

BMJ Open Vaccination status, personal and workplace experiences of early career health professionals in the WiSDOM cohort study during the COVID-19 pandemic in South Africa

Laetitia Rispel ¹, Prudence Ditlopo ², Janine A White ³, Duane Blaauw ²

To cite: Rispel L, Ditlopo P, White JA, *et al.* Vaccination status, personal and workplace experiences of early career health professionals in the WiSDOM cohort study during the COVID-19 pandemic in South Africa. *BMJ Open* 2024;**14**:e089998. doi:10.1136/bmjopen-2024-089998

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (<https://doi.org/10.1136/bmjopen-2024-089998>).

Received 14 June 2024
Accepted 11 November 2024



© Author(s) (or their employer(s)) 2024. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to

Prof Laetitia Rispel;
laetitia.rispel@wits.ac.za

ABSTRACT

Introduction The knowledge gaps on the experiences of early career health professionals during the COVID-19 pandemic informed this study, which examined their vaccination status, personal and workplace experiences in South Africa.

Methods Wits Longitudinal Study to Determine the Operation of the labour Market among its health professional graduates (WiSDOM), a prospective longitudinal cohort study established in 2017, consists of eight health professional groups of clinical associates, dentists, doctors, nurses, occupational therapists, oral hygienists, pharmacists and physiotherapists. As a part of annual follow-up surveys, we examined the personal and workplace experiences and the vaccination status of cohort members during the COVID-19 pandemic years: 2020 until 2022. We measured workplace experiences using a Likert scale that ranged from 1 (strongly disagree) to 7 (strongly agree). We constructed a composite index of positive workplace COVID-19 support using a principal component analysis.

We compared differences among the professional groups using proportions for categorical variables and means for numerical variables. We used multiple linear regression to investigate factors associated with the workplace COVID-19 support score and Firth's penalised logistic regression for COVID-19 infection and vaccination.

Results In 2022, the mean age of the 363 cohort members was 28.9 (± 2.1), and the majority were female (74.2%). In 2020, 22.6% of the cohort reported COVID-19 infections but this increased to 45.3% by 2021. The composite index shows that doctors and nurses reported the lowest COVID-19 workplace support, while oral hygienists and dentists reported the most support. Although 89.5% of cohort members reported full COVID-19 vaccination status, 9.4% indicated non-intention to get vaccinated. The regression analysis showed that doctors ($p < 0.001$) and women ($p < 0.05$) reported significantly lower workplace COVID-19 support scores. Those working in hospitals had 17.1% higher COVID-19 infections ($p < 0.01$). The lack of a COVID-19 supportive workplace resulted in 15.7% higher infections among early career health professionals ($p < 0.01$).

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ A major strength of the study is the longitudinal cohort design.
- ⇒ The cohort study covers eight categories of early career health professionals.
- ⇒ This study provides empirical evidence on the vaccination status, personal and workplace experiences of eight categories of early career health professionals during the COVID-19 pandemic.
- ⇒ The study is limited by the self-reported nature of the information obtained from early career health professionals.
- ⇒ The cohort members are representative of the graduates of one, large South African university.

Conclusion The study findings underscore the need for positive practice environments for early career health professionals in South Africa.

INTRODUCTION

The COVID-19 pandemic unleashed an unprecedented global crisis and had a profound impact on health systems,¹ illustrated by the disruption of essential health services and compromised quality of care.^{2,3} Healthcare workers (HCWs) have been vital to the pandemic response, and they will be critical to postpandemic health system recovery.⁴ However, the COVID-19 pandemic has exposed the chronic underinvestment in the health workforce and exacerbated staff shortages, gender inequalities and poor working conditions.⁵

There is a substantial literature on the multi-dimensional impact of COVID-19 on frontline HCWs.^{6–11} Central to the health workforce impact was the increased risk of COVID-19 infection and disease during the pandemic, with far-reaching consequences for healthcare delivery.¹² Furthermore, preventable

COVID-19 infections in HCWs had enormous economic costs, ranging from an estimated 1.5%–8.4% as a share of total health expenditure.¹² The pandemic also aggravated the health workforce crisis, with a global estimate of more than 100 000 COVID-19 deaths among HCWs.⁵

In many healthcare systems, the COVID-19 pandemic led to an increased workload for HCWs because of the surge in patient numbers, changes in healthcare delivery, inadequate staffing and limited resources.³ Consequently, HCWs experienced physical exhaustion, exacerbated by the lack of personal protective equipment (PPE).¹³ The pandemic also highlighted the poor mental health of frontline HCWs, driven by a combination of rapidly changing and inconsistent protocols, inadequate PPE, fears for their personal safety, gender inequalities and inadequate access to mental health and psychosocial support services.¹³ Many frontline HCWs were exposed to the trauma of critically ill patients and deaths and they experienced moral distress.^{10 11 14}

In South Africa, the COVID-19 pandemic amplified the health system fragilities and historical underinvestment in the health workforce.¹⁵ The initial response failed to prioritise HCWs, and to implement strategies for psychosocial support, and safe work environments.¹⁵ South African researchers highlighted the adverse effects of COVID-19 on the well-being of HCWs, including physical exhaustion, anxiety, psychological distress, depression and traumatic stress.^{16–18} Many HCWs reported fluctuating emotions, fear of contracting COVID-19 and guilt at their inability to provide quality healthcare to individuals with HIV and tuberculosis.¹⁹ Women HCWs were exposed to higher risk of infection and poor working conditions.²⁰

The COVID-19 pandemic also worsened the health workforce crisis in South Africa, with 1320 reported deaths among HCWs.²¹ However, two studies highlighted the importance of positive practice environments that included occupational health and safety policies, availability of PPE, training and supportive workplace relationships in mitigating both the risk of infection and psychological distress.^{19 22}

Notwithstanding the multidimensional and negative impact of the pandemic on the health workforce, there is a dearth of studies that compare the personal and workplace experiences of multiple groups of early career health professionals during the COVID-19 pandemic in South Africa. Their experiences are important as they are the future health workforce. The WiSDOM (Wits longitudinal Study to Determine the Operation of the labour Market among its health professional graduates) study in South Africa presented the opportunity for such an empirical, comparative study that involves eight health professional categories of clinical associates, dentists, doctors, nurses, occupational therapists, oral hygienists, pharmacists and physiotherapists.²³ The WiSDOM cohort was established in 2017 to investigate the career trajectories and job location decisions of these eight health professional categories in the South African labour market.^{23–25} As the novel WiSDOM cohort study commenced prior to

the pandemic's outbreak, the annual follow-up surveys enabled us to examine longitudinally the personal (eg, COVID-19 infections) and workplace experiences (eg, availability of PPE and emotional support) and their vaccination status during one of the world's most significant public health crises.

