WAVE 4

National Income Dynamics Study (NIDS) – Coronavirus Rapid Mobile Survey (CRAM)

COVID-19 vaccine hesitancy in South Africa:

Results from NIDS-CRAM Wave 4

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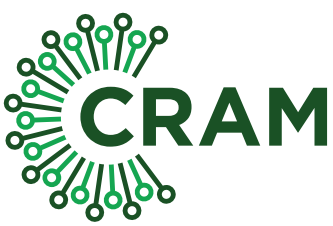
12 May 2021

N.i.D.S.
NATIONAL INCOME DYNAMICS STUDY



COVID-19 vaccine hesitancy in South Africa:

Results from NIDS-CRAM Wave 4[1]

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Abstract

The arrival of vaccines signalled a new era in South Africa's fight against the COVID-19 pandemic, with the focus shifting from containment to eliminating the pandemic. However, given uncertainty about vaccine delivery dates, logistical concerns, and vaccine hesitancy, it looks increasingly unlikely that the virus will be under control by the end of 2021. In this study, we focus on vaccine hesitancy, analysing the recently released NIDS-CRAM wave 4 data that asked respondents about their willingness to be vaccinated, if vaccinations were available. We track reasons for hesitancy as well as correlates with hesitancy. We find that 71% of South African adults say they would get vaccinated if a COVID-19 vaccine was available. Among the 29% of respondents who were vaccine hesitant, the three leading reasons for their hesitancy were that they were worried about the side effects (31%), did not believe it was effective (21%) or did not trust vaccines in general (18%). Encouragingly, those with chronic conditions and the elderly – who are at a higher risk of becoming severely ill or dying if infected with the virus – were more willing than the general population to accept a vaccine. Respondents who said that they trusted social media as a source of information and those under 25 had considerably and significantly higher levels of vaccine hesitancy.

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Executive summary

71% of South African adults say they would get vaccinated if a COVID-19 vaccine was available. In the latest wave of NIDS-CRAM all respondents were asked "If a vaccine for COVID-19 were available, I would get it" and four response options were read aloud: "Strongly agree, somewhat agree, somewhat disagree, and strongly disagree". The 71% willingness figure is made up of two groups: the 55% choosing 'Strongly agree' and the 16% selecting 'Somewhat agree.' Among the 29% who did not agree, 16% strong disagreed, 8% somewhat disagreed, and just under 6% of adults reported that they do not know if they would accept a vaccination. Relative to other countries then, vaccine acceptance is higher than recent estimates from the US and France, but lower than China, Brazil and the UK. The youth and those with only a primary school education were more likely to be vaccine hesitant On the other hand, those who exhibit high mortality risk - those over 60 and those who have a chronic condition (HIV, TB, lung condition, heart condition or diabetes) - are less likely to be vaccine hesitant. Note that after controlling for income, education and other variables race is not a significant predictor of vaccine hesitancy.

Among the 29% of respondents who were vaccine hesitant, the three leading reasons for their hesitancy were that they were worried about the side effects (31%), did not believe it was effective (21%) or did not trust vaccines in general (18%). If respondents were hesitant about getting a vaccine they were asked for reasons why they were hesitant. The vast majority (84%) only cited one reason. Importantly, only 8% of those exhibiting vaccine hesitancy say they are reluctant to get vaccinated because they believe they have a low risk of getting COVID-19.

Our estimate is the highest estimate of vaccine intention for adults in South Africa to date. Two other recent surveys have found similar levels of vaccine intention. The University of Johannesburg (UJ) and Human Sciences Research Council's (HSRC) COVID-19 Democracy survey (Runciman et al., 2021), conducted in December 2020 and January 2021 estimated a vaccine intention rate of 67% amongst South Africans, while the IPSOS-World Economic Forum survey (2021) reported a 64% estimate at the end of February 2021. Caution is needed when comparing NIDS-CRAM estimates to other surveys due to varying sampling strategies and subsequent representivity. Given that the NIDS-CRAM sampling frame was drawn from an existing nationally representative survey (the National Income Dynamics Study) we would argue that the NIDS-CRAM estimates are the most representative vaccine intention results to date.

Those most at risk of COVID-19 (those with chronic conditions and the elderly) were more willing than the general population to accept a vaccine. As predicted by theories such as the health belief model, the Wave 4 data show that increased mortality risk lowered reported vaccine hesitancy. The measures of mortality risk that were significant in the analysis were self-reported chronic conditions and advanced age. After controlling for other factors, those with chronic conditions were seven percentage points less likely to be vaccine hesitant, and those 60 and over were six percentage points less likely. Worryingly, those that are obese or experience hypertension were not more likely to accept a vaccine.

There are social pockets with much higher levels of vaccine hesitancy. For instance, we find significantly higher levels of vaccine hesitancy amongst the youth (18-24 years). Compared to the Christian majority, non-religious respondents, Hindu respondents and African spiritualists were more likely – 10, 31 and 7 percentage points respectively – to say that they would not get a vaccine if it were available. These findings were robust to changes in how socioeconomic status was specified. For subgroups, populations, and regions where hesitancy is higher, additional vaccine promotional efforts would be required. In areas, or for groups, where hesitancy is low and intention is high, it is vital to minimise the time cost of vaccination to make it as easy and burden free as possible.

42% of Afrikaans home language respondents were vaccine hesitant, much higher than the national

average (29%) and significantly higher than 7 of the 11 language groups. For the purpose of targeting we look at mean hesitancy from bivariate analysis. The lowest hesitancy rates were found among Tshivenda (18%) and isiNdebele (19%) respondents, as well as isiXhosa, isiZulu and Sepedi respondents (all 25%). While many of these language groups have overlapping confidence intervals (i.e. their estimates are not statistically significantly different), the difference between Sesotho (35%) and five language groups is also significant (all at the 90% significance level).

Although NIDS-CRAM is not provincially representative, in light of the language results and the predominance of Afrikaans in the Western Cape and Northern Cape, it is also clear that respondents from these provinces had higher vaccine hesitancy on average. Specifically, our bivariate analysis shows that 42% of those respondents in the Western Cape and 41% of those in the Northern Cape were vaccine hesitant compared to 22% of those in Limpopo, 26% of those in the North West and 28% of those in Gauteng. Taken together, these language and provincial results suggest that campaigns targeted at both of these provinces and at Afrikaans' home language speakers is supported by this data. We recommend further community engagement and research to investigate and understand this finding.

We approximate socioeconomic status through four different measures (a poverty index, income quintiles, grant receipt, and recent household hunger), but find no evidence of a strong and monotonic[8] relationship between any measure of socioeconomic status and vaccine hesitancy. We do, however, find evidence of a pathway via education: respondents with only primary schooling or less are more likely to be vaccine hesitant.

In line with what has been reported internationally, individuals who trust social media as an information source were significantly more likely to exhibit vaccine hesitancy. In Wave 1 respondents were asked the following question: “Where do you get information about the Coronavirus that you trust?” Respondents who reported social media as their trusted information source were seven percentage points more likely to be vaccine hesitant. Social media can also, however, be a cost-effective way to spread accurate and updated information directly to users and subpopulations, as we have seen with the government COVID-19 WhatsApp service. Infodemiological and infoveillance methods can be used to monitor fake news, myths and misinformation. This way falsehoods can be flagged and addressed at an early stage.

We also find that reliance on health workers or government information sources as trusted source of information did not predict lower rates of vaccine hesitancy, despite these previously being associated with better adherence to mask wearing and social distancing (Burger et al., 2020). So it is clear that in the past these channels did help to counter misinformation and did play a positive role, but with no current evidence of these channels helping to counter vaccine misinformation and hesitancy, which could be because vaccine information is different or because these information channels have not been deployed as effectively. It would be important to study and document the government's national and provincial efforts to counter vaccine misinformation as anecdotal evidence suggests there has been far less effort from the government to counter misinformation about vaccines compared to efforts about knowledge of COVID-19 symptoms and ways to prevent COVID-19 infection.

Current COVID-19 vaccines are very effective at preventing people from falling ill or being hospitalised with COVID-19, but there is uncertainty regarding the ability of the vaccines to protect people from simply getting infected with or transmitting the virus. As such, continued, widespread adoption of non-pharmaceutical interventions (NPIs) remains crucial during vaccine roll-out. We analyse how the degree of NPI adherence varies by COVID-19 vaccine intentions. We find relatively little variation in self-reported adherence to NPIs across COVID-19 vaccine intentions among South African adults. This implies that policymakers may not need to rely heavily on vaccine beliefs to increase NPI adherence during the evolution of the vaccine roll-out. However, this should be continuously monitored as the adoption of NPIs may wane as the roll-out progresses.

8 Monotonic means that the relationship between the variables is either always increasing or always decreasing.

It is vital to continue to track vaccine hesitancy over time. Much uncertainty about the vaccination plans remains. Hesitancy is dynamic and responds to the shifts that occur regularly when new research on vaccine efficacy is released – especially relating to the COVID-19 variant that was first identified in South Africa. Hesitancy may also respond to COVID-19 outbreaks, vaccine availability and take up, as well as disinformation. Additionally, while the survey results on vaccine hesitancy are useful and can add value, these are stated intentions. Behavioural studies have shown that there may often be a large gap between stated intentions in response to a survey question and the actual choices and behaviour of individuals. We cannot assume that intentions will automatically translate into behaviour, but this gap may narrow with the decrease of uncertainty and fear as the rollout gathers momentum and a growing number of first-hand vaccination experiences can inform and correct misaligned expectations. In wave 5 of NIDS-CRAM we have added a number of additional probes, including open-ended questions, to ensure that we do not only continue to track vaccine hesitancy, but also understand the motivations behind it and with what conviction these beliefs are held.

1. Introduction

Human behaviour plays a central role in determining the effectiveness of biomedical interventions for many health problems globally, and is a key factor that will determine the effectiveness of vaccines in controlling the COVID-19 pandemic. For vaccines to eradicate or control COVID-19, a high percentage of the population must be vaccinated (Anderson et al., 2021; Bartsch et al., 2020). However, studies from many countries worldwide (Sallam, 2021) find that a large proportion of individuals report vaccine hesitancy – concerns or reluctance about the vaccine that affect intention to seek or accept a vaccine once available.

