

# Factors influencing Covid-19 vaccine uptake among women in the rural communities of South Africa (SDG 3, target 3.b.1)

**Kholisani Ndlovu,<sup>1</sup> Siwelile S. Ndlangamandla,<sup>2</sup> Bukola G. Olutola<sup>3</sup>**

<sup>1,2,3</sup> School of Engineering, Science and Health, Independent Institute of Education (IEMSA)

<sup>3</sup> Corresponding author: [bolutola@iiemsa.co.za](mailto:bolutola@iiemsa.co.za)

© Authour(s)

OIDA International Journal of Sustainable Development, Ontario International Development Agency, Canada.

ISSN 1923-6654 (print) ISSN 1923-6662 (online) [www.oidaijsd.com](http://www.oidaijsd.com)

Also available at <https://www.ssm.com/index.cfm/en/oida-intl-journal-sustainable-dev/>

**Abstract:** Women in rural areas are less likely to have access to health care and more likely to have poorer health outcomes. The WHO has a gender-based approach, which addresses the specific health vulnerabilities and risks of rural women and girls that are addressed in health service delivery such as Covid-19 vaccination. Globally, Covid-19 has caused different health, social and economic outcomes. This led to the manufacturing of vaccines to manage the pandemic and has been a success story. The true measure of success depends on the rates of vaccine uptake globally and locally and among the marginalised populations. Therefore, this study looked at Covid 19 vaccine uptake among rural South women aged 15 and above. Data used were from the 2022 South African General Household Survey, a nationally representative survey. Descriptive statistics and multivariable logistic regression analysis were used to describe the characteristics of the sample and to identify factors associated with Covid-19 vaccine uptake amongst women who were 15 years and above in rural South Africa. Of the 7961 female respondents, 27.98% (2432) were between 15 and 24 years followed by those who were 45 years and older (26.53%, n=2537). The number of respondents who took the Covid-19 vaccine were almost the same as those who never had (48.5% vs. 48.6%). A higher percentage of those who were on a medical aid scheme took the Covid-19 vaccine than those who were not on the scheme (74.8% vs. 48.4%;  $p < 0.001$ ). Women with more than a grade 12 education were more likely to have taken the Covid-19 vaccine compared to those with no education. Those who did not have a cell phone were less likely to have taken the vaccine compared to those who had a cell phone. Other factors that were associated with Covid-19 vaccine uptake were- marital status, Covid -19 diagnosis, having a medical aid/insurance, diagnosis of hypertension by a physician, ethnicity/race, self-rated health, and age. Understanding factors affecting vaccine uptake allows for more targeted, equitable and effective vaccination campaigns. The study showed the different factors that affect Covid-19 uptake amongst rural women in South Africa.

**Key words:** Covid-19, South Africa, rural women, Covid-19 vaccine, Education

## Introduction

Gender can impact how people experience crises and emergencies, their susceptibility to disease and their ability to access healthcare facilities. Gender inequality in healthcare access is a noteworthy concern that impacts individuals globally. The gender inequality and discrimination experienced by women and girls endanger their health and well-being. Women frequently encounter more significant obstacles than men in accessing health information and services (World Health Organization, 2021). This is a life-threatening issue when outbreaks such as Covid 19 occur. In a study conducted by Flor et al, on 193 countries, women were less likely than men to receive relevant vaccine information and less likely to get vaccinated. This was attributed to work and their domestic care obligations. It was also revealed that they had less trust in vaccines.

The COVID-19 pandemic exacerbated existing socio-economic vulnerabilities, including access to healthcare and its impacts on impoverished communities (Bob, Munien and Gumede, 2022). It tested the resilience of even the most robust health systems globally. The COVID-19 pandemic and its challenges unfolded within fragile health infrastructures that were already struggling to manage the existing health burdens (Haileamlak, 2021; Menendez et al., 2020). Moreover, the pandemic highlighted the pre-existing gaps and their impact on the prevention services for

communicable and non-communicable diseases, one of those gaps where the gender disparities in healthcare services (Haileamlak, 2021; Menendez et al., 2020; World Health Organization, 2021b). Vaccines have played a central role in limiting the spread and mitigating the impact of the virus (The Lancet, 2021).

