SOCIODEMOGRAPHIC AND WORK-RELATED FACTORS ASSOCIATED WITH PSYCHOLOGICAL RESILIENCE IN SOUTH AFRICAN HEALTHCARE WORKERS

by

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PREAMBLE

PLAGIARISM DECLARATION

I, Thandokazi "Thandi" Mcizana, hereby declare that the work on which this dissertation/thesis is based is my original work (except where acknowledgements indicate otherwise) and that neither the whole work nor any part of it has been, is being, or is to be submitted for another degree in this or any other university.

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ABSTRACT

Background: Psychological resilience facilitates adaptation in stressful environments and is an important personal characteristic that enables healthcare workers to navigate the challenges encountered in their occupation. To date, there is not much information available on factors associated with psychological resilience in South African healthcare workers.

Objectives: To determine the prevalence, sociodemographic and work-related factors associated with psychological resilience in a group of South African medical doctors and ambulance personnel.

Materials and Methods: This analytical cross-sectional study used secondary data obtained from two cross-sectional studies conducted in healthcare workers. This study investigated the factors associated with resilience as measured by the Connor-Davidson Resilience Scale-10. Inferential analysis was computed to assess the association between independent variables and resilience.

Results: A total of 647 healthcare workers were included in the study, consisting of 259 doctors and 388 ambulance personnel. The healthcare workers had low resilience scores (27.6 ± 6.6) overall, with ambulance personnel having a higher average resilience score (28.0 ±6.9) compared to doctors (27.1 ± 6.0) ($p = 0.006$). Significantly higher resilience scores were observed for doctors: in males ($p < 0.001$), higher income earners ($p = 0.020$), current smokers ($p = 0.012$); for ambulance personnel: previous users of alcohol ($p = 0.002$). Significantly lower resilience scores were observed in participants with a mental health condition (doctors: $p = 0.037$; ambulance personnel: $p = 0.010$), being on treatment for a mental health condition (ambulance personnel: $p = 0.029$) and feeling the need to drink alcohol to manage work-related stress (doctors: $p = 0.034$; ambulance personnel: $p= 0.048$). Multivariable analysis confirmed that current smoker status (β: 3.52, 95%CI: 0.89 – 6.16, $p = 0.009$) and higher salary in doctors (β: 5.11, 95%CI: 1.46 – 8.177, $p = 0.006$), and previous alcohol use in ambulance personnel (β: 3.22, 95%CI: 1.10 - 5.34, $p = 0.003$) were protective against low resilience. Female sex (β:

-1.77, 95%CI: -3.39 - -0.15, p = 0.032) and over-time work in doctors (β: -5.11, 95%CI: -9.42 - -0.80, p = 0.006) increased the likelihood of low resilience.

Conclusions: Resilience was relatively low in this group of South African healthcare workers. The strong association between low resilience and individual and workplace factors such as female gender, lower income, high over-time worked, mental health status and substance use provide avenues for early intervention and provision of greater support to healthcare workers in low-and middle-income settings.

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ABBREVIATIONS AND ACRONYMS

BRCS:	Brief Resilience Coping Scale
BRS:	Brief Resilience Scale
CART:	Classification and regression tree
CD-RISC:	Connor-Davidson Resilience Scale
CD-RISC-10:	Connor-Davidson Resilience Scale 10
CD-RISC-25:	Connor-Davidson Resilience Scale 25
CI/ 95%CI:	95% Confidence Interval
COVID-19:	Coronavirus disease
DALYs:	Disability-Adjusted-Life-Years
ED:	Emergency Department
EMS:	Emergency Medical Services
CPs:	Community Pharmacists
GPs:	General Practitioners
HCWs:	Healthcare Workers
HICs:	High-income countries
HIV/ AIDS:	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
HREC:	Human Research Ethics Committee
ICC:	Intraclass Correlation Coefficient
ICU:	Intensive Care Unit
IQR:	Interquartile Range
LMICs:	Low- and middle- income countries
m:	Mean
MICE:	Multivariate Imputation by Chained Equation

N:	Number
N/A:	Not Applicable
NHI:	National Health Insurance
OR:	Odds Ratio
p/ p-value:	Probability Value
PPE:	Personal Protective Equipment
PTSD:	Post-traumatic Stress Disorder
r:	Correlation Coefficient
RAS:	Resilience Assessment Scale
Ref:	Reference level
RS:	Resilience Scale
SD:	Standard Deviation
SEM:	Socio-Ecological Model
UCT:	University of Cape Town
VPTG:	Vicarious Posttraumatic Growth
WHO:	World Health Organisation
WRS:	Work-Related Stress
ZAR/ R:	South African Rand
β:	Standard Regression Coefficient

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PART A: RESEARCH PROTOCOL

1. LITERATURE REVIEW

1.1. INTRODUCTION

Frontline healthcare workers are frequently the first to be called upon during major public health emergencies and are exposed to several occupational and social pressures including witnessing human suffering and death, isolation, long work shifts and increased public scrutiny (Liang et al., 2020). On 30 January 2020, the World Health Organisation (WHO) declared the coronavirus disease (COVID-19) a public health emergency. Healthcare workers were considered essential workers throughout the various phases of the pandemic (Cook et al., 2021). Higher levels of psychological resilience and coping skills were required of them compared to the general population to be able to deal with the increased pressures brought about by the COVID-19 pandemic (Cook et al., 2021). Psychological resilience is an important personal characteristic that enable healthcare workers to navigate the challenges brought about by their occupation (Cheng et al., 2022).

Research on the role of psychological resilience as a protective factor in frontline healthcare workers has increased significantly during the COVID-19 pandemic. This research has focus on the associations between psychological resilience and the participants' sociodemographic characteristics; mental health and burnout; and the role of workplace factors (Awano et al., 2022). Research in this area has mostly been conducted in high- income countries and little is known about the factors that predict psychological resilience in low-and middle-income countries (LMICs), including South Africa as an upper middle-income country. This literature review will describe what is already known about the level of and the factors associated with psychological resilience of healthcare workers in LMICs and will identify areas of future research.

DEFINING PSYCHOLOGICAL RESILIENCE

Psychological resilience is a multidimensional term, with varying definitions used in different contexts (Herrman et al., 2011; Robertson et al., 2016; McKinley et al., 2019). Herrman et al. (2011) explored the evolution of the term in their narrative review and concluded that fundamentally, resilience is the inherent ability for one to adapt positively following adversity or stressful events. In addition, Huey et al. (2020) in their systematic review of existing literature on resilience in healthcare workers noted that the majority of studies used the word

"adversity" in their definition of resilience. Robertson et al. (2016) in their systematic review on resilience amongst primary healthcare workers found that most research on the topic primarily frames resilience as an explanatory variable in relation to burnout. Psychological resilience describes an individual's coping, optimism, self-efficacy, sense of coherence, high levels of hope and thriving mental health amid adversity and challenging circumstances (Koen et al., 2011). For this study, we draw on these definitions and define psychological resilience in broad terms as a means of facilitating adaptation in stressful environments.

PSYCHOLOGICAL RESILIENCE AMONGST HEALTHCARE WORKERS IN LOW AND MIDDLE-INCOME COUNTRIES

The healthcare system of most LMICs is under severe strain due to high patient numbers and burden of disease; lack of finance and human resources, particularly healthcare workers; corruption and poor administration (Bangdiwala et al., 2010; Kruk et al., 2018). This has resulted in a 'brain-drain' phenomenon that has contributed to the large differences in the global distribution of healthcare workers observed between countries and within a country (Ndebele et al., 2022). Within regions, healthcare workers tend to favour the private sector, thus, moving healthcare resources away from rural and underserved areas that largely depend on the public healthcare sector (Bangdiwala et al., 2010). The absolute number of healthcare workers trained and employed in health systems of LMICs therefore remains inadequate to meet the population's needs, and further predisposing those who remain in the system to high stress levels and increasing demands.

Healthcare workers in LMICs face increased demand for health services and workload, which impacts their psychological resilience. In 2019, for example, 2.2 billion disability-adjusted-life-years (DALYs) were recorded in LMICs, making up 86% of the global non-communicable diseases (World health organisation, 2020). In addition, many LMICs suffer from a double burden of disease; communicable and non-communicable diseases (Kruk et al., 2018). The combined disparities in financial and human resources and burden of diseases causes immense pressure on healthcare workers in LMICs. As such, resilience in these healthcare workers may protect against burnout and support the delivery of healthcare services in LMICs. **Table 1** provides a summary overview of systematic reviews performed to date, with resilience as the main or one of the main outcomes of interest.