Consequently, the primary aim of this study was to examine the vaccination status, personal and workplace experiences of early career health professionals in South Africa during the COVID-19 pandemic from 2020 to 2022. A secondary aim was to investigate the factors that influence these experiences. The rationale for the study is both its scholarly contribution and its policy relevance. The study contributes to and advances the empirical knowledge on how the COVID-19 pandemic affected early career health professionals in South Africa. The study contributes to the discourse on postpandemic health system recovery and possible strategies to mitigate the impact of public health emergencies on the health workforce in South Africa, with relevance for other low- and middle-income countries (LMIC).

METHODS

Study design

WiSDOM is a prospective, longitudinal health workforce cohort study that commenced in 2017.²⁵ The cohort shares three characteristics: health professional qualification, final year studies in 2017 and education and training at the Faculty of Health Sciences of the same South African University.

Study population

The WiSDOM cohort, described elsewhere, consists of all eight health professions—clinical associates, dentists, doctors, nurses, occupational therapists, oral hygienists, pharmacists and physiotherapists—educated at the University of the Witwatersrand in Johannesburg, South Africa.^{23 25}

At baseline in 2017, all final year students (n=571) were invited to participate in the study; hence, there was no sampling as we targeted the universe of health professional students.²⁵ We obtained a response rate of 89.5% at baseline.²⁵ Hitherto, we have maintained an overall response rate of 71.0%, ranging from 56.4% for medical doctors to 100% for oral hygienists.

Data collection tool

Since the inception of WiSDOM in 2017, a customised self-administered questionnaire (SAQ) collects annual information electronically on the two main WiSDOM study outcomes, namely the long-term career choices and job location decisions of health professionals.^{23 25}

Given the declaration of the COVID-19 pandemic in 2020, we included additional questions on the cohort's personal experiences of COVID-19 infections, namely whether they tested positive for SARS-CoV-2 or not. We included five questions on workplace experiences:

infection, prevention and control (IPC) training; availability of PPE; feelings of stress; availability of emotional support (eg, counselling) when needed; and perceptions of supervisor support. In 2021, we repeated these questions and added a question on vaccination. In 2022, we posed questions on their vaccination status and obtained reasons for partial or non-vaccination. We measured workplace experiences using a Likert scale that ranged from 1 (strongly disagree) to 7 (strongly agree). The online supplemental figure provides an overview of the longitudinal data generated for this article.

Data collection

The WiSDOM baseline data collection details have been described previously.^{23–25} As the WiSDOM cohort will be followed up for 15 years,²⁵ we do annual electronic follow-up surveys to elicit information on the main study outcomes.²³ The annual survey entails sending a unique survey link to the email address of the participating cohort members.²³ Every year, we obtain voluntary, informed consent from each participant, prior to completion of the SAQ via Research Electronic Data Capture (REDCap), an online database system, designed to collect, store, secure, organise and analyse data.²⁶ The annual survey happens over a period of six weeks, with weekly reminders sent to the mobile numbers of the participating cohort members.

Data analysis

The data were imported from REDCap into Stata 17 for analysis. Differences between the professional groups were compared using proportions for categorical variables and means and SD for numerical variables. To simplify the interpretation of the 7 point Likert scale responses for workplace experiences, we combined the ‘slightly agree’, ‘agree’ and ‘strongly agree’ responses to compute the proportion of respondents who agreed with each statement.

We also constructed a composite index of positive workplace COVID-19 support from the five items using principal component analysis (PCA). Cronbach’s alpha for the scale was 0.745, and the Kaiser–Meyer–Olkin test score was 0.710, which are acceptable.²⁷ The main advantage of developing a composite COVID-19 workplace index is that it combines the selected indicators (e.g., on PPE and availability of psychosocial support) into a single metric that provides information on workplace (i.e., health system) support during the COVID-19 pandemic. The composite index also enables an analysis of the factors that influence health professionals’ perceptions of COVID-19 workplace support.

Sociodemographic and workplace factors associated with a positive COVID-19 experience, COVID-19 infection and COVID-19 vaccination were evaluated using regression. We used multiple linear regression to investigate factors associated with the workplace COVID-19 support score and Firth’s penalised logistic regression²⁸ for COVID-19 infection and vaccination because the high proportions for certain subgroups result in separation

problems with standard logistic regression analysis. Logistic models are presented as marginal effects and the differences between the professional groups are calculated as marginal contrasts to the (unweighted) mean of the groups rather than to a base category. All statistical tests were considered significant at the 5% level.

Patient and public involvement

No patients or the broader public are involved, as WiSDOM is a cohort of health professionals who graduated from a South African university. We provide annual feedback to all 2017 health professional graduates, regardless of their ongoing study participation.

RESULTS

In this article, we present the findings for the early career health professionals in the WiSDOM cohort, representing 71.0% of the original cohort that was established in 2017. Between 2020 and 2022, the annual follow-up response rate remained constant and ranged from 56.4% for medical doctors to 100.0% for clinical associates and oral hygienists. We excluded the cohort members who were not in employment at the time of the survey (n=27); hence, the tables reflect the findings for 336 cohort members.

Table 1 Sociodemographic characteristic of the WiSDOM cohort, 2022

		Total (n=363)
Age	(Mean±SD)	28.9±2.1
Age group		
<30 years		77.7%
≥30 years		22.3%
Female	(%)	74.2%
Self-identified	Black African	49.7%
Race* (%)	Coloured	2.8%
	Asian/Indian	19.6%
	White	27.9%
Rural birth	(%)	13.7%
Geographical area of work	%	
Rural (Farm, village)		9.4%
Urban (Town, City)		90.6%
Employment sector	%	
Public sector		54.4%
Private-for-profit		42.6%
NGO/Not-for-profit		3.0%
Hospital setting	%	48.1%

*Given South Africa’s apartheid legacy, ‘race’ continues to influence perspectives and socioeconomic outcomes; hence, we left it to study participants to self-identify. NGO, Non-governmental organisation; WiSDOM, Wits longitudinal Study to Determine the Operation of the Market among its health professional graduates.