The South African health system faced numerous challenges during the COVID-19 pandemic, including shortages of personal protective equipment (PPE), elevated mortality rates, mental health issues, increased substance abuse, and a resurgence of non-communicable diseases (NCDs). The existing difficulties in healthcare service delivery were further compounded as the health system grappled with the overwhelming impact of the pandemic (Mbunge, 2020). The country reported over 4 million COVID-19 cases and 100,000 deaths. Despite the delayed initiation of South Africa's national COVID-19 vaccination program in May 2021, the target of vaccinating two-thirds of the population by the end of 2021 was not met (The Lancet, 2021). As of 24 September 2023, approximately 41 million vaccine doses have been administered to the population of over 60 million people (World Health Organization, 2023). Vaccine hesitancy continues to impede vaccination uptake in South Africa.

Rural-urban health inequalities still exist in many regions of the world with regard to sociodemographics, access to healthcare, health status and prevalence of diseases (Peltzer, Phaswana-Mafuya and Pengpid, 2019). However, in South Africa, vaccine hesitancy was found to be higher in the urban areas compared to the rural areas, i.e. more rural people take Covid-19 vaccine than the urban populace (Kollamparambil, U et al., 2021). Improved health services and social grants have contributed to the advancement of rural South African women. Nonetheless, there are significant disparities that affect women in rural regions, including limited access to essential health services and high-quality education (Kabudula, Ohene-Kwofie and Wagner, 2021). The World Health Organization adopts a gender-based approach to public health, specifically targeting and addressing the distinct health vulnerabilities and risks faced by rural women and girls within health service delivery (World Health Organization, 2021).

The intersectionality of gender and other factors such as socioeconomic status and geography are important to acknowledge as these intersections contribute to distinctive experiences in terms of health and access to healthcare. Therefore, this study's aim was to identify factors influencing COVID-19 vaccine uptake among rural South women aged 15 and above.

## Methods

The sample design for the GHS 2022 was based on the 2013 master sample (MS). A two-stage, stratified design with probability-proportional-to-size (PPS) sampling of primary sampling units (PSUs) from within strata, and systematic sampling of dwelling units (DUs) from the sampled PSUs were used. The sampling weights for the data collected from the sampled households were constructed so that the responses could be properly expanded to represent the entire civilian population of South Africa. The design weights, which are the inverse sampling rate (ISR) for the province, are assigned to each of the households in a province. The detailed methods used in ensuring standardized data collection, interviews and consent procedures for the GHS have been previously published (Data First. General Household Survey, 2022). This study's respondents were women who lived in rural settlements, characterised as traditional or farm settlements in the survey. This study classified them as rural or non-urban settlements.

## Dependent variable

Covid-19 uptake was assessed by the question "Has ..... received a COVID-19 vaccine?". The options were dichotomised into No and Yes ("Yes, partially vaccinated (still require a second Pfizer shot)", "Yes, fully vaccinated (single Johnson & Johnson OR two Pfizer shots)", and "Yes, fully vaccinated with booster shot"). A rural settlement was defined as traditional and farm settlements in the analysis.

## Independent Variables

Using the 2022 GHS persons data, the age and the gender of the head of household were asked. The age was categorized into 15-24 years, 25-34 years, 35-44 years, and 45 years and above. Questions on socioeconomic and demographic factors such as employment status (employed, unemployed and unspecified), highest education level (No schooling, grades 1-11, grade 12 and above grade 12), marital status (married/living together, divorced/separated/widowed, and single), ethnicity/racial group (African/black, Coloured, Indian/Asian and White) were asked. Other factors include cell-phone ownership, having medical aid/insurance, self-rated health, and health workers' diagnosis of morbidities like asthma, diabetes, HIV, hypertension, tuberculosis, bronchitis/pneumonia, and Covid-19.

## Data analysis

The data were analyzed using STATA version 12 (STATA Corp Inc., College Station, TX, USA). Group differences were tested using chi-squares and the t-test for categorical and continuous variables respectively. All statistical tests were two-tailed, and the level of significance was set at  $p < 0.05$ . A multivariable logistic regression model was used to assess the factors associated with having taken Covid-19 vaccines in rural South Africa.

## Results

Of the 7742 respondents, 28% (n=2432) were between 15 and 24 years while the 35–44-year age group had the lowest representation in the study (20%; n= 1343). Most of the study respondents were black/ Africans (95.9%; n=7719). Less than half (48.5% (n=3954)) of the women reported that they had received the covid-19 vaccine either partially or fully. (Table 1). Very few had any form of morbidities like asthma, diabetes, HIV, hypertension, tuberculosis, bronchitis/pneumonia as well as Covid-19 (Table 2).

