vaccinated.

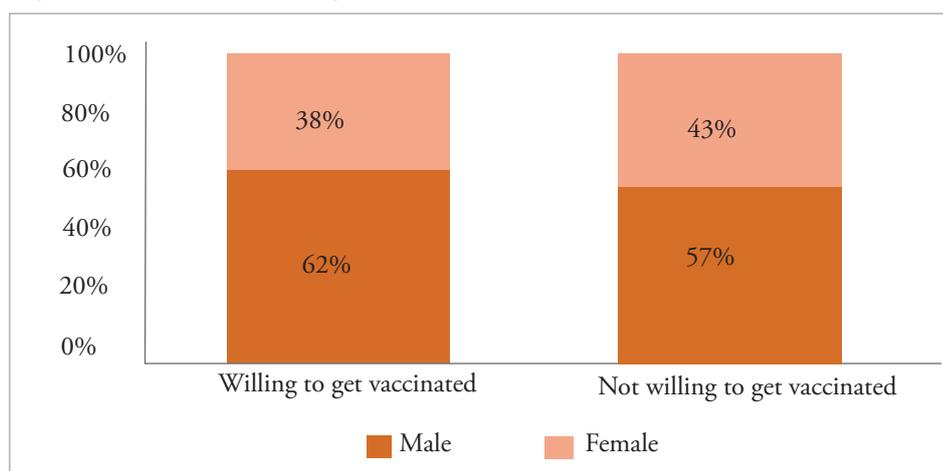
Table 2: Underlying medical conditions vs. willingness to get vaccinated

Medical conditions	Willing to get vaccinated		Not willing to get vaccinated		Total	
	Freq.	Percent	Freq.	Percent	Freq.	Percent
Chronic kidney disease (undergoing dialysis)	11	15%	19	13%	30	14%
A compromised immune system (immunosuppression)	35	47%	53	36% ¹	88	40%
Diabetes	10	13%	21	14%	31	14%
A serious heart disease	1	1%	17	12%	18	8%
Chronic lung disease	2	3%	8	5%	10	5%
Moderate to severe asthma	16	21%	29	20%	45	20%
Total	75	34%	147	66%	222	

Source: Authors' calculations based on Port Moresby retail sector employment – COVID-19 survey, October 2021.

In terms of gender, out of those willing to get vaccinated, 62 percent of males were willing to get vaccinated compared to 38 percent of the female with the same pattern being reflected on those not willing to get vaccinated. Apparently, 63 percent of the females were not willing to get vaccinated compared to 58 percent of the males.

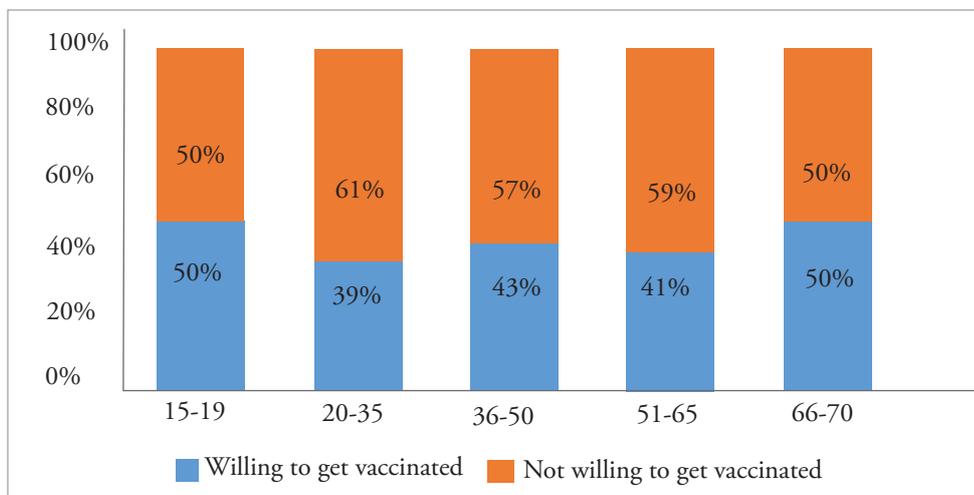
Figure 7: Gender vs. willingness to vaccinated



Source: Authors' calculations based on Port Moresby retail sector employment – COVID-19 survey, October 2021.