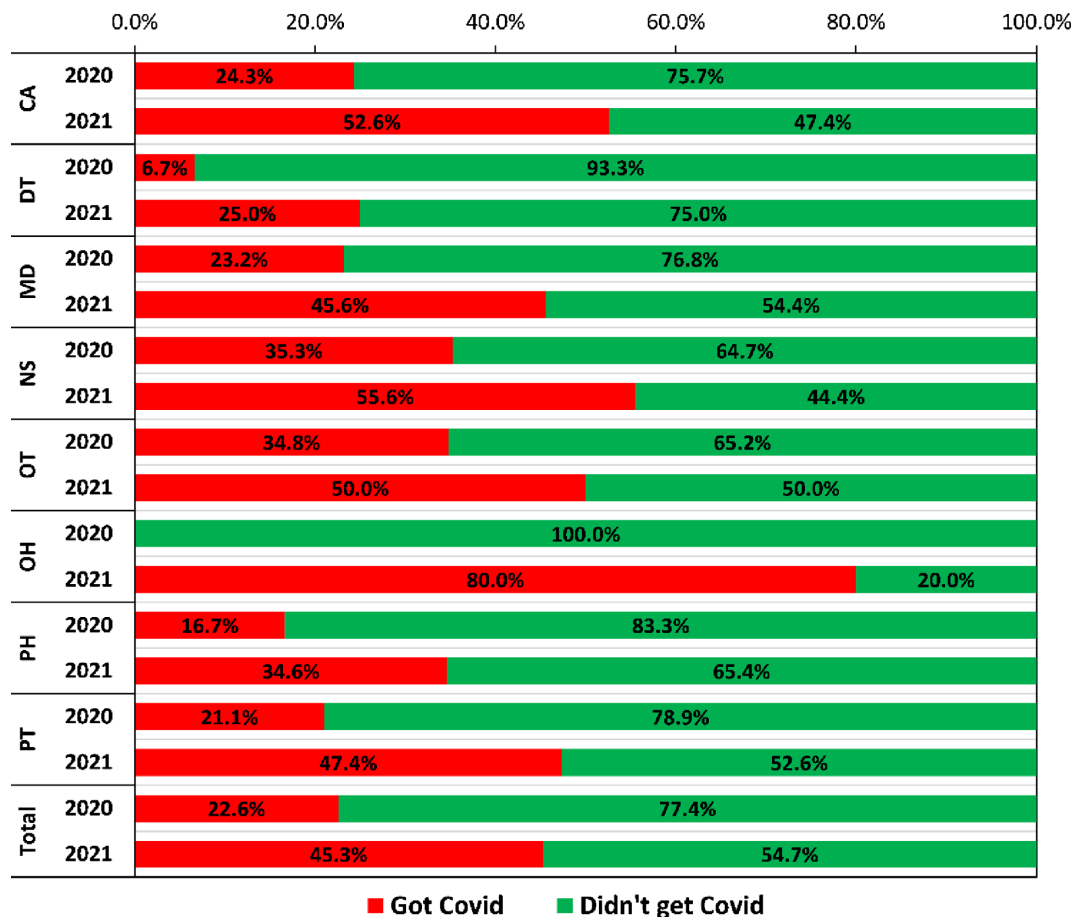


Figure 1 Reported COVID-19 infections among WiSDOM cohort members, 2020–2021. CA, clinical associate; DT, dentist; MD, medical doctor; NS, nurse; OH, oral hygienist; OT, occupational therapist; PH, pharmacist; PT, physiotherapist; WiSDOM, *W*its longitudinal *S*tudy to *D*etermine the *O*peration of the labour *M*arket among its health professional graduates.

Demographic characteristics

Table 1 shows the sociodemographic characteristics of the WiSDOM cohort in 2022. The mean age of the cohort was 28.9 (\pm 2.1) and the majority (77.7%) were less than 30 years old, and female (74.2%). At baseline, we established that 13.7% of cohort members were born in a rural area. 5 years later in 2022, 9.4% of cohort members were working in rural areas. In 2022, 54.4% of cohort members were working in the public sector, and 48.1% were working in hospitals (**table 1**).

Personal experiences of COVID-19 infections

Figure 1 shows the WiSDOM's cohort experiences of COVID-19 infections for 2020 and 2021, and for each of the eight health professionals. In 2020, at the height of the pandemic, 22.6% of the cohort reported COVID-19 infections, ranging from 0.0% for oral hygienists to 35.3% for nurses. In 2021, 45.3% of the cohort reported COVID-19 infections, ranging from 25.0% for dentists to 80.0% for oral hygienists.

Workplace experiences during the COVID-19 pandemic

Table 2 shows the cohort's workplace experiences and the composite index of COVID-19 workplace support. In 2020, 55.4% of all cohort members agreed with a

statement that they 'did not always have PPE when needed', ranging from 0.0% for oral hygienists to 76.5% for medical doctors. In 2021, 47.8% of the cohort agreed with this statement, ranging from 17.7% for pharmacists to 68.9% for medical doctors.

In 2020, 56.9% of the WiSDOM cohort agreed with the statement that they received adequate training in IPC, compared with 56.1% in 2021. In both years, the lowest agreement was among doctors (47.7% in 2020 and 48.7% in 2021) and nurses (44.4% in 2020 and 50.0% in 2021).

In 2020, 70.2% of the cohort agreed with a statement that they 'felt more stressed at work than before the lockdown', compared with 67.5% in 2021. With the exception of oral hygienists (20.0%), the percentage agreement among all other groups varied from 56.9% for pharmacists to 91.3% for occupational therapists. In 2020, 26.2% of the cohort agreed with the statement that they 'received emotional support (eg, counselling) when needed', while in 2021, there was a slight increase of 1.3%, with 27.5% of the cohort agreeing with this statement.

In 2020, the majority (61.9%) agreed with a statement that the supervisor at the facility was supportive: this ranged from the lowest figure of 50.0% for nurses to a high of 86.7% for dentists. In 2021, 65.7% agreed

Table 2 Workplace experiences during the COVID-19 pandemic, 2020–2021

Group	Year	% Agreeing					Composite COVID-19 support index*
		I did not always have protective equipment when I needed it	I received adequate training in infection, prevention and control	I felt more stressed at work than before the lockdown	I received emotional support (eg, counselling) when I needed it	My supervisor at the facility where I work was supportive	
CA	2020	43.2%	56.8%	64.9%	27.0%	54.1%	0.367±2.05
(n=37)	2021	36.8%	55.3%	63.2%	36.8%	52.6%	
DT	2020	40.0%	93.3%	66.7%	60.0%	86.7%	1.458±1.40
(n=15)	2021	20.0%	93.3%	66.7%	26.7%	73.3%	
MD	2020	76.5%	47.7%	70.6%	17.7%	56.9%	−0.879±1.66
(n=153)	2021	68.9%	48.7%	68.9%	19.6%	68.2%	
NS	2020	44.4%	44.4%	66.7%	27.8%	50.0%	−0.004±1.67
(n=18)	2021	38.9%	50.0%	61.1%	33.3%	44.4%	
OT	2020	47.8%	78.3%	95.7%	43.5%	73.9%	0.757±1.83
(n=23)	2021	34.8%	60.9%	91.3%	43.5%	86.9%	
OH	2020	0.0%	60.0%	75.0%	0.0%	75.0%	1.525±1.12
(n=4)	2021	20.0%	80.0%	20.0%	20.0%	100.0%	
PH	2020	27.1%	56.3%	56.3%	27.1%	70.8%	0.807±1.67
(n=48)	2021	17.7%	52.9%	56.9%	25.5%	58.8%	
PT	2020	39.5%	73.7%	78.9%	36.8%	65.8%	0.793±1.83
(n=38)	2021	43.2%	72.9%	75.7%	40.5%	67.6%	
Total	2020	55.4%	56.9%	70.2%	26.2%	61.9%	0.000±1.90
(n=336)	2021	47.8%	56.1%	67.5%	27.5%	65.7%	

