

# Was It About COVID-19 Vaccine Acceptance or Societal Culture and Livelihoods? A Case of The Kruger National Park Employees, South Africa

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## Abstract

*The study tested whether the employees at the Numbi Gate of the Kruger National Park (KNP) were influenced by community or conservation-related benefits to take the COVID-19 vaccine. The study involved 35 employees of the KNP including Game rangers, administration staff, and conservationists. This study was purely quantitative and used a structured questionnaire with predetermined answers and some open-ended questions and applied three Generalised Linear models from the R statistical Software to address the objectives of this study. However, in all the key questions, there was a deliberate space provided for an open-ended answer for the employees, but none of them mentioned conservation as their answers were fixed on their benefit. The study also showed that respondents who were eager to get vaccinated were driven by the prospect of maintaining their livelihoods rather than by conservation reasons as the majority reported fear of losing their tourist tips. The findings of this study provide critical insights into the factors that contributed to vaccine hesitancy among employees at KNP. The significant influence of social media and conspiracy theories highlights the challenges posed by misinformation in the digital age. This study therefore concluded that vaccine hesitancy was more influenced by employee benefits instead of conservation. (All tables and figures used for this study are original and were developed from the study data by the author).*

**Keywords:** *Opinions, Media, Conservation, Community, Livelihoods.*

## Introduction

The COVID-19 pandemic posed an extraordinary threat to the health, safety, and freedom of workers around the world (Mahato et al., 2023; West et al., 2021; Maiti and Locke, 2021). West et al. (2021) reported that highly effective vaccines against COVID-19 may hold a benefit for workers. However, studies reported vaccine hesitancy among workers (Heyerdahl et al., 2022; Paris et al., 2021; Troiano and Nardi, 2021). For example, in Bangladesh, an overall 25% hesitancy was reported among temporary foreign national workers (West et al., 2021). Troiano and Nardi (2021) reported 69% hesitancy in their study, whereas Paris et al. (2021) reported healthcare workers with lower levels of medical literacy to be vaccine-resistant. Thurstan et al. (2021) reported a decline in food security of the employees of protected areas as most of them relied on tourist tips, trade, and tourism all risk a reduction in incentives to conserve local biodiversity.

Studies reported that the impacts of COVID-19 were immediately felt by tourist destinations and conservation areas that depended upon tourism and visitor revenue to finance conservation (Bhammar et al., 2021; Lindsey et al., 2020; Miller-Rushing et al., 2021; Waithaka et al., 2021). While West et al. (2021) reported that highly effective vaccines against COVID-19 may hold a benefit for workers, the literature scan has not revealed studies with empirical data to show the influence of workers, especially workers in protected area setups that are tourist-dependent.

Scholars reported that some African societies reject the vaccine due to religious beliefs; preference for indigenous medicine; and fear of side effects (Njoga, 2022; Adane, Ademas & Kloos, 2022). However, the literature scan did not reveal any study in Africa that reported acceptance or vaccine hesitancy about conservation or community benefits. This study, therefore, assesses whether there was COVID-19 vaccine hesitancy amongst the employees or whether was it about community or conservation-related benefits to taking the COVID-19 vaccine. The study aimed to determine whether the employees reporting at the Numbi Gate of the Kruger National Park were influenced by community or conservation-related benefits to take the COVID-19 vaccine. This main aim was addressed through the following sub-objectives

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To determine what influenced employees to take the COVID-19 vaccine or to be vaccine-hesitant

To determine employees' beliefs and vaccination hesitancy

To assess the role the communication channels that were used to disseminate COVID

19 vaccination news contributed to the employees of the KNP's vaccine hesitancy

### *Research Design*

The study design is purely quantitative with a postpositivist philosophical worldview approach and was purposive in nature. The study collected data from the employees of the Kruger National Park reporting at the Numbi Gate using a questionnaire with closed-ended questions. A structured questionnaire was administered to 35 participants employed by the Kruger National Park reporting at the Numbi Gate and received 33 usable questionnaires from the 35 employees. Two questionnaires were spoiled as some of the critical questions were not answered. The study purposely selected employees who are reporting at the Numbi Gate of the Park as this is the gate that is dupped unsafe for tourists (Veshe, 2022) of all the gates of the Park. Even though COVID-19 hesitancy was reported across industries in South Africa (Katoto et al., 2022) this study anticipated different results from other gates as this gate is not frequently used by tourists (Brett, 2018).