Table 1: Systematic reviews and meta-analysis of resilience amongst healthcare workers in high income and low- and middle-income countries

Author/ Year	Aim	Studies included (HICs/ LMICs)	Most used resilience tool	Main findings
Hart et al., 2014	Understand resilience research on nursing population.	7 studies; All HICs	CD-RISC	**Positive predictors**: Hope, coping, toughening up, work-life balance, self-efficacy, critical reflection, reconciliation, social support. **Negative predictors**: Challenging workplaces, diminishing inner balance, psychological emptiness, sense of dissonance in the workplace.
Robertson et al., 2016	To examine research on resilience in primary healthcare professionals.	13 studies; 12 HICs, 1 LMICs.	RS	**Positive predictors**: Personal growth, leisure time, accomplishment, high persistence, coping, high self-directedness, demanding professional role, physical activity, low avoidance of challenges, family support, control. **Negative predictors**: Numbers of hours worked, alcohol use in male GPs, responsible for home and family.
McKinley et al., 2019	Review literature on influences of resilience levels of medical doctors.	24 studies; 23 HICs, 1 LMICs.	RS and CD-RISC	**Positive predictors**: Self-compassion, mindfulness, hobbies, determination, persistence, coping, adversity, support (family, community, networks, superiors), patients' connection, early adversity, control, lighter workload, career development, tolerance of clinical uncertainly, physical, and cultural activities, influence at work, freedom in the workplace. **Negative predictors**: Harm Avoidance.
Yu et al., 2019	Factors associated with nurse resilience.	38 articles; All HICs.	CD-RISC	**Positive predictors**: Coping, social support,self-efficacy, job satisfaction, general wellbeing, job retention. **Negative predictors**: Stress, posttraumatic stress disorder, burnout, fatigue, workplace bullying.

Author/ Year	Aim	Studies included (HICs/ LMICs)	Most used resilience tool	Main findings
Li et al., 2020	Investigating interaction between resilience, stress, and well-being amongst nursing students.	12 studies; 8 HICs, 4 LMICs.	CD-RISC	**Positive predictors**: Psychological health, self-efficacy, years of study, academic efficacy, well-being. **Negative predictors**: Emotional, stress.
Zanatta et al., 2020	Describe resilience in palliative care healthcare workers.	6 studies; All HICs.	CD-RISC	**Positive predictors**: Openness to new experiences, sense of humour, vicarious posttraumatic growth. **Negative predictors**: Death anxiety, secondary traumatic stress.
Labrague et al., 2021	Investigating resilience, coping behaviours, and social support among health care workers during COVID-19.	31 articles: 13 HICs, 18 LMICs.	CD-RISC	**Positive predictors**: Group skill training programmes, effective leadership, organisational support, safe working environment, communication. **Negative predictors**: COVID-19, anxiety, depression
Cheng et al., 2022	Investigating resilience among health care workers: prevalence and factors.	41 studies; 33 HICs, 8 LMICs.	RS	**Positive predictors:** social support. **Negative predictors**: stressful, unhealthy job demands, workload, worry of transmitting disease to family, working hours.
Jeamjitvibool et al., 2022	Investigate resilience and psychological distress during COVID-19: healthcare workers, population, and patients.	33 studies; 2 HICs, 14 LMICs for healthcare workers.	CD-RISC	**Positive predictors**: Psychosocial support. **Negative predictors**: Psychological distress.
Castillo-González et al., 2023	Investigate burnout and resilience in nursing population: factors of resilience.	29 studies; 17 HICs, 12 LMICs.	CD-RISC	**Positive predictors**: Service experience, acceptable salaries, worked non-rotating shifts, nuclear-style family, education status, male. **Negative predictors**: Workload, burnout, emotional exhaustion, depersonalisation.

BRCS: Brief Resilience Coping Scale; BRS: Brief Resilience Scale; CD-RISC: Connor-Davidson Resilience Scale; COVID-19: coronavirus disease; HICs: High-income countries; LMICs: Low- and middle- income countries; RAS: Resilience Assessment Scale; RS: Resilience scale

Table 1 highlights that most studies on resilience (particularly those published prior to the COVID-19 pandemic) originated from high-income countries.

MEASURING TOOLS FOR PSYCHOLOGICAL RESILIENCE

There is currently no 'gold standard' measurement scale or tool for psychological resilience (Windle et al., 2011; Cheng et al., 2022). Various validated diagnostic tools have been used to measure resilience in research and clinical practice settings (**Table 1**). The use of these tools however differs depending on the study population of interest; costs to purchase the tool and resources available to the researchers to distribute the tool. Both qualitative and quantitative approaches have been found useful for measuring psychological resilience, including the use of retrospective self-reported data (Herrman et al., 2011). These different approaches to measuring psychological resilience has however resulted in inconsistent results which have made comparison of results obtained in different studies challenging (Windle et al., 2011; Yue et al., 2019).

Windle et al. (2011) conducted a review of the various measurement tools currently in use to assess for psychological resilience in peer reviewed journal articles. They found fifteen key measurement scales that were reported to measure psychological resilience. Overall, the authors found that questionnaires developed for use on adult populations tend to achieve better quality assessment scores; namely, the Connor-Davidson Resilience Scale (CD-RISC), the Resilience Scale for Adults (RSA) and the Brief Resilience Scale (Windle et al., 2011). They also concluded that more research is required focusing on validating resilience measures for different populations (Windle et al., 2011). **Appendix 1** provides a summary of the findings as presented by Windle et al. (2011) for these three measurement scales.

1.2. SEARCH STRATEGY AND SELECTION CRITERIA

The primary literature search was conducted on four public databases: Pubmed, Web of Science, Scopus and EBSCOHost. The last search was conducted on the 22 August 2023, using the following search strings:

- (Resilien*) AND
- (Healthcare workers OR doctors OR paramedics OR first responder OR emergency personnel OR nurs* OR pharmacist*) AND
- (Connor-Davidson Resilience* OR CD Risk scale OR CD Risk score OR CD-RISC*)) AND
- Lastly, the Low- and Middle-income countries (LMIC) search filter as provided by the University of Cape Town library (August 2021 version) was used to determine journal articles relevant to LMICs.

In addition, the above computer searches were supplemented by hand searching of the reference lists.

The following selection criteria was used:

- Only research published in English were included, with full text available online.
- Only research published in peer-reviewed journals were included.
- Only research looking at a variety of healthcare workers as the population of interest were considered; specifically, research considering only nurses or nursing students were excluded.
- Only research using CD-RISC scale as a measure of resilience.
- Only research measuring psychological resilience and considering factors associated with psychological resilience were included (even if psychological resilience was an explanatory variable for the study).
- No date restrictions were applied.

The applicable literature was extracted, and duplicates were removed using Rayyan and inspection by the author. The eligibility of each article was assessed by the author, considering the title and abstract firstly to establish relevance. The author then summarized specific information from the included studies.

For this study, the Connor-Davidson Resilience Scale has been chosen as the psychological resilience measurement scale of interest, as an internationally recognised and validated resilience measurement tool (Jeamjitvibool et al., 2022). Its ease of completion and administration; high levels of acceptability and interpretability; high internal consistency and reliability have made it a widely used measurement tool in research and clinical settings across the world (Windle et al., 2011; Jeamjitvibool et al., 2022). It is comprised of 25 questions, each rated on a 5-point Likert scale (0-4). Later versions include the 10-item questionnaire, which has been found to be as equally effective in measuring psychological resilience (Windle et al., 2011) (**Appendix 2**). Higher CD-RISC scores indicate greater psychological resilience (Davidson, 2019). While the CD-RISC is one of the most widely used resilience measurement scale in published studies on resilience, most of these have however been conducted in high income countries and in the general adult population (**Table 1**).

This review therefore aims to determine the prevalence and factors associated with psychological resilience of healthcare workers practising in LMICs using the CD-RISC Scale.

1.3. RESULTS

The database search resulted in 636 English journal articles. A total of 174 records remained after removal of duplicates (n = 462). Twenty-two journal articles remained after removing articles that did not meet the eligibility criteria (152 irrelevant journal articles removed). **Figure 1** provides details of the data search.