*Composite support index calculated over both years combined.
 CA, clinical associate; DT, dentist; MD, medical doctor; NS, nurse; OH, oral hygienist; OT, occupational therapist; PH, pharmacist; PT, physiotherapist.

with this statement on supportive supervision, with the lowest percentage agreement among nurses (44.4%) and the highest among the small group of oral hygienists (100.0%).

The PCA has a mean of zero (table 2). The composite COVID-19 support index shows that doctors (−0.879±1.66) and nurses (0.004±1.67) reported less COVID-19 workplace support, while oral hygienists (1.525±1.12) reported the most support.

COVID-19 vaccination status of the WISDOM cohort

Figure 2 shows the reported vaccination status of cohort members in 2022. Although 89.5% of cohort members reported full COVID-19 vaccination status, this ranged from 78.9% for nurses to 100% for occupational therapists and physiotherapists. Of concern is that 9.4% of all cohort members and 21.1% of nurses indicated that they did not intend to get vaccinated.

The top three reasons for declining vaccination were: reservations about COVID-19 vaccines (32.4%); not seeing the benefits of vaccination (26.5%) and concern about the side effects of vaccines (14.7%). The lack of trust in politicians or the pharmaceutical industry

accounted for 8.8% and spiritual/religious objections or health contraindications for another 8.8%.

Factors influencing vaccination, personal and workplace experiences

The regression analysis showed that medical doctors ($p<0.001$) and women ($p<0.05$) reported significantly lower workplace COVID-19 support scores (table 3). Once adjusted for the lack of workplace support, medical doctors had 16.0% ($p<0.01$) and pharmacists 15.1% ($p<0.05$) lower COVID-19 infections, while oral hygienists had 36.2% ($p<0.001$) higher infections. Those working in hospitals had 17.1% higher COVID-19 infections ($p<0.05$), while the lack of a COVID-19 supportive workplace resulted in 15.7% higher infections among early career health professionals ($p<0.01$).

Full vaccination status was 11.4% higher among those cohort members working in non-governmental or not-for-profit organisations, compared with those working in the public or private-for-profit sectors.

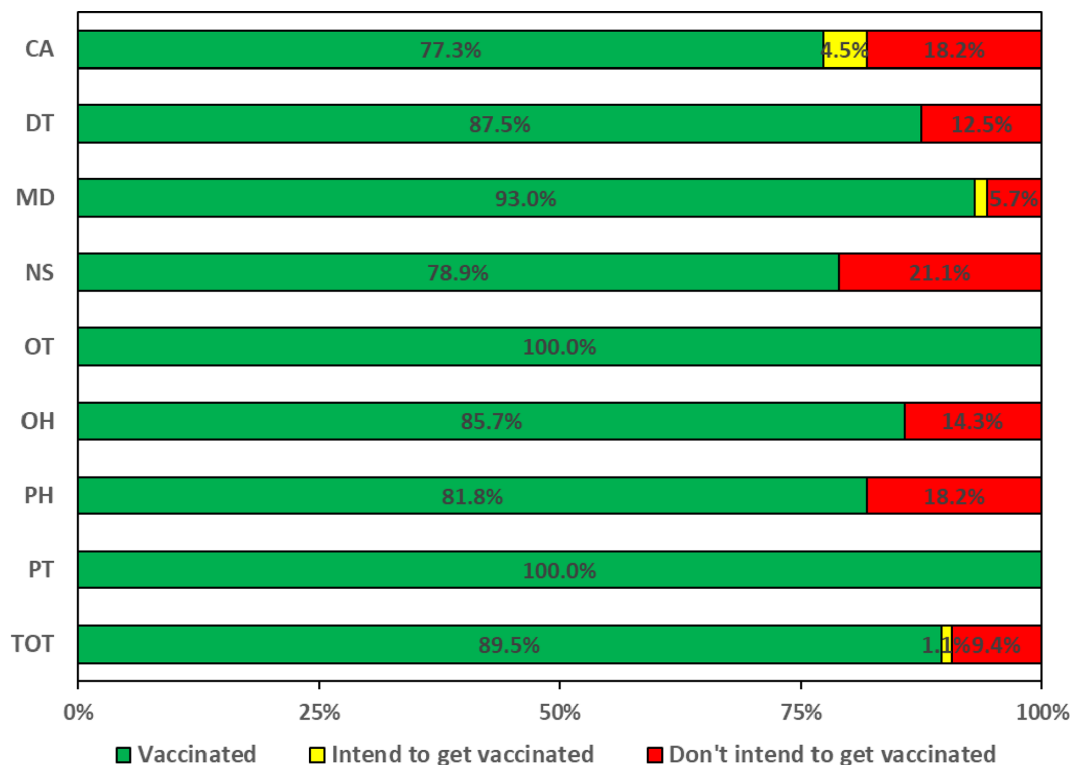


Figure 2 COVID-19 vaccination status of WiSDOM cohort members, 2022. CA, clinical associate; DT, dentist; MD, medical doctor; NS, nurse; OH, oral hygienist; OT, occupational therapist; PH, pharmacist; PT, physiotherapist; WiSDOM, Wits longitudinal Study to Determine the Operation of the labour Market among its health professional graduates.

DISCUSSION

In this article, we have examined the vaccination status, and the personal and workplace experiences of the WiSDOM health professional cohort during the COVID-19 pandemic in South Africa. The WiSDOM cohort consists of eight categories of early career health professionals, as shown by their mean age of 28.9 years in 2022. The vulnerability of early career health professionals and the negative consequences of the pandemic for this group have been highlighted,^{29 30} as they were on the frontline of caring for patients with COVID-19.