**Table 1: Characteristics of the study respondents**

Characteristics	%(n)
<b>Age categories (years)</b>	
15-24	28.0 (2432)
25-34	25.6 (1649)
35-44	20.0 (1343)
45 and above	26.5 (2537)
<b>Employment status</b>	
Employed	34.6 (2412)
Unemployed	21.9 (1589)
Unspecified/Not economically active	43.6 (3960)
<b>Education category</b>	
No schooling	4.3 (408)
Grades 1-11	64.8 (5214)
Grade 12	23.6 (1681)
Above grade 12	7.3 (538)
<b>Marital status</b>	
Married/Living together	28.5 (2269)
Divorced/Separated/Widowed	4.1 (407)
Single	67.4 (5285)
<b>Ethnicity/Racial group</b>	
African/Black	95.9 (7719)
Coloured	1.6 (101)
Indian/Asian	0.4 (13)
White	2.3 (128)
<b>Medical aid/Insurance</b>	

Yes	5.8 (425)
No	94.2 (7528)
<b>Self-rated health</b>	
Excellent	24.6 (1910)
Very good	27.1 (2078)
Good	40.4 (3219)
Fair	6.0 (570)
Poor	2.0 (182)
<b>Disability</b>	
Yes	8.6 (799)
No	91.4 (7162)
<b>Cell-phone ownership</b>	
Yes	81.9 (6421)
No	18.1 (1540)
<b>Covid-19 vaccine</b>	
No	48.6 (3788)
Yes	48.5 (3954)
Don't know	2.8 (212)
Refuse	0.9 (7)

**Table 2: Health care professional diagnosed morbidities among the study respondents**

<b>Characteristics</b>	<b>%(n)</b>
<b>Asthma Diagnosis</b>	
Yes	0.9 (77)
No	99.7 (7884)
<b>Diabetes Diagnosis</b>	
Yes	1.8 (182)
No	98.2 (7779)
<b>HIV Diagnosis</b>	
Yes	3.0 (238)
No	97.0 (7723)

<b>Hypertension Diagnosis</b>	
Yes	5.5 (558)
No	94.5 (7403)
<b>Tuberculosis Diagnosis</b>	
Yes	0.8 (71)
No	99.2 (7890)
<b>Bronchitis/Pneumonia Diagnosis</b>	
Yes	0.1 (8)
No	99.9 (7953)
<b>Covid Diagnosis</b>	
Yes	0.5 (38)
No	99.5 (7923)

Looking at the age of those who took the Covid-19 vaccine, the older the respondents, the more the percentage of those took the vaccine. The 15–24-year age-group had the lowest percentage while those who were 45 years and above group had the highest percentage of people who took the vaccine. Also, the percentage of those who took the vaccine was higher among the employed than the unemployed (58.8% vs. 43.8%;  $p < 0.001$ ). However, there was no difference in Covid-19 uptake with respect to ethnicity or race. Regarding cell-phone ownership, more women who had cellphone took the vaccine than those who did not have a cellphone (52.6% vs. 38%;  $p < 0.001$ ) (Table 3).

In terms of morbidities, more women with diabetes took the vaccine than those without diabetes (74.2% vs. 49.5%;  $p < 0.001$ ). Also, the percentage of people who took the vaccine was more among those living with HIV than those not living with HIV (60.4% vs. 49.6%;  $p = 0.009$ ). However, there was no difference in the proportion of people who took the vaccine between those with or without asthma. (Table 4).

**Table 3: Covid vaccine uptake among the study respondents**

Characteristics	%(n)	p-value
<b>Age categories (years)</b>		<0.001
15-24	37.3 (889)	
25-34	44.7 (713)	
35-44	52.1 (660)	
45 and above	66.6 (1692)	
<b>Employment status</b>		<0.001
Employed	58.8 (1378)	
Unemployed	43.8 (685)	