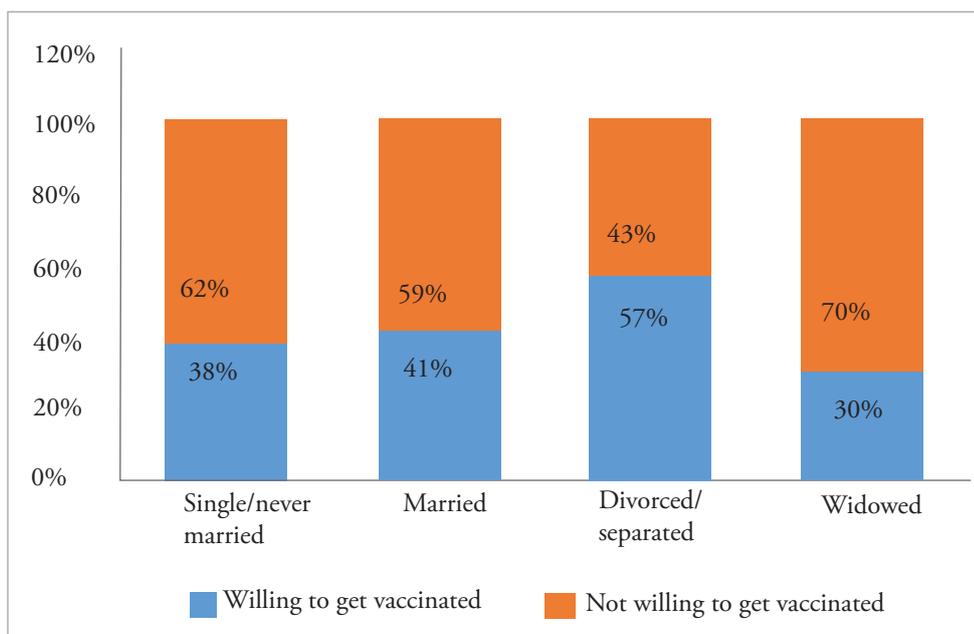
Figure 8 indicates the age group with reference to willingness to be vaccinated. Most of the respondents in each age group were not willing to get vaccinated with those aged between 20 to 35 years having a higher percentage (61 percent). Compared to the other age groups, 78 percent of those aged between 20 to 35 years were not willing to get vaccinated.

Figure 8: Age groups vs. willingness to be vaccinated



Source: Authors' calculations based on Port Moresby retail sector employment – COVID-19 survey, October 2021.