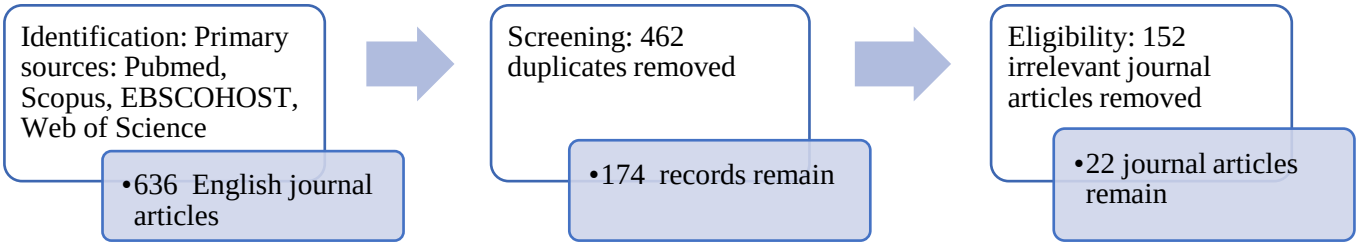

Figure 1: Flow diagram of records identified, screened, and included in the literature review

Amongst the 152 irrelevant journal articles removed, 74 articles considered nurses as the sole study population (**Appendix 3**). The psychological resilience of nurses has been extensively studied, particularly due to the global nursing shortage and its linkage to burnout (Guo et al., 2018). In addition, 21 of the 152 removed journal articles did not consider factors associated with psychological resilience in healthcare workers (**Appendix 4**). Prior to COVID-19, there was little research available on resilience of healthcare workers operating in LMICs. Thirteen of the 22 journal articles that met the criteria provided COVID-19 as the motivation for the reason to perform the study. China contributed the most research, with 12 studies. The weighted average resilience score for the 9 862 participants in the 22 studies (where provided) was calculated as 63.48 and 25.95 for the CD-RISC-25 and CD-RISC-10 respectively. **Table 2** provides a summary of the 22 studies included in the review.

Table 2: Resilience as measured by CD-RISC Scale among healthcare workers in low- and middle-income countries

Author/ Year	Country	Study design	Study Population (Mean age, SD)	Diagnostic tools used	Main outcome	Mean Resilience Score (SD)	Factors significantly associated with resilience (p<0.05)
Rossouw et al., 2013	South Africa	Cross-sectional	132 HCWs in primary healthcare settings	CD-RISC-25	Burnout, Depression, Resilience.	71.51 (SD=12.77)	**Positive predictors**: Personal accomplishment; delivered quality care. **Negative predictors**: Medication use.
Kang et al., 2018	China	Cross-sectional	227 ambulance personnel (31.76 (SD=6.52))	CD-RISC-10	Vicarious Posttraumatic Growth, Social Support, Resilience.	28.97 (SD=6.75)	**Positive predictors**: Social support (β =0.51), VPTG (r=0.67), relating to others (r=0.57), new possibilities (r=0.60), Spiritual change (r=0.63), appreciation of life (r=0.53), personal strength (r=0.63).
Huang et al., 2020	China	Cross-sectional	587 HCWs in radiology department (33 (IQR: 28–43))	CD-RISC-25	Resilience	65.76 (SD=17.26)	**Positive predictors**: Knowledge of COVID-19 (β =2.88), availability of protective materials (β= −1.27), knowledge of COVID-19 protective measures (β=3.26). **Negative predictors**: Perceived stress (β=–1.32). **Lower resilience:** Female (β= −4.74).
Lin et al., 2020	China	Cross-sectional	114 non-local HCWs sent to Wuhan	CD-RISC-25	Resilience	67.03 (SD=13.22)	**Positive predictors**: Employment type, active coping styles (β=1.31), training or support (β=3.51). **Negative predictors**: Anxiety (β= −1.09), depression (β= −0.81).

Author/ Year	Country	Study design	Study Population (Mean age, SD)	Diagnostic tools used	Main outcome	Mean Resilience Score (SD)	Factors significantly associated with resilience (p<0.05)
van der Merwe et al., 2020	South Africa	Cross-sectional	270 pre-clinical; 230 clinical	CD-RISC-25	Resilience.	Pre-clinical: 72.5 (SD=14.5); Clinical: 75.4 (SD=11.7)	**Higher resilience**: Adaptive coping strategies. **Lower resilience**: Dysfunctional strategies.
Wang et al., 2020	China	Cross-sectional	274 HCWs (37 (IQR: 22–64))	CD-RISC-10	Anxiety, Stress, Depression, Sleep quality, Resilience.	28	**Positive predictors**: Age (r=0.15), years of experience (r=0.13).
Tam et al., 2021	China	Cross-sectional	1 029 HCWs in HIV clinic (38.39 (SD=9.20))	CD-RISC	Resilience, COVID-19 stress, Psychological distress, Institutional Support.	Not reported.	**Positive predictors**: Institutional support (r=0.28). **Negative predictors**: COVID-19 stressors (r= −0.13), psychological distress (r = −0.43).
Wang et al., 2021	China	Cross-sectional	115 military medical staff (32.89 (SD=5.8))	CD-RISC-25	Resilience, Fatigue, Physical burden, Anxiety.	66.45 (SD=13.27)	**Negative predictors**: Fatigue (β= -0.52), anxiety (β= -0.24).
Xuan et al., 2021	Malaysia	Cross-sectional	524 medical interns (median= 26 (IQR: 11))	CD-RISC-10	Resilience, Emotional quotient, Coping style.	28.6 (SD=6.33)	**Positive predictors**: Active sport (β=1.09), emotional quotient (β=0.56), interest to become a doctor (β=0.81), coping using humour (β=0.54). **Negative predictors:** Coping by venting (β= -0.45). **Lower resilience**: Failures in any clinical posting (β= -1.00).

Author/ Year	Country	Study design	Study Population (Mean age, SD)	Diagnostic tools used	Main outcome	Mean Resilience Score (SD)	Factors significantly associated with resilience (p<0.05)
Alameddine et al., 2022	Lebanon	Cross-sectional	459 CPs	CD-RISC-25	Resilience, Burnout.	68.0 (SD=13.37)	**Positive predictors**: Perception of safety (β=0.27), married (β=0.38). **Negative predictors:** Workload (β=0.28), burnout (β=0.32).
Elkudssiah Ismail et al., 2022	Malaysia	Cross-sectional	164 GPs (45 (SD=12.71)); 87 CPs (35 (SD=9.08))	CD-RISC-10	Resilience.	GPs: 30.93 (SD=6.25); CPs: 28.20 (SD=6.12)	**GPs: Positive predictors**: Age (β= -0.53), years of experience (β=0.75). **Lower resilience:** Female (β= -2.57).
Ghaedi-Heidari et al., 2022	Iran	Cross-sectional	235 medical students	CD-RISC-25	Anxiety, Resilience, Posttraumatic Growth.	50.60 (SD=15.9)	**Positive predictors**: Posttraumatic growth (r=0.42).
Hatami et al., 2022	Iran	Cross-sectional	150 dental students (23.43(SD=3.11))	CD-RISC-25	Spiritual health, Resilience, Happiness.	65.19 (SD=5.03)	**Positive predictors**: Spiritual health (r=0.50).
Keragholi et al., 2022	Iran	Cross-sectional	115 Emergency personnel (32.63 SD=7.56)	CD-RISC-25	Mental health, Resilience.	72.25 (SD=12.63)	**Positive predictors**: Employment type. **Negative predictors**: Mental health (β= -0.77).
Li W, et al., 2022	China	Cross-sectional	309 HCWs in isolation wards (33.5 (SD=9.5))	CD-RISC-25	Resilience, Coping style, COVID-19 stress, Quality of life.	60.8 (SD=15.7)	**Positive predictors:** Active coping (r=0.61), quality of life (r=0.57). **Negative predictors:** COVID-19 stress (r= −0.21).
Liu et al., 2022	China	Cross-sectional	390 HCWs	CD-RISC-25	Resilience, Anxiety.	63.28 (SD=14.83)	**Positive predictors**: Coping style (r=0.70), self-efficacy (r=0.53).