Unspecified	46.1 (1891)	
<b>Education category</b>		<0.001
No schooling	59.8 (248)	
Grades 1-11	45.6 (2402)	
Grade 12	53.4 (865)	
Above grade 12	70.2 (370)	
<b>Marital status</b>		<0.001
Married/Living together	64.7 (1488)	
Divorced/Separated/Widowed	69.2 (283)	
Single	42.4 (2183)	
<b>Ethnicity/Racial group</b>		0.1783
African/Black	49.7 (3824)	
Coloured	50.0 (48)	
Indian/Asian	36.1 (7)	
White	60.3 (75)	
<b>Medical aid/Insurance</b>		<0.001
No	48.4 (3641)	
Yes	74.8 (307)	
<b>Self-rated health</b>		0.0039
Excellent	52.4 (985)	
Very good	48.9 (978)	
Good	47.5 (1527)	
Fair	58.4 (354)	
Poor	57.7 (109)	
<b>Cell-phone ownership</b>		<0.001
Yes	52.6 (3355)	
No	38.0 (599)	

**Table 4: Covid-19 uptake by health care professional diagnosed morbidities**

Characteristics	%(n)	p-value
<b>Asthma Diagnosis</b>		0.833
Yes	51.4 (43)	
No	50.0 (3911)	
<b>Diabetes Diagnosis</b>		<0.001
Yes	74.2 (140)	
No	49.5 (3814)	
<b>HIV Diagnosis</b>		0.009

Yes	60.4 (146)	
No	49.6 (3808)	
<b>Hypertension Diagnosis</b>		<0.001
Yes	76.5 (441)	
No	48.4 (3513)	
<b>Tuberculosis Diagnosis</b>		0.018
Yes	67.2 (45)	
No	49.8 (3909)	
<b>Bronchitis/Pneumonia Diagnosis</b>		0.6894
Yes	58.3 (5)	
No	49.9 (3949)	
<b>Covid Diagnosis</b>		0.003
Yes	76.1 (27)	
No	49.8 (3927)	

In multivariable logistic regression, there was no statistically significant difference between the use of Covid-19 uptake between 15-24-year-olds and 25-34-year-olds. Those who were 45 years and above and those who were between 35 and 44 years were more likely to take Covid-19 vaccine. Those who were single were less likely to take Covid-19 compared to married women (AOR: 0.68; 95% Conf. Int: 0.58-0.79). Those who did not have hypertension or Covid-19 were less likely to take the vaccine compared to those with hypertension or Covid-19. (Table 5).

**Table 5: Factors associated with Covid-19 vaccine uptake**

Characteristics	AOR (95% Confidence Interval)	P-value
<b>Age (Years)</b>		
15-24	Reference	
25-34	1.10 (0.95-1.28)	0.219
35-44	1.38 (1.15-1.63)	<0.001
>45	2.07 (1.71-2.49)	<0.001
<b>Education category</b>		
No education	Reference	
Grades 1-11	0.94 (0.72-1.22)	0.632
Grade 12	1.24 (0.94-1.65)	0.134
More than a grade 12	2.03 (1.42-2.89)	<0.001
<b>Marital status</b>		
Married/living together	Reference	
Divorced/Separated/Widowed	1.12 (0.84-1.48)	0.437
Single	0.68 (0.58-0.79)	<0.001
<b>Racial group</b>		

African/Black	Reference	
Coloured	0.94 (0.52-1.71)	0.850
Indian/Asian	0.48 (0.11-2.14)	0.334
White	0.51 (0.34-0.77)	0.001
<b>Medical aid /insurance</b>		
No	Reference	
Yes	1.83 (1.39-2.42)	<0.001
<b>High Blood Pressure/Hypertension Diagnosis</b>		
Yes	Reference	
No	0.54 (0.41-0.71)	<0.001
<b>Covid-19 Diagnosis</b>		
Yes	Reference	
No	0.44 (0.20-0.96)	0.040
<b>Self-rated Health</b>		
Excellent	Reference	
Very good	0.85 (0.69-1.04)	0.106
Good	0.74 (0.61-0.89)	0.002
Fair	0.84 (0.63-1.12)	0.235
Poor	0.98 (0.63-1.51)	0.912
<b>Own a mobile phone</b>		
Yes	Reference	
No	0.72 (0.61-0.84)	<0.001