Figure 9: Marital status vs. willingness to be vaccinated

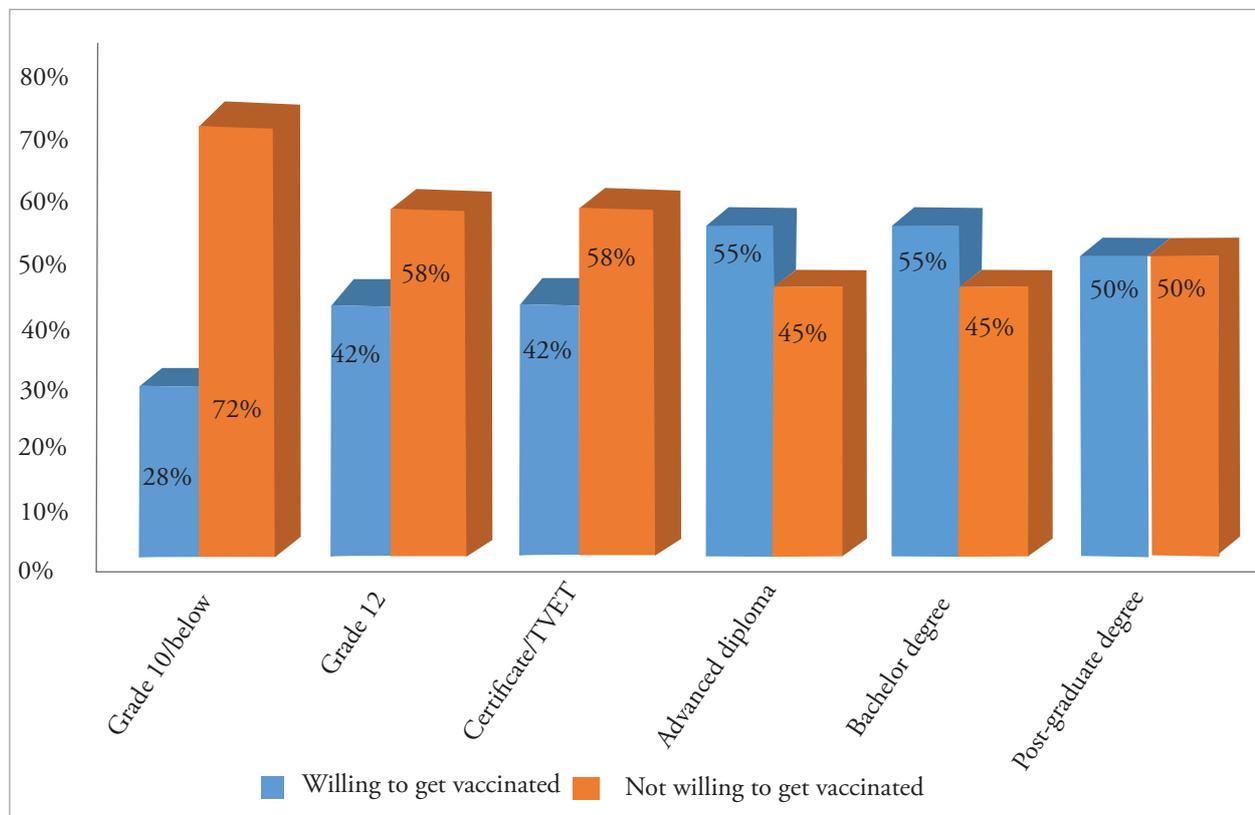


Source: Authors' calculations based on Port Moresby retail sector employment – COVID-19 survey, October 2021.

With regard to marital status, with an exception of divorced/separated respondents who had slightly below 50 percent not willing to get vaccinated, over 55 percent of the rest of respondents in the various marital status categories were not willing to get vaccinated (Figure 9). Fifty-one percent and 46 percent of those not willing to get vaccinated respectively were single/never married and married.

As shown in Figure 10, 72 percent of those who had completed grade 10 or below were not willing to get vaccinated compared to 58 percent of those who had completed grade 12 and certificate or technical and vocational education and training (TVET), 45 percent of those who had completed advanced diploma and a bachelor's degree, and 50 percent of those who had completed a postgraduate degree. Overall, over 50 percent of those who had completed at least an advanced diploma were willing to get vaccinated when COVID-19 vaccine becomes available compared to at most 42 percent of those who had completed at a certificate/TVET and below.

Figure 10: Highest level of education completed vs. willingness to be vaccinated



Source: Authors' calculations based on Port Moresby retail sector employment – COVID-19 survey, October 2021.

Table 3 suggests that willingness to get vaccinated declined with the gross employment income. Forty-six percent of the respondents earning less than K400 were willing to get vaccinated compared to 0.8 percent of those earning more than K9600. The same scenario was replicated on those not willing to get vaccinated with 64 percent earning less than K400 not willing to get vaccinated compared to 0.5 percent earning more than K9600. Generally, 32 percent of those earning less than K400 were willing to get vaccinated compared to 23 percent of those earning from K400 to K700, 3 percent of those earning from K700 to K1300, 0.5 percent of those earning from K1300 to K2700, and 0.5 percent of those earning more than K9600.

Table 3: Gross employment income/earnings per fortnight vs. willingness to get vaccinated

Willing to get vaccinated?	Less than K400	K400- K700	K700 - K1300	K1300 - K2700	K2700 - K9600	More than K9600	Total
Yes	228(46%)	165 (33%)	59(12%)	28(5.6%)	12(2.4%)	4(0.8%)	496(40%)
No	480(64%)	190(25%)	49(6.5%)	24(3.2%)	4(0.5%)	4(0.5%)	751(60%)
Total	708(57%)	355(28.5%)	108(9%)	52(4%)	16 (1%)	8(0.5%)	1,247

Source: Authors' calculations based on Port Moresby retail sector employment – COVID-19 survey, October 2021