Author/ Year	Country	Study design	Study Population (Mean age, SD)	Diagnostic tools used	Main outcome	Mean Resilience Score (SD)	Factors significantly associated with resilience (p<0.05)
Ramadianto et al., 2022	Indonesia	Cross-sectional	532 medical students (20.65 (SD=1.98))	CD-RISC-25	Anxiety, Coping style, Depression, Resilience.	68 (IQR: 58–77)	**Negative predictors**: Depressive symptoms (r= -0.43), anxiety symptoms (r= -0.30).
Rayani et al., 2022	Iran	Cross-sectional	184 HCWs (35.54 (SD=7.11))	CD-RISC-25	Anxiety, Resilience.	63.10 (SD=15.84)	**Positive predictors**: Number of children (r=0.21). **Negative predictors:** Anxiety (r= −0.21).
Yue et al., 2022	China	Cross-sectional	2217 medical postgraduates	CD-RISC-25	Mental health, Physical activity.	60.35 (SD=15.49)	**Positive predictors:** Physical activity (r=0.19).
Zhang Q et al., 2022	China	Cross-sectional	1064 HCWs (33.3 (SD=8.2))	CD-RISC-10	Psychological distress, Perceived Stress, Social support, Resilience.	27.31 (SD=6.98)	**Positive predictors**: Social support (r=0.53). **Negative predictors:** Psychological distress (r= -0.31).
Zhou et al., 2022	China	Cross-sectional	1877 resident doctors (24.65 (SD=1.47))	CD-RISC-10	Workplace bullying, Insomnia, Resilience, Subjective wellbeing.	23.24 (SD=9.27)	**Positive predictors** Wellbeing (r=0.55), life satisfaction (r=0.50). **Negative predictors:** Insomnia (r= -0.33), workplace bullying (r= -0.30), organizational Injustice (r= -0.24).
Hamdan et al., 2023	Jordan	Cross-sectional	135 orthopaedic surgeons (39.10 (SD=11.26))	CD-RISC-10	Resilience, Burnout, Grit.	Not reported.	**Positive predictors:** Age (r=0.23), years of experience (r=0.27), grit (r=0.48). **Negative predictors:** Burnout (r= -0.31).

Author/ Year	Country	Study design	Study Population (Mean age, SD)	Diagnostic tools used	Main outcome	Mean Resilience Score (SD)	Factors significantly associated with resilience (p<0.05)
Song et al., 2023	China	Cross-sectional	138 paediatric residents (26.25 (SD=2.61))	CD-RISC-25	Burnout, Social support, Resilience, Anxiety, Depression.	58.26 (SD=15.66)	**Positive predictors:** Social support (r=0.43). **Negative predictors:** Stress (r= −0.54), anxiety (r= −0.57).

CD-RISC: Connor-Davidson Resilience Scale; COVID-19: coronavirus disease; CPs: Community pharmacists; GPs: General practitioners; HCWs: Healthcare workers; IQR: Interquartile range; r: Correlation coefficient; SD: Standard deviation; VPTG: Vicarious Posttraumatic Growth; β: Standard regression coefficient.

1.4. DISCUSSION

Psychological resilience in the literature has largely been described as an explanatory variable for outcomes such as burn out, depression, anxiety and PSTD in healthcare workers. Research findings on the prevalence and factors associated with psychological resilience (as an outcome measure) of healthcare workers is limited compared to that of the nursing professionals. Due to the shortage of research related to resilience in non-nursing healthcare workers in LMICs in general, the discussion that follows will note key findings from high-income settings and nursing professionals where appropriate.

PREVALENCE AND LEVEL OF PSYCHOLOGICAL RESILIENCE IN HEALTHCARE WORKERS IN LMIC SETTINGS

The mean resilience scores reported in the studies for healthcare workers ranged from 50.60 and 75.40 for the CD-RISC-25 Scale; and 23.24 and 30.93 for the CD-RISC-10 Scale. These differences observed in the resilience of healthcare workers are likely due to years of experience, speciality type, geographic location, and period over which the study was conducted (such as during the COVID-19 pandemic) (Jo et al., 2021; Cheng et al., 2022). Van der Merwe et al. (2020) observed that clinical students had higher resilience scores (CD-RISC mean score = 75.40, SD = 11.70) compared to pre-clinical students (CD-RISC mean score = 72.50, SD = 14.50), and this difference in resilience was statistically significant ($p = 0.02$). Jo et al. (2021) also reported a small to moderate effect in resilience between nurses working in different countries (Japan, Republic of Korea, Turkey, and United States). Cheng et al., (2022) in their systematic review found no significant association between geographic region and prevalence of low resilience in healthcare workers. Cheng et al. (2022) argued that differences in availability of resource; healthcare system infrastructure; and cultural values and norms may result in different coping styles amongst health care workers, which would affect the level of resilience observed.

RISK FACTORS ASSOCIATED WITH PSYCHOLOGICAL RESILIENCE IN HEALTHCARE WORKERS

This review found that psychological resilience is influenced by various factors which can be classified as personal or host characteristics, workplace, or occupational factors and social or lifestyle factors (Herrman et al., 2011; Robertson et al., 2016; Cheng et al., 2022). The socio-ecological model (SEM) framework will be used to discuss factors associated with psychological resilience, namely (i) personal, lifestyle and social factors; (ii) work-related factors and organisational support; and (iii) policy level factors (Jo et al., 2021).

Personal, lifestyle and social factors

Increasing age in healthcare workers has been associated with higher psychological resilience likely due to older healthcare workers receiving more training; and having better professional skills and experience in dealing with complex situations in the workplace (Lin et al., 2020; Wang et al, 2020). Wang et al. (2020) and Hamdan et al. (2023) similarly found that increasing age amongst healthcare workers was correlated significantly with better resilience ($r = 0.15$; $r = 0.23$ respectively).

Female gender has been additionally found to be a risk factor for lower resilience. Huang et al. (2020) and Elkudssiah Ismail et al. (2022) noted that males had significantly higher resilience than females ($\beta = -4.74$; $\beta = -2.57$ respectively). This finding could be attributed to females assuming multiple roles at home and in the workplace, experiencing more emotional exhaustion and being more sensitive and susceptible to stress (Robertson et al., 2016; Huang et al., 2020). The difference could also be due to social desirability bias, with males answering in a way that portrays an image of being able to manage pressure better (Elkudssiah Ismail et al., 2022).

A systematic review by Castillo-González et al. (2023) described similar finds in nursing professionals. Personal sociodemographic characteristics such as age, gender (male), educational level and marital status all were positively associated with psychological resilience in nurses. In contrast however, Rossouw et al. (2013), Wang et al. (2021) and Yue et al. (2022) did not find any significant associations between resilience and sociodemographic data (age, education, and gender) in healthcare workers. Herman et al. (2011) noted that these

inconsistences observed between resilience and sociodemographic factors may be due to differences in study methodologies and the definition of resilience used by the researchers.

A large proportion of studies included in this review reported significant correlations between resilience and the diagnosis of general medical and mental health conditions including substance use, depression, anxiety, and burnout (Rossouw et al., 2013; McKinley et al., 2019; Ghaedi-Heidari et al., 2022). Rossouw et al. (2013) found that healthcare workers in Cape Town using medication had significantly lower resilience than those not using medication ($p = 0.03$). Medication and substance use are recognized as maladaptive coping mechanism used by those with mental health issues or work-related stress (Sinha, 2008; Khan et al., 2023). Song et al. (2023) reported a negative correlation between anxiety and psychological resilience amongst paediatric residents in China ($r = -0.57$, $p < 0.01$). Similarly, Ghaedi-Heidari et al. (2022) found a positive significant correlation between psychological resilience and posttraumatic growth ($r = 0.42$, $P < 0.001$). These findings illustrate that those with higher resilience are less likely to suffer from or report general and mental health conditions.

Personality traits such as self-confidence, self–control, self-efficacy and optimism were found to be positively associated with resilience (Herman et al., 2011; McKinley et al., 2019). Liu et al. (2022) reported a significantly positive association between resilience and positive coping style ($\beta = 0.70$, $p < 0.001$) and self-efficacy ($\beta = 0.53$, $p < 0.001$) in healthcare workers in China. Hart et al. (2014) in their systematic review also found personality traits such as hope, self-efficacy, self-determination and coping to be positively associated with resilience. Positive personality traits are considered characteristics of resilient people (Koen et al., 2011).