Vaccine hesitancy is complex and influenced by a range of cognitive, psychological, socioeconomic, cultural, social, and environmental factors (Murphy et al., 2021; Sallam, 2021). Large regional differences in vaccine hesitancy underscore both the complexity of the problem and the importance of detailed country-level analyses. Within each setting, it is important that we understand the degree of vaccine hesitancy and the characteristics that determine whether individuals are more likely to be hesitant or more likely to accept a vaccine.

In this paper we use data from a national longitudinal survey in South Africa to (1) determine the proportion of adult individuals who reported hesitancy to a COVID-19 vaccine; (2) identify the main underlying reasons for vaccine hesitancy; (3) determine the characteristics of individuals that are associated with vaccine hesitancy.

In considering COVID-19 vaccine intentions and perceptions it is important to consider the context in which these were observed. Data were collected in February and early March 2021, in the period following the second, and most severe, wave of COVID-19 infections in South Africa: early December 2020 to end January 2021. At the peak of the second wave (second week of January 2021) approximately 20 500 daily new COVID-19 cases were recorded – more than 1.5 times that of the peak of the first wave of infections in mid-July 2020. During December 2020 and January 2021, over 22 000 COVID-19 related deaths were recorded, doubling the total number of deaths attributable to COVID-19 in two months.

A number of important vaccine-related events took place during the period in which our data on COVID-19 vaccine intentions were collected: 2 February to 10 March 2021. On 1 February 2021, South Africa received shipment of one million doses of the Oxford AstraZeneca vaccine. However, just six days later, it was announced that the Oxford–AstraZeneca COVID-19 vaccine did not work well in protecting clinical trial participants from mild or moderate illness caused by the 501.V2 variant (first identified in South Africa), and the vaccination programme in South Africa was put on a hold. On 16 February 2021, South Africa received its first consignment of the Johnson & Johnson vaccine, and on 17 February 2021, the national COVID-19 vaccination programme was officially rolled out to frontline healthcare workers as part of the Sisonke research programme. On the first day of the programme, President Cyril Ramaphosa and Minister of Health Zweli Mkhize received their vaccinations live on camera, and the event was widely publicised. By 5 March 2021, the number of doses administered surpassed 100 000. Following a temporary suspension on 13 April 2021 for a possible link between the Johnson & Johnson vaccine and blood clots, the roll-out resumed on 28 April 2021, with just under 300 000 individuals having been vaccinated by the time of writing. The data analysed in this paper were collected prior to this pause which may affect vaccine intent.

Findings from this paper are relevant for strategies to counter vaccine hesitancy and encourage vaccine uptake. The success of these strategies will be a crucial determinant of the trajectory of the epidemic in South Africa.

2. Data and methodology

Sample

This paper uses representative survey data from Wave 4 from the National Income Dynamics Study: Coronavirus Rapid Mobile Survey (NIDS-CRAM). Waves 1 to 3 were conducted throughout 2020, with Wave 4 being conducted from 2 February to 10 March 2021. The NIDS-CRAM is a broadly representative, individual-level and individual-based telephone series of longitudinal surveys designed as a 'barometer' for assessing the socio-economic impact of the COVID-19 pandemic on South African individuals and households (Spaull et al., 2020). The survey is based on a subsample of adults who were previously surveyed as part of Wave 5 of the National Income Dynamics Study (NIDS) in 2017 (from which we additionally draw information, given the panel nature of the data), and approximately 7 000 individuals were successfully interviewed in Wave 1, 5 700 in Wave 2, 6 130 in Wave 3 (including a top-up sample[9]), and 6 630 in Wave 4.

Measures

The NIDS-CRAM survey instrument includes a wide array of questions on income and employment, sociodemographic characteristics, and household welfare. The health module has questions about COVID-19-related behaviour, including questions about adherence to prevention measures and vaccination hesitancy.[10] Similar to the IPSOS question, respondents were asked to what extent they agree or disagree with the statement that "If a vaccine for COVID-19 were available, I would get it". Four options were read aloud: "Strongly agree, somewhat agree, somewhat disagree, and strongly disagree". We defined vaccination intention to include both those who 'strongly' or 'somewhat' agree with the statement. Conversely, vaccine hesitancy was defined as those who 'strongly' or 'somewhat' disagreed, as well as those who said that they did not know. Respondents who demonstrated vaccine hesitancy and those who did not want to answer the question about vaccine hesitancy were asked a follow-up question to better understand their motivation. "What is the main reason why you would not take a vaccine for COVID-19?" Respondents could list as many reasons as they liked. These reasons include worry about the vaccine's side effects, vaccine efficacy, antagonistic beliefs about vaccines in general, and safety.

Measures of prevention behaviours were derived from an open-ended question asking respondents about their behaviour change. Specifically, the question reads: "Are you behaving differently to protect yourself from the Coronavirus?". All responses were recorded and included, for example, reporting handwashing, wearing a face mask, physical distancing, avoiding large crowds, and staying at home. Interviewers were instructed not to read out any options, but select all applicable items in the order they were reported, and respondents were not limited in the number of behaviours they could report.

We included questions regarding trusted sources of information from NIDS-CRAM Wave 1. Respondents were asked "Where do you get information about the Coronavirus that you trust?" with no options read aloud. In Wave 1, we also asked "Do you have any of these chronic conditions (you don't have to tell us which one): HIV, TB, lung condition, heart condition or diabetes?"

We include information on respondents' biometrics from NIDS Wave 5. The survey captured both their BMI – through two repeated measurements of length and weight – and their blood pressure (BP) through two measurements in the left arm after a five minute rest period using a factory-calibrated

9 In NIDS-CRAM Wave 3, a top-up sample of approximately 1 100 individuals was included to increase the sample size due to attrition across the panel.

10 Because of the NIDS-CRAM sampling design, the sample is regarded as 'broadly' representative of the adult South African population in 2020. Specifically, the weighted NIDS-CRAM estimates are only representative of the outcomes in 2020 of those aged 15 years and older who were surveyed as part of the NIDS in 2017 and were followed up 3 years later.

Omron M7 BP multi-size cuff. These biometrics are useful even though they are three years old: it is exceptional for blood pressure and obesity to decline dramatically and our comparison between 2017 and 2014 NIDS biometrics indicate this. Moreover, chronic disease risk such as cardiac problems and diabetes accumulate over a lifetime, therefore recent obesity and hypertension remain relevant medical knowledge even if the patient may now have lost weight or improved their hypertension control.

Due to concerns about the reliability and bias in the one-shot household income variable (26% of respondents did not report any value), we estimate two alternative proxies to capture differences in socioeconomic status for our sample. We formulate a deprivation and poverty index based on the respondent's 2017 household assets and living circumstances. The list of household assets included ownership of a range of marketable assets, access to a savings account, to clean water, to electricity, and to adequate sanitation. Using multiple correspondence analysis, we extract relative weights for each of these dimensions, and then compile quintiles for the analysis.

We adjust the income variable to infer missing values. We do this in three steps. First, we re-weight observations by generating bracket weights to account for selection into bracket responses, as done in Köhler and Bhorat (2020) and Hill and Köhler (2020) with the NIDS-CRAM Wave 2 data, as well as the Post-Apartheid Labour Market Series (PALMS). Additionally, to address potential bias in the household income variable, we seek to account for selection into bracket responses, outliers, and missing values. These weights are calculated as the inverse of the probability of an actual monetary (Rand) response in a particular bracket in a particular wave multiplied by the sampling weight for each individual. In essence, this process weights up individuals whose reported incomes are in brackets where the proportion of actual monetary responses are lower, relative to brackets where such response is high. Second, outlier values are identified and coded as missing by using the "extreme studentised residuals" approach as advised by Wittenberg (2017). This is done by estimating a Mincerian-style Ordinary Least Squares (OLS) regression of the logarithm of nominal household income on a vector of observable covariates and identifying outliers as those observations with absolute residuals in excess of five. Third, we impute values by estimating and using the within-bracket median response. This process resulted in a significant reduction in the extent of missing values from 26% to 6% of the sample.

Additionally, we also use recent household hunger and whether the respondent received a social grant as alternative indicators of socioeconomic status. While we are aware of the shortcomings of each of these measures individually, we believe that collectively they would cover an important share of the socioeconomic status variation of our sample of respondents.

Analysis

We conducted cross-sectional analyses on aggregate and between-group variation. Unless specified otherwise, estimates are weighted using the relevant sampling weights after accounting for the complex survey design to adjust for non-random non-response and attrition. Also note that the weights included in this analysis differ from previous sampling weights used for the policy reports released with the NIDS-CRAM Wave 1 to Wave 3 analysis. Specifically, we employ the weight which includes the top-up sample to calculate cross-sectional estimates, scaled to the NIDS Wave 5 population total. For more information on the NIDS-CRAM sampling design, see NIDS-CRAM Release Note (2021) and Ingle et al. (2021).

The study employs two-way descriptive analyses as well as a multivariate analysis. The multivariate analysis examines the correlations between vaccine hesitancy and a large number of relevant characteristics of the respondent, including demographic, ethnic, social, and economic dimensions as well as trusted information sources for learning more about COVID-19, and perceptions of infection risk and mortality risk. The analysis examines five different outcome variables: the first is vaccine hesitancy (including all reasons), and the subsequent four are devoted to the four most oft-cited reasons for vaccine hesitancy, namely side effects, ineffectiveness, general opposition

to vaccines, and safety concerns. For the regressions that consider a specific reason for vaccine hesitancy, the y-variable was defined as the intersection between the specific reason and vaccine hesitancy, while it was coded as 0 if either this reason was not cited or the respondent was not reluctant to become vaccinated.

We rely on four variables to proxy differences in socioeconomic status across this sample – income quintiles, poverty and exclusion quintiles, grant receipt, and recent household hunger. Due to multicollinearity and missing values we prefer to not include all four variables in our main model specification, but in the appendix we have included a series of regressions to examine the robustness of the results to the inclusion and exclusion of these socioeconomic proxies. We find no evidence of a strong, monotonic relationship between vaccine intention and socioeconomic status. We only reported results in the findings section of this report if they were robust to the inclusion of various combinations of socio-economic status, as shown by Appendix Table 1. Finally, to accommodate the inclusion of the top-up sample we convert their Wave 1 missing values to zeros and add a binary indicator for the top-up sample.