## Discussion

The study's findings revealed that age, education, marital status, having a medical aid/insurance, race, diagnosis of hypertension by a physician, Covid-19 diagnosis, self-rated health and owning a mobile phone were the factors associated with Covid-19 vaccine uptake among women in the rural communities of South Africa. This study showed that women above 45 years were more likely to have taken the Covid-19 vaccine compared to the 15-24 age group. A similar finding was reported in a cross-sectional study among Ugandan women whereby the older age group (40-49) were less likely to refuse vaccination against Covid-19. This is because older women had less fear of pain from vaccination, and they had limited beliefs about the vaccines due to the lack of exposure to social media platforms (Backhaus, 2023). Also, in another study among Nigerian residents who were aged between 40-69 years, there were positive perceptions towards Covid – 19 vaccines compared to ages below this range (Adedeji-Adenola, Olugbake, & Adeosun, 2022). The younger age groups believed that they had better immunity, thus no need for vaccination and being exposed to misinformation related to the vaccines resulted in low uptake of the Covid-19 vaccines (Adedeji-Adenola et al., 2022). However, the study included both genders but there were more females compared to males, 63.9% and 36.1% respectively (Adedeji-Adenola et al., 2022).

Moreover, the study's findings highlighted that rural women with more than a grade 12 education were more likely to have taken the Covid-19 vaccine compared to those with no education. Corresponding results were also reported in the rural areas of India where educated women were 1.16 times more likely to be vaccinated compared with people



with no schooling (Shashidhara, Barnhardt, & Mukherjee, 2023). Individuals with lower education levels may be less likely to get vaccinated because they lack information regarding the safety, efficacy of vaccinations and rigid anti-vaccine beliefs (Hudson & Montelpare, 2021). This reveals the importance of education in the uptake of Covid-19 vaccine. Therefore, educational campaigns may be a useful tool for filling up knowledge gaps and dispelling the myths about Covid-19 vaccinations because health knowledge is linked to more positive attitudes regarding vaccinations (Hudson & Montelpare, 2021). Furthermore, single women were less likely to take the Covid – 19 vaccines compared to those who were married in this study. This coincides with a study conducted in the US whereby married women were more likely to be vaccinated compared to single women (Preis, Mahaffey & Lobel, 2023). According to Liu et al, 2023, married women are more desired to protect their children, family and community against Covid-19 and single women are more likely to live in socioeconomically disadvantage neighbourhoods with limited healthcare facilities (Liu et al., 2023).

In addition, this study showed that white women were less likely to take the Covid – 19 vaccines compared to rural black women. This is like the findings of previous South African studies (Kollamparambil, Oyenubi, & Nwosu, 2021, Sewpaul et al.,2023).

Also, it has been observed that rural women in South Africa who possessed a medical aid/insurance were more likely to be vaccinated compared to those who did not have. This is similar to a study conducted in Jamaica which showed that a higher percentage of women who had health insurance coverage were vaccinated compared to those who were not health insured, 66.4% and 33.6% respectively (Pinkney et al., 2023). Similarly, a study in Nigeria reported that respondents who were health-insured had a higher probability of willingness to take Covid-19 vaccines (Oyekale, 2023). Therefore, health insurance is vital in promoting pro-health behaviour by utilizing preventative medical services such as the uptake of vaccines against Covid – 19. However, the South African government is embarking on the National Health Insurance which will provide universal health coverage for all South Africans.

The NHI is a type of a health financing system which will provide access to quality affordable personal health services for all South Africans based on their health needs, irrespective of their socio-economic status (South African Government, 2023). In rural communities of South Africa, access can be a major contributor to non-vaccination with confusion about where to get vaccinated, eligibility for vaccination, and factors associated with the ability to access vaccination sites (Kahn et al., 2022).

Meanwhile, rural women who were not diagnosed with Covid 19 were less likely to receive the vaccine compared to those who were diagnosed. The fear of re-infection and experiencing the harsh symptoms, increases the willingness to take the Covid – 19 vaccines (Centres for Disease Control and Prevention, [CDC], 2023). Nevertheless, there was no association among women who self-rated their health as very good, fair, and poor except those who rated themselves with good health because people with good health assume that their immune system is strong, thus they are less likely to be infected. Nonetheless, in another study an association was observed where the chances of getting vaccination were higher for those with fair or good self-reported health status, however it was performed in both rural and urban areas (Zakar et al., 2022).