Social and contextual factors such as access to educational and community facilities; religiosity, cultural and recreational opportunities; social relationships; and safe and supportive social and family environment have been found to be positively associated with resilience (Herrman et al., 2011; Robertson et al., 2016). It has been observed that social support is significantly and positively associated with resilience in Chinese healthcare workers (Kang et al., 2018; Zhang Q et al., 2022; Song et al., 2023). Individuals with high social support are probably able to cope better with stress, which is highly associated with psychological status and resilience (Labrague

et al., 2021; Zhang Q et al., 2022). In addition, both Xuan et al. (2021) and Yue et al. (2022) observed a significantly positive association between psychological resilience and active involvement in sports ($\beta = 1.09$; $r = 0.19$ respective). Involvement in sports and physical activity likely act as a distraction and coping mechanism, which builds resilience (Labrague et al., 2021). Further, Hatami et al. (2022) found a significantly positive correlation between dental students' spiritual health and resilience ($r = 0.50$, $p < 0.001$). Hatami et al. (2022) notes that spirituality can compensate for various mental health conditions and challenges, and contributes positively to an individual's coping strategies, which builds resilience.

Work-related factors and organisational support

Psychological resilience is positively correlated with several work-related and occupational factors including income level or salary package, years in practice, position or role held, workplace training, workload control, supportive colleagues, supportive leaders, and transparent organisational policies (McKinley et al., 2019; Labrague et al., 2021). Wang et al. (2020) and Hamdan et al. (2023) found that years in practice was positively correlated with resilience ($r = 0.13$; $r = 0.27$ respectively). Lin et al. (2020) further noted that certain professional roles may have higher resilience compared to others. They noted that resilience was highest for physicians (CD-RISC mean score = 73.48, SD = 11.49), then support staff (CD-RISC mean score = 67.78, SD = 12.43) then nurses (CD-RISC mean score = 64.86, SD = 13.46) in non-local Chinese healthcare workers ($p = 0.03$). Croghan et al. (2021) argued that nurses tend to experience more stressors due to greater direct exposure to patients and their families than doctors, which can result in lower resilience. Tam et al. (2021) further found that psychological resilience was positively correlated with receiving institutional workplace support amongst healthcare workers working in China ($r = 0.28$, $p < 0.001$). Others however have found no statistically significant association between resilience and work-related factors such as job description, over-time hours and years in practice (Rossouw et al., 2013). Rayani et al. (2022) also found no significant association between psychological resilience and education ($p = 0.66$) and economic status ($p = 0.70$) in Iranian healthcare workers.

With respect to the COVID-19 pandemic and its impact on healthcare workers, psychological resilience was reported to be significantly associated with organisational support provided to healthcare workers including provision of clear COVID-19 protocols, open communication,

supply of adequate personal protective equipment (PPE) and access to regular COVID-19 testing (Huang et al., 2020; Jo et al., 2021; Alameddine et al., 2022). Li Wet al. (2022) observed a negative correlation between resilience and COVID-19 stress in their study of healthcare workers in isolation wards in China ($r = -0.21$, $p < 0.001$). Huang et al. (2020) observed a positive correlation between psychological resilience and availability of protective materials in their study of healthcare workers in a radiology department in China ($\beta = -1.27$, $p = 0.04$). Adequate protective material can improve psychological security and provide personal safety, which may result in greater resilience and feelings of being protected by the employer (Huang et al., 2020). Alameddine et al. (2022) found that pharmacists indicating a decrease in their workload during the pandemic had significantly lower psychological resilience than those indicating an increase in their workload ($\beta = 0.28$). The researchers noted the business model of pharmacists in Lebanon as the reason for the association observed, which is contrary to other studies. The income of community pharmacists in Lebanon is related to their sales volumes, as such, higher workloads result in better income, which leads to greater job satisfaction and higher psychological resilience (Alameddine et al., 2022).

Policy level factors

Existing government health policies have a direct impact on the quality and strength of the healthcare system of a country. As such, the government can control the working environment of healthcare workers. A prime example is South Africa and the free care national policy introduced in 1996, which removed user fees for all public primary care services for vulnerable groups (Walker and Gilson, 2004). Though access to healthcare increased for most previously disadvantaged populations, the unintended consequence of this national policy resulted in increased workloads and demands among public sector healthcare workers (Walker and Gilson, 2004). South Africa's government is currently implementing the National Health Insurance scheme, however, the country’s preparedness remains uncertain, especially given the shortage of healthcare workers (Ndebele et al., 2022).

In addition, new government policies introduced during the COVID-19 pandemic had a significant impact on healthcare workers and their resilience levels (Jo et al., 2021). For example, China's central government organized healthcare workers from other provinces to be sent to Wuhan in the beginning of the pandemic, to relieve local healthcare workers (Lin et al., 2020). Lin et al. (2020) argued that the mental health and resilience of non-local healthcare

workers during this period is likely to differ significantly from local workers, due to being away from their family and home, and working in an unfamiliar work environment with new colleagues.

Furthermore, regulations of a country with respect to the education system vary and impact the level of education, training, and experience of healthcare workers (Jo et al., 2021). Studies in high income countries have shown that education level and training is positively associated with greater resilience (Herrman et al., 2011; Jo et al., 2021). Herman et al. (2011) further argued that more can be done by the government and state entities to create healthcare environments conducive to the wellbeing of healthcare workers.

1.5. CONCLUSION

Though there are various definitions of psychological resilience, this review has described the prevalence and factors associated with it in healthcare workers in LMIC settings. These factors can be categorised as personal, social and lifestyle factors; work-related factors and organisational support; and policy level factors. Research on psychological resilience for healthcare workers operating in LMICs is limited and contradictory at times, with most studies having been conducted in China. Further research is needed in other LMIC contexts such as South Africa, to better characterise the sociodemographic and work-related factors impacting the psychological resilience of healthcare workers in these regions to enable improved support of healthcare workers in these health systems.

2. **STUDY PROTOCOL**

2.1. PURPOSE AND BENEFITS

Psychological resilience facilitates adaptation in stressful environments. To date, not much information is known about the factors that predict psychological resilience in South African healthcare workers (**Table 1**). This research study will assess the level and prevalence of psychological resilience in a sample of South Africa healthcare workers in the medical and emergency medicine field and contribute to understanding the factors associated with psychological resilience. The knowledge gained may inform future interventions and

prevention strategies aimed at preserving and strengthening psychological resilience amongst healthcare workers in the medical and emergency medicine field.

Research questions:

1. What is the prevalence and level of psychological resilience amongst a sample of South Africa healthcare workers inclusive of doctors and emergency medical services personnel?
2. What are the sociodemographic and work-related factors associated with psychological resilience in a sample of South African healthcare workers in the medical and emergency medicine field?

Hypothesis:

There are varying degrees of psychological resilience in South African healthcare workers in the medical and emergency medicine field, and this is influenced by different sociodemographic characteristics and work-related factors.

2.2.AIM AND OBJECTIVES

The overall aim of the study is to determine the sociodemographic and work-related factors associated with psychological resilience amongst a group of healthcare workers of South Africa inclusive of doctors and emergency medical services personnel.

Research objectives:

- To determine the prevalence and level of psychological resilience amongst a group of South African healthcare workers comprising doctors and emergency medical services personnel employed in the Western and Eastern Cape province.
- To determine the sociodemographic risk factors (age, gender, education, language, relationship status, mental and general health status, substance use, alcohol use and smoking) associated with psychological resilience in a group of South African healthcare workers comprising doctors and emergency medical services personnel employed in the Western and Eastern Cape province.

- To determine the work-related and occupational factors (salary, working over-time, years employed) that are associated with psychological resilience in a group of South African healthcare workers comprising doctors and emergency medical services personnel employed in the Western and Eastern Cape province.

2.3.METHODOLOGY

Study design and population:

An analytical cross-sectional study design using secondary data from two cross-sectional studies will be employed. The first study was conducted in 2019 on emergency medical services (EMS) workers in the Western Cape province (Ntatamala & Adams, 2022); while the second study was conducted in 2022 on medical doctors in the Eastern Cape province (Khan et al, 2023).

Population and sampling:

The study population will comprise of EMS workers in the Western Cape (n = 388) and medical doctors in the Eastern Cape province (n = 260) who were included in the previous cross-sectional studies. EMS workers included in the original study consisted of both operational (n = 277) and support staff (n = 111) (Ntatamala & Adams, 2022). The medical doctors in the second study included all cadres of staff including medical interns (n = 84), medical officers (n = 76) and medical specialists or consultants (n = 54) (Khan et al, 2023).