In 2020, 22.6% of the WiSDOM cohort reported COVID-19 infections, with the highest proportion of infections reported by occupational therapists and nurses. Other studies have demonstrated the occupational risk of COVID-19 infections among HCWs, especially those involved in direct patient care.^{12 31} The 2020 reported prevalence of infections among the WiSDOM cohort members was higher than the 2020 WHO estimate of 14% among HCWs.³² We could not find nationally representative data of COVID-19 infections among HCWs, except the COVID-19 hospital surveillance data in South Africa that focused on hospital admissions, morbidity and mortality.²¹ However, the WiSDOM cohort infection prevalence was similar to that of another South African study among public sector employees where 22% reported COVID-19 infections.¹⁶

In 2021, 45.3% of the WiSDOM cohort members reported COVID-19 infections, with high proportions of infections among clinical associates, nurses and oral

hygienists. This could be due to the second pandemic wave in 2021 caused by the Beta lineage, which was associated with a higher incidence of COVID-19 infections, increased hospital admissions and increased in-hospital mortality.³³ Our novel composite index on COVID-19 workplace support combined IPC training, availability of PPE, feelings of stress, availability of emotional support when needed and perceptions of supervisor support. The perceived lack of a COVID-19 supportive workplace resulted in 15.7% higher infections among early career health professionals ($p < 0.01$). We could not find other studies that have used a similar composite index to examine the association between COVID-19 infections and workplace support. Nonetheless, our findings are consistent with a 2023 systematic review and meta-analysis, which found that HCWs who reported the use of PPE were 29% less likely to test positive for COVID-19.³⁴ Another South African study, while not comparable, found that hospitals with higher occupational health and safety compliance scores (eg, PPE availability) had significantly lower COVID-19 infection rates.²²

Those WiSDOM cohort members working in hospitals also had 17% higher COVID-19 infections, probably because hospitals were the first line of defence against the pandemic.³⁵ We do not know why infection rates were lower among doctors and pharmacists, after adjusting for a COVID-19 supportive workplace in the analysis. It could be that they were more aware of infection risk and took appropriate preventive measures.

Table 3 Factors that influenced WiSDOM COVID-19 experiences

	COVID-19 support (PCA score)	COVID-19 infection	COVID-19 vaccination
		Penalised logit	Penalised logit
	Linear regression	Marginal effects	Marginal effects
Professional group (vs mean)			
CA	0.092 (−0.528 to 0.712)	−0.055 (−0.217 to 0.107)	−0.013 (−0.123 to 0.096)
DT	0.969* (0.091–1.847)	−0.128 (−0.372 to 0.117)	−0.139 (−0.387 to 0.110)
MD	−1.004*** (−1.529 to −0.480)	−0.160** (−0.281 to −0.039)	0.083 (−0.001 to 0.168)
NS	−0.398 (−1.219 to 0.423)	−0.056 (−0.266 to 0.154)	−0.081 (−0.244 to 0.082)
OT	0.226 (−0.539 to 0.991)	0.149 (−0.026 to 0.324)	0.039 (−0.201 to 0.278)
OH	−0.157 (−1.839 to 1.524)	0.362*** (0.180–0.544)	0.047 (−0.177 to 0.271)
PH	0.147 (−0.410 to 0.704)	−0.151* (−0.293 to −0.010)	−0.021 (−0.127 to 0.086)
PT	0.125 (−0.519 to 0.769)	0.039 (−0.122 to 0.199)	0.084 (−0.069 to 0.238)
Female	−0.578* (−1.041 to −0.114)	−0.073 (−0.202 to 0.056)	0.005 (−0.072 to 0.082)
Age: 30+years	−0.054 (−0.567 to 0.458)	0.102 (−0.041 to 0.244)	−0.028 (−0.127 to 0.072)
Race			
Indian/Asian (reference)	—	—	—
Black African	−0.049 (−0.614 to 0.516)	0.013 (−0.146 to 0.172)	−0.141** (−0.238 to −0.045)
Coloured	−0.125 (−1.327 to 1.077)	0.038 (−0.292 to 0.367)	−0.030 (−0.234 to 0.174)
White	0.313 (−0.277 to 0.903)	−0.089 (−0.252 to 0.075)	0.032 (−0.036 to 0.100)
Working in urban area	0.367 (−0.301 to 1.034)	0.004 (−0.181 to 0.189)	0.058 (−0.054 to 0.171)
Sector of work			
Public (reference)	—	—	—
Private-for-profit	0.246 (−0.318 to 0.810)	−0.033 (−0.190 to 0.125)	0.041 (−0.059 to 0.140)
Private not-for-profit	0.209 (−1.019 to 1.437)	−0.031 (−0.367 to 0.305)	0.114* (0.013–0.216)
Working in hospital	−0.139 (−0.645 to 0.367)	0.171* (0.031–0.311)	0.003 (−0.087 to 0.093)
COVID-19 support PCA score<mean		0.157** (0.048–0.265)	
N	292	291	320
R ² /Pseudo-R ²	0.190	0.087	0.226

***p<0.001, **p<0.01 and *p<0.05.
 CA, clinical associate; DT, dentist; MD, medical doctor; NS, nurse; OH, oral hygienist; OT, occupational therapist; PCA, principal component analysis; PH, pharmacist; PT, physiotherapist; WiSDOM, Wits longitudinal Study to Determine the Operation of the labour Market among its health professional graduates.

In 2020, more than half (55.4%) of cohort members agreed with the negative statement that they did not have PPE when needed (table 2), with the highest percentage agreement among the medical doctors, occupational therapists and nurses. Doctors and nurses, the majority of frontline HCWs, were disproportionately affected by the pandemic, exacerbated by the lack of or inadequate PPE.^{13 36} The 48% agreement by occupational therapists could be because there was a higher need for occupational therapy services for at-risk individuals recovering from COVID-19 illness.³⁷ A global survey also found that 36% of occupational therapists indicated that PPE was never or only sometimes available,³⁷ but we could not find similar studies in South Africa.