This study acknowledges the limitations of interviewing employees from one-gate. Interviewing those employees will give different opinions on COVID-19 vaccine hesitancy as that gate attracts fewer tourists (Brett, 2018) and there is a potential for less hesitancy. Data validity and reliability for this study were tested by first piloting the questionnaire with 9 employees before actual data collection and Cronbach Alpha was used to test the scale data on the questionnaire.

Data for this study was analysed using Microsoft Excel and R Statistical software, and the questions on the questionnaire were analysed descriptively using Microsoft Excel and inferentially using R Software.

The study acquired ethical clearance from the Anonymised before data was collected with the protocol number Anonymised

### *Data Analysis*

The study gathered data from the employees of Kruger National Park to determine whether there was COVID-19 vaccine hesitancy amongst the employees or whether it was about conservation and livelihoods. This study applied descriptive and inferential statistics to analyse the questionnaire data. The main study question was answered by assessing 1) vaccine hesitancy; 2) participants' beliefs; and 3) communication channels used during the COVID-19 pandemic.

To assess vaccine hesitancy, the study applied a Generalized Linear model (GLM) with a Poisson distribution fitted from the *glm* function and set the number of responses to the question of the reasons that made the respondents hesitant to take the COVID-19 vaccine as the outcome variable. The questions of the respondents' 1) level of knowledge about the vaccine; 2) trust in the vaccine; and 3) whether the respondents were initially hesitant to get the vaccine since most respondents reported being vaccinated were set as predictor variables for this model.

Secondly, the study assessed participants' beliefs on the COVID-19 vaccine by running a Generalised Linear Mixed Model (GLMM) with a Poisson family fitted from the *lme4* function with the responses to the question of the position of the respondents in the Kruger National Park set as the outcome variable. The number of responses to the question that sought to find out the type of COVID-19 healing interventions participants believed in was set as a random effect to account for the potential biases that could arise from the rural-inclined belief systems of the study community. Indeed, most rural communities in South Africa especially those that are abutting protected areas, have been reported to believe in traditional healing (Tsawu,

S., 2022; Swemmer et al., 2017; Smith et al., 2021). The questions of 1) the participants' belief system; 2) whether the participants believe COVID-19 is natural or man-made; 3) whether the vaccine should be mandated for everyone regardless of personal beliefs and the question of 4) whether COVID-19 is against the employees' belief were asked separately on the questionnaire were set as fixed effects of the model.

Lastly, the study assessed whether the communication channels that were used to disseminate COVID-19 vaccination news contributed to the employees of the KNP's vaccine hesitancy by applying another GLMM with Poisson distribution. The number of responses to the question of how COVID-19 vaccine acceptance or rejection by the participants has been influenced by the vaccine roll-out was set as a predictor variable of the model. The question of the type of employment was set as the random effect. This was to account for the potentially high number of respondents that could be employed by the Kruger National Park (KNP) permanently as compared to other employees since the study area was on the edge of the KNP and the number of participants permanently employed by the KNP could be higher and influence the outcome variable. The questions of 1) the media sources that influenced the participants' COVID-19 vaccine acceptance; 2) the reliability of media sources the participants used to influence their COVID-19 vaccine acceptance; 3) the question on conspiracy theories that were surrounding the COVID-19 vaccine and 4) that influenced their vaccine acceptance were set as the model's fixed effects.