The present study will include all healthcare workers who had completed the Connor-Davidson Resilience Scale (CD-RISC) questionnaire and relevant sociodemographic and occupational questions.

Measurements:

This study will use secondary data generated from self-administered questionnaires that were completed by participants in both studies that consisted of sociodemographic and occupational or workplace questions (**Appendix 5 and 6**); and the CD-RISC-10 questionnaire used as a

measure for psychological resilience. The full list of variables common to both previous studies and to be included in the present study is listed in **Appendix 7**.

Sociodemographic and occupational factors (questionnaire designed by authors)

The authors of the original studies generated questionnaires consisting of questions on sociodemographic and occupational data to measure the predictors or correlated variables, such as age, gender, language, level of education, marital status, job category, professional qualification, over-time worked, salary, and length of service. In addition, mental health and medical historical information was obtained, including self-reported mental health conditions and substance use (namely smoking, alcohol use, illicit and prescription drugs) including the use of substances to manage work-related stress. The age at which smoking and use of illicit drugs began will also be included in this study.

10-item Connor-Davidson Resilience Scale (CD-RISC-10)

The authors of the original studies measured psychological resilience using the 10-item CD-RISC questionnaire. The CD-RISC-10 is a self-administered 10-item questionnaire, which is a shorter version of the CD-RISC-25. The participants identify their adaptive behaviours in stressful situations and score these on a 5-point Likert scale (0 = not at all true, 4 = true nearly all the time). The resultant score ranges between 0 to 40. This scale has previously been reported as a reliable and efficient measure of psychological resilience for adults (**Appendix 1**). In addition, it has previously been validated for use in South Africa by Pretorius et al. (2022) to measure psychological resilience. The tool has previously been used to measure psychological resilience of South African healthcare providers (Rossouw et al., 2013; van der Merwe, 2020; Cook et al., 2021; Ntatamala & Adams, 2022; Khan et al., 2023).

2.4. DATA MANAGEMENT AND ANALYSIS PLAN

In this study, the secondary data will be received and cleaned in password protected Microsoft Excel after obtaining ethical approval from the University of Cape Town. R statistical software (version 4.3.1) will be used for analysis of all data received. The association between psychological resilience and sociodemographic and occupational factors will be investigated as follow:

1. Descriptive statistics for continuous variables in this study will be presented as means (standard deviation) and median (interquartile range) where appropriate. Descriptive statistics for categorical variables will be presented in this study as proportions.
2. Bivariable analysis will be used to evaluate the associations between psychological resilience and exposures (sociodemographic and work-related factors, including working hours, smoking status).
3. Logistic and linear regression will be used to investigate association between predictor and outcome variables, adjusting for confounders identified through the bivariable analysis. Statistical significance will be set at a p-value < 0.05.

Predictor variables:

In this study, the explanatory variables are the sociodemographic (age, gender, marital status), occupational (duration of employment, job category, type of employment, over-time worked, salary, work-place interventions required), and behavioural factors (smoking status, alcohol use, illicit drug use, mental health).

Outcome variables:

In this study, psychological resilience as measures by the CD- RISC-10 questionnaire is the main outcome variable of interest. The mean score of the CD- RISC-10 for each professional group and healthcare workers combined will be obtained by totalling the score of each of the 10 items making up the CD- RISC Scale. In addition, the CD-RISC score will be transformed to a categorical variable, with a score of less than 26 indicating low resilience, 26 to 36 indicating medium resilience and scores greater than 36 indicating high resilience (Davidson, 2019).

Covariates or confounders:

Potential confounders to be considered, including age (categorical variable) and gender.

2.5.STUDY LIMITATIONS

1. As a secondary data analysis will be undertaken, the information available is limited to

what has been provided and collected from the previous studies.

2. Casual associations cannot be inferred via a cross-sectional study design, and the risk factors identified will be interpreted accordingly.
3. Self-reported data will be used for the study with the risk of social desirability bias as healthcare workers' responses could have been influenced by stigma associated with mental health and substance use. In addition, recall bias may have occurred during the initial data collection phase where participant's memory was relied upon. Most questions used in this study however did not require recall over many months.
4. Selection bias was largely unavoidable as participation in the initial surveys was on a voluntary basis, and those who had been experiencing problems such as PTSD or burnout would have been more likely to complete the survey. Concerns related to confidentiality may also affect participation and contribute to bias. The initial investigators had put in place measures to mitigate this bias, including introductory letters to explain data handling procedure and preservation of confidentiality.
5. The healthy worker effect may result in overestimation of the healthcare workers' resilience status since those with low levels of resilience may have already left active work.
6. The cross-sectional nature of the previous studies excludes participants who were not available to participate or provided the opportunity to participate.

2.6.ETHICAL CONSIDERATION AND COMMUNICATION

This study will be submitted for ethical review by the Departmental Research Ethics Committee in the School of Public Health and approval from the University of Cape Town (UCT) Human Research Ethics Committee (HREC) of the Faculty of Health Sciences. The research will be conducted as per guiding principles of the Belmont Report and Declaration of Helsinki (World Medical Association. 2013).

Autonomy

Participation in both initial studies was voluntary, with no charge to the employees. In addition, written informed consent (entered electronically or manually) was requested prior to completing the questionnaires. Also, withdrawal from the studies was allowed at any time. For

this secondary data analysis, no direct interaction with participants will occur, so no additional informed consent is required.

Confidentiality

During the initial data collection process, the information obtained from the participants was kept confidential on password protected devices. No personal or identifying information was used. Data received was coded, with confidentiality maintained using password protected computers and software. Secondary data to be provided for use will not include identifier or personal information of the participants. For academic presentations, data will be provided in summarised form with no identifiers presented.

Beneficence

Findings from this study will provide information on sociodemographic and occupational factors contributing to psychological resilience in healthcare workers. Information gained from this study can be used to inform how psychological resilience can be increased and supported in the workplace.

Non-maleficence

This study will be of minimal risk to the participants. During the initial data collection, participants that may stop completion of the questionnaire should they experience discomfort. Furthermore, participants were provided with information where further assistance can be sought for mental health support services. For this secondary data analysis, no direct interaction with participants will occur.

Justice

There is a need to better understand psychological resilience, especially amongst healthcare workers as reported in both local and international literature, which justifies the need to conduct further research.

2.7.REPORTING AND DISSEMINATION OF RESEARCH RESULTS

The outcome of this study will quantify the level of psychological resilience amongst healthcare workers in South Africa. It will also determine the sociodemographic, work-related, and behavioural factors associated with psychological resilience. The results of this study will be used for the purpose of a Master of Public Health dissertation and the results are to be submitted to a peer-reviewed journal for further dissemination. Presentation at local and international conferences will also be undertaken.

2.8.RESOURCES

The study will be conducted by the author with no additional resources required. Given no data collection is required, this is considered adequate resourcing and no funding is required.

2.9.LOGISTICS

The study will commence as soon as ethical approval has been granted by the UCT HREC. It is anticipated that this will be in November 2023 (**Figure 2)**. Collation of the secondary data and merging of the data sets will occur over a period of one to two weeks, followed by data cleaning and analysis over the next two weeks. The write up of the report will follow, which is estimated to take between two and three months.

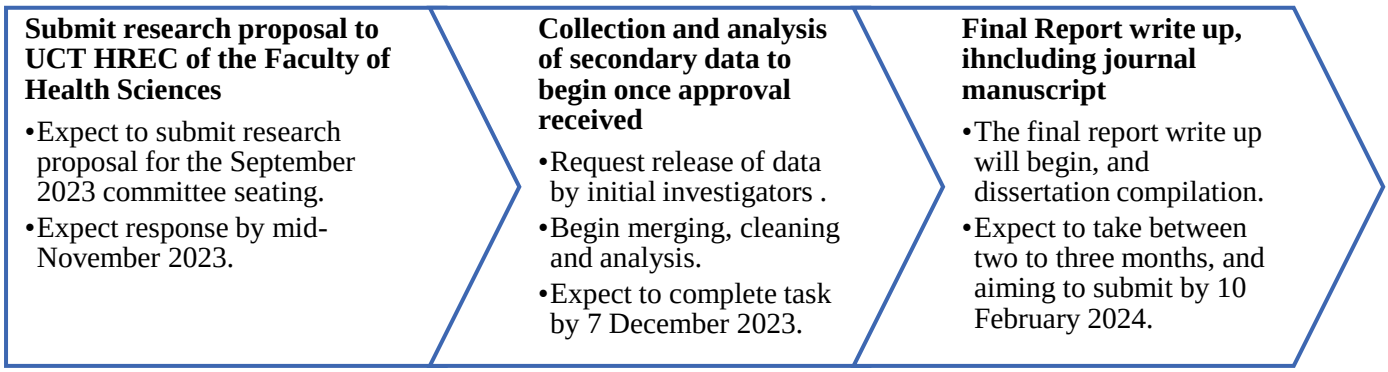

Figure 2: Estimated timeline for research process (up till submission)

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PART B: JOURNAL MANUSCRIPT

TITLE PAGE

SOCIODEMOGRAPHIC AND WORK-RELATED FACTORS ASSOCIATED WITH PSYCHOLOGICAL RESILIENCE IN SOUTH AFRICAN HEALTHCARE WORKERS

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ABSTRACT

Background: Psychological resilience facilitates adaptation in stressful environments and is an important personal characteristic enabling workers to navigate occupational challenges.