Women who did not have hypertension were less likely to be vaccinated against Covid -19 compared to those who had hypertension. This could be due to the women not believing Covid -19 as a threat to their personal health, thus not being vulnerable to the infection whilst those who are diagnosed with hypertension, the potential benefit of the vaccination will increase their willingness towards the Covid-19 vaccine, such as reducing their risk of being infected and preventing severe illness. Amongst those who did not own a cell phone, the women were less likely to receive the Covid-19 vaccine than those who had cell phones and similar results were shown in a study conducted by Zakar et al., 2022, whereby 92.8% of vaccinated respondents had cell phones. This is because different digital strategies were used to encourage people to receive the Covid – 19 vaccines such as sending reminders for first and second doses, vaccine information (adverse effects, benefits, evidence-based facts) and locations where people can be vaccinated (Zakar et al., 2022).

This study is not without its limitations. One of the limitations is that the variables were subject to self-report bias. Also, the study could not establish causation and temporality because of its cross-sectional nature. However, the strength of the study lies in its use of nationally representative data which increased the generalizability of the findings.

## References

1. Adedeji-Adenola, H., Olugbake, O. A., and Adeosun, S. A. (2022). Factors influencing COVID-19 vaccine uptake among adults in Nigeria. *PLoS One*, 17(2), e0264371. Doi:<https://doi.org/10.1371/journal.pone.0264371>
2. Backhaus, A. (2023). Socio-demographic factors associated with COVID-19 vaccine uptake and refusal among Ugandan women. *Globalization and Health*, [online] 19(1), 68. Doi:<https://doi.org/10.1186/s12992-023-00968-z>
3. Bob, U., Munien, S. and Gumede, A. (2022). Gender-based Violence in Rural Areas in South Africa Impacts on Home-based Learning during the Coronavirus Disease 2019 Pandemic. *Alternation Interdisciplinary Journal for the Study of the Arts and Humanities in Southern Africa*, [online] 29(1). doi:<https://doi.org/10.29086/2519-5476/2022/v29n1a16>.
4. Centres for Disease Control and Prevention (2023). Benefits of Getting A COVID-19 Vaccine. [online] <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/vaccine-benefits.html> [Accessed 24 Nov. 2023].
5. Data First. General Household Survey. (2022). <https://www.datafirst.uct.ac.za/dataportal/index.php/catalog/945> (Accessed 25/11/2023)
6. Flor LS, Friedman J, Spencer CN, et al. Quantifying the effects of the COVID-19 pandemic on gender equality on health, social, and economic indicators: a comprehensive review of data from March, 2020, to September, 2021. *Lancet* 2022; published online March 2. [https://doi.org/10.1016/S0140-6736\(22\)00008-3](https://doi.org/10.1016/S0140-6736(22)00008-3).)
7. Haileamlak, A. (2021). The impact of COVID-19 on health and health systems. *Ethiopian journal of health sciences*, [online] 31(6),1073–1074. doi:<https://doi.org/10.4314/ejhs.v31i6.1>.
8. Hudson, A and Montelpare, W. J. (2021). Predictors of vaccine hesitancy: implications for COVID-19 public health messaging. *International journal of environmental research and public health*, [online] 18(15), 8054. Doi:<https://doi.org/10.3390/geriatrics8040069>
9. Kabudula, C.W., Ohene-Kwofie, D. and Wagner, R.G. (2021). *What has changed for rural South African women in the last 25 years*. [online] The Conversation. Available at: <https://theconversation.com/what-has-changed-for-rural-south-african-women-in-the-last-25-years-170040> [Accessed 24 Nov. 2023].
10. Kahn, K., Pettifor, A., Mataboge, P., Kelly, N.K., Mashinini, D.P., Nair, H., Campbell, H, Cohen, C., Gómez-Olivé, F. X and Tollman, S. (2022). COVID-19 vaccine hesitancy in rural South Africa: Deepening understanding to increase uptake and access. *J Glob Health*. [online] 14(12),5013. doi:10.7189/jogh.12.05013. PMID: 35567586; PMCID: PMC9107307.
11. Kollamparambil, U., Oyenubi, A. and Nwosu, C. (2021). COVID19 vaccine intentions in South Africa: health communication strategy to address vaccine hesitancy. *BMC Public Health* 21, 2113. <https://doi.org/10.1186/s12889-021-12196-4>
12. Liu, H., Nowak III, G. R., Wang, J and Luo, Z. (2023). A National Study of Marital Status Differences in Early Uptake of COVID-19 Vaccine among Older Americans. *Geriatrics*, [online] 8(4), 69. Doi:10.3390/geriatrics8040069
13. Mbunge, E. (2020). Effects of COVID-19 in South African health system and society: An explanatory study. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, [online] 14(6),1809–1814. doi:<https://doi.org/10.1016/j.dsx.2020.09.016>.
14. Menendez, C., Gonzalez, R., Donnay, F. and Leke, R.G.F. (2020). Avoiding indirect effects of COVID-19 on maternal and child health. *The Lancet Global Health*, [online] 8(7), 863–864. doi:[https://doi.org/10.1016/s2214-109x\(20\)30239-4](https://doi.org/10.1016/s2214-109x(20)30239-4).
15. Oyekale A. S. (2023). Effect of Health Insurance Uptake on Hesitancy toward COVID-19 Vaccines in Nigeria: A Recursive Bivariate Probit and Decomposition Estimation. *International journal of environmental research and public health*, [online] 20(3), 2566. Doi:<https://doi.org/10.3390/ijerph20032566>
16. Peltzer, K., Phaswana-Mafuya, N. and Pengpid, S. (2019). Rural–urban health disparities among older adults in South Africa. *African Journal of Primary Health Care & Family Medicine*, [online] 11(1). doi:<https://doi.org/10.4102/phcfm.v11i1.1890>.
17. Pinkney, J.A., Bogart, L.M., Carroll, K.N., Bryan, L., Witter, G., Ashour, D., Shebl, F.M., Hurtado, R.M., Goldfarb, I.T., Hyle, E.P., Psaros, C. and Ojikutu, B.O. (2023). Factors Associated With Coronavirus Disease 2019 Vaccine Uptake Among Pregnant Women and Nonpregnant Women of Reproductive Age in Jamaica. *Open Forum Infectious Diseases*, [online] 10(5). doi:<https://doi.org/10.1093/ofid/ofad201>.