Econometric results

Logit Model was used to estimate the magnitude and direction of various determinants of wholesale and retail sector workers' willingness to get vaccinated when the vaccine becomes available. Some of the survey response categories had very few observations necessitating combination of some categories. For instance, respondents aged between 15 to 19 years (6 respondents) and 20 to 35 years (959 respondents) were combined to create a 15 to 35 years category, while those aged between 51 to 65 years (39 respondents) and 66 to 70 years (2

respondents) were combined to form more than 50 years category. Ethnicity was dropped as over 99 percent were PNG nationals. Respondents earning K1300 to K2700 (16), and more than K9600 (8) were combined to form more than K1300 category. Those with underlying medical conditions were combined to form a dummy variable equal to 1 if the respondent had any of the listed underlying conditions, otherwise, 0. Bachelor's degree respondents (82) and postgraduate degree respondents (16) were combined to form at least a bachelor's degree variable. The final model is shown in Table 4.

Table 4: Logistic regression results and marginal effects results

	Regression Estimates		Marginal effects	
	Coeff	z	(dy/dx)	z
Willingness to get vaccinated				
<i>Employment status (Base category: full time)</i>				
Part time (less than 40 hours a week)	-0.828***	-2.790	-0.156***	-3.130
Temporary employees	-0.244	-0.760	-0.049	-0.770
<i>Sufficient information (Base category: had sufficient information)</i>				
Did not have all the information	-1.208***	-5.610	-0.256***	-6.310
Did not have any information	-0.978***	-5.530	-0.213***	-5.940
Not sure	-1.356***	-6.440	-0.281***	-7.420
<i>Level of COVID-19 threat (Base category: very high threat)</i>				
High threat	-0.488***	-2.630	-0.101***	-2.660
Moderate Threat	-0.212	-1.160	-0.045	-1.160
Low Threat	-0.387*	-1.800	-0.081*	-1.820
Very low threat	-0.976***	-3.310	-0.192***	-3.610
Do not know	-0.233	-0.760	-0.049	-0.770
<i>Underlying medical condition (Base category: no underlying medical condition)</i>				
Underlying medical condition	-0.320*	-1.820	-0.064*	-1.860
<i>Gender (Base category: male)</i>				
Female	-0.162	-1.200	-0.033	-1.210
<i>Marital status (Base category: Single)</i>				
Married	-0.128	-0.880	-0.026	-0.890
Divorced/Separated	0.460	1.100	0.096	1.090
Widowed	-0.530	-0.690	-0.103	-0.740
<i>Age group in years (Base category: 15 – 35 years)</i>				
36 – 50	0.120	0.650	0.025	0.650
More than 50 years	-0.126	-0.330	-0.025	-0.330
<i>Highest level of education completed (Base category: grade 10/below)</i>				
Grade 12	0.478***	2.860	0.097***	2.870
Certificate/TVET	0.475**	2.350	0.097**	2.320
Advanced diploma	0.846***	3.620	0.177***	3.560
At least a Bachelor's degree	0.744**	2.450	0.154**	2.380
<i>Gross income per fortnight (Base category: less than K400)</i>				
K400 – K700	0.313**	2.000	0.065**	1.980
K700 – K1300	0.598**	2.230	0.126**	2.190
More than K1300	0.544*	1.660	0.114	1.620

Living/Working place (Base category: Big city)

Remote/rural	0.107	0.370	0.021	0.370
Suburban/small town	0.335**	2.050	0.067**	2.070
Urban/big town	0.527***	3.060	0.107***	3.090
_cons	-0.253	-1.260		
Number of observations	1221			
Prob > chi2	0.0000			

Key: ***, **, & * denote 1%, 5% and 10% level of significance, respectively. Dummy variables are moving from 0–1. dy/dx for factor levels is the discrete change from the base level.

Source: Authors' calculations based on Port Moresby retail sector employment – COVID-19 survey, October 2021.