Objectives: To determine the prevalence and factors associated with resilience in a group of medical doctors and ambulance personnel in South Africa.

Methods: This analytical cross-sectional study used secondary data obtained from studies conducted in healthcare workers. Factors associated with resilience as measured by the Connor-Davidson Resilience Scale-10 were evaluated.

Results: The study included 647 healthcare workers. Resilience scores were low overall (27.6 ±6.6), but higher for ambulance personnel (28.0 ±6.9) than doctors (27.1 ±6.0) ($p = 0.006$). Factors associated with high resilience in doctors: male sex, higher income, current smoking; whilst for ambulance personnel: previous alcohol use. Significantly lower resilience was observed in participants with a mental health condition, and on treatment for one. Multivariable analysis confirmed that protective factors in doctors were: current smoking (β: 3.52, $p = 0.009$) and higher salary (β: 5.11, $p = 0.006$), whilst in ambulance personnel it was previous alcohol use (β: 3.22, $p = 0.003$). Female sex (β: -1.77, $p = 0.032$) and over-time work in doctors (β: -5.11, $p = 0.006$) increased the likelihood of low resilience.

Conclusions: Resilience was low in this group of South African healthcare workers. The strong association between low resilience and individual and workplace factors provide avenues for early intervention and building resilience in healthcare workers.

Contribution: This study provides an update on the prevalence and factors of resilience amongst South African healthcare workers.

Keywords: resilience; healthcare workers; ambulance personnel; occupational, doctors

INTRODUCTION

Psychological resilience is an important personal characteristic that enables healthcare workers to navigate the challenges encountered in their occupation.[1] Herrman et al. (2011) explored the evolution of the term in their narrative review and concluded that fundamentally, resilience is the 'inherent ability' for one to adapt positively following adversity or stressful events.[2] As such, psychological resilience describes an individual's coping mechanism, optimism, self-efficacy, high levels of hope and thriving mental health amid adversity and challenging circumstances.[3]

The healthcare system of most low- and middle- income countries (LMICs) is under severe strain due to high patient numbers; large burden of disease (communicable and non-communicable); lack of human and financial resources, the brain drain phenomenon; corruption and poor administration.[4,5,6,7] South Africa faces similar challenges, with a quadruple burden of disease: HIV/ AIDS and tuberculosis; communicable diseases (high maternal and child mortality); high levels of violence and injuries; and non-communicable diseases.[8] Poor health outcomes and a disproportionate distribution of healthcare resources in the country may be ascribed to the legacy of an undemocratic political apartheid regime (1948-1993) compounded by ongoing challenges in managing the health system in a post-apartheid South Africa.[7,8] South Africa's government is at present in the process of implementing a National Health Insurance (NHI) scheme in an effort to address the tremendous challenges that plague the health system. However, the country's preparedness remains uncertain, especially given the ongoing shortage of healthcare worker posts and rising unemployment in the health sector.[8,9] These challenges place immense pressure on employed healthcare workers, making psychological resilience an important inherent ability that can aid in supporting and protecting healthcare workers against adverse mental health outcomes and contributing to improved service delivery.

Research on the role of psychological resilience as a protective factor in frontline healthcare workers has increased recently during the coronavirus disease (COVID-19) pandemic. Much of the research in this area has been conducted in high-income countries (HICs) and China, and not much is known about the factors that predict psychological resilience in workers in LMICs,

including South Africa, an upper middle-income country. Robertson et al. (2016) in their systematic review on resilience amongst primary healthcare workers found that most research on the topic primarily frames resilience as an explanatory variable in relation to burnout.[10] This study therefore aims to determine the prevalence and the factors associated with psychological resilience of healthcare workers practising in the South African healthcare system.

METHODS

This is an analytical cross-sectional study using secondary data obtained from two cross-sectional studies conducted in healthcare workers in South Africa. The first study focused on ambulance personnel in the Western Cape province and the second study focused on medical doctors in the Eastern Cape province.[11,12] The present study included data on all healthcare workers who had completed the Connor-Davidson Resilience Scale-10 (CD-RISC-10) questionnaire and relevant sociodemographic and occupational questions. This study was approved by the University of Cape Town's Human Research Ethics Committee (HREC 712/2023).

Measurements

This study used secondary data generated from self-administered questionnaires that consisted of sociodemographic factors, work-related factors and the CD-RISC-10 questionnaire.

Sociodemographic and work-related factors

Data obtained from the questionnaires included information on age, gender, language, marital status, job category, professional qualification, over-time work, salary, and length of service. In addition, data on mental health and medical history was obtained, including self-reported mental health conditions and substance use (smoking, alcohol use, illicit and prescription drugs) debut; and the use of substances to manage work-related stress.

10-item Connor-Davidson Resilience Scale (CD-RISC-10)

Psychological resilience (outcome variable) was measured using the 10-item CD-RISC questionnaire. The CD-RISC-10 is a self-administered 10-item questionnaire, which is a shorter version of the CD-RISC-25. Participants identified their adaptive behaviours in stressful situations and scored these on a 5-point , with the resultant score ranged between 0 to 40.[13] This scale has previously been reported as a reliable and efficient measure of psychological resilience for adults.[14] In addition, it had previously been validated for use in South Africa by Pretorius et al. (2022) as a measure of psychological resilience and has been used in several studies of South African healthcare workers.[6,11,12,15,16,17] Written permission to use the scale was previously obtained.[11,12]

Statistical analysis

The secondary data was received and cleaned in password protected Microsoft Excel after ethical approval. R statistical software (version 4.3.1) was used for analysing the data and performing statistical tests. Descriptive statistics for continuous variables in this study are presented as means (standard deviation) and median (interquartile range) where appropriate. In addition, descriptive statistics for categorical variables is presented as proportions.

Mann-Whitney and Kruskal-Wallis tests were used to determine significant differences in CD-RISC-10 scores. In addition, unadjusted logistic regression and adjusted logistic regression (adjusted for age and gender) was performed. Low resilience, as an outcome measure was defined as a CD-RISC-10 score of less than 25.5.[18] Variables from the adjusted logistic analysis with a p-value of less than 0.250 were selected for the multivariable linear regression model, to investigate factors associated with increasing levels of resilience scores. Due to the size of the dataset, multinomial logistic regression was not performed as it would not produce useful results. The beta statistics, odds ratio and their 95% confidence interval were calculated for both the univariable and multivariable analyses. A p-value of less than 0.050 was considered as the cut-off point for statistical significance.

Missing data

Only the age factor had missing data greater than 1% of the total recorded values, and thus necessitated imputation (see **Supplementary Table 1** and **Supplementary Figure 1**). Imputation of the age factor is also important when performing this regression analysis as age has previously been reported as an important confounder of psychological resilience, and would need to be adjusted for when performing regression analysis[19,20,21] Multiple imputation was chosen as it results in valid statistical inferences.[22] To assess the sensitivity of the results with respect to the multiple imputation method chosen, multiple imputation using the three methods available in the Multivariate Imputation by Chained Equation (MICE) package in R were performed (see **Supplementary Table 2**). The imputed data from the Classification and regression tree (CART) method was chosen for use in the regression analysis that follows, given its minimal impact on the distribution of the age factor. **Supplementary Figure 2** shows the distribution of the age factor before and after CART imputation.

RESULTS

From the original datasets received, only one record was removed as the participant indicated that they were gender non-conforming. As such, there were 647 questionnaires included in the present analysis, of which 259 were doctors and 388 were ambulance personnel.

