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To cite this article: Sara Cooper, Heidi van Rooyen & Charles Shey Wiysonge (2021): COVID-19 vaccine hesitancy in South Africa: how can we maximize uptake of COVID-19 vaccines?, Expert Review of Vaccines, DOI: [10.1080/14760584.2021.1949291](https://doi.org/10.1080/14760584.2021.1949291)

To link to this article: <https://doi.org/10.1080/14760584.2021.1949291>



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Published online: 12 Jul 2021.



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COVID-19 vaccine hesitancy in South Africa: how can we maximize uptake of COVID-19 vaccines?

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ABSTRACT

Introduction: Acceptance of COVID-19 vaccines is critical to personal health, protecting vulnerable populations, reopening socio-economic life, and achieving population health and safety through immunity. The primary aim of this review was to investigate the extent and determinants of COVID-19 vaccine hesitancy in South Africa to inform the development of strategies to address it. A secondary aim was to enhance understandings of and responses to vaccine hesitancy more generally in South Africa, with potential positive effect on vaccination uptake during and beyond the COVID-19 pandemic.

Areas covered: We reviewed the findings from surveys conducted in South Africa from February 2020 to March 2021 that investigated acceptance of COVID-19 vaccines. Surveys were identified through searching electronic databases of peer-reviewed and gray literature and contacting experts.

Expert opinion: The review reveals the inherently social nature of COVID-19 vaccine hesitancy in South Africa, potentially influenced by age, race, education, politics, geographical location, and employment. Along with the provision of information, COVID-19 vaccine communication strategies need to form part of broader trust-building measures that focus on relationships, transparency, participation, and justice. The pandemic also provides a unique opportunity to positively intervene and reduce vaccine hesitancy trends more generally in South Africa and potentially elsewhere.

ARTICLE HISTORY

Received 16 April 2021

Accepted 25 June 2021

KEYWORDS

COVID-19 vaccines; determinants; interventions; South Africa; review; vaccine hesitancy; vaccine confidence

1. Introduction

It has been over a year since the World Health Organization (WHO) declared the outbreak of COVID-19 to be a Public Health Emergency of International Concern (PHEIC) [1]. Since then, the world has experienced much uncertainty, as a result of changing COVID-19 evidence, new and emergent strains of the virus, and an ever-shifting landscape of travel bans and lockdowns. Ensuring a solid understanding of, demand for, and promoting acceptance of current and forthcoming COVID-19 vaccines is critical to personal health, protecting the most vulnerable populations, reopening social and economic life, and potentially achieving population health and safety through immunity [2]. The development of COVID-19 vaccines has indeed generated a renewed sense of hope for many who have been devastated by the loss of lives and livelihoods from the disease.

However, as the acquisition and roll-out of COVID-19 vaccines gain momentum, tensions are also growing. Supply-related challenges, trends of vaccine nationalism, and associated inequitable vaccine access both within and across countries are generating increased concerns [3,4]. Emerging COVID-19 vaccine hesitancy is an additional concern [2,5]. A number of recently conducted national, continental, and global surveys suggest that hesitancy and refusal of COVID-19 vaccines

is an emerging problem [6–9]. Indeed, a rapid systematic review of 126 surveys on COVID-19 vaccination intentions (covering a total of 31 countries), including 23 academic studies and 103 opinion polls published by 20 October 2020 found declining global vaccine (anticipated) acceptance, from greater than 70% in March to less than 50% in October [10]. Against this backdrop, addressing current and future potential COVID-19 vaccine hesitancy is critical.

Vaccine hesitancy is, however, neither new nor unique to COVID-19 vaccines [11]. Nearly two years prior to the first approval of COVID-19 vaccines, the WHO identified vaccine hesitancy as one of the ten main threats to global health [11]. This was the culmination of growing concern worldwide about the increased numbers of individuals and communities who are questioning vaccines, seeking alternative vaccination schedules and delaying or refusing vaccination [12–14]. For example, in an analysis of three years of WHO/United Nations Children Fund (UNICEF) Joint Report Form (JRF) data (2015–2017), vaccine hesitancy was reported in over 90% of the 194 member states, including in countries across all WHO regions and all categories of country income levels [15]. Moreover, recent global outbreaks of largely eliminated vaccine-preventable diseases, such as the various measles outbreaks in the United States of America (USA) and Europe, have been

Article highlights

- Acceptance of COVID-19 vaccination is critical to personal health, protecting vulnerable populations, reopening socio-economic life, and achieving population health and safety through immunity.
- This review synthesises findings from surveys conducted in South Africa between February 2020 and March 2021 that investigated acceptance of COVID-19 vaccines.
- The survey findings reveal the inherently social nature of COVID-19 vaccine acceptance in South Africa, suggesting the need for more multi-disciplinary vaccine hesitancy research which investigates multiple levels of influence; from the individual to the more social and political factors.
- Strategies to address hesitancy towards, and promote acceptance of, COVID-19 vaccines need to be responsive to the concerns and associated information needs people have about the safety and effectiveness of COVID-19 vaccines.
- COVID-19 vaccine communication strategies must also involve more than information and factor in that people develop their own beliefs through their life experiences and that culture, personal background, religion, and political leanings all shape people's reactions to facts supplied to them. Such strategies therefore need to form part of broader trust-building measures that focus on relationships, transparency, participation, and justice.
- How national and global institutions manage COVID-19 vaccines, and responses to the pandemic more broadly, are likely to have a major effect on vaccine hesitancy trends during and beyond the COVID-19 pandemic in South Africa and potentially elsewhere.

largely attributed to vaccine hesitancy [16–19]. The low public acceptance of vaccination against the 2009 H1N1 pandemic influenza reported in the USA and United Kingdom [20], controversies around the human papillomavirus (HPV) vaccine in India and Japan [21], and the 2003–2004 polio vaccine boycott in Nigeria [22] are just a few examples of growing vaccine questioning, mistrust, and resistance on a global scale.

South Africa is no exception. An emerging body of research suggests that vaccine hesitancy is a developing phenomenon in the country. For example, vaccine hesitancy amongst parents was identified as one of the main challenges facing vaccination programmes in a study conducted in 2009 among national and provincial Expanded Programme on Immunization (EPI) managers [23]. Vaccine hesitancy was also highlighted as playing a significant role in the various measles outbreaks in South Africa between 2003 and 2011 [24–26]. Moreover, a range of studies conducted before [27–31] and after [32,33] the introduction of the national school-based HPV vaccination programme in 2014, all revealed the presence of HPV vaccination hesitancy and refusal amongst parents, adolescents, and other relevant stakeholders in the country. There are also concerns about a rising trend of internet-based anti-vaccination lobbying in South Africa [34,35]. However, despite this small but growing evidence base, our understanding of vaccine hesitancy in South Africa— including its extent and determinants, and strategies to prevent and address it — is still limited [36–38].

South Africa officially began its national COVID-19 vaccination programme in February 2021 [39]. Both the Johnson and Johnson (single dose) and Pfizer (two-dose) vaccines have been used in the national COVID-19 vaccine rollout, which is

being implemented in a phased manner according to a national prioritization framework. Phase 1 is targeting healthcare workers; Phase 2 is prioritizing essential workers, people older than 60 years, adults with co-morbidities, and people in congregate settings; and Phase 3 will focus on the remaining adult population. The aim of the COVID-19 vaccination rollout is to vaccinate a minimum of 67% of the South Africa's 60 million population in order to achieve herd immunity. As of 2 June 2021, more than 1.1 million people had received at least one dose of a COVID-19 vaccine in South Africa [40]. As the programme gains increased momentum, vaccine hesitancy has acquired renewed attention as an important national public health concern [41].

Vaccine hesitancy research in the country has also increased significantly, with numerous surveys having been conducted over the last year to explore anticipated acceptance of COVID-19 vaccines amongst South Africans. In this paper we review the findings from these surveys. We identified surveys conducted on or before 15 March 2021 by conducting searches in PubMed, Scopus, and Africa Wide; searching gray literature; and contacting experts and others known to be working in the field of vaccine hesitancy in South Africa. The primary aim of this review was to gain a better understanding of COVID-19 vaccine hesitancy in South Africa to inform the development of contextually relevant and appropriately targeted strategies to address it in the country. A secondary aim of this review was to contribute important potential insights into our understanding of and responses to vaccine hesitancy in South Africa more generally, with a potential positive effect on vaccination demand and uptake during and beyond the COVID-19 pandemic.

2. Surveys on COVID-19 vaccine hesitancy in South Africa: key findings

In total, we identified nine surveys investigating (potential) acceptance of COVID-19 vaccines amongst South Africans conducted by 15 March 2021. With the exception of the South African Social Attitudes Survey (SASAS) [42], all the surveys focused specifically on COVID-19 vaccines i.e. they did not investigate attitudes toward any other vaccines. The SASAS investigated attitudes toward vaccination in general, and how these attitudes may have differed before and after the national COVID-19 lockdown [42], which was first instituted in March 2020 [43]. Sample sizes ranged from 403 and 75,518. Acceptance of the COVID-19 vaccine ranged from 52% to 82%. Below we describe the findings from each survey separately, except for the Ipsos three rounds of COVID-19 focused surveys which are described together. A summary of the surveys, including methodological elements and key findings, is depicted in Table 1.

We used the Joanna Briggs Institute's checklist for prevalence studies to assess the quality and rigor of the studies [44]. This checklist assesses the appropriateness of the sample frame to address the target population, the appropriateness of participant sampling, the adequacy of the sample size, appropriateness of the description of the study setting and subjects, sufficiency of the coverage of identified sample in the data analysis, validity of methods used for the

Table 1. Summary of studies included in the review.

Study reference	COVID-19			South African Social Attitudes Survey [40]	CMS COVID-19 Vaccine Survey [54]
	COVID-SCORE Global Survey [9,41]	Africa CDC Survey [42,43]	Democracy Survey [47-50]		
Lead study organization	Emerson College, United States of America	Africa Centres for Disease Control and Prevention (Africa CDC)	University of Johannesburg and the Human Sciences Research Council, South Africa	Human Sciences Research Council, South Africa	Council for Medical Schemes, South Africa
Peer reviewed publication	Yes	No	No	Yes	No
Date conducted	16-20 June 2020	17 September-16 October 2020	29 December 2020-6 January 2021	February - March 2020 and November 2020-February 2021	4 February - 8 March 2021
Sample size	619	1056	10,618	2844	75,518
Nationally representative sample	No	Yes	Yes	Yes	No
Willingness to accept COVID-19 vaccination	82%	76%	64% (round 1); 68% (round 2); 53% (round 3)	Not assessed	82%
Other key findings	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed
Main reasons for COVID-19 vaccine hesitancy or refusal	Not assessed	Not assessed	Worry about vaccine side effects (53%; 30%; 65% rounds 1-3 respectively); Opposed to vaccines in general (23%; 21%; 23% rounds 1-3 respectively)	Belief that vaccinations can lead to severe health conditions increased by 8% percentage points and belief that infection-acquired immunity preferable to vaccine-acquired immunity increased by 11% percentage points between March 2020 and February 2021	COVID-19 vaccines too new (34%); Worry about vaccine side effects (21%); Distrust in government to ensure COVID-19 vaccines are safe and effective (14%)
Factors influencing COVID-19 vaccine acceptance	Not assessed	Age, employment status, urbanicity, geographical location	Age, race, education, political discontent	Not assessed	Employment status, urbanicity, geographical location

(Continued)

Table 1. (Continued).

	COVID-SCORE Global Survey	Africa CDC Survey	Ipsos online surveying (3 rounds)	COVID-19 Democracy Survey	Ask Afrika COVID-19 Tracker study	South African Social Attitudes Survey	CMS COVID-19 Vaccine Survey
Key novel or significant findings as interpreted by review authors	High discrepancy between reported COVID-19 vaccine acceptance (82%) and whether one would follow employer's recommendation to get the vaccine (46%)	Negative effect of pandemic on vaccine acceptance more generally – at least one in five respondents less inclined to vaccinate in general than before the pandemic	Relatively high rates of opposition to vaccines in general	Those with more education, less accepting of the COVID-19 vaccine; Political factors contribute to hesitancy; Belief in conspiracy theories low	Men less trusting of COVID-19 vaccine than women; Government decision to stop AstraZeneca vaccine rollout reduced trust in vaccine safety and confidence in the process	Relatively high rates of vaccine hesitancy in general	Preferences for specific COVID-19 vaccines; Political factors contribute to hesitancy

Africa CDC: Africa Centres for Disease Control and Prevention.

CMS: Council for Medical Schemes.

identification of the condition (i.e. vaccine hesitancy), standardization and reliability of the measurement of the condition, appropriateness of statistical analyses, and the adequacy and handling of the response rate. The studies had varying degrees of quality and rigor (as indicated under each study below) and we decided to provide a narrative synthesis, without pooling study data.

2.1. COVID-SCORE global survey

The COVID-SCORE study, coordinated by Emerson College, sought to understand, and validate an instrument to measure public perceptions of government responses to COVID-19 in countries heavily affected by the pandemic [9,45]. The survey was administered between 16 and 20 June 2020, with an online panel of 13,426 respondents aged 18 years or older from 19 countries, including South Africa. Participants were recruited by consensus strategies through multiple international online panel providers for each country. Sampling was random. The sample size in South Africa was 619 participants, with 52% of participants having a bachelor's degree and 65% being between 25 and 54 years of age. Two questions were asked regarding COVID-19 vaccine acceptance: 'If a COVID-19 vaccine is proven safe and effective and is available to me, I will take it' and 'I would follow my employer's recommendation to get a COVID-19 vaccine once the government has approved it as safe and effective'. Responses to both questions were recorded on a five-point Likert scale from 'completely disagree' to 'completely agree.'

Regarding whether they would take a COVID-19 vaccine if it was proven safe, effective, and available, 82% of South African responded positively ('somewhat agree' or 'completely agree'), higher than the global average of 72%. In terms of whether they would follow their employer's recommendation to get a COVID-19 vaccine, 46% of South Africans responded positively ('somewhat agree' or 'completely agree'), slightly lower than the global average of 48%. This discrepancy between reported acceptance of a COVID-19 vaccine and acceptance if vaccination was recommended by one's employer was found across all countries included in the survey. The authors of the survey suggest that this may relate to people's concerns about COVID-19 vaccination being mandated by employers which may be thought to limit employees' freedom of choice and/or be a manifestation of employers' self-interest.

2.2. Africa Centres for Disease Control and Prevention (Africa CDC) survey

ORB International, in collaboration with the Vaccine Confidence Project at the London School of Hygiene & Tropical Medicine, on behalf of Africa CDC conducted a survey to investigate public knowledge and perceptions of both the COVID-19 pandemic itself and COVID-19 vaccine among adults in 15 African countries, including South Africa [46,47]. In South Africa, face-to-face questionnaires were administered from 17 September 2020 until 16 October 2020 with a total sample of 1056 adults over the age of 18. The sample was broadly representative in terms of age and sex.

Three quarters of the South African respondents (76%) said they would take a new COVID-19 vaccine if it were publicly available. A total of 81% of respondents agreed ('strongly agree' or 'tend to agree') that the COVID-19 vaccine is important, 73% agreed that the COVID-19 vaccine is effective and 70% of respondents agreed that the COVID-19 vaccine is safe. Half of respondents believed that coronavirus is linked to 5 G (49%) and 27% believed that COVID-19 is man-made.

Acceptance of a new COVID-19 vaccine was found to be influenced by age, employment status, urbanicity, and geographical location. Specifically, respondents older than 35 years were more willing to take a new vaccine than respondents younger than 35 years (78% versus 73%). People who are employed were more likely to think a new vaccine would be safe (72%) in comparison to students (61%). Those who live in cities were more willing to take a new vaccine compared with those who live in villages (79% versus 69%). Those in the Eastern Cape (98%), Northern Cape (95%) and Limpopo (81%) Provinces were more willing to take a new vaccine compared with those in the Western Cape (68%), Free State (68%), and Mpumalanga (68%) Provinces. Reported willingness to accept a COVID-19 vaccine was also higher among those who think vaccines in general are safe; those who do not think that the threat of COVID-19 has been exaggerated; those who do not believe COVID-19 related conspiracy theories; those who know someone with a positive COVID-19 test, and those who do not rely on social media as a trusted source of information. Men were more skeptical about the safety of COVID-19 vaccine (66%), compared to 74% of women who think the COVID-19 vaccine is safe.

Confidence in both vaccines generally and confidence in COVID-19 vaccines were found to be relatively similar. For example, 24% of respondents think vaccines in general are unsafe, and a similar proportion (26%) say the same about the COVID-19 vaccine. Similarly, 80% of respondents agree ('strongly agree' or 'tend to agree') that vaccines in general are important, and a similar proportion (81%) of respondents agree that the COVID-19 vaccine is important. The pandemic has, however, influenced vaccine acceptance more generally – at least one in five respondents reported that they are now less inclined to vaccinate in general than before the pandemic.

2.3. Three rounds of Ipsos online surveying

Ipsos conducted three rounds of COVID-19 focused surveys on its Global Advisor online survey platform in 2020 – the first between 24 July and 07 August 2020 [48], the second between 08 and 13 October 2020 [49] and the third between 17 and 20 December 2020 [50]. All three rounds included a sample from South Africa. All three rounds asked the following question: '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.' Answers were captured on a scale ranging from strong agreement to strong disagreement. A second survey question asked in all three rounds was: 'Which best describes why you would not take a vaccine for COVID-19?' with options: 'I am worried about the side effects'; 'I am worried that a vaccine is moving through clinical trials too fast'; 'I don't think it will be effective'; 'The risk to me of getting COVID-19 is

low'; 'I am against vaccines in general'; and 'Other.' The October round included two additional questions regarding attitudes toward COVID-19 vaccines. The first additional question was 'To what extent do you agree or disagree with each of the following: The chance of getting COVID-19 is so low that a vaccine is not necessary.' Answers were captured on a scale ranging from strong agreement to strong disagreement. The second question was: 'How soon after the COVID-19 vaccine becomes available and the vaccine is available to all, would you become vaccinated?', with various timeframes provided for possible responses.

The July-August survey round was conducted with nearly 20,000 adults from 27 countries, with a sample of approximately 500 from South Africa. The October survey round had more than 18,000 adults from 15 countries, with a sample of approximately 1000 from South Africa. The December survey round was conducted in 15 countries among 13,500 adults, with a sample of approximately 500 from South Africa. The samples in South Africa in all three rounds were individuals aged 18–74 years who were more urban, more educated, and more affluent than the general population. Therefore, and as indicated by the survey researchers, the results need to be viewed as reflecting the perspectives of the more 'connected' segment of the general South African population. The data were, however, weighted so that the sample composition best reflects the demographic profile of the adult population according to the most recent census data.

Regarding the findings from the July-August survey round [48], 64% of respondents from South Africa said that they will get the vaccine if it were available, which was below the global average (74%). The most common reasons given by those South Africans who indicated they would not get a vaccine were worry about side effects (53%), doubts about its effectiveness (24%), and being opposed to vaccines in general (23%).

Regarding the findings from the October round [49], there was a slight increase from the previous survey in the proportion of South Africans willing to get the vaccine if it were available (68%), although this was again below the global average (73%). The most common reasons given by those South Africans who indicated they would not get a vaccine were worry about side effects (30%), concerns that a vaccine is moving through clinical trials too fast (23%), and the perception of not being enough at risk from COVID-19 to warrant vaccination (10%). Of those South Africans who said that they did not intend to take the vaccine when available, 21% indicated that they are opposed to vaccines in general. In addition, 27% of South Africans believe that the chance of getting COVID-19 is so low that a vaccine is not necessary. Regarding how soon they would get the COVID-19 vaccine once it becomes available to all, 21% of South African respondents indicated they would get it immediately, 42% said within three months, and 61% said within one year.

Regarding the findings from the December round [50], there was a significant decline from previous survey rounds in willingness to get the vaccine in South Africa (53%) and globally (66%). The change in perceptions in South Africa was the largest decline (along with France) recorded in the global survey. The most common reasons given by those who

indicated they would not get a vaccine was worry about side effects (65%), followed by doubt about its effectiveness (24%) and the perception of not being enough at risk from COVID-19 (17%). Of those South Africans who said that they did not intend to take the vaccine when available, 23% indicated that they are opposed to vaccines in general.

2.4. COVID-19 democracy survey

The COVID-19 Democracy Survey, conducted jointly by the University of Johannesburg and the Human Sciences Research Council (HSRC), aimed to determine public perceptions of the economic, social, and political impact of COVID-19 on life across the country [51–54]. The survey was available in multiple languages and administered online, using the #data-free Moya Messenger App and through links from social media adverts on Facebook and Twitter. The third round of the survey, conducted between 29 December 2020 and 06 January 2021, explored people's willingness to take a COVID-19 vaccine. It included the question: 'If a COVID-19 vaccine became available to you, would you take it?' This was followed by a simple, open-response question: 'please explain your answer,' where respondents could explain, in their own words, why they would or would not take a vaccine. Only adults living in South Africa were included. The survey was fully completed by 10,618 participants and the data were weighted using Statistics South Africa data for race, education, and age. This produced findings that can be regarded as broadly representative of the adult population at large. The qualitative findings were based on an analysis of a random sub-sample of 1,960 responses taken from the main sample.

Regarding COVID-19 vaccination acceptance, 67% of respondents said they would definitely or probably take a vaccine, 18% said they would definitely or probably not take the vaccine, and 15% were unsure if they would take the vaccine. The survey identified some key demographic and other influences on vaccine acceptance. Attitudes toward taking a COVID-19 vaccine were found to vary by race. White adults were least accepting, with only 56% willing or probably willing to be vaccinated. Comparable figures were 69% for Black African adults, 68% for Indian adults, and 63% for Colored adults. Education was also found to play a role in vaccine acceptance, with those with more education being less accepting. Specifically, those with a tertiary education were the least accepting of the vaccine; only 59% of those with a tertiary education would definitely or probably take a vaccine, compared to 72% of those who did not complete high school. Age was another significant influencing factor, with support for vaccination increasing with age; people 55 years and older were more likely to report that they would take a vaccine than those aged 18 to 24 (74% versus 63%).

In addition to issues of race, education and age, the study also found that political factors shape COVID-19 vaccination attitudes. Political party support was a significant issue, with supporters of the African National Congress (ANC) – South Africa's governing political party – being more willing to vaccinate (78%) compared to supporters of other political parties in the country. In addition, political discontent or

disillusionment was found to influence attitudes toward COVID-19 vaccination. For example, amongst respondents who said they would not vote, only 48% indicated they would accept the vaccine. Furthermore, respondents who thought the President of the Republic and the national government were doing a bad job were less likely to want vaccination, compared to those who thought the President and national government were doing a good job (36% versus 73%). Similarly, only 45% of those who rated the national government's COVID-19 response poorly were favorably disposed to vaccination, compared to 73% of those who were positive about the government's performance.

Regarding self-reported reasons for vaccine acceptance or refusal, the most common explanations given for wanting to vaccinate were the desire to protect oneself (29%) and to protect others (25%). The most common reasons for not wanting to vaccinate were concerns about side effects of the vaccine (25%); doubts in the vaccine's effectiveness (18%); lack of trust in the vaccine, with no further explanation (14%); and needing more information or a general statement of being unsure accounted (10%). Explanations related to conspiracy theories (e.g. doubt in the existence of COVID-19 or attributing the virus or vaccine to powerful groups or interests) or to the occult accounted for 7% and 4% of self-reported reasons respectively.

2.5. The Ask Afrika COVID-19 tracker study

Since April 2020, Ask Afrika, an independent South African market research company, has been conducting the pro-bono 'COVID-19 Tracker study' [55–57]. The study seeks to better understand the socio-economic impact that COVID-19, national lockdown, and the gradual re-opening of the economy is having on South Africans. The study comprises 15-minute questionnaires, administered in English and through online interviews, Computer Aided Telephonic Interviews (CATI), and Ask Afrika's power panel platform. Between 03 and 11 February 2021, the questionnaire included various questions around attitudes toward vaccines, including: 'Will you get vaccinated when the vaccine roll-out reaches you?: (Yes, No, Unsure)'; 'Are you concerned about getting vaccinated?: (Yes, No, Unsure)'; 'How much do you trust in the safety of the vaccine?: (Distrust, Neutral, Trust, Completely trust)'; 'Which of the following five aspects are the most important to you with regards to the vaccine?: (Safety of the vaccine, Efficacy of the vaccine, Thoroughness in developing the vaccine, The speed of delivery to South Africa, The speed of the roll-out).' A sample size of 403 respondents, that was proportionally distributed according to the South African demographic profile, was included in the analysis on vaccines.

Regarding COVID-19 vaccination acceptance, just over half of respondents (52%) said they planned to get vaccinated when the vaccine roll-out programme reaches them, 19% of respondents said they did not plan to get vaccinated, and 28% said they were unsure whether they would get vaccinated. Vaccine safety and efficacy were the biggest priority for respondents: 44% of respondents indicated that 'safety of the vaccine' is most important to them with regards to the vaccine, 22% said 'efficacy of the vaccine,'

14% indicated 'thoroughness in developing the vaccine,' and 11% and 9% indicated 'the speed of delivery to South Africa' and 'the speed of the roll-out' respectively. Concerns about COVID-19 vaccines were relatively high, with 53% of respondents saying they had concerns. Participants younger than 34 years had significantly more concerns about getting vaccinated than those older than 35 years. Regarding trust in the vaccine, 47% of respondents said they had trust in the vaccines. The survey also found that the Government's decision to stop the roll out of the AstraZeneca vaccine in South Africa significantly reduced levels of trust in the safety of the vaccines as well as confidence in the process.

The study found various sex differences in perceptions of vaccines. There was higher distrust of the vaccines among men than women (39% compared to 26%). However, of the men who indicated distrusting the safety of the vaccine, 45% said they would not get vaccinated; whereas of the women who said they distrusted the safety of the vaccine, 60% said they would not get vaccinated. Concerns about getting vaccinated among women were significantly higher among those who indicated distrusting the safety of the vaccine compared to those who said they trusted the vaccine (72% versus 42%). A similar trend was not seen among men; concerns about getting vaccinated were reasonably consistent between those males who distrusted and those who trusted the vaccine (60% versus 54%). Among men who trusted the safety of the vaccine, the speed of delivery to South Africa was the most important consideration, while for women the efficacy of the vaccine was most important.

2.6. South African social attitudes survey

The South African Social Attitudes Survey (SASAS), administered by the Human Sciences Research Council (HSRC) since 2003, is a nationally representative survey of adults aged 16 and older conducted annually to investigate public attitudes, beliefs, behavior patterns, and values [42]. The latest survey round (Round 17) included three vaccination-related questions, taken from the health module designed by the International Social Survey Programme. These questions sought to gauge general vaccination views amongst South Africans by asking respondents to indicate how much they agree or disagree with the following statements about vaccination: 1) 'Vaccinations can lead to severe health conditions'; 2) 'It is better to develop immunity by getting sick than by getting a vaccination'; and 3) 'I believe that vaccinations prevent the disease they are supposed to prevent.' A five-point Likert scale was used for responses, ranging from 'strongly agree' to 'strongly disagree.' The survey was administered face-to-face, with approximately 40% completed in February–March 2020 and, due to the national lockdown brought about by COVID-19, the remaining surveying was completed from November 2020 and February 2021. This unplanned disruption in fieldwork provided an opportunity to examine patterns of variation in vaccination attitudes before and after the national COVID-19 lockdown. The total sample size was 2844, with the data benchmarked and weighted to Statistics South Africa's most recent mid-year population estimates.

One-third (34%) of participants believed that vaccination could result in serious health side effects, while only 28% were dismissive of this viewpoint. In terms of views about immunity, a larger share of the participants believed that infection-acquired immunity is preferable to vaccine-acquired immunity; 40% agreed with this while 26% disagreed. In relation to vaccine effectiveness, 58% reported that they believe that vaccinations prevent the disease they are intended for, in contrast to 10% who were skeptical about vaccine effectiveness. The percentage of respondents who believed that vaccinations can lead to severe health conditions increased from 28% in March 2020 to 36% in February 2021, while the percentage of people who believed that infection-acquired immunity is preferable to vaccine-acquired immunity increased from 33% to 44%. The public perceptions of the effectiveness of vaccines remained in a relatively positive light during this period, from March 2020 to February 2021.

2.7. Council for Medical Schemes COVID-19 vaccine survey

The Council for Medical Schemes (CMS) conducted a cross-sectional, self-administered anonymous online survey from 04 February to 08 March 2021 to gauge support for COVID-19 vaccination amongst medical scheme members [58]. Various platforms were used to advertise and circulate the survey, including distribution to their members amongst industry associations, medical schemes, and administrators. The survey included a range of questions related to support for COVID-19 vaccination, including trust in the vaccine, acceptability, intention to get vaccinated, reasons for not getting the vaccine, effect and influence of one's employer and someone that members know getting vaccinated, and awareness and communication around vaccines. A total of 75,518 medical scheme members completed the survey. Regarding sample characteristics, 51% of respondents were women, 37% were older than 60 years (with a weighted average age of 50.6 years), 87% resided in an urban suburb setting, 72% of respondents resided in the Gauteng or Western Cape Provinces, 42% of respondents were employed in the private sector, and over 40% had chronic health conditions.

Regarding COVID-19 vaccine acceptance, intention and trust, 82% of respondents reported that they would get vaccinated, 76% indicated that they would trust the vaccine if someone close to them would vaccinate, and 71% indicated that they trust that the vaccine will prevent them from contracting COVID-19. The survey found that respondents may have preferences with regards to specific vaccines: the Johnson and Johnson's vaccine accounted for 48% of preferences, followed by the Pfizer/BioNTech vaccine at 25%, Moderna at 10%, AstraZeneca/University of Oxford vaccine at 10%, Sinopharm vaccine at 2%, and other at 5%. Regarding the potential influence of the employer recommending vaccination, 58% of participants answered that they would accept the COVID-19 vaccine if their employer would recommend it, while 20% gave a neutral response and 8% completely disagreed.

The survey found that vaccine acceptance, intention and trust varied by certain demographics. For example,

participants in the Northern Cape Province had lower rates on all three dimensions (acceptance, intention, trust) in comparison to other provinces and 83% of participants in an urban suburb area indicated they would get vaccinated compared to between 73% and 78% in other settings. Compared with other employment categories, government and public sector employees had the lowest intent of getting vaccinated (79%), while pensioners had the highest response rate (87%).

Amongst those respondents who indicated an intent not to get vaccinated, the main reason (34%) was that the vaccines were too new and they preferred to wait and see how it would work on other people. This reason was followed by worries about the possible side effects (21%) and not trusting the government to make sure the vaccine is safe and effective (14%). These three factors accounted for just over two-thirds of all the reasons which respondents gave for not wanting to get vaccinated. Belief that politics had played too much of a role in the COVID-19 vaccine development process and not trusting vaccines in general accounted for 8% and 6% of the reasons respectively.

3. Discussion and conclusion

In this paper we have summarized some of the main findings emerging from the various surveys that have investigated (potential) acceptance of COVID-19 vaccines in South Africa over the last year. There is some variability in the levels of acceptance reported in existing surveys, with levels ranging from 52% to 82%. In all three rounds of the Ipsos surveys, South Africans' willingness to take COVID-19 vaccines was reportedly below global averages, whereas the COVID-SCORE Global Survey observed a higher tendency toward acceptance in South Africa compared to other countries.

These discrepancies may be explained by the small and/or unrepresentative samples in some of the surveys, as well as variations between the surveys regarding how the vaccine acceptance questions were formulated. Such variations might also reflect the actual volatility of public perceptions within the context of a highly uncertain and shifting COVID-19 landscape. The current climate is one of rapidly changing knowledge about the disease and strategies to manage it, including in the realm of vaccination. Variations in public acceptance of COVID-19 vaccines is therefore to be expected. This is pertinently revealed by the swings in vaccine acceptance found in the Ipsos surveys, whereby the same survey was repeated at three different points in time. Ultimately, all of this suggests that reported levels of COVID-19 vaccine acceptance, particularly those obtained at a point in time, need to be interpreted and acted upon with a fair degree of caution.

The studies revealed a diverse range of factors that may play a role in shaping COVID-19 vaccination attitudes. Many of these factors are not necessarily unique to South Africa nor COVID-19 vaccines but have been identified as determinants of vaccine acceptance in other settings and for other vaccines. For example, the COVID-19 Democracy Survey, Ask Afrika, and Africa CDC studies all found that age may be important, with older adults in all three studies having less concerns and/or being more accepting of COVID-19 vaccination. This finding has been similarly shown in COVID-19 vaccination acceptance studies in diverse

settings [6–8,59]. The COVID-19 Democracy Survey revealed that race and education attainment may play a role in shaping COVID-19 vaccine acceptance, with white adults and people with higher levels of education being less accepting of the vaccine than other groups. This direct relationship between vaccine hesitancy and education – with higher levels of education being associated with increased vaccine hesitancy – has been identified for various vaccines in various contexts [14,60]. The Ask Afrika study suggested that sex may influence COVID-19 vaccine acceptance, with women being potentially less hesitant than men toward COVID-19 vaccines. This contrasts with findings from other COVID-19 vaccine acceptance studies elsewhere [6,8,10,59], and studies on vaccine hesitancy more generally [61–63]; where women have frequently been found to be more hesitant than men. This finding from the Ask Afrika study, however, needs to be interpreted with caution: the relationship between sex and vaccine acceptance was complex and somewhat ambiguous in this study, and none of the other South African studies found a consistent association between sex and COVID-19 vaccine acceptance.

Both the COVID-19 Democracy and CMS studies found political factors to play a significant role in shaping attitudes toward COVID-19 vaccination. More specifically, the COVID-19 Democracy survey suggested that political discontent or disillusionment may play a key role; people who had positive attitudes toward the government generally and its handling of COVID-19 in particular were more likely to accept COVID-19 vaccination. Relatedly, the CMS found that not trusting the government's capability in ensuring that the vaccine is safe and effective, and believing that politics played too much of a role in the vaccine development process, accounted for 14% and 8% of the total reasons for not wanting to get COVID-19 vaccination respectively. These findings corroborate with other COVID-19 vaccine acceptance studies elsewhere [7,10,59], as well as the broader vaccine hesitancy literature, where it is now well-documented that public views and experiences of government and other forms of authority – past and present, local and global, directly and indirectly related to vaccination – can have a profound effect on trust in vaccines (or a lack thereof) [11,14,60,63,64].

Other factors identified by the surveys as potentially influencing COVID-19 vaccination attitudes included urbanicity and geographical location. Both the CMS and Africa CDC studies found that people in urban suburb areas and those from cities are more accepting of COVID-19 vaccination. Both studies also identified the importance of geographical location, although there were discrepant findings between these studies regarding which sub-national locations were more accepting of the vaccine. The CMS survey also found that there may be preferences for different COVID-19 vaccines, with nearly half of the respondents preferring the Johnson and Johnson one-dose vaccine.

Across the surveys, anxieties around COVID-19 vaccine safety and effectiveness emerged as salient concerns. The SASAS found that approximately a third of South Africans

believe that vaccination could result in serious health side effects, concerns that increased substantially during the course of the COVID-19 pandemic. In the COVID-19 Democracy Survey, concerns around safety constituted a quarter of the total reasons for not wanting to vaccinate, followed by doubts regarding vaccine effectiveness. Similarly, in all three rounds of Ipsos surveying, worry about safety was the primary reason given for not wanting to get the vaccine in South Africa, followed by doubts about vaccine effectiveness, and concerns that the vaccines were moving too fast through clinical trials. Moreover, in the Ask Afrika survey, nearly half of the respondents indicated that safety was the most important issue for them with regards to the vaccine. Efficacy of the vaccine was the second biggest priority for respondents. Finally, the CMS found the top two reasons for not wishing to get vaccinated were concerns that the vaccines were too new (with participants preferring to wait to see how the vaccines would work on other people) and worries about possible side effects. Concerns about vaccine safety and effectiveness are most certainly not unique to COVID-19 vaccines nor South Africa- similar concerns have been extensively documented in studies on COVID-19 vaccine acceptance in other settings [7,8,10,59] and the vaccine hesitancy literature more broadly [63,65]. These apprehensions may, however, be heightened for COVID-19 vaccines due to the unprecedented speed at which they were developed and approved as well as their novelty. The latter has indeed been the case for other new vaccines, such as the swine flu [66] and HPV vaccines [67].

A particularly disheartening finding emerging from many of the surveys was the high levels of vaccine hesitancy in general in South Africa, particularly when compared to global vaccine hesitancy estimates [68]. For example, in all three rounds of the Ipsos surveys, approximately a quarter of South Africans who said that they did not intend to take the COVID-19 vaccine when available indicated that they were opposed to vaccines in general. Similarly, about a third of participants in the SASAS believed that vaccination generally could result in serious health side effects, while 40% believed that infection-acquired immunity is preferable to vaccine-acquired immunity. As indicated previously, research on vaccine hesitancy in South Africa is still relatively limited [36–38], and we therefore currently do not have quantitative estimates of its magnitude and determinants. However, the findings from the surveys in this review suggest that COVID-19 vaccine hesitancy may be a tip of the iceberg of general vaccine hesitancy in South Africa. The review findings also suggest that the COVID-19 pandemic may be exacerbating current vaccine hesitancy trends in the country. For example, the SASAS found that beliefs in the serious health side effects of vaccines and preferences for infection-acquired immunity have increased significantly since the COVID-19 national lockdown, while the Africa CDC survey revealed that at least one in five respondents were less inclined to vaccinate in general than before the pandemic. Ultimately, all of this suggests

an interacting relationship exists potentially between COVID-19, COVID-19 vaccine hesitancy and vaccine hesitancy more generally, one which requires increased attention.

4. Expert opinion

COVID-19 vaccine hesitancy in South Africa is currently gaining increased attention, and rightly so. Despite ample evidence of the safety and efficacy of COVID-19 vaccines that have received emergency use authorization, this review found that about one-third of the adult population in South Africa is hesitant toward these vaccines. The review also suggests that COVID-19 has substantially increased vaccine concerns and potential hesitancy predispositions in South Africa. Strategies to address COVID-19 vaccine hesitancy and sustain demand and uptake of vaccination in the country are therefore critical. The findings from the included surveys suggest that a range of varying factors may play a role in shaping COVID-19 vaccine attitudes in South Africa. More research in this area is, however, needed for more definitive conclusions to be drawn. This is important so that better targeted strategies can be developed, which focus on hesitancy-prone population subgroups (and potentially specific vaccines) and are tailored to their specific concerns.

What the survey findings quite definitively reveal, however, is the inherently social nature of COVID-19 vaccination views in South Africa; influenced by factors such as age, race, education, politics, geographical location, and employment. Dominant conceptual models for understanding vaccine hesitancy more generally tend to focus on the individual determinants of vaccine views and practices, drawing heavily on psychological models of decision-making behavior. While the constructs of these frameworks have been recognized as highly relevant, these frameworks have also been criticized for prioritizing individual factors over more social processes [14,60,63,69]. The findings from the surveys included in this review give weight to this critique, and to associated appeals for theory and responses to vaccine hesitancy to place a greater emphasis on more social and community levels of influence. Specifically, the findings suggest that responding to vaccine hesitancy, including COVID-19 vaccine hesitancy, requires a better understanding of the often complex and multi-layered issues influencing vaccination views and practices, and tailoring interventions accordingly [70,71]. Individualistic, decontextualized, and 'one-size-fits-all' approaches are unlikely to have much traction.

One of the most consistent findings across the included surveys was the widespread concerns people have about COVID-19 vaccine safety and effectiveness. Much hype and media attention in South Africa has been placed on issues related to disinformation, conspiracy theories, and occult perceptions as drivers of COVID-19 vaccine hesitancy [52]. While these issues are important, the surveys suggest that more attention needs to be placed on the legitimate worries people

have about the effectiveness of COVID-19 vaccines and the possibility of the vaccines having an adverse impact on their health. Communication campaigns and other forms of community engagement that are responsive to these concerns and associated information needs could help build people's confidence in the safety and effectiveness of the vaccines. For example, the Ask Afrika survey indicated that stopping the roll-out of the AstraZeneca vaccine reduced both levels of trust in vaccine safety and confidence in the process. This was a good opportunity to show that safety signals are working and that experts are operating in the public interest. Clear messaging explaining, for example, that the vaccine was withdrawn because it was shown to be ineffective against the variant discovered in South Africa after the vaccine was purchased could have reassured citizens that they were being protected from a less effective vaccine by excellent South African phylogenetic science. Unfortunately, this kind of messaging was not well expressed [41,72]. Ultimately, more effective and timely communication when vaccine-related decisions are made could go a long way in recognizing and assuaging people concerns as they arise. It is, however, also important for such communications to provide balanced and transparent information, including about potential adverse effects, evidence gaps, and uncertainties surrounding the vaccine [73,74]. Overconfident declarations of vaccine safety and effectiveness in absolute terms could be counterproductive.

Appropriate forms of communication around the safety and efficacy of COVID-19 vaccines are, however, not enough to build people's confidence in the vaccines. Strategies to address hesitancy toward, and promote acceptance of, COVID-19 vaccines must involve more than information; and factor in that people develop their own beliefs through their life experiences and that culture, personal background, education, class, religion, and political leanings all shape people's reactions to facts supplied to them [41]. In particular, building people's confidence in COVID-19 vaccines in South Africa and potentially elsewhere also needs to form part of broader development and trust-building measures that focus on relationships, transparency, participation, and justice. For example, strong leadership and clarity around responses to the COVID-19 pandemic, including but not limited to vaccines, is important. So too is community involvement and participation in the COVID-19 vaccination programme. Here, non-governmental and civil society organizations as well as influential faith and cultural leaders, could play a crucial role in motivating communities toward trust in and acceptance of COVID-19 vaccination [75]. Ensuring fair decision-making around COVID-19 vaccine allocations, locally and globally, could also go a long way in building trust in the vaccines and those distributing them. The COVID-19 vaccination roll-out programme is also likely to stand out starkly amid weak basic public services in South Africa, and as such would benefit from integration with broader programmes for public well-being [76]. As various Global Polio Eradication Initiative activities in the 1990s and 2000s taught us, acceptance of more targeted health promotion efforts may depend on how these

are used to simultaneously address the wider range of socio-economic issues that citizens prioritize [77,78]. Ultimately, how national and global institutions manage COVID-19 vaccines, and responses to the pandemic more broadly, are likely to have a major effect on public trust and acceptance of COVID-19 vaccination.

Such management and responses are also likely to have a significant impact on vaccine hesitancy trends more generally. As suggested by many of the surveys in South Africa, COVID-19, COVID-19 vaccine hesitancy specifically and vaccine hesitancy more generally are interlinked, all potentially having a negative effect on each other. This negative effect, however, need not necessarily be the case. The pandemic provides a unique opportunity to a positively intervene in the growing trends of vaccine hesitancy in South Africa and elsewhere. For example, discussions that were previously confined mostly to the realm of the medical and scientific community – infectious diseases, vaccinology, immunity, and epidemiology – are now being widely discussed in public fora. While this presents all sorts of challenges, it also provides an unprecedented opening for public participation in the politics of knowledge around vaccination specially and science and scientific evidence more broadly. The pandemic also provides an occasion for reflexive self-scrutiny amongst scientific and governmental bodies of their own practices and knowledge systems, with potential positive effect on (re)building public trust [64]. The pandemic could also be used to fuel demand for vaccination and social mobilization or advocacy around more equitable access to COVID-19 vaccines and vaccination more generally [79]. Ultimately, these kinds of initiatives, if properly supported, hold great potential to bolster acceptance of and demand for vaccines during and beyond the COVID-19 pandemic.

Funding

This paper was not funded.

Declaration of interest

The authors have no relevant affiliations or financial involvement with any organization or entity with a financial interest in or financial conflict with the subject matter or materials discussed in the manuscript. This includes employment, consultancies, honoraria, stock ownership or options, expert testimony, grants or patents received or pending, or royalties.

Reviewer disclosures

Peer reviewers on this manuscript have no relevant financial or other relationships to disclose.

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