3. Findings

Vaccine hesitancy

Our weighted estimates in Figure 1 and Table 1 suggest that, at the time of the survey in February and March 2021, 71% of South African adults were willing to get a vaccine for COVID-19 if one were available to them, which means that just under a third expressed unwillingness to be vaccinated. Most of the individuals who expressed willingness to be vaccinated reported feeling strongly about getting the vaccine. That is, 55% and 16% of adults strongly or somewhat agree that they would get one subject to availability, respectively.

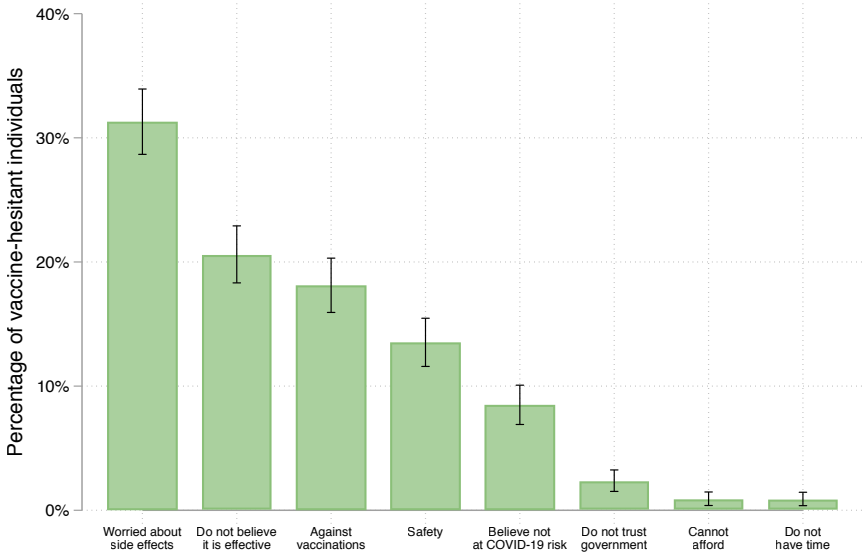
We find that 29% of South African adults are hesitant about vaccines. This includes 16% who strongly disagreed with the statement that they would get a vaccine for COVID-19 if one were available to them, 8% who somewhat disagreed, and just under 6% of adults reporting they do not know if they would accept a vaccination – reflecting a relatively low amount of vaccine uncertainty.

Reasons for vaccine hesitancy

Figure 1 below explores the main reasons why adults exhibit low vaccine intent. The vast majority of individuals who exhibited low vaccine intent only gave one main reason (84%), with 15% of respondents providing two reasons and 1% three reasons. Of those respondents who are hesitant about vaccines, nearly a third (31%) reported being worried about side effects, 21% don't believe they will be effective, 18% do not trust vaccines or report being against vaccines in general, 14% report being afraid or expressed feeling unsure about how safe the new vaccine is. These estimates are statistically significantly different from one another.[11] Just 8% of those exhibiting vaccine hesitancy do not believe they are at risk of getting COVID-19. Comparatively few respondents attributed their vaccine hesitancy to a lack of trust in government (2%), affordability concerns (1%), and a lack of time (1%).

11 All differences between the prevalence of worry about side effects and another vaccine hesitancy reason are statistically significant at the 1% level. The difference between the prevalence of concern regarding effectiveness and safety is significant at the 5% level, and the difference between the prevalence of antagonistic beliefs against vaccines and safety concerns is significant at the 10% level.

Figure 1: Main reasons for COVID-19 vaccine hesitancy, February/March 2021



Authors' own calculations.
Source: NIDS-CRAM Wave 4 (2021).
Notes: [1] Estimates weighted using sampling weights which include the top-up sample, scaled to NIDS Wave 5, after accounting for the complex survey design. [2] Sample restricted to vaccine-hesitant respondents as defined in Section 2. [3] Capped spikes represent 95% confidence intervals.

Although our estimate for vaccine intent amongst South African adults is 71%, this aggregated statistic masks important underlying variation in vaccine intent across different groups. Table 1 below presents our estimates of vaccine intent and main reasons for those exhibiting hesitancy by gender, age, race, and highest level of education. We observe that vaccine intent is statistically higher among men, older individuals, self-reported African/Black individuals, and those with a tertiary education.

By gender, 73% of men but 69% of women are willing to take a vaccine for COVID-19 – a significant difference at the 5% level. The main reasons for vaccine hesitancy do not vary considerably by gender, with a concern about side effects being the most common reason among both hesitant men and women. However, we do observe one exception: concerns around safety, where more than 16% of vaccine-hesitant women cite this as a reason, as opposed to 10% of men (a significant difference at the 10% level). By age, we find that the youth (18–24 years) are significantly more likely to be vaccine-hesitant relative to older individuals. Specifically, just 63% of youth are willing to take a COVID-19 vaccine, as opposed to 72 – 73% of individuals aged 25–59 years and those older than 60 years (a significant difference at the 1% and 5% levels for each group relative to youth, respectively). Reasons for hesitancy again do not vary considerably by age, with the exception of older individuals (60+) exhibiting significantly less antagonistic beliefs regarding vaccines in general (10% versus 19 – 21% of individuals aged 18–24 years and 25–59 years, respectively). By race, we find intent to be highest among African/Black individuals (74%) and lowest among Coloured (58%) and White (65%) individuals (significant at the 1% and 5% levels, respectively),[12] with no notable variation in hesitant beliefs across race groups. Finally, we find that more than 75% of adults with a tertiary education are willing to take a COVID-19 vaccine, as opposed to 69 – 70% of those with less formal education (a significant difference at the 10% level). Although concern regarding side effects remains the most common reason for hesitancy across education groups, we find that those with lower levels of education are less concerned about vaccine efficacy.[13]

12 The estimate for Indian/Asian individuals (58%), although lower, is not statistically different from that of African/Black individuals. This is likely driven by the relatively small sample of these individuals.

13 Differences in these estimates by education group are significant at the 5% level.

Table 1: Between-group variation in vaccine intent and reasons for hesitancy

	Willing to take vaccine (%)		Main reason for those not willing (%)			
			Side effects	Effectiveness	Against vaccines	Safety
Total	**70.8**		**31.3**	**20.6**	**18.1**	**13.5**
Gender						
Male	73.0	**	33.0	22.3	19.7	10.0
Female	68.9		29.9	19.2	16.8	16.4
Age						
18-24	62.9	(base)	33.8	25.5	20.8	12.9
25-59	72.1	***	29.2	19.1	18.6	12.0
60+	72.8	**	40.0	21.0	10.3	24.3
Population group						
African/Black	73.5	(base)	29.9	19.5	20.5	12.9
Coloured	57.6	***	30.2	17.3	17.1	13.1
Indian/Asian	60.7		47.0	22.4	.	10.6
White	64.7	**	36.0	30.6	10.9	18.7
Education						
Up to primary	69.7	(base)	25.1	10.9	16.9	21.5
Up to secondary	69.4		31.3	20.8	21.0	13.7
Complete secondary	68.8		34.7	21.7	20.1	8.0
Tertiary	75.1	*	31.0	24.0	11.4	15.3

Authors' own calculations. Source: NIDS-CRAM Wave 4 (2021).
Notes: [1] Estimates weighted using sampling weights which include the top-up sample, scaled to NIDS Wave 5, after accounting for the complex survey design. [2] Asterixis represent conventional statistically significant differences in means: *** 1% level, ** 5% level, * 10% level.

The relationship between mortality risk and vaccination intention was assessed in Table 2 below using hypertension, self-reported chronic conditions, obesity, and being over 60 years old as indicators of elevated mortality risk. The vaccination intention rates are similar across most conditions, apart from a large gap for hypertension (77% of those with hypertension are willing to take a COVID-19 vaccine, as opposed to 70% of those with normal blood pressure levels – significant at the 5% level) and self-reported chronic conditions (77% of those with any chronic condition and 71% for those without, also significant at the 5% level). We observe slightly higher vaccine intent among adults who are older than 60 years (73%) relative to those younger (71%), but this difference is not statistically different. We also do not observe a significant difference in intent for the obese versus non-obese.

Table 2: COVID-19 vaccine intent and reasons for hesitancy, by mortality risk

	Willing to take vaccine (%)		Main reason for those not willing (%)			
			Side effects	Effectiveness	Against vaccines	Safety
Has any chronic condition						
No	70.5	**	32.0	20.9	19.5	14.4
Yes	76.6		28.2	18.9	16.6	15.2
Over 60 years						
No	70.5		30.1	20.5	18.9	12.3
Yes	73.1		42.2	21.3	11.5	24.2
Obese						
No	71.5		31.2	21.2	19.3	12.4
Yes	70.2		28.7	21.9	18.4	16.2
Hypertensive						
No	70.3	**	31.4	22.3	18.2	12.3
Yes	76.5		24.9	6.4	26.9	24.3

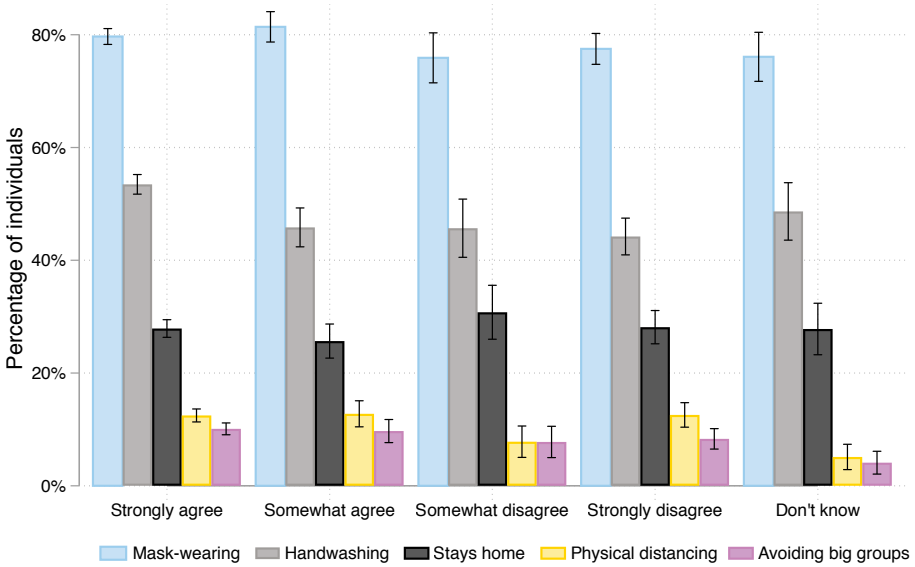
Authors' own calculations. Source: NIDS Wave 5 (2017) and NIDS-CRAM Wave 4 (2021).
Notes: [1] Estimates weighted using sampling weights which include the top-up sample, scaled to NIDS Wave 5, after accounting for the complex survey design. [2] Asterixis represent conventional statistically significant differences in means: *** 1% level, ** 5% level, * 10% level.