Several diagnostic tests were carried out to check the fitness of the model. The Hosmer-Lemeshow chi-squared value of 8.45 on 8 degrees of freedom with a p-value of 0.3907 indicated no evidence of lack of fit. The model was found to be adequate as indicated insignificant p-value of 0.606. The overall model was statistically significant as indicated by the p-value of less than 0.001. A unit increase in part time workers in both retail and wholesale sectors would lead to a decline in the log odds of those willing to get vaccinated. Similarly, a unit increase in those with underlying medical conditions, those with less or no information and the threat of COVID-19 would lead to a decline in the log odds of those willing to get vaccinated. On the other hand, a unit increase in those having completed at least grade 12, those with gross income of more than K400 and those living in suburban/small towns and urban/big towns will lead to an increase in the log odds of those willing to get vaccinated.

The respondents employed on part time (less than 40 hours a week) basis were 15 percent less likely willing to get vaccinated. Access to information was important in influencing the willingness to get vaccinated when a COVID-19 vaccine becomes available. Respondents who did not have all information were 26 percent less likely willing to get vaccinated than their counterparts who had sufficient information. Similarly, respondents having no information and those not sure were 21 percent and 28 percent, respectively less likely willing to get vaccinated than their counterparts who had sufficient information. Ahearn (2021) noted that misinformation and lack of trust in authority was so widespread in PNG to the extent that the social media questioned and vilified the country's most experienced doctors and scientists (see also Choudhury, 2021). With almost 70 percent of Papua New Guineans having a Facebook account where they receive most of their information, misinformation on social media could be a key driver in spreading false information (Save the Children Australia, 2021). Of those willing to get vaccinated and with sufficient information, 34 percent had received information from the government/health authority while 29 percent from the social media.

The level of threat significantly influenced the willingness to get vaccinated when a COVID-19 vaccine becomes available. Regardless of the level of threat category, all respondents were less likely willing to get vaccinated than their counterparts who thought that COVID-19 posed a very high threat. Only the moderate and do not know category were not important in influencing the willingness to get vaccinated. The respondents who thought that COVID-19 posed a high threat, low threat and very low threat to them and/or their family members were 10 percent, 8.1 percent and 19 percent, respectively less likely willing to get vaccinated than their counterparts who thought that COVID-19 posed a very high threat.

With respect to underlying medical conditions, respondents who had diabetes, serious heart disease, compromised immune system (immunosuppress), a chronic lung disease, and moderate to severe asthma as underlying medical condition were 6.4 percent less likely willing to get vaccinated than their counterparts who did not have any underlying medical condition. These results are consistent with Kelly et al. (2021) who found that respondents with increased risk because of underlying medical conditions or morbid obesity were less willing to get vaccinated than their lower risk counterparts.

The level of education completed was important in influencing the willingness to get vaccinated when COVID-19 vaccine becomes available. Respondents having completed grade 12, certificate/TVET, advanced diploma, and at least a bachelor's degree were 9.7 percent, 9.7 percent, 17 percent and 15 percent more likely willing to get vaccinated than their counterparts who had completed grade 10 or below. The size of effect was more from those having completed both advanced diploma and at least a bachelor's degree compared to those who had completed grade 12 and certificate/TVET. These results are inconsistent with Handebo et al. (2021) who found that respondents with a university degree had a decreased intention to receive the vaccine compared to those who received college diploma. At the same time, our results regarding college degrees are contrary to Kelly et al. (2021) who concluded that people with less education are the ones who are less willing to get vaccinated. Our results comparing education levels other than college degrees are consistent with Kelly et al. (2021) in that those with advanced diploma were 17 percent more likely willing to get vaccinated than their counterparts who had completed grade 10 or below.

Gross employment income/earnings per fortnight was important in influencing the willingness to get vaccinated when a COVID-19 vaccine becomes available with those earning from K400 to K700 and K700 to K1300 having 6.5 percent and 13 percent more probability of getting vaccinated than their counter parts with gross income of less than K400 per fortnight. Those earning more than K1300, though not significant in influencing willingness to get vaccinated, were 11 percent more likely willing to get vaccinated than their counterparts with gross income of less than K400 per fortnight. This could be explained by the fact that most of the respondents working in retail and wholesale sectors were earning a gross employment income/earnings per fortnight of less than K400.