The 2021 WiSDOM study findings suggest that there was a slight improvement in the availability of PPE, with 47.8% agreement among cohort members. However, 68.9% of medical doctors agreed with the negative statement, suggesting that they did not have PPE in the second year of the pandemic. This could be because the majority of medical doctors in the WiSDOM cohort worked in the public health sector, where the lack or shortage of PPE was most acutely felt, exacerbated by procurement corruption allegations.³⁸ In both years, dentists and oral hygienists had the least agreement with this statement, suggesting that they did not experience problems with PPE. This was also reflected in the composite index where oral hygienists and dentists reported the most support,

compared with the other groups. A possible explanation is that all the oral health professionals worked in the well-resourced private health sector and/or had access to PPE as their work involved the use of PPE prior to the pandemic.¹³ Nonetheless, the lack of PPE remains one of the most important risk factors for occupationally acquired infections^{13 34 39} and contributes to occupational stress.⁴⁰

In both years, the majority of cohort members agreed with a statement that they felt more stressed at work than before the lockdown, which ended in April 2022.⁴¹ In 2020, the least reported stress was by pharmacists, while almost all occupational therapists reported increased work stress. In 2021, oral hygienists reported the least stress, with the majority of occupational therapists again reporting that they felt more stress at work.¹³ Another South African study found that the COVID-19 pandemic added to the work stress of inexperienced and early career occupational therapists,⁴² while a global survey found that those who continued to work during the pandemic reported stress and fatigue resulting from increased workloads.³⁷

Worldwide, the mental health of all HCWs was adversely affected by the pandemic.^{43 44} HCWs had poor access to mental health and psychosocial support services,¹³ especially in LMIC.⁴⁵ Our survey provided further evidence of these gaps. In the 2020 and 2021 survey years, a minority of the entire cohort reported that they received emotional support, with wide variations across the eight professionals. A supportive supervisor could facilitate access to emotional support and/or psychosocial support services. However, our study demonstrates the variations in perceived supervisor support by these early career health professionals. The differences among the eight professionals could relate to the nature of their work (eg, independent dental practice vs nursing patients in hospitals), and whether employment was in the public or private sector. Nonetheless, the gaps in supportive supervision and emotional support for nurses are of concern, as they are the majority of HCWs in the country. Our findings resonate with those conducted globally,^{13 36} and with a study in South Africa that found that nurses requested emotional support and empathy from their managers.⁴⁶ It is unacceptable that these early career health professionals in the WiSDOM cohort received insufficient psychosocial or supervisor support, given the advocacy efforts and development of guidelines by different stakeholders.^{16–19 46 47}

Medical doctors in our study reported a significantly lower COVID-19 supportive workplace. This could be because the majority worked in the resource-constrained public health sector and in hospitals that struggled to cope during the pandemic, exacerbated by pre-existing health system weaknesses and leadership failures.¹⁵

In our study, women health professionals reported a significantly lower COVID-19 supportive workplace. Globally, women HCWs had a higher risk of infection, they had inadequate access to poorly designed PPE,⁴ they assumed greater responsibility for family care, despite heavy patient

care loads, and were more prone to poor mental health outcomes.⁴⁸ Similarly in South Africa, women HCWs had a higher risk of infection and experienced poor working conditions, exacerbated by their junior position in the health hierarchy.²⁰

In South Africa, Phase 1 of the COVID-19 vaccination programme prioritised HCWs.⁴⁹ Although 21% of nurses and 18% of clinical associates indicated that they did not intend to get vaccinated, the high vaccination rates among the other six professionals are encouraging. We are unable to compare our findings on global vaccination rates as there is insufficient information on health workforce COVID-19 vaccination coverage.¹³ We found that those cohort members working in private not-for-profit organisations had an 11.4% higher vaccination rate. This is a small group, mostly working in research organisations, and this could explain the finding.

In our study, the reasons for vaccine refusal ranged from reservations about COVID-19 vaccines to spiritual or religious objections. A 2020 study among HCWs in academic hospitals in the Eastern Cape province of South Africa found a 90.1% acceptance of COVID-19 vaccines, influenced by education and prior vaccine refusal.⁵⁰ However, all the WiSDOM participants are university graduates; hence, education level is unlikely to be a factor in vaccine hesitancy. Another South African study found high levels of COVID-19 vaccine hesitancy among HCWs, with older participants and medical doctors more likely to accept vaccination than younger participants.⁵¹ Those individuals who did not trust COVID-19 vaccines were the most hesitant.⁵¹ Importantly, our study provides empirical evidence on actual vaccination rates and reasons for vaccine refusal among early career health professionals.

A study limitation is that the pandemic experiences of the WiSDOM cohort members are self-reported. Furthermore, the reported experiences are only representative of the 2017 health professional graduates of a large, well-established South African university. A major methodological strength is the cohort study design, enabling us to examine and compare longitudinal data of eight health professional groups during the pandemic. Importantly, we advance the discourse on postpandemic health systems recovery in several ways, given that the health workforce is central to such recovery.⁴ First, we provide empirical evidence on the vaccination status, and personal and workplace experiences of a sizeable number of early career health professionals during the COVID-19 pandemic. Second, we provide evidence of the association between the lack of a COVID-19 supportive workplace and infections among HCWs in South Africa. Although the COVID-19 pandemic is over, HCW infections resulted in disruption to health systems and broader costs to society in addition to the health workforce impact of illness, inability to work and diminished productivity.¹² Hence, our study makes the case for positive practice environments to ensure the retention of early career health professionals, especially in an African context. Third, we compare the vaccination status and the COVID

experiences of eight categories of early career health professional categories in South Africa.

Our study provides further evidence to prioritise health workforce investment in South Africa, which includes their occupational health and safety. Although the strategies to achieve such investment are enunciated in South Africa's 2030 Human Resources for Health (HRH) Strategy,⁵² implementation remains poor. Hence, our recommendations prioritise decentralised implementation. Mental health and psychological support programmes should be central to the implementation of occupational health and safety legislation and the policies of provincial health departments. Such programmes should be tailored to the specific needs of early career health professionals and involve them in the design and roll-out. Positive practice environments could be achieved by raising awareness among all managers or supervisors of the evidence on the stress and workplace challenges experienced by early career health professionals. We recommend improved communication between health facility managers/supervisors and early career health professionals, which is likely to foster collaborative and supportive workplaces.

Finally, professional organisations, trade unions, health workforce researchers and the media should advocate for the implementation of South Africa's HRH strategy and existing occupational health and safety policies that support the health and well-being of early career professionals.

Conclusion

Our cohort study is one of the first to measure and compare the vaccination status and COVID-19 experiences of multiple groups of early career health professionals in South Africa, and indeed globally. Our results underscore the need for positive practice environments, which include occupational safety, mental health and psychosocial support programmes for early career health professionals. Ultimately, they are the future health workforce, which is crucial for a resilient and responsive health system.

Author affiliations

¹Centre for Health Policy and SARChI Chair, School of Public Health, University of the Witwatersrand Johannesburg Faculty of Health Sciences, Johannesburg, Gauteng, South Africa

²Centre for Health Policy, University of the Witwatersrand Johannesburg Faculty of Health Sciences, Johannesburg, Gauteng, South Africa

³School of Public Health, University of the Witwatersrand Johannesburg Faculty of Health Sciences, Johannesburg, Gauteng, South Africa

Acknowledgements We thank the WiSDOM cohort members for their ongoing participation, especially the study champions.