Vaccine hesitancy and adherence to NPIs

One continuing unknown with currently approved COVID-19 vaccines is the extent to which they are effective against transmission as opposed to just symptomatic infection. In other words, although the vaccines are effective at preventing people from falling ill or being hospitalised with COVID-19, there is uncertainty regarding the ability of the vaccines to protect people from getting infected with or transmitting the virus. As such, continued, widespread adoption of non-pharmaceutical interventions (NPIs) remains important during vaccine roll-out. NPIs can reduce the rate of infection while a vaccine is targeted to vulnerable population groups, while a premature relaxation of NPIs (before sufficient immunity has been established) likely increases the likelihood of a large wave of infection (Moore et al., 2021). Several epidemiological studies show that vaccination alone is insufficient to contain outbreak, and that early relaxation of NPIs can jeopardise the benefits of vaccines in the short-term (Gozzi et al., 2021; Moore et al., 2021). As expressed by Wells and Galvani (2021), the interplay between NPI compliance, vaccine roll-out, and behavioural dynamics is key to shaping transmission dynamics. In this light, we explore how the degree of NPI adherence varies by COVID-19 vaccine intentions, depicted in Figure 2.

It is plausible to expect a positive correlation between vaccine intent and NPI adherence; individuals who report being willing to get a COVID-19 vaccine may be more likely to adhere to NPIs. Despite this, as shown in Figure 2, we observe relatively little variation in self-reported adherence to preventive behaviours across COVID-19 vaccine intentions among South African adults, at least on aggregate. This indicates that COVID-19 vaccine intentions are not correlated with other behaviours that reduce COVID-19 risk. This is a notable finding, given that risk perceptions are fundamental drivers of behavioral shifts (Wells & Galvani, 2021). Policymakers may not need to rely heavily on vaccine beliefs in particular to increase NPI adherence during the evolution of the vaccine roll-out.

Figure 2: NPI adherence and willingness to get a COVID-19 vaccine, February/March 2021



Authors' own calculations. Source: NIDS-CRAM Wave 4 (2021).
Notes: [1] Estimates weighted using sampling weights which include the top-up sample, scaled to NIDS Wave 5, after accounting for the complex survey design. [2] Capped spikes represent 95% confidence intervals.

Vaccine hesitancy correlates

Appendix Tables 1 to 6 presents tabulations of the relationship between vaccination hesitancy and various individual characteristics and attributes. Appendix Table 1 examines whether vaccination intention varies by demography, home language, and geography. Younger respondents (18–24) are significantly more likely to report vaccine hesitancy than the prime aged respondents (25–59). The prevalence of vaccine hesitancy amongst the young is 37%, but only 28% amongst prime aged respondents. Females have a higher vaccine hesitancy (31%) than males (27%), but this gender gap in vaccine hesitancy is not significant. African/Black respondents tend to have far lower hesitance about vaccines at 27%, while the Coloured population group have higher levels at 42%. This difference is significant – the upper confidence interval of the mean for the African/Black group is below the lower confidence interval of the mean for the Coloured group. The mean difference in vaccine hesitancy of Coloured respondents compared to the overall mean is large at 13 percentage points.

For home language, the Tshivenda speakers have the lowest levels of reluctance at 18%, and the Afrikaans speakers the highest level at 42%. These confidence intervals do not overlap, so it is a significant difference. There are few language groups lying above the 29% mean: Siswati at 30%, English at 34%, Sesotho at 35% and Afrikaans at 41%. Vaccine hesitancy rates amongst Afrikaans speakers were much higher than the national average (29%) and significantly higher than 7 of the 11 language groups at the 10% significance level. The lowest vaccine hesitancy rates were found among Tshivenda (18%) and isiNdebele (19%) respondents, as well as isiXhosa, isiZulu and Sepedi respondents (all 25%). While many of these language groups have overlapping confidence intervals, the difference between Sesotho (35%) and five language groups is also significant at the 10% significance level.

With respect to residential areas, only two types of residential areas have means above the overall mean of 29%: formal residence at 34% and shacks at 32%. The confidence intervals of the category means overlap in all cases, indicating that these differences are not significant. Similarly, only two provinces have means above the overall mean: Western Cape (42%) and Northern Cape (41%). These two provincial means are significantly different from the Limpopo province's 22% mean, but

not from the remainder of the provincial means. Rural residents (27%) have a slightly lower mean for vaccination reluctance than urban residents (30%), but the difference is not significant.

Appendix Table 2 considers vaccine hesitancy, religion, and trust towards others. It shows that there is substantial variation in vaccine hesitancy based on religion. The lowest vaccine hesitancy is amongst Jewish respondents at 20%, while the highest hesitancy is amongst Hindu respondents at 55%. However, because neither of these religions has high prevalence, it is not surprising that the confidence intervals are broad and do overlap, although the overlap is slight. The hesitancy of Hindu respondents is, however, significantly higher than that of Christians (28%) and African traditional spiritualists (30%). There is no monotonic relationship between importance of religion and vaccine hesitancy, nor for trusting others and vaccine hesitancy.

Examining the relationship between vaccine hesitancy and socioeconomic status, we find little evidence that there is a clear, compelling and monotonic relationship (Appendix Table 3). For both the poverty quintiles and the income quintiles there are relatively small differences from the overall mean value, and there is also no linear trend across quintiles. Respondents with tertiary education are less likely to be apprehensive about taking vaccines, with a mean of 25% compared to a 30% and 31% average for lower education levels. The differences are, however, not significant. Similarly, the differences in vaccine hesitancy are not significant for grant recipients or households experiencing recent hunger.

Appendix Table 4 below shows that there are no significant relationships based on risk beliefs. The gap between means is largest for infection risk: respondents who believe that they are at risk of getting COVID-19 have a mean vaccination reluctance of 26%, whereas those who believe that they are not at risk, have a mean of 31%. The differences are, however, not significant. There are also no significant differences between the means of self-efficacy and consistent confidence about low infection risk (across all four waves of the panel). For both these variables, the means were 29%. For self-efficacy, the 'don't know' group had a higher mean of 37%, but the difference was not significant. For those who know someone who has been diagnosed with COVID-19, vaccination hesitancy was lower (27% vs 30% for others), but not significantly so.

Appendix Table 5 considers the relationship between mortality risk and vaccine hesitancy. We find that there is a large difference in the likelihood of hesitancy for the hypertensives (24%) vs others (30%), and the difference was significant. Respondents with chronic conditions had a lower mean vaccine hesitancy (23%) than those without chronic conditions (30%) but this difference was not significant. Respondents who were 60 years and older were less likely to be hesitant towards vaccination (27% vs. 30%), but the difference was not significant. The likelihood of vaccine hesitancy was the same for the obese and the non-obese, the overweight and those who were not overweight (29%).

Appendix Table 6 examines whether the means of reluctant vaccination hesitancy vary by the information sources that respondents rely on for learning more about the pandemic. Respondents could name more than one trusted source of information. The largest gap in means was for social media (36% hesitancy for those who trust social media vs 28% for the rest), but it was not significant.

Vaccine hesitancy regression analysis

The regression analysis in Table 3 shows that there are a number of robust and significant relationships with vaccine hesitancy. Robust here refers to relationships that are significant in not only the specific model shown in Table 3 below, but also in all the models shown in Appendix Table 7. Due to the questions around how to best control for socio-economic variation, we included a number of different measures – poverty index quantiles, income quantiles (based on an adjusted income measure with imputations), grant recipient and recent household hunger in our analysis in Appendix Table 7.

Younger respondents (18–24) are 10 percentage points more likely to be unwilling to accept the vaccination, while those who are 60 and above are 6 percentage points less likely to be unwilling. These are relatively large effects, considering that the mean for this variable lies at 29%, and the regression cut-off is 43%. The effect for the older cohort is likely to be attributable to the higher mortality risk for this age group. Female respondents were more likely to be unwilling to be vaccinated (3 percentage points) and the effect was significant in this regression in Table 3, but not robust to the selection of the specific control for socioeconomic status, as Appendix Table 7 shows.

Respondents with no secondary education ("Up to primary" in the regression table) are 6 percentage points more likely to report that they are unwilling to get a vaccination. The coefficient on tertiary education was negative, also 6 percentage points and significant, as depicted in Table 3, but not robust to the selection of socioeconomic status controls variables for the model.

Sesotho and Setswana home language speakers were respectively 18 and 15 percentage points more likely than Zulu speakers to accept a vaccine, and these differences were significant at the 10% significance level. There were a number of other languages that had significant coefficients in the regressions in this table, including Afrikaans, but they were not robust to the inclusion of other socioeconomic control variables, as shown in Appendix Table 7.

Compared to the Christian majority, non-religious respondents, Hindu respondents and African spiritualists were more likely – 10, 31 and 7 percentage points respectively – to say that they would not get a vaccine if it were available. These findings were robust to changes in how socioeconomic status was specified.

In terms of risk perceptions, we find that thinking that you are likely to get COVID-19 has a negative correlation with vaccine hesitancy. Respondents who thought that they might get COVID-19 were 4 percentage points less likely to report vaccine hesitancy. Respondents who were uncertain about their self-efficacy were more likely to be unwilling to get vaccinated (9 percentage points). Neither of these effects were robust to the selection of socioeconomic proxies included in the regression model.

Mortality risk had a clear and large role. Those with self-reported chronic conditions, and respondents with hypertension (based on two measurements in the 2017 NIDS survey), were respectively 7 and 4 percentage points more likely to be willing to accept the vaccine. Lastly, we find that respondents who cited social media as a trusted information source were 7 percentage points more likely to be unwilling to accept the vaccine. However the significance of the relationship between hypertension and vaccine hesitancy was not robust to the choice of socioeconomic indicators.