All models for this study were applied on R Statistical Software ([www.r-project.org](http://www.r-project.org), R version 4.4.0 (2024-04-24, statistical tests were two-tailed. The test statistics used for the models were Wald for the GLM and Chi-Square tests for the GLMM, and the P values (set at were set at  $p \leq 0.05$ ); the degrees of freedom were determined by the *Anova* function from the *car* package in R. All graphs for this study were produced using *ggplot2* and the tables were produced using Microsoft Excel. Data for the three models is presented as bar charts and output tables.

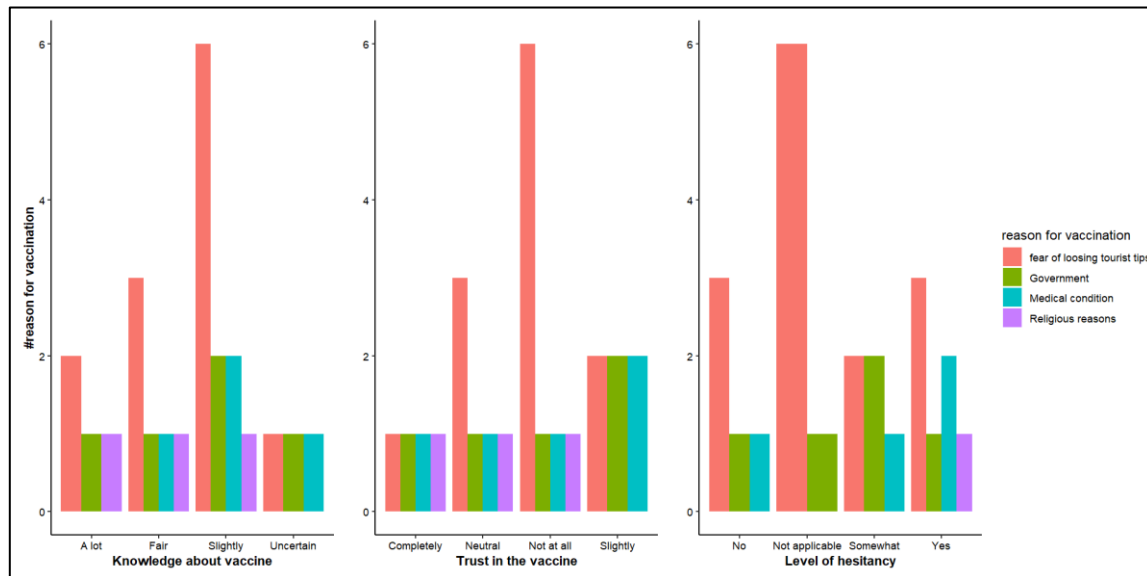
## Results

This study, assessed whether the employees of the Kruger National Park, Numbi Gate got vaccinated for community or conservation-related benefits and collected data from 33 employees to come to the following results and conclusions.

### *COVID-19 Vaccination Influence*

The study assessed what influenced the employees to take or not take the ' COVID-19 vaccine the study applied a General linear model (GLM) and the results showed a statistically significant difference in the questions of the level of knowledge about the vaccine (Wald  $\chi^2 = 2.127$ ;  $P=0.000$ ); the participants' trust in the vaccine (Wald  $\chi^2 = 0.899$ ;  $P=0.030$ ). However, there was no statistically significant difference found for the question of whether the respondents were initially hesitant to get the vaccine (Wald  $\chi^2 = 1.929$ ;  $P=0.587$ ). Furthermore, across all three predictor variables, losing tourist tips came out strong as the reason for vaccination (Figure 1). Even the highest number of employees who did not report hesitancy mentioned being scared to lose the tips as their main reason for vaccination (Figure 1).