Sociodemographic and work-related characteristics

Among 259 doctors, the majority were female (57.9%), while most ambulance personnel were male (54.9%) (**Table 1**). Most doctors were English speaking (66.0%) and in the 20 - 29 years age group (42.5%), while most ambulance personnel were Afrikaans speaking (45.9%) and in the 30 - 39 years age group (37.1%). Most respondents worked for the ambulance service in operational roles having direct contact with patients (42.8%). Doctors' years of service in the current role was lower with a median of 2 (IQR: 4), while ambulance personnel had a median of 7 (IQR: 9). A higher percentage of doctors reported working over-time (96.9%) compared to ambulance personnel (68.6%).

Substance use, mental health and work-related stress management

The prevalence of smoking was higher amongst ambulance personnel (30.4%) compared to doctors (8.9%); while current alcohol usage was higher for doctors (64.1%) compared to ambulance personnel (51.5%) (**Table 2**). Only 2.8% of the overall sample reported current use of illicit substances or drugs. A quarter (25.1%) of the doctors reported having been diagnosed with a mental health condition compared to 11.1% of ambulance personnel. In addition, 17.4% of doctors reported being on treatment for a mental health condition, compared to 7.2% of ambulance personnel.

With regards to managing work-related stress (WRS), over a quarter (26.5%) of the ambulance personnel self-reported the need to smoke to manage WRS, while 20.5% of doctors reported the need to use alcohol to manage WRS. Interestingly, 4.5% of the overall sample felt the need to use illicit drugs to manage WRS, higher than the current prevalence of illicit drug use. Most participants supported the provision of psychological counselling (76.0%) and addressing staff shortages (74.7%) to assist with reducing WRS.

Overall CD-RISC-10 score and level of resilience

The overall average CD-RISC-10 score was 27.6 (±6.6) amongst the 647 healthcare workers in this study (**Table 2**). The average CD-RISC-10 score for ambulance personnel was 28.0 (±6.9), which was significantly higher than the doctors' score of 27.1 (±6.0) ($p = 0.006$). The total score for CD-RISC-10 can be classified into a 4-level variable using quantiles: lowest (0 – 24), low (25 – 28), moderate (29 – 32), and highest (33 – 40).[13] More than half of the doctors (58.7%) were classified as having the lowest or low resilience. For ambulance personnel, the majority (54.2%) were however classified as having moderate or high resilience.

Table 1: Sociodemographic and work-related characteristics

Participant characteristics	Doctors		Ambulance personnel		Overall	
	N	%	N	%	N	%
Sex						
Male	109	42.1%	213	54.9%	322	49.8%
Female	150	57.9%	175	45.1%	325	50.2%
Age						
20 – 29	110	42.5%	52	13.4%	162	25.0%
30 – 39	73	28.2%	144	37.1%	217	33.5%
40 – 49	50	19.3%	106	27.3%	156	24.1%
> 50	26	10.0%	37	9.5%	63	9.7%
Missing	0	0.0%	49	12.6%	49	7.6%
Home language						
English	171	66.0%	122	31.4%	293	45.3%
Afrikaans	54	20.8%	178	45.9%	232	35.9%
IsiXhosa	31	12.0%	84	21.6%	115	17.8%
Other	3	1.2%	4	1.0%	7	1.1%
Relationship Status						
Married	117	45.2%	174	44.8%	291	45.0%
Never married	127	49.0%	172	44.3%	299	46.2%
Divorced/ Separated/ Widowed	15	5.8%	42	10.8%	57	8.8%
Professional health qualification						
Yes	259	100.0%	322	83.0%	581	89.8%
No	0	0.0%	66	17.0%	66	10.2%
Job category						
Operational services/ EMS	0	0.0%	277	71.4%	277	42.8%
Support staff/ EMS	0	0.0%	111	28.6%	111	17.2%
Junior doctors	85	32.8%	0	0.0%	85	13.1%
Senior doctors	174	67.2%	0	0.0%	174	26.9%
Years employed in current role †	2 (4)		7 (9)		5 (8)	
Missing (%)	0	0.0%	5	1.3%	5	0.8%
Over-time work						
Yes	251	96.9%	266	68.6%	517	79.9%
No	8	3.1%	122	31.4%	130	20.1%
Monthly Salary (ZAR)						
R0 - R15 000	0	0.0%	165	42.5%	165	25.5%
R15 001 - R30 000	0	0.0%	193	49.7%	193	29.8%
R30 001 - R50 000	88	34.0%	30	7.7%	118	18.2%
> R50 001	171	66.0%	0	0.0%	171	26.4%

† Data are presented as median (interquartile range)

EMS: Emergency medical services; ZAR/ R: South African Rand

Table 2. Frequency and distribution of general and mental health specific variables

Participant characteristics	Doctors		Ambulance personnel		Overall	
	N	%	N	%	N	%
Age started smoking (m, SD) †	20.1	3.7	18.6	4.6	18.9	4.4
Age started illicit drugs (m, SD) †	20.1	3.8	21.4	6.6	21.0	6.0
Smoking history						
Never used	213	82.2%	235	60.6%	448	69.2%
Previous smoker	23	8.9%	35	9.0%	58	9.0%
Current smoker‡	23	8.9%	118	30.4%	141	21.8%
Alcohol history						
Never used	54	20.8%	110	28.4%	164	25.3%
Previous alcohol user	39	15.1%	78	20.1%	117	18.1%
Current drinker ‡	166	64.1%	200	51.5%	366	56.6%
Illicit drug use						
Never used	239	92.3%	342	88.1%	581	89.8%
Previous illicit drug user	13	5.0%	35	9.0%	48	7.4%
Current illicit drug user ‡	7	2.7%	11	2.8%	18	2.8%
Substance use to manage WRS						
Feel need to smoke to manage WRS	45	17.4%	103	26.5%	148	22.9%
Feel need to drink alcohol to manage WRS ‡	53	20.5%	44	11.3%	97	15.0%
Feel need to use illicit drugs to manage WRS ‡	13	5.0%	16	4.1%	29	4.5%
Mental health						
Ever diagnosed with a mental health condition ‡	65	25.1%	43	11.1%	108	16.7%
Currently on treatment for mental health condition	45	17.4%	28	7.2%	73	11.3%
Resilience, CD-RISC-10 score (m, SD) †	27.1	6.0	28.0	6.9	27.6	6.6
Lowest (0 - 24)	75	29.0%	101	26.0%	176	27.2%
Low (25 - 28)	77	29.7%	77	19.8%	154	23.8%
Moderate (29 - 32)	63	24.3%	105	27.1%	168	26.0%
Highest (33 - 40)	44	17.0%	105	27.1%	149	23.0%
Which intervention would assist most with reducing WRS?						
Address staff shortages	240	92.7%	243	62.6%	483	74.7%
Lessen workload	102	39.4%	119	30.7%	221	34.2%
Have more supportive management	171	66.0%	242	62.4%	413	63.8%
Rotate shifts to allow enough rest	115	44.4%	82	21.1%	197	30.4%
Provide psychological counselling	104	40.2%	388	100.0%	492	76.0%

† Data presented as mean and standard deviation

‡ Missing data (see Supplementary Table 1 for details)

CD-RISC-10: Connor-Davidson Resilience Scale-10; WRS: work-related stress

Inferential analysis

Bivariable analysis was undertaken to examine differences in CD-RISC-10 scores across several sociodemographic and work-related variables (**Table 3**). Male doctors had significantly higher resilience scores compared to females ($p < 0.001$). Certain job categories such as senior doctors and ambulance personnel had significantly higher resilience than junior doctors ($p = 0.019$). In addition, doctors who earned in the highest salary bracket demonstrated higher resilience than those who earned less ($p = 0.020$). Doctors who were current smokers had higher resilience (30.7) than those who have never smoked (27.2) or were previous smokers (26.7) ($p = 0.012$). In addition, a history of alcohol use significantly increased resilience for ambulance personnel (30.5) compared to current users (27.6) and never users (27.1) ($p = 0.002$). Participants who self-reported as having been diagnosed with a mental health condition had significantly lower resilience scores compared to those who have not, for doctors ($p = 0.037$), ambulance personnel ($p = 0.010$) and overall sample ($p < 0.001$). In addition, ambulance personnel and the overall sample currently on treatment for a mental health condition had significantly lower resilience scores ($