Table 3: Linear probability model estimates of vaccine hesitancy

		Vaccine hesitancy				
		Overall	**Side effects**	**Effective**	**Antivax**	**Safety**
Gender	Female	0.034*	0.0043	-0.0045	-0.012	0.025***
Age	18-24	0.10***	0.03	0.040*	0.032**	0.029*
[cf. 25-59]	60+	-0.064**	-0.02	-0.01	-0.02	0.00033
Population group	Coloured	-0.023	0.03	-0.071	-0.015	-0.04
[cf. Black Africa]	Asian/Indian	-0.12	-0.059	-0.21**	-0.027	-0.12
	White	-0.039	0.069	-0.073	-0.0054	-0.017
Language	IsiNdebele	-0.1	0.024	-0.019	-0.012	-0.022*
[cf.Zulu]	IsiXhosa	-0.012	-0.046*	0.026	0.015	0.003
	Sepedi	0.10*	0.043	0.046*	0.0042	-0.0082
	Sesotho	0.18***	0.049	0.055**	-0.011	0.033
	Setswana	0.15**	0.032	0.081**	0.015	-0.012
	SiSwati	0.0018	-0.008	0.015	-0.031	-0.01
	Tshivenda	0.18	0.19*	0.044*	-0.026	-0.016
	Xitsonga	0.14**	0.071**	0.063**	-0.042*	-0.017
	Afrikaans	0.23**	0.0033	0.11*	-0.021	0.059
	English	0.15	0.089	0.11*	-0.043	0.071
	Other	0.68***	0.91***	1.08***	-0.02	-0.11***
Religion	Not religious	0.096**	0.018	-0.0085	0.023	0.0045
[cf.Christian]	Jewish	-0.071	-0.015	-0.065***	-0.0063	-0.014
	Muslim	-0.053	-0.11***	0.12	0.073	0.15
	Hindu	0.31***	0.13	0.36***	0.024	0.13
	African traditional	0.070**	0.0072	0.026	-0.0047	-0.0026
	Other	-0.0073	-0.0081	0.0013	0.016	-0.037***
Importance of religion	Unimportant	-0.023	0.013	0.0033	0.018	0.0018
[cf. Very unimportant]	Important	0.024	0.024	-0.0011	0.004	-0.0019
	Very important	0.026	0.016	0.0048	0.03	0.00094

Education	Up to Primary	0.059*	-0.0071	-0.0093	-0.0096	0.030**
[cf. Completed Secondary]	Up to Secondary	0.014	0.007	0.002	-0.005	0.024***
	Tertiary	-0.062**	-0.037**	-0.012	-0.020*	0.011
Quantiles of poverty and exclusion	Q2	-0.024	-0.011	-0.039*	0.033*	0.013
[cf. Q1]	Q3	-0.0022	0.012	-0.065***	0.033	0.025**
	Q4	-0.037	-0.017	-0.049**	0.022	0.0084
	Q5	-0.0089	-0.013	-0.043	0.018	0.022*
Hunger	Recent household hunger	-0.038	-0.014	-0.028***	0.0054	-0.020**
Residential area	Formal residential	-0.0088	0.017	0.022	0.038*	-0.017
[cf. Township]	Shack	0.02	-0.0072	0.016	0.0069	0.004
	Peri-urban	-0.046	-0.0061	0.032*	0.030*	-0.011
	Traditional	-0.042	-0.016	0.0084	0.038**	-0.0099
	Farm/small holding	-0.016	-0.011	0.035	0.036	-0.015
	Rural other	-0.011	0.0029	0.023	0.021	-0.021*
Infection risk	Likely get COVID-19	-0.040**	-0.018	0.0038	-0.016**	-0.014
[cf. Unlikely to get COVID-19]	Don't know if likely to get COVID-19	0.015	-0.021	0.0015	-0.022*	0.014
Self-efficacy	Can avoid COVID-19	0.0044	-0.015	0.01	0.014	0.00019
[cf. Cannot avoid getting COVID-19]	Don't know if can avoid COVID-19	0.088*	-0.02	-0.018	0.0061	-0.023
Mortality risk	Self-reported chronic conditions	-0.068***	-0.007	-0.008	-0.014	-0.015*
	Overweight	0.022	-0.026*	-0.015	0.025*	0.025*
	Obese	0.0093	0.029*	0.016	0.00046	-0.015
	Hypertension	-0.038*	-0.021*	-0.040***	0.0086	0.01
Trusted information sources	Social media	0.069**	0.022	-0.0042	0.025	0.021
	Community leader	-0.077	-0.02	0.04	-0.0092	-0.02

Constant	**0.43****	**0.25****	**0.11**	**-0.034**	**0.0093**
Observations	**4928**	**4558**	**4558**	**4558**	**4558**
R-squared	**0.10**	**0.08**	**0.08**	**0.07**	**0.06**

Authors' own calculations. Source: NIDS Wave 5 (2017) and NIDS-CRAM Waves 1 (2020) and 4 (2021).
Notes: [1] All estimates weighted using relevant sampling weights after accounting for complex survey design. [2] Although not shown here, the set of regressions includes controls for districts and dummies for the top-up sample who were not asked the Wave 1 questions about trusted information sources and chronic conditions. [3] Asterixis represent conventional statistically significant differences in means: *** 1% level, ** 5% level, * 10% level.

Discussion

Using recently collected data from Wave 4 of the National Income Dynamics Study: Coronavirus Rapid Mobile Survey (NIDS-CRAM), we have described the extent of COVID-19 vaccine hesitancy in South Africa as of early 2021 and characterised the sociodemographic correlates of vaccine hesitancy. Our analysis shows that 29% of South African adults did not agree with the statement that they would get a vaccine if it became available.

Our estimated willingness to accept the vaccine among adults in South Africa is consistent with results from other surveys, including UJ-HSRC's estimate of 67% in December 2020 and January 2021 in a large urban sample of more than 10 000 respondents (Runciman et al., 2021), but notably higher than the 64% estimated IPSOS and the World Economic Forum (WEF) in February 2021 (a smaller, urban, more affluent and educated sample; see Appendix 3). Compared to other countries globally, South Africa had lower vaccine intention and higher hesitancy in February 2021 than all but two of the 15 countries surveyed (See Figure A3.2 in Appendix 3).

The implications of having a third of the population expressing unwillingness to be vaccinated require further attention. The community immunity threshold for SARS-CoV-2 is likely to be considerably higher than for other countries due to the lower efficacy of the vaccine against our dominant viral strain, with initial estimates suggesting thresholds in the region of 70-80 (Karim, 2021). This means that a substantial majority of South Africans will either need to be vaccinated or rendered immune through prior disease in order to halt community transmission. We know from prior studies of intentions or stated preferences that there are often large gaps between intentions and behaviour (DiBonaventura & Chapman, 2005, Bowyer et al., 2014) this suggests that the 70% stated willingness to get the vaccine may be an upper bound for the proportion that eventually accept the vaccine.

Specific concerns driving vaccine hesitancy that were frequently cited by South African respondents in the NIDS-CRAM survey included concerns about side effects and safety, disbelief about vaccine efficacy, and belief that the vaccine is not necessary or that the respondent is not at risk for COVID. Less frequently mentioned were issues of trust in government, concerns about cost, or not having time. Side effects (Arce et al., 2021), safety, and effectiveness concerns have also been documented as frequent sources of hesitancy in similar survey efforts in the US (KFF Monitor, 2021), Spain (Eguia et al., 2021), the United Kingdom (Robertson et al., 2021), among other countries.

COVID-19 vaccine intentions were not correlated with preventative behaviours that reduce COVID-19 risk, providing some tentative reassurance that there are not at this stage steep trade-offs between vaccine intentions and adherence to preventive behaviour.

The analysis shows that in line with findings elsewhere (Robinson et al., 2021), the young tend to be more prone to vaccine hesitancy. Whereas previous studies found that females were significantly more hesitant (Arce et al., 2021), our analysis did not find robustly significant gender differences.

We find no evidence of a strong and reliably monotonic relationship between vaccine hesitancy and socioeconomic status as captured by a poverty index, income quintiles, grant receipt and recent household hunger. The findings are aligned with earlier findings for South Africa (UJ-HSRC study as reported in Runciman et al., 2021), but stand in contrast to two US studies that found that higher SES respondents were more likely to accept vaccinations (Ruiz & Bell, 2021; Khubchandani, et al., 2021). There is, however, evidence of a role for education: respondents with only primary schooling are more likely to be vaccine hesitant. This is in contrast to the UJ-HSRC (Runciman et al., 2021) study which reported significantly lower vaccine intention for those with tertiary education.

For the purposes of targeting, there is a rationale to consider mean vaccine hesitancy from the bivariate analysis. We find that 42% of Afrikaans home language respondents were vaccine hesitant, much higher than the national average (29%) and if we use a 90% significance threshold, the mean for Afrikaans speakers are significantly higher than 7 of the 11 language groups. Although NIDS-CRAM is not provincially representative, in light of the language results and the predominance of Afrikaans in the Western Cape and Northern Cape, it is also clear that respondents from these provinces had higher vaccine hesitancy on average. Specifically, our bivariate analysis shows that 42% of those respondents in the Western Cape and 41% of those in the Northern Cape were vaccine hesitant compared to 22% of those in Limpopo, 26% of those in the North West and 28% of those in Gauteng. Taken together, these language and provincial results suggest that campaigns targeted at both of these provinces and at Afrikaans' home language speakers is supported by this data. We recommend further community engagement and research to investigate and understand this finding.

There is frequent reference in the literature to the important relationship between trust, and specifically lack of trust in government, and vaccine hesitancy (Sallam, 2021). We do not have any questions on trust in government in our data, but we could include two variables on trust in others. The analysis indicates that trust in others were not correlated with vaccine hesitancy.

Importantly, respondents who described social media as a trusted information source were more likely to be hesitant about vaccines. It would be important to study and document the government's national and provincial efforts to date as anecdotal evidence suggests there has been far less effort from the government to counter misinformation about vaccines compared to efforts about knowledge of COVID-19 symptoms and ways to prevent COVID-19 infection. Such a discrepancy could help explain why we do find that those who trust information from health workers and government knew more COVID-19 knowledge and more often wore masks and kept a safe distance, while they did not have significantly lower levels of COVID-19 vaccine hesitancy (Burger et al., 2020).