Contributors LR: Conceptualisation, funding acquisition, methodology, data collection, project management and supervision, writing and editing. PD: Conceptualisation, methodology, data collection, contribution to writing. JAW: Data collection, review and contribution to writing. DB: Conceptualisation, methodology, data collection, data analysis, review, writing and editing. All authors read and approved the final manuscript. LR acts as the guarantor of the paper and accepts full responsibility for the work and/or the conduct of the study, had access to the data and controlled the decision to publish.

Funding The South African Research Chair Initiative (SARChI) of the National Research Foundation funded this study (Grant # 102219). Laetitia Rispel is the Chair holder. The views expressed in this study are those of the authors. The funding

source was not involved in the design of the study, in the data collection or analysis, in the interpretation of the results, or in the writing of the manuscript.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by In 2017, we obtained ethics approval for the study from the University of the Witwatersrand Human Research Ethics Committee (Medical (#M170 550) and we renewed the ethics approval in 2022 (#M220 672). All study procedures followed are in accordance with the Singapore Declaration on Research Integrity of 2010, available at: www.singaporestatement.org. We also obtained study permission from all the relevant university authorities. The details are contained in previous publications. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement No data are available. The data sets generated and analysed for the current study cannot be shared publicly because this is an active cohort study of health professional graduates who are being followed up every year. The Human Research Ethics Committee (Medical) of the University of the Witwatersrand has imposed restrictions because of the confidential and sensitive nature of the data. Additionally, the Protection of Personal Information Act prohibits the sharing of personal information without explicit participant consent.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Laetitia Rispel <http://orcid.org/0000-0001-7806-6331>

Prudence Ditlopo <http://orcid.org/0000-0002-5772-3125>

Janine A White <http://orcid.org/0000-0001-8547-2012>

Duane Blaauw <http://orcid.org/0000-0002-0605-7134>

REFERENCES

- 1 Aguas R, White L, Hupert N, *et al*. Modelling the COVID-19 pandemic in context: an international participatory approach. *BMJ Glob Health* 2020;5:e003126.
- 2 World Health Organization. *Pulse survey on continuity of essential health services during the COVID-19 pandemic: interim report*. Geneva: World Health Organization, 2020.
- 3 Haldane V, De Foo C, Abdalla SM, *et al*. Health systems resilience in managing the COVID-19 pandemic: lessons from 28 countries. *Nat Med* 2021;27:964–80.
- 4 Bourgeault IL, Maier CB, Dieleman M, *et al*. The COVID-19 pandemic presents an opportunity to develop more sustainable health workforces. *Hum Resour Health* 2020;18:83.
- 5 World Health Organization. *The impact of COVID-19 on health and care workers: a closer look at deaths*. Geneva: World Health Organization, 2021.
- 6 Billings J, Ching BCF, Gkofa V, *et al*. Experiences of frontline healthcare workers and their views about support during COVID-19 and previous pandemics: a systematic review and qualitative meta-synthesis. *BMC Health Serv Res* 2021;21:923.
- 7 Cabarkapa S, Nadjidai SE, Murgier J, *et al*. The psychological impact of COVID-19 and other viral epidemics on frontline healthcare workers and ways to address it: A rapid systematic review. *Brain Behav Immun Health* 2020;8:100144.