18. Preis, H., Mahaffey, B., & Lobel, M. (2023). Factors related to COVID-19 vaccination intention and uptake among childbearing women. *Health Psychology*, [online] 42(8), 567. Doi:<https://doi.org/10.1037/hea0001221>
19. Shashidhara, S., Barnhardt, S. and Mukherjee, S. (2023). COVID-19 Vaccination Status and Hesitancy: Survey Evidence from Rural India. In: I. Gupta and M. Das, eds., Contextualizing the COVID Pandemic in India. [online] India, 225–247. doi:[https://doi.org/10.1007/978-981-99-4906-9\\_11](https://doi.org/10.1007/978-981-99-4906-9_11).
20. Sewpaul R, Sifunda S, Gaida R, Mokhele T, Naidoo I, Reddy SP. (2023). Vaccine hesitancy and related factors among South African adults in 2021: unpacking uncertainty versus unwillingness. *Frontiers in Public Health*, 11. DOI=10.3389/fpubh.2023.1233031
21. South African Government (2012). National Health Insurance | South African Government. [online] [www.gov.za](http://www.gov.za). Available at: <https://www.gov.za/about-government/government-programmes/national-health-insurance-0> [Accessed 3 Dec. 2023].
22. The Lancet (2021). Access to COVID-19 vaccines: looking beyond COVAX. *The Lancet*, [online] 397(10278),941. doi:[https://doi.org/10.1016/s0140-6736\(21\)00617-6](https://doi.org/10.1016/s0140-6736(21)00617-6).
23. World Health Organization (2021a). *Gender and health*. [online] World Health Organization. Available at: <https://www.who.int/news-room/questions-and-answers/item/gender-and-health> [Accessed 23 Nov. 2023].
24. World Health Organization (2021b). *The Impact of COVID-19 on Global Health Goals*. [online] [www.who.int](http://www.who.int). Available at: <https://www.who.int/news-room/spotlight/the-impact-of-covid-19-on-global-health-goals> [Accessed 27 Nov. 2023].
25. World Health Organization (2023). *WHO Coronavirus Disease (COVID-19) Dashboard*. [online] [covid19.who.int](https://covid19.who.int). Available at: <https://covid19.who.int/region/afro/country/za> [Accessed 24 Nov. 2023].
26. Zakar, R., Momina, A. U., Shahzad, S., Hayee, M., Shahzad, R., & Zakar, M. Z. (2022). COVID-19 vaccination hesitancy or acceptance and its associated factors: findings from post-vaccination cross-sectional survey from Punjab Pakistan. *International Journal of Environmental Research and Public Health*, [online] 19(3), 1305. <https://doi.org/10.3390/ijerph19031305>