As predicted by theories such as the health belief model, we find that mortality risk lowered reported vaccine hesitancy. The measures of mortality risk that were significant in the regression were self-reported chronic conditions and advanced age. It is difficult to compare these findings as we could not find any studies that included self-reported chronic conditions. Studies including old age tend to show a positive and significant relationship with vaccination intention (Salmon et al., 2021; Lazarus et al., 2021). While it is encouraging that patients with higher mortality risk are less likely to be hesitant about COVID-19 vaccinations, it remains concerning that we do not see a significantly lower coefficient for vaccine hesitancy for obese respondents and a more robust relationship with hypertension.

Limitations

We note the limitations of our study, especially in terms of reported behaviour and stated intentions. Our open-ended question about preventive behaviours tracks adherence to specific preventive measures in a binary way, without reflecting the frequency or fidelity of preventive behaviour (e.g. how often masks are worn, or whether they are worn properly). Also, we acknowledge that reporting bias due to social desirability bias may affect our findings. Finally, we are aware that our survey questions on vaccine hesitancy reflect a stated intention, and the literature has shown substantial gaps between stated intentions and realised decisions.

Policy recommendations

- Counter falsehoods via social media. Our study shows that trusting social media as an information source significantly increases the likelihood of vaccine hesitancy. While social media has often been demonised as a negative influence and channel for spreading conspiracy theories, it can also be a cost-effective way to convey accurate and updated information directly to targeted subpopulations – as we have seen with the government COVID-19 WhatsApp and SMS services. Infodemiological and infoveillance methods can be used to monitor fake news, myths and misinformation, and to flag and address disinformation quickly. Messages disseminated via social media to counter misinformation should also be incorporated into other platforms, such as government communication channels, newspapers, and television, to increase the intensity of the messaging and to ensure maximum reach (Hoffman et al., 2021).
- Target messages and other interventions to specific social and age groups. These clear differences in hesitancy levels between social groups show that there may be room for targeted approaches, for Afrikaans speakers but especially for the youth. Messaging must be on a platform favoured by the youth, e.g. TikTok, using language and visuals they understand and accept. For subgroups, populations, and regions where hesitancy is higher, additional intensive vaccine promotional efforts will be required. It is recommended that messages are developed in collaboration with key actors of local geographical areas and subgroups to ensure that messages are delivered appropriately and have maximum impact.
- Pilot and evaluate behavioural nudges. Given that we are initiating our large-scale vaccination roll-out much later than other countries, we can learn from their successes and failures.
    - Minimise hassle factors and time costs that can drive intention-behaviour gaps. The steps to identify vaccine availability, make an appointment, and attend a clinic should be as low-barrier and frictionless as possible. This requires effective communication with the public. The latter must be matched with system efficiencies in order to ensure that expectations regarding the vaccine services provided is matched with what the services deliver (Volpp et al., 2020; Bloomberg Philanthropies, 2021).
    - Provide opportunities to pre-commit to getting a vaccine through pre-registration portals or sign-ups. This also gives people an action to take before the vaccine is widely available (Volpp et al., 2020).
    - Foreground the social benefits of the vaccine by highlighting how it can fast-track economic recovery, including jobs, and greater stability (Dzinamarira et al., 2021; WHO, 2020).
    - Leverage loss aversion in communications, focusing on possible regret if people miss the opportunity to be vaccinated. In particular, messaging that a vaccine dose has been "reserved for you" invokes scarcity, loss aversion and reciprocity (Milkman et al., 2021).
    - For two-dose regimens, use evidence-based default scheduling and reminder messages to maximise second dose completion (Milkman et al., 2021).
    - Increase visibility of pro-vaccination social norms by purposeful selection of central sites for vaccination centres and providing ways for people to show that they have been vaccinated (WHO, 2020).
- Solicit and promote endorsements from trusted community members, social media influencers, traditional healers, traditional leaders and religious leaders (WHO 2020; Volpp et al., 2020; Bloomberg Philanthropies, 2021)
- Track vaccine hesitancy over time. Due to uncertainty surrounding the vaccination plan and the shifts that occur regularly when new research on vaccine efficacy is released – especially relating to the variant first identified in South Africa – hesitancy is dynamic and will likely respond to COVID-19 outbreaks and to vaccine availability and take up, as well as to news and disinformation. More importantly, while the survey results on vaccine hesitancy are useful and can add value, these are stated intentions and behavioural studies have shown that there may often be a large gap between stated intentions in a survey question and the actual choices

and behaviour of individuals. We cannot assume that intentions will automatically translate into behaviour.

- In our tracking of vaccine hesitancy it is important to structure the choice set on vaccine intentions questions to allow people to record intentions including “wait and see” or “no but I might change my mind” rather than a definite “no”.
- Ask people “what’s your why?” for getting vaccinated as a way to increase intention.

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Appendix

Appendix Table 1: Vaccination hesitancy by age, gender, population group, home language and geography

	Mean	LowerCI	UpperCI
Age			
18-24	0.371	0.316	0.427
25-59	0.279	0.252	0.306
60+	0.272	0.224	0.321
Gender			
Male	0.27	0.238	0.302
Female	0.311	0.285	0.338
Population group			
African/Black	0.265	0.243	0.287
Coloured	0.424	0.323	0.524
Asian/Indian	0.393	0.192	0.594
White	0.353	0.268	0.437
Home language (2017)			
IsiNdebele	0.188	0.099	0.277
IsiXhosa	0.248	0.202	0.295
IsiZulu	0.248	0.203	0.293
Sepedi	0.253	0.196	0.309
Sesotho	0.345	0.285	0.405
Setswana	0.295	0.229	0.36
SiSwati	0.299	0.204	0.395
Tshivenda	0.181	0.068	0.293
IsiTsonga	0.28	0.21	0.351
Afrikaans	0.421	0.349	0.492
English	0.32	0.217	0.422
Residential area			
Formal residential	0.343	0.286	0.4
Township	0.272	0.23	0.314
Shack	0.32	0.243	0.398
Peri-urban	0.266	0.223	0.31
Traditional	0.25	0.198	0.302
Farm/small holding	0.285	0.21	0.361
Rural other	0.289	0.229	0.349

Province			
Western Cape	0.416	0.327	0.504
Eastern Cape	0.277	0.226	0.327
Northern Cape	0.406	0.307	0.506
Free State	0.284	0.232	0.336
KwaZulu-Natal	0.28	0.236	0.323
North West	0.257	0.193	0.321
Gauteng	0.276	0.222	0.33
Mpumalanga	0.292	0.241	0.342
Limpopo	0.221	0.176	0.267
Urban vs rural resident			
Rural resident	0.27	0.234	0.306
Urban resident	0.299	0.27	0.328

Appendix Table 2: Vaccination hesitancy by religion and level of trust in others

	Mean	LowerCI	UpperCI
What religion are you?			
Not religious	0.328	0.257	0.399
Christian	0.282	0.258	0.306
Jewish	0.202	0.01	0.395
Muslim	0.323	0.158	0.488
Hindu	0.551	0.376	0.725
African traditional spiritual beliefs	0.296	0.212	0.379
Other	0.237	0.019	0.455
How important are religious activities in your life?			
Not important at all	0.304	0.221	0.388
Unimportant	0.241	0.147	0.335
Important	0.284	0.251	0.318
Very important	0.297	0.265	0.329
How much do you trust other South Africans?			
1	0.286	0.232	0.341
2	0.237	0.182	0.292
3	0.273	0.218	0.328
4	0.282	0.237	0.326
5	0.348	0.298	0.398
6	0.289	0.234	0.344
7	0.273	0.18	0.366
8	0.266	0.18	0.352
How much do you trust other people you know?			
Not at all	0.316	0.252	0.38
Just a little	0.261	0.229	0.294
I trust them somewhat	0.316	0.275	0.356
I trust them a lot	0.249	0.194	0.304

Appendix Table 3: Vaccination hesitancy by socioeconomic status

	Mean	LowerCI	UpperCI
Poverty and exclusion quintiles			
Q1	0.292	0.242	0.343
Q2	0.327	0.278	0.377
Q3	0.307	0.254	0.36
Q4	0.25	0.214	0.286
Q5	0.284	0.243	0.326
Income quintiles			
Q1	0.293	0.248	0.337
Q2	0.345	0.3	0.391
Q3	0.248	0.208	0.287
Q4	0.272	0.231	0.314
Q5	0.256	0.184	0.328
Highest education level completed			
Up to Primary	0.303	0.252	0.354
Up to Secondary	0.306	0.268	0.344
Matric	0.312	0.271	0.354
Tertiary	0.249	0.21	0.288
Respondent receives a social grant			
Not grant recipient	0.288	0.26	0.317
Grant recipient	0.297	0.264	0.329
In last 7 days, has anyone in the household gone hungry			
No recent household hunger	0.295	0.269	0.32
Recent household hunger	0.265	0.225	0.305

Appendix Table 4: Vaccination hesitancy by risk perceptions

	Mean	LowerCI	UpperCI
Infection risk (Likelihood to get COVID-19)			
Yes	0.263	0.228	0.298
No	0.314	0.284	0.343
Don't know	0.298	0.235	0.362
Self-efficacy (Believe can avoid getting COVID-19)			
Yes	0.288	0.264	0.312
No	0.291	0.233	0.349
Don't know	0.369	0.27	0.469
Consistently confident about low infection risk			
Yes	0.29	0.243	0.337
No	0.286	0.254	0.319
Know someone who contracted COVID-19			
Yes	0.27	0.24	0.31
No	0.30	0.28	0.33

Appendix Table 5: Vaccination hesitancy by mortality risk

	Mean	LowerCI	UpperCI
Hypertension			
0	0.301	0.276	0.327
1	0.235	0.194	0.277
Chronic condition			
0	0.295	0.266	0.324
1	0.234	0.192	0.276
60 years and older			
0	0.295	0.27	0.321
1	0.272	0.224	0.321
Obese			
0	0.285	0.257	0.312
1	0.298	0.263	0.333
Overweight			
0	0.286	0.256	0.317
1	0.29	0.261	0.319

Appendix Table 6: Vaccination hesitancy by trusted sources of information

	Mean	LowerCI	UpperCI
News media identified as trusted source of information			
0	0.306	0.27	0.342
1	0.285	0.256	0.314
Health workers identified as trusted source of information			
0	0.294	0.269	0.32
1	0.261	0.21	0.311
Community leaders identified as trusted source of information			
0	0.29	0.267	0.314
1	0.333	0.202	0.463
Acquaintances identified as trusted source of information			
0	0.294	0.271	0.318
1	0.214	0.108	0.319
Social media identified as trusted source of information			
0	0.283	0.259	0.307
1	0.361	0.296	0.425

Appendix Table 7: Robustness of results to specification of SES measure

		(1)	(2)	(3)	(4)	(5)
Gender	Female	0.026	0.028	0.012	0.013	0.019
Age	18-24	0.098***	0.099***	0.082**	0.081**	0.085**
[cf. 25-59]	60+	-0.066**	-0.068**	-0.057*	-0.058*	-0.054*
Population group	Coloured	-0.024	-0.026	0.0082	0.0082	0.012
[cf. Black Africa]	Asian/Indian	-0.12	-0.12	-0.097	-0.11	-0.1
	White	-0.036	-0.041	-0.018	-0.02	-0.019
Language	IsiNdebele	-0.11*	-0.12*	-0.14**	-0.14**	-0.13*
[cf.Zulu]	IsiXhosa	-0.026	-0.027	-0.061	-0.06	-0.046
	Sepedi	0.09	0.092	0.074	0.077	0.084
	Sesotho	0.16***	0.16***	0.15**	0.15**	0.17***
	Setswana	0.13**	0.13**	0.13**	0.13**	0.14**
	SiSwati	-0.0074	-0.0053	-0.032	-0.03	-0.024
	Tshivenda	0.17	0.17	0.12	0.13	0.13
	IsiTsonga	0.13**	0.13**	0.062	0.067	0.073
	Afrikaans	0.22*	0.21*	0.16	0.15	0.16
	English	0.14	0.14	0.091	0.085	0.098
	Other	0.68***	0.67***	0.66***	0.65***	0.65***
Religion	Not religious	0.096**	0.096**	0.096**	0.097**	0.094**
[cf.Christian]	Jewish	-0.077	-0.072	-0.048	-0.04	-0.028
	Muslim	-0.052	-0.053	-0.021	-0.019	-0.018
	Hindu	0.29***	0.30***	0.32***	0.32***	0.34***
	African traditional	0.063*	0.066*	0.054	0.057*	0.061*
	Other	-0.012	-0.0082	0.000017	0.0022	0.0022
Importance of religion	Unimportant	-0.027	-0.029	-0.069	-0.069	-0.064
[cf. Very unimportant]	Important	0.022	0.021	-0.0037	-0.0033	-0.0025
	Very important	0.028	0.027	0.0094	0.0093	0.0075
Education	Up to Primary	0.059*	0.059*	0.061*	0.061*	0.063*
[cf. Completed Secondary]	Up to Secondary	0.012	0.013	0.0099	0.01	0.011
	Tertiary	-0.055*	-0.058*	-0.037	-0.04	-0.044

Residential area	Formal residential	-0.0057	-0.0054	0.023	0.024	0.022
[cf. Township]	Shack	0.017	0.024	0.018	0.025	0.022
	Peri-urban	-0.035	-0.03	-0.027	-0.024	-0.038
	Traditional	-0.045	-0.037	-0.036	-0.027	-0.032
	Farm/small holding	-0.022	-0.014	-0.021	-0.013	-0.014
	Rural other	-0.0059	-0.004	0.015	0.016	0.0094
Infection risk	Likely to get COVID-19	-0.045**	-0.046**	-0.033	-0.034	-0.028
[cf. Not likely to get COVID-19]	Don't know get COVID-19	0.01	0.009	0.012	0.011	0.016
Self-efficacy	Can avoid COVID-19	0.0044	0.003	0.0063	0.004	0.0064
[cf. Don't think can avoid COVID-19]	Don't know if can avoid COVID-19	0.085*	0.083	0.078	0.074	0.081
Mortality risk	Self-reported chronic conditions	-0.073***	-0.074***	-0.077***	-0.078***	-0.072***
	Overweight	0.027	0.026	0.022	0.022	0.018
	Obese	0.011	0.0097	0.012	0.0099	0.0094
	Hypertension	-0.033	-0.032	-0.033	-0.033	-0.038*
Trusted information sources	Social media	0.083**	0.083**	0.087**	0.086**	0.073**
	Community leader	-0.086	-0.084	-0.083	-0.081	-0.073
Poverty and exclusion	Q2		-0.014		-0.0017	-0.011
[cf. Q1]	Q3		-0.0066		-0.01	-0.0047
	Q4		-0.042		-0.047	-0.04
	Q5		-0.016		-0.003	0.0053
Income	Q2			0.0011	0.0021	-0.008
[cf. Q1]	Q3			-0.080***	-0.081***	-0.083***
	Q4			-0.069***	-0.070***	-0.073***
	Q5			-0.083*	-0.087*	-0.086*
Grant	Respondent received a grant					0.0022
Hunger	Recent household hunger					-0.046*
Constant		**0.44****	**0.45****	**0.49****	**0.50****	**0.49****
Observations		**4939**	**4939**	**4657**	**4657**	**4644**
R-squared		**0.1**	**0.1**	**0.1**	**0.1**	**0.11**

Although not shown here, the set of regressions includes controls for districts, and dummies for the top-up sample who were not asked the Wave 1 questions about trusted information sources and chronic conditions.

Appendix 2: Timeline tracking decisions and information about vaccine rollout

- A media release on 4 December 2020 announced that the Ministerial Advisory Committee on COVID-19 Vaccines recommends participation in the COVAX Facility as a means to gain access to vaccines rapidly to vaccinate at least 10% of South Africa's population.
    - AstraZeneca was one of the vaccines identified to be distributed through this facility.
    - At this point, no application for vaccine approval had been made with the South African Health Products Regulatory Authority (SAHPRA).
    - South Africa was set to receive the first batch of vaccines in the second quarter of 2021.
    - Candidate vaccines in South Africa were those produced by AstraZeneca, Novavax, Johnson & Johnson (J&J), and Pfizer/ BioNTech.
- In a presentation at the Portfolio Committee meeting on Health on 7 January, AtraZeneca was identified as one of the vaccines that was in the advanced stages of study. It showed an efficacy level of 70%, and it required two doses. This was one of 11 vaccines that were being considered, and had established immunogenicity
- On 7 January 2021, the minister of health announced that South Africa would be receiving 1 million doses of the AstraZeneca vaccine in January and another 500 000 in February. Health care workers would be prioritised as part of the vaccine roll out strategy.
    - The acquisition of the AstraZeneca vaccine was done directly by the department of health, and not through COVAX. It was procured from the Serum Institute in India.
- The large-scale AstraZeneca studies showed 70% efficacy against mild/moderate infection, but the small scale South African study (including 2000 individuals with an average age of 31) showed minimal protection for mild/moderate infection in South Africa (Madhi, et al, 2021), where a new virus variant in South Africa was identified in November 2020.
    - The results of the small-scale study were released on 7 February 2021.
    - The study could not provide evidence about the protection offered against severe infection and hospitalisation as none of the more than 2000 (mainly healthy and young) patients in the study died or were hospitalised.
    - This lack of evidence on protection against severe illness is what led to the decision to halt the roll-out of the AstraZeneca vaccine.
- The initial plan proposed by the Ministerial Advisory Committee on COVID-19 was a two-step roll out plan of the AstraZeneca vaccine.
    - The plan would include 100 000 healthcare workers, and carefully monitoring hospitalisation rate of patients with the vaccine.
    - If the hospitalisation rate was below a set threshold, the vaccine would be administered to the rest of the healthcare workers
    - If the rate was above the threshold, the plan would provide severely ill patients with a 'booster' shot or a different vaccine from a different manufacturer J&J or Pfizer.
    - The study proposed by the Advisory committee was never carried out.
- The decision to halt the use of the AstraZeneca vaccine was due specifically to the low efficacy of the vaccine against the South African variant, coupled with general challenges of the vaccine such as the lack of safety data for the elderly.
    - There were concerns from the advisory committee regarding the expiry date of the AstraZeneca vaccine and when South Africa would be able to complete their trial (two-step roll-out plan).

- At the time the vaccine was imported into South Africa, it showed end of April 2021 as the expiry date, which effectively means that it would have expired within two months' time at the point in time when the decision was made.
- Government therefore decided to offer their AstraZeneca vaccine doses to the African Union.

- On 17 February 2021 South Africa started its phase one Covid-19 vaccine roll-out plan, using 80 000 doses received from Johnson & Johnson pharmaceuticals.
- The three-phase roll-out plan initiated by the South African government has specific objectives as outlined below:
- The **first phase** is the one which is currently in progress, which has prioritised an estimated 1.25 million frontline healthcare workers. These individuals will be vaccinated at district-level public and private hospitals.
- The **second phase** aims to vaccinate approximately 16 million individuals. This includes essential workers, persons in congregate settings, people over the age of 60 and people over the age of 18 with co-morbidities.
- The **third phase** will involve vaccinating the remaining adult population of approximately 22.5 million people.
- Pregnant and/or breastfeeding mothers are exempt from getting the vaccine, but may do so if they choose.

Procured vaccines

- South Africa has procured **31million J&J doses.**
  - 1.1 million doses of these vaccines will become available between 22–24 April.
  - This batch will be produced locally by Aspen pharmaceuticals – a South African based company contracted by J&J to pack and fill some of its jabs.
  - An advantage outlined for locally produced vaccines, is that it will shorten the dispatch from the plant and delivery to the vaccination centre.
  - South Africa expects 900 000 doses in May, 900 000 in June and 9 million in July.
  - J&J has a 64% efficacy rate at preventing the more contagious South African variant (Zhang & Hefter, 2021).
- **20 million of the** Pfizer **doses** have been procured through a bilateral agreement between government and Pfizer.
  - 5.5 million will arrive between April to June and 1.25 million from COVAX.
- The Pfizer vaccine has been shown to have 100% efficacy against symptomatic COVID cases in South Africa (where the 501Y.V2 variant is dominant).
- The administration of these vaccines will be a challenge for South Africa:
  - **Two doses of this vaccine** will be required.
  - It has **strict storage requirements.** The vaccine needs be kept at a temperature of **-70 degree Celsius** (cf. storage temperature of the J&J vaccine between 2 and 8 degrees Celsius).
  - There are, however, new options, including that it can be stored in the shipping containers using dry ice for up to a month and new research by the FDA has shown that it can be stored for up to two weeks at temperatures between -15 degrees Celsius and -25 degrees Celsius.
  - The Pfizer vaccines will expire within six months.
- There is still uncertainty about how the period over which vaccines will provide immunity, but data suggest that it will be at least six to eight months.

Timelines for vaccine rollout

- The first phase of the vaccination roll-out plan is set to end on 17 May 2021, which is when the mass rollout campaign is set to begin.
- The second phase is anticipated to go on for six months and will run until October 2021.
- It is debatable whether or not South Africa will meet their vaccination targets in each phase within their targeted time-frames.
    - The J&J vaccine alone was registered and approved by SAHPRA on 30 March 2021 for general use. Its first administration to healthcare workers and the president of South Africa was under the Sisonke implementation study (trial conditions), using them as part of the study.
    - Due to Pfizer's storage requirements, the government would need to overcome much red tape to approve the Pfizer vaccines. Health care workers at the storage sites for these vaccines would need to be able to vaccinate a large number of people each day.
    - The department of health says it will be able to vaccinate about 200 000 people each day at their peak, at 2000 vaccination sites that have been identified. At this stage it is difficult to know if this is achievable, but it seems ambitious compared to the daily rates achieved by other developing countries such as Chile and Argentina. Since 17 February 2021, South Africa has vaccinated just over 250 000 healthcare workers, which comes to an average of 6 866 vaccinations per day.

Registration of vaccinations

- The chief director of the department of health announced in April that those who qualify for phase two, may start to register for the vaccine on the Electronic Vaccination Data System (EVDS)
- This system is mainly for people to be able to get an appointment for their vaccine. It can also be used to track who gets vaccinated, and which vaccine each individual receives.
- The system will also capture reasons given for vaccine refusal.

Funding of COVID-19 vaccinations

- COVID-19 vaccination is a Prescribed Minimum Benefit since 4 January 2021, which means that it is obligatory for the medical schemes to cover it for free.
- For the uninsured, the vaccine will be funded by the government.

Decision to pause use of J&J vaccine

- On 14th of April 2021, South Africa decided to pause the use of the J&J vaccine.
- This was done after the US detected six cases of a rare blood-clot disease in more than 6.8 million doses of the vaccine.
- All six cases were in women aged between 18 and 48, with symptoms appearing six to 13 days after vaccination.
- No cases of blood clots have been reported in South Africa, but SAHPRA claims that it paused the roll-out because it is prioritising the safety of the participants in the Sisonke study, while also looking at the totality of evidence which includes the data provided by the US. This takes into account that the US has vaccinated much larger numbers than South Africa.

- SAHPRA states that this pause is only temporary and was done as a precautionary measure, and should only be lifted on the conditions that there is strengthening, screening and monitoring participants who are at high risk of blood clotting disorder (vaccine-induced thrombosis and thrombocytopenia).
- New participants in the study will be made aware of this adverse event in their consent forms and participation sheets.

Appendix 3: Findings from previous surveys of vaccine hesitancy in South Africa

3.1. 3.1. IPSOS-WEF

The IPSOS-WEF survey was conducted by IPSOS on its Global Advisor online platform. Adults 16–74 years were eligible for participation in the study in all of the country samples apart from Canada, South Africa and the US where the minimum age was 18. The study covered 15 countries: Canada, South Africa, and the United States, Australia, Brazil, China (mainland), France, Germany, Italy, Japan, Mexico, Russia, South Korea, Spain, and the United Kingdom. While most of these country samples are representative of the adult population under 75 years, this is not true for the samples in Brazil, China (mainland), Mexico, Russia and South Africa. These samples were smaller (500+) and are not representative of the population because of their reliance on online platforms for the surveys in these countries. For these surveys, including South Africa, the survey samples are biased towards urban residents as well as more educated and the more affluent respondents. Their main question about vaccine intention is phrased as "To what extent do you agree or disagree with each of the following: If a vaccine for COVID-19 were available, I would get it".

Figure A3.1 Vaccine intention for South Africa, IPSOS-WEF survey, August 2020 to February 2021

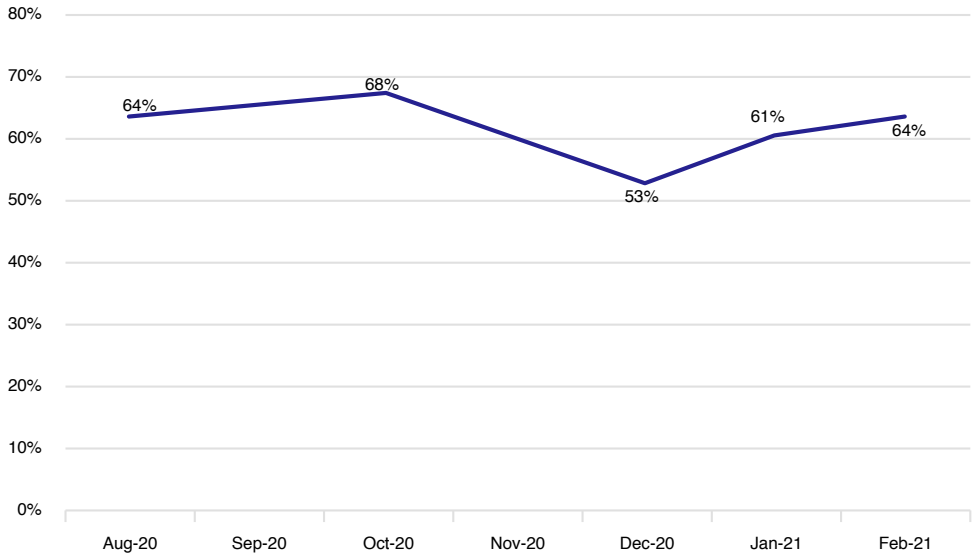

Figure A3.2: Vaccine intention for 15 countries participating in the IPSOS-WEF Global Attitudes on a COVID-19 vaccine, conducted from 25-28 February 2021

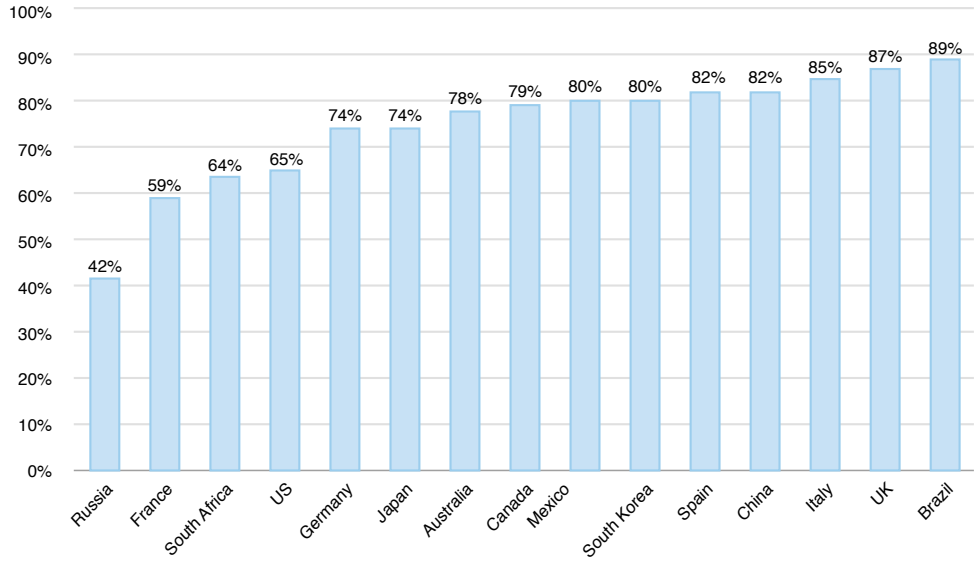

Figure A3.2 above shows the latest IPSOS-WEF vaccine intention estimates from their February 2021 surveys. Compared to the other 14 countries included in their study, South Africa's vaccine intention estimate is notably lower than that of other countries, ranking amongst the bottom three out of 15 countries.

3.2. HSRC-UJ

An online survey HSRC-UJ COVID-19 Democracy Survey Round 3 was conducted by the University of Johannesburg (UJ) and the Human Sciences Research Council (HSRC), between 29 December 2020 and 6 January 2021. It included a question on willingness to get vaccinated. An open invitation was used to recruit respondents, through the Moya Messenger App and through links from social media adverts on Facebook and Twitter. The Moya Messenger app has 4 million users, of which one in five are daily users. The survey was available in six South African languages: Afrikaans, English, Zulu, Xhosa, Setswana, and Sesotho.

The survey was completed by 10 618 respondents. The data were weighted using Stats SA data for race, education and age, because of the skewness in terms of who uses social media and has access to smartphones (particularly between younger and older people). The produced findings can be regarded as broadly representative of the total adult population (over the age of 18) at large because of the weighting (education, age and race) used on the data.

The survey's question on vaccine intention was phrased as "If a Covid-19 vaccine became available to you, would you take it?" They find that 67% of respondents indicated that they are definitely or probably willing to be vaccinated (52% – Definitely willing, 14% – Probably willing) and 18% of respondents would definitely not or probably not be willing to get vaccinated (12% – Definitely not, 6% – Probably not).

Findings from the survey indicate that education plays a role in vaccine acceptance. Contrary to what the literature reports for other countries, individuals with tertiary education were found to be the least accepting of a vaccine. The survey shows that 72% of those with a less than matric level education were accepting of the vaccine compared to 59% of those with tertiary education. The results do not show a clear association between personal income and the likelihood of vaccine acceptance. Interestingly, the highest levels of acceptance of COVID-19 vaccine were among the poor and wealthy individuals, whilst the most hesitancy was among the middle category.

For further information please see **cramsurvey.org**