- 8 Couarraze S, Delamarre L, Marhar F, *et al.* The major worldwide stress of healthcare professionals during the first wave of the COVID-19 pandemic - the international COVISTRESS survey. *PLoS One* 2021;16:e0257840.
- 9 Croghan IT, Chesak SS, Adusumalli J, *et al.* Stress, Resilience, and Coping of Healthcare Workers during the COVID-19 Pandemic. *J Prim Care Community Health* 2021;12:21501327211008448.
- 10 Johnson SU, Ebrahimi OV, Hoffart A. PTSD symptoms among health workers and public service providers during the COVID-19 outbreak. *PLoS ONE* 2020;15:e0241032.
- 11 Maunder RG, Heeney ND, Hunter JJ, *et al.* Trends in burnout and psychological distress in hospital staff over 12 months of the COVID-19 pandemic: a prospective longitudinal survey. *J Occup Med Toxicol* 2022;17:11.
- 12 Wang H, Zeng W, Kabubei KM, *et al.* Modelling the economic burden of SARS-CoV-2 infection in health care workers in four countries. *Nat Commun* 2023;14:2791.
- 13 Downey H, Fokalade HS, Catton H. *What the COVID-19 pandemic has exposed: the findings of five global health workforce professions.* Geneva: World Health Organization, 2023.
- 14 Donkers MA, Gilissen VJHS, Candel MJJM, *et al.* Moral distress and ethical climate in intensive care medicine during COVID-19: a nationwide study. *BMC Med Ethics* 2021;22:73.
- 15 Rispel LC, Marshall C, Matiwane B, *et al.* Innovations, contestations and fragilities of the health system response to COVID-19 in the Gauteng Province of South Africa. *PLoS One* 2021;16:e0261339.
- 16 Curran R, Bachmann M, Van Rensburg AJ, *et al.* Personal and occupational experiences of COVID-19 and their effects on South African health workers' wellbeing. *S Afr Med J* 2021;111:607-8.
- 17 Dawood B, Tomita A, Ramlall S. "Unheard," "uncared for" and "unsupported": The mental health impact of Covid -19 on healthcare workers in KwaZulu-Natal Province, South Africa. *PLoS One* 2022;17:e0266008.
- 18 Lee H-L, Wilson KS, Bernstein C, *et al.* Psychological Distress in South African Healthcare Workers Early in the COVID-19 Pandemic: An Analysis of Associations and Mitigating Factors. *Int J Environ Res Public Health* 2022;19:9722.
- 19 Yang B, Egg R, Brahmabhatt H, *et al.* Mental health experiences of HIV/TB healthcare workers during the COVID-19 pandemic - lessons for provider well-being and support from a qualitative study in seven South African provinces. *BMC Health Serv Res* 2023;23:727.
- 20 Rees K, Dunlop JL, Patel-Abrahams S, *et al.* Primary healthcare workers at risk during COVID-19: An analysis of infections in HIV service providers in five districts of South Africa. *S Afr Med J* 2021;111:309-14.
- 21 National Institute for Occupational Health. *COVID-19 hospital surveillance- update on hospitalized health care workers: week 50 of 2022.* Johannesburg: National Institute for Occupational Health, 2022.
- 22 Zungu M, Voyi K, Mlangeni N, *et al.* Organizational factors associated with health worker protection during the COVID-19 pandemic in four provinces of South Africa. *BMC Health Serv Res* 2021;21:1080.
- 23 Rispel LC, Ditlopo P, White J, *et al.* Methodological considerations in establishing and maintaining longitudinal health workforce studies: Lessons learned from the WiSDOM cohort in South Africa. *Glob Health Action* 2021;14:1996688.
- 24 Rispel LC, Ditlopo P, White J, *et al.* Perspectives of the cohort of health professionals in the WiSDOM study on the learning environment, transformation, and social accountability at a South African University. *Med Educ Online* 2023;28:2185121.
- 25 Rispel LC, Ditlopo P, White JA, *et al.* Socio-economic characteristics and career intentions of the WiSDOM health professional cohort in South Africa. *PLoS One* 2019;14:e0223739.
- 26 Harris PA, Taylor R, Thielke R, *et al.* Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. *J Biomed Inform* 2009;42:377-81.
- 27 Shrestha N. Factor Analysis as a Tool for Survey Analysis. *AJAMS* 2021;9:4-11.
- 28 Firth D. Bias reduction of maximum likelihood estimates. *Biometrika* 1993;80:27-38.
- 29 Bahls M, Gaber MH, Jorstad HT, *et al.* Impact of COVID-19 on young healthcare professionals. *Eur J Prev Cardiol* 2022;29:e293-4.
- 30 Spiers J, Buszewicz M, Chew-Graham C, *et al.* What challenges did junior doctors face while working during the COVID-19 pandemic? A qualitative study. *BMJ Open* 2021;11:e056122.
- 31 Bandyopadhyay S, Baticulon RE, Kadhum M, *et al.* Infection and mortality of healthcare workers worldwide from COVID-19: a systematic review. *BMJ Glob Health* 2020;5:e003097.
- 32 World Health Organization. *Prevention, identification and management of health worker infection in the context of COVID-19.* Geneva: World Health Organization, 2020.
- 33 Jassat W, Mudara C, Ozougwu L, *et al.* Difference in mortality among individuals admitted to hospital with COVID-19 during the first and second waves in South Africa: a cohort study. *Lancet Glob Health* 2021;9:e1216-25.
- 34 Dzinamarira T, Nkambule SJ, Hlongwa M, *et al.* Risk Factors for COVID-19 Infection Among Healthcare Workers. A First Report From a Living Systematic Review and meta-Analysis. *Saf Health Work* 2022;13:263-8.
- 35 Zhang J, Lu X, Jin Y, *et al.* Hospitals' responsibility in response to the threat of infectious disease outbreak in the context of the coronavirus disease 2019 (COVID-19) pandemic: Implications for low- and middle-income countries. *Glob Health J* 2020;4:113-7.
- 36 Zipf AL, Polifroni EC, Beck CT. The experience of the nurse during the COVID-19 pandemic: A global meta-synthesis in the year of the nurse. *J Nurs Scholarsh* 2022;54:92-103.
- 37 Hoel V, Zweck C von, Ledgerer R, *et al.* The impact of Covid-19 for occupational therapy: Findings and recommendations of a global survey. *World Fed of Occup Therapists Bull* 2021;77:69-76.
- 38 Special Investigating Unit. Finalised matters in respect of the: Investigation into the procurement of, or contracting for goods, works and services, including the construction, refurbishment, leasing, occupation and use of immovable property, during, or in respect of the National State of Disaster, as declared by Government Notice No. 313 of 15 March 2020, by or on behalf of the State Institutions Proclamation No R23 of 2020: 23 July 2020 to 25 November 2020 Pretoria, South Africa: Special Investigating Unit (SIU), 2021. Available: https://static.pmg.org.za/210210R23_of_2020_Final_report_on_matters_finalised_for_public_release_05022021_2_sided.pdf
- 39 Martin CA, Pan D, Nazareth J, *et al.* Access to personal protective equipment in healthcare workers during the COVID-19 pandemic in the United Kingdom: results from a nationwide cohort study (UK-REACH). *BMC Health Serv Res* 2022;22:867.
- 40 Morgantini LA, Naha U, Wang H, *et al.* Factors contributing to healthcare professional burnout during the COVID-19 pandemic: A rapid turnaround global survey. *PLoS One* 2020;15:e0238217.
- 41 South African Government Communication Information System. *Statement by president Cyril Ramaphosa on the termination of the national state of disaster in response to the COVID-19 pandemic.* GCIS, 2022.
- 42 Bruce M, de Witt PA, Botha M, *et al.* Burnout in Inexperienced South African Occupational Therapists during the COVID-19 Pandemic Lockdown. *Occup Ther Ment Health* 2023;39:251-70.
- 43 De Kock JH, Latham HA, Leslie SJ, *et al.* A rapid review of the impact of COVID-19 on the mental health of healthcare workers: implications for supporting psychological well-being. *BMC Public Health* 2021;21:104.
- 44 Chutiyami M, Cheong AMY, Salihu D, *et al.* COVID-19 Pandemic and Overall Mental Health of Healthcare Professionals Globally: A Meta-Review of Systematic Reviews. *Front Psychiatry* 2021;12:804525.
- 45 Chemali S, Mari-Sáez A, El Bcheraoui C, *et al.* Health care workers' experiences during the COVID-19 pandemic: a scoping review. *Hum Resour Health* 2022;20:27.
- 46 Engelbrecht MC, Heunis JC, Kigozi NG. Post-Traumatic Stress and Coping Strategies of South African Nurses during the Second Wave of the COVID-19 Pandemic. *Int J Environ Res Public Health* 2021;18:7919.
- 47 Robertson LJ, Maposa I, Somaroo H, *et al.* Mental health of healthcare workers during the COVID-19 outbreak: A rapid scoping review to inform provincial guidelines in South Africa. *S Afr Med J* 2020;110:1010-9.
- 48 Sriharan A, Ratnapalan S, Tricco AC, *et al.* Women in healthcare experiencing occupational stress and burnout during COVID-19: a rapid review. *BMJ Open* 2021;11:e048861.
- 49 National Department for Health. *South Africa commences early access vaccine rollout to healthcare workers - Sisonke! let's work together to protect our healthcare workers.* Pretoria: NDoH, 2021.
- 50 Adeniyi OV, Stead D, Singata-Madliki M, *et al.* Acceptance of COVID-19 Vaccine among the Healthcare Workers in the Eastern Cape, South Africa: A Cross Sectional Study. *Vaccines (Basel)* 2021;9:666.
- 51 Wiysonge CS, Alobwede SM, de Marie C Katoto P, *et al.* COVID-19 vaccine acceptance and hesitancy among healthcare workers in South Africa. *Expert Rev Vaccines* 2022;21:549-59.
- 52 National Department of Health. *2030 human resources for health strategy: investing in the health workforce for Universal health coverage.* National Department of Health, 2020.