**Figure 1.** Number Of Reports About Reasons for Vaccination Reported by Employees of Numbi Gate of The Kruger National Park, South Africa. Knowledge About the Vaccine (Left); Trust in The Vaccine (Middle) And the Level of Hesitancy (Right)



### Participants Beliefs and Vaccine Hesitancy

The study assessed employees' reason for vaccination by applying a Generalised Linear Mixed Model (GLMM) and the model showed statistically significant differences on the questions of whether 1) the participants' belief system (Wald  $\chi^2 = 0.353$ ;  $P=0.011$ ); the participants believe COVID-19 is natural or man-made (Wald  $\chi^2 = 0.841$ ;  $P=0.003$ ) and whether the vaccine goes against the participants' belief (Wald  $\chi^2 = 0.009$ ;  $P=0.005$ ). However, there was no statistically significant difference found for the question of whether the vaccine should be mandated for everyone regardless of personal beliefs (Wald  $\chi^2 = 1.116$ ;  $P=0.572$ ). Furthermore, across all three predictor variables, there were significant differences found in the participants' belief systems for those who preferred not to say their religion; those participants who reported that they were not sure if COVID-19 was natural or man-made and those who reported that they do not know if COVID-19 is natural or man-made (Table 1).

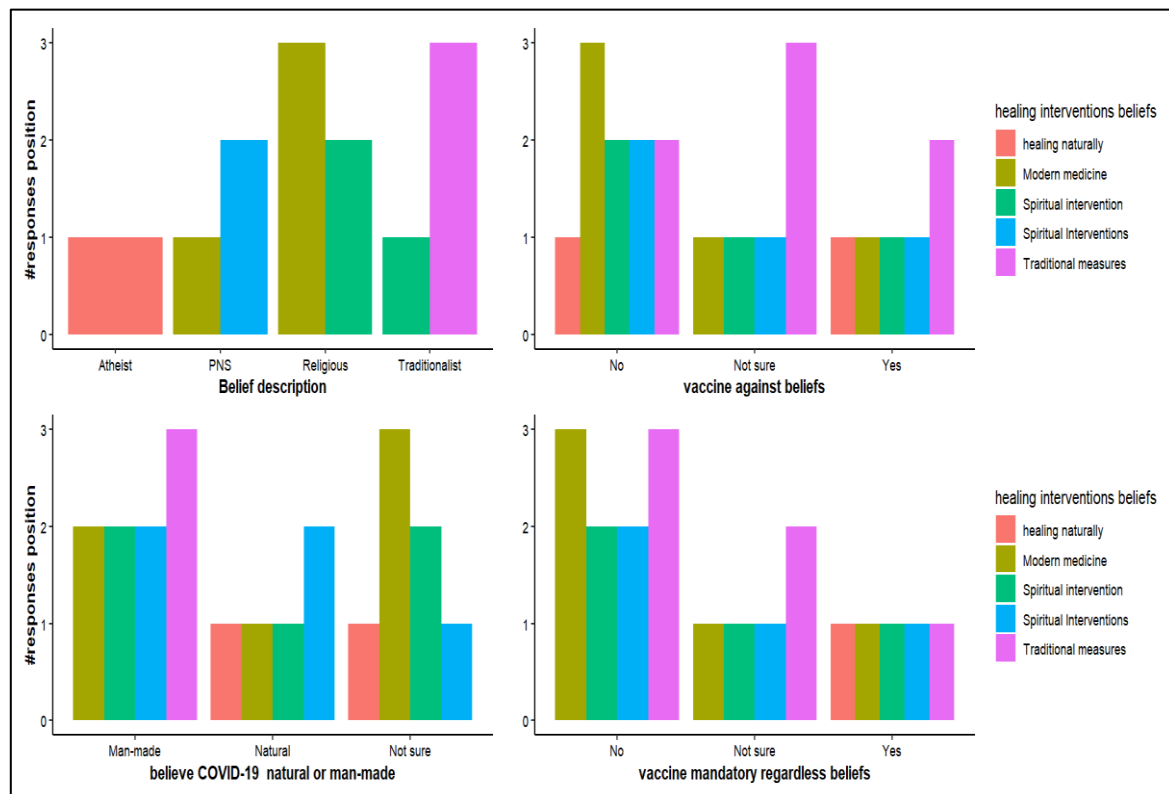
**Table 1.** Output of A Generalised Linear Mixed Model on the COVID-19 Healing Intervention Beliefs of the Kruger National Park Employees. Significant Values Are Shown In Bold.