The place the respondents were living and working was key in influencing the willingness to get vaccinated when a COVID-19 vaccine becomes available. Those living in suburban/small towns and those living in urban/big towns were 6.7 percent and 10.7 percent respectively, more likely willing to get vaccinated than their counterparts living and working in the big city. Though insignificant, those living in remote/rural areas were 2.1 percent more likely willing to get vaccinated than those living in big city. The high willingness to get vaccinated against COVID-19 among retail and wholesale service workers living or working in suburban and small towns in and around Port Moresby may be attributed to the Motu Koita Mobile Vaccination Program. The program not only run a mobile vaccination clinic, but it also involves raising awareness of COVID-19 and promoting good hygiene and hand-washing practices for communities in Motu-Koitabu villages to reduce the spread of the virus and save lives. The campaign has ensured that the turnout for vaccination in the villages has been high, with the pace limited only by the lack of nursing staff to rollout out the vaccination and COVID-19 awareness campaigns⁹.

Qualitative analysis of survey comments

As noted before, the survey also allowed participants to make any comments in relation to the effect of COVID-19 pandemic on their work. Therefore, in addition to the descriptive and quantitative analysis above, a selection of survey respondent's comments in relation to COVID-19 in PNG generally, and specifically in relation to their willingness to get vaccinated against COVID-19, is provided below. Overall, the comments indicate a negative and probably somewhat biased view, but nevertheless can be cross-checked with the statistical results to enhance validity and provide a richer insight to some aspects.

A strong theme that evolved from the survey comments was that although forcing workers to get vaccinated could be considered unfair per se, there was some scope for demystifying myths about COVID-19 and reducing vaccine hesitancy. The following comments were typical;

"I think government should tell us the facts about the effects and benefits of it rather than forcing people to get vaccine which is not right".

"I want correct information first, then I will get vaccinated. Otherwise I'm going to resign and go home".

⁹ <https://www.thenational.com.pg/mobile-clinic-covered-nine-villages-nurse-says/>. Accessed 7/12/2021.

“I am afraid of COVID-19.... But as for me and my family, we decided not to get those doses because it's new to us or our country. We will wait for clear information”.

Another emerging theme from the survey comments was that vaccination against COVID-19 is gradually becoming indispensable for continuing employment in the wholesale and retail businesses. Clearly, the following comments demonstrate the concern expressed by many respondents who reluctantly took the vaccine or are grudgingly willing to get vaccinated against;

“I did not want to resign and stay home because city life is very hard. So, I got vaccinated in order to continue with my job to live in the city”.

“I am scared of taking the vaccine but on the other hand not taking it would affect my job”.

“Vaccination has [kind of] became a threat and made jobs insecure. Many employees really didn't want the vaccine but had to get it as they did not want to lose their jobs”.

“I don't want to lose my job, so I already got vaccinated”.

“Why is my employer forcing us to be vaccinated to enter office? Also, if we are not vaccinated, we will have to lose our jobs, meaning no job no job”.

The above comments suggest that with lack of choice in vaccination against COVID-19, there also emerged the possibility that some wholesale and retail service workers were/are decisively not willing to get vaccinated. Instead, they opted or are opting to quit their jobs altogether, as reflected in the following comments;

“COVID-19 pandemic has made people lose their jobs because every business house in PNG want all their staff to be vaccinated, which not good”.

“If COVID-19 increases, I am the one who's going to leave my job because I don't want to be vaccinated”.

“I don't want to get vaccine. If it is mandatory, then I will leave my job and go home”.

Conclusion and policy implications

In this paper, we have used Port Moresby retail sector employment - COVID-19 survey for October 2021 data to assess the willingness of workers to get vaccinated when a COVID-19 vaccine becomes available. The predictors of willingness to get vaccinated considered include employment status, access to information, underlying medical conditions, perceived threat of the virus, gender, marital status, age, education, income and residence. Willingness to get vaccinated when a COVID-19 vaccine becomes available was captured by a dummy variable equals to 1 for willingness to get vaccinated and zero otherwise. Receiving the first or both doses versus having not received any was also used to estimate the determinants of willingness to get vaccinated

Overall, 1,265 employees working in retail and wholesale sector businesses in Port Moresby were interviewed out of which only 39 percent were willing to get vaccinated when a vaccine for COVID-19 became available. Out of those willing to get vaccinated, 26 percent had not received any of the doses while 25 percent and 49 percent had received the first and both doses, respectively. It is unsurprising that 93 percent of those not willing to get vaccinated had not received the vaccine doses. Our estimate of the percentage of workers who indicated that they were willing to get a COVID-19 vaccine in October 2021 has improved compared to polls taken in May to July 2021 when vaccine acceptance at workplaces was only 15 to 22 percent. This may be reflective of the fact that many workers were increasingly becoming afraid of losing their jobs, so they were grudgingly willing to get vaccinated in order to continue working.

In the econometric analysis, we estimated a logistic regression with individual characteristics as the independent variables. On the one hand, respondents employed on part time basis, having no sufficient information or no information at all, considering the level of COVID-19 threat to be high, low and very low, and with underlying medical issues were less likely willing to get vaccinated when a vaccine for COVID-19 became available compared to their counterparts. On the other hand, those having completed grade 12 and above, earning more than K400 as gross income, and living in suburban/small town or urban/big town were more likely willing to get vaccinated when a vaccine for COVID-19 became available than their counterparts.

The government as well as the PNG Council of Churches should step up their efforts and concentrate on educating the population and ensuring the right information regarding COVID-19 vaccine is shared with the public on time before the vaccine becomes available as people are highly affected by untrusted messages transmitted via social media. Given a higher percentage received information via social media, the government should invest in internet infrastructure and ensure they develop a website which is known to all population where they could access the right information from. Health communication programs should emphasise on educating on the threats of COVID-19 and the benefit of the COVID-19 vaccine to improve their willingness. The government ought to build public confidence in the vaccine for the willingness to accept the COVID-19 vaccine to be improved.

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Appendix

Table A1: Survey variables and measures

Variable	Question	Response options and measurements
Outcomes <i>Willingness to get vaccinated</i>	When a vaccine for COVID-19 become available, will you be willing to get vaccinated?	1 if Yes, I am willing to get vaccinated, 0 if No, if not willing to get vaccinated
	Have you received the first dose or both first and second doses of COVID-19 vaccine?	1 if yes (first dose) and first and second doses, 0 if no.
Predictors		
<i>Employment status</i>	Which of the following best describe your current employment status?	1 if Part time (less than 40 hours a week) otherwise 0, 1 if temporary employee otherwise 0. Full time employee (at least 40 hours a week)-base category
<i>Sufficient information</i>	Did you feel that you had access to enough information to make decisions about vaccinating against the coronavirus (COVID-19)?	1 if did not have all the information otherwise 0, 1 if did not have any information otherwise 0, 1 if not sure otherwise 0. Having sufficient information - base category
<i>Level of COVID-19 threat</i>	What level of threat do you think COVID-19 poses to you and/or your family?	1 if high threat otherwise 0, 1 if moderate threat otherwise 0, 1 if low threat otherwise 0, 1 if very low threat otherwise 0, 1 if don't know otherwise 0. Very high threat-base category
<i>Underlying medical condition</i>	Do you have any of the following underlying medical conditions?	1 if has an underlying medical condition (compromised immune system (immunosuppress), diabetes, a serious heart disease, chronic lung disease, moderate to severe asthma, and chronic kidney disease (undergoing dialysis) otherwise 0. No underlying medical condition-base category
<i>Gender</i>	What is your gender?	1 if female otherwise 0, male-base category
<i>Marital status</i>	What is your marital status?	1 if married otherwise 0, 1 if divorced/separated otherwise 0, 1 if widowed otherwise 0. Single/never married-base category.
<i>Age</i>	What is your age (in years)?	1 if 36 – 50 years otherwise 0, 1 if more than 50 years otherwise 0. 15 -35 years–base category.
<i>Education</i>	What was the highest level of education you completed?	1 if grade 12 otherwise 0, 1 if certificate otherwise 0, 1 if advanced diploma otherwise 0, 1 if bachelor degree otherwise 0, 1 if postgraduate degree otherwise 0. Grade 10/below –base category
<i>Gross income</i>	What is your gross employment income/ earnings per fortnight?	1 if K400- K700 otherwise 0, 1 if K700 - K1300 otherwise 0, 1 if more than K1300 otherwise 0. Less than K400-base category
<i>Residence</i>	Which of these places best describe where you live and work?	1 if Urban / Big Town otherwise 0, 1 if Suburban / Small Town otherwise 0, 1 if Rural / Remote place otherwise 0. Big city-base category



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