Parameters	Estimates	Std errors	Wald	P-values
Belief System: Prefer not to say	<b>-0.025</b>	<b>0.793</b>	<b>-0.032</b>	<b>0.003</b>
Belief System: Religious	-0.038	0.797	-0.048	0.962
Belief System: Traditionalist	0.114	0.840	0.136	0.892
Vaccine against belief: Not sure	-0.168	0.251	-0.670	0.974
Vaccine against belief: Yes	-0.202	0.268	-0.753	0.451
Believe COVID-19 is natural or man-made: No	<b>-0.012</b>	<b>0.376</b>	<b>-0.034</b>	<b>&lt;0.001</b>
Believe COVID-19 is natural or man-made: Not sure	<b>0.019</b>	<b>0.245</b>	<b>0.080</b>	<b>0.000</b>
Vaccines should be made compulsory regardless of beliefs: Not sure	-0.213	0.243	-0.876	0.381
Vaccines should be made compulsory regardless of beliefs: Yes	-0.244	0.320	-0.763	0.446

The majority of the respondents who were religious and traditionalist believe in modern medicine and traditional measures respectively when it comes to the COVID-19 treatment (Figure 2). Also, the majority of the respondents who reported that they were not sure if COVID-19 was against their belief reported

traditional medicine as their healing intervention together with those who reported yes to the vaccine being against their belief (Figure 2). In addition, the majority of the participants who believed COVID-19 is man-made also believed in traditional medicine to cure COVID-19. Furthermore, the majority of the respondents who think vaccines should be made mandatory also believe in traditional measures to cure COVID-19 (Figure 2)

**Figure 2:** Number of Reports About Participants COVID-19 Healing Interventions Beliefs By Belief Description (Top Left); Vaccine Against Their Beliefs (Top Right); Belief COVID-19 Is Natural Or Manmade (Bottom Left) and That COVID-19 Vaccination Should Be Made Mandatory Irrespective Of Their Personal Beliefs' (Bottom Right) From The Sampled Community. (PNS=Pref Not to Say)



### Communication Channels Used For COVID-19 Vaccine Rollout

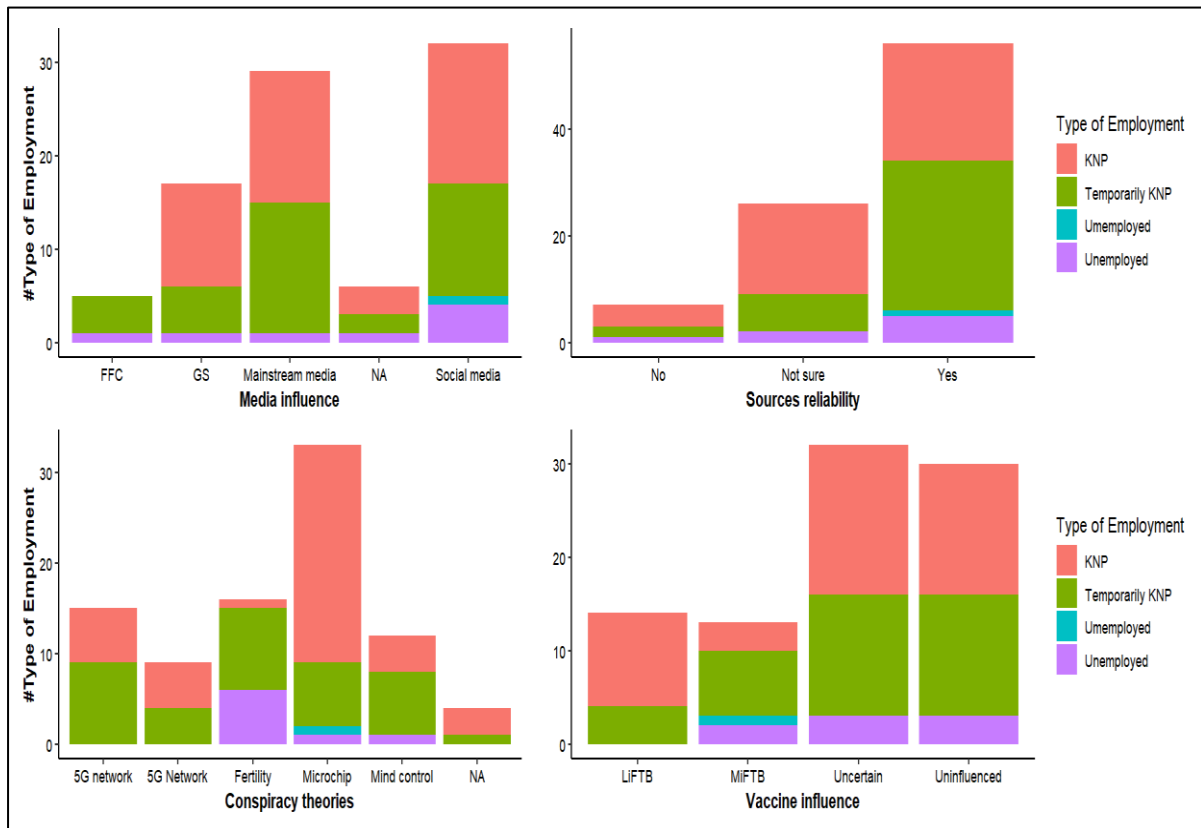
The study further assessed whether the communication channels that were used to disseminate COVID-19 vaccination news contributed to the employees of the KNP's vaccine hesitancy by applying another Generalised Linear Mixed Model (GLMM) and the model revealed statistically significant differences on the questions of 1) the media sources that influenced the participants' COVID-19 vaccine acceptance; (Wald  $\chi^2 = 0.274$ ;  $P=0.011$ ); the reliability of media sources the participants used to influence their COVID-19 vaccine acceptance (Wald  $\chi^2 = 0.642$ ;  $P=0.000$ ); the question on conspiracy theories that were surrounding the COVID-19 vaccine (Wald  $\chi^2 = 0.527$ ;  $P=0.005$ ) and the question of what influenced their vaccine acceptance (Wald  $\chi^2 = 0.330$ ;  $P=0.041$ ). Furthermore, across all predictor variables, there were significant differences found in the participants' responses for social media influence; those participants who reported not being sure about the reliability of the media they got their vaccine news from; Participants who believed the microchip conspiracy theories; and those who were uncertain about their vaccine influence (Table 2).

**Table 2.** Output of a Generalised Linear Mixed Model on the Role of the Communication Channels That Were Used to Disseminate COVID-19 Vaccination News Contributed to Their Vaccine Hesitancy. Significant Values Are Shown In Bold.

Parameters	Estimates	Std errors	Wald	P-values
Media influence: Government Source	0.235	0.537	0.438	0.662
Media influence: Mainstream media	0.094	0.499	0.189	0.850
Media influence: Not Applicable	0.127	0.626	0.203	0.839
Media influence: social media	<b>0.130</b>	<b>0.508</b>	<b>0.256</b>	<b>0.003</b>
Sources reliability: Not sure	<b>0.281</b>	<b>0.440</b>	<b>0.640</b>	<b>0.005</b>
Sources reliability: Yes	0.334	0.417	0.801	0.423
Conspiracy theory: 5G Network	-0.007	0.245	0.470	0.987
Conspiracy theory: Fertility	0.055	0.243	0.372	0.882
Conspiracy theory: Microchip	<b>-0.047</b>	<b>0.320</b>	<b>0.320</b>	<b>&lt;0.001</b>
Conspiracy theory: Mind control	0.194	0.245	0.405	0.632
Conspiracy theory: Not Applicable	0.103	0.579	0.579	0.858
Vaccine influence: More in Favour Than Before	0.579	0.411	-0.018	0.986
Vaccine influence: Uncertain	<b>0.135</b>	<b>0.333</b>	<b>0.408</b>	<b>0.030</b>
Vaccine influence: Uninfluenced	-0.000	0.337	-0.003	0.998

The majority of the respondents who got their vaccine news are permanently employed by the Kruger National Park and their sources were reliable and they believed in the microchip conspiracy theory and they were uncertain about what influenced their vaccine taking or hesitancy (Figure 3).

**Figure 3.** Number of Reports of Participants on Whether The Communication Channels Used To Disseminate COVID-19 Vaccination News Contributed To Their Responses By Type Of Media Source Influences (Top Left); Media Sources Reliability (Top Right); Conspiracy Theories (Bottom Left) And Vaccine Acceptance Influence (Bottom Right) From the Sampled Community. (FFC=Friends, Family And Colleagues; GS=Government Sources; Liftb=Less In Favour Than Before; Miftb=More In Favour Than Before)



## Discussion of the Study Findings

The study assessed vaccine hesitancy among respondents by first evaluating the influence of three key predictor variables on the reasons for vaccine hesitancy 1) the respondents' level of knowledge about the vaccine, 2) their trust in the vaccine, and 3) their initial level of hesitancy toward getting vaccinated. The respondents with slight knowledge about the vaccine were more likely to express fear of losing tourist tips as a reason for vaccination. This suggests that those with a limited understanding of the vaccine may have been motivated by external factors rather than a comprehensive understanding of the vaccine's benefits. Respondents with fair or uncertain knowledge of the vaccine had more diverse reasons for vaccination, including government mandates and medical conditions. This diversity indicates that varying levels of knowledge about the vaccine can lead to different motivations for vaccination, but those with more substantial knowledge are less likely to cite fear of losing tourist trips as their primary reason. The respondents with no trust in the vaccine were predominantly motivated by the fear of losing tourist tips, which again highlights an external, rather than intrinsic, motivator for vaccination. Respondents who were not initially hesitant to get vaccinated overwhelmingly cited fear of losing tourist tips as their primary motivator. This could indicate that individuals who were eager to get vaccinated were driven by the prospect of maintaining their livelihoods rather than by health-related reasons.

The study also examined the intersection of beliefs and perceptions regarding COVID-19 and its vaccination among employees at Kruger National Park with four belief systems associated with different healing intervention beliefs.

The Religious and Traditionalist participants show a broader spread across different healing interventions, with a notable preference for traditional measures. These results were not surprising as the study community was conducted in the rural part of South Africa where most communities believe in their tradition (Flora, 2018). The results showed that belief systems are strongly correlated with preferences for healing interventions whereby Traditionalists, for instance, are likely to rely on traditional measures. The majority of the respondents, especially those with traditionalist views, believe that the vaccine is against their beliefs. This implies that resistance to vaccination within certain belief groups, particularly traditionalists, could be rooted in a conflict between modern medical interventions and established cultural or religious practices. A notable number of religious participants reported to be uncertain about the origin of COVID-19, while traditionalists seem divided between thinking it is man-made or being unsure. The uncertainty and division in beliefs about the origin of COVID-19 suggest a level of skepticism or lack of information, particularly among religious and traditionalist groups. This could influence their overall perception and acceptance of the vaccine. There was a significant amount of uncertainty across all groups on whether the vaccine should be mandatory, regardless of personal beliefs. The resistance to mandatory vaccination, particularly among traditionalists and religious participants, aligns with their general skepticism towards the vaccine and possibly their healing intervention preferences. The uncertainty might indicate a need for more targeted information and education.

The study further assessed the impact of communication channels on vaccine hesitancy among employees of the Kruger National Park (KNP) during the COVID-19 vaccine roll-out. Different media sources influenced the participants' vaccine acceptance or hesitancy with social media having the most significant influence, particularly among the unemployed. Mainstream media also played a substantial role, particularly for temporarily employed and unemployed participants. In contrast, government sources and friends, family, and colleagues had less influence, suggesting that traditional and interpersonal communication channels were less effective in this context. This suggests that the type of media used to disseminate information significantly impacted the employees' vaccine hesitancy. Social media's prominence could be due to its

It was evident that a considerable portion of the participants were uncertain about the reliability of the sources they used, with the "Not sure" category showing a significant response. Interestingly, those who believed their sources were reliable also showed a high level of vaccine hesitancy. This suggests that even when individuals trusted their media sources, the content they consumed might have been misleading or contributed to hesitancy. The uncertainty and skepticism surrounding media reliability highlight a crucial challenge in public health communication, particularly during crises like the COVID-19 pandemic. Effective communication strategies must not only disseminate accurate information but also build trust in the sources of that information. The microchip theory, which suggests that the vaccine could be used to implant tracking devices, had the most substantial influence, particularly among the unemployed and temporarily employed. Other theories, such as the 5G network and fertility concerns, also had a notable impact, though to a lesser extent. This finding aligns with broader global trends where misinformation and conspiracy theories have significantly contributed to vaccine hesitancy. The strong influence of these theories among certain employment types suggests that these groups may be more vulnerable to misinformation, possibly due to their socioeconomic status or access to reliable information.

## Conclusions

Our study concludes that vaccine hesitancy is multifaceted and is influenced by a combination of knowledge, trust, and initial hesitancy. The study indicates that the fear of losing tourist tips was a significant motivator for vaccination among those with low knowledge, low trust, and no initial hesitancy. This suggests that external pressures instead of conservation per se, such as maintaining community livelihoods, played a critical role in driving vaccination decisions for the employees of the KNP. The study, therefore, underscores the need for public health initiatives to not only address external motivators for vaccination but also to foster greater knowledge and trust in vaccines. By doing so, it may be possible to reduce vaccine hesitancy and ensure that decisions to vaccinate are based on informed, health-related reasons rather than external pressures.



There was a clear connection between belief systems and perceptions toward COVID-19 and its vaccine among employees in the Kruger National Park. Traditionalists and religious individuals exhibit more resistance to vaccination and are more likely to believe in alternative healing measures, reflecting a potential clash between modern medical approaches and traditional or religious values. Given these insights, interventions aimed at increasing vaccine acceptance might need to be tailored to address the specific concerns of different belief groups. For instance, educational campaigns that resonate with traditionalist values or that do not directly confront religious beliefs might be more effective. Further research could explore the underlying reasons for the uncertainty observed among participants and develop targeted strategies to address this. It would also be beneficial to explore how these belief systems influence other health-related behaviors, not just vaccination.

The findings of this study provide critical insights into the factors that contributed to vaccine hesitancy among employees at KNP. The significant influence of social media and conspiracy theories highlights the challenges posed by misinformation in the digital age. The uncertainty surrounding the reliability of information sources and the mixed responses to the vaccine roll-out further emphasise the need for targeted, transparent, and reliable communication strategies in public health. Moving forward, health authorities and policymakers need to address these issues by promoting media literacy, ensuring transparent communication, and directly confronting misinformation. Understanding the diverse influences on vaccine acceptance can help tailor future health interventions to be more effective, particularly in vulnerable populations like those represented in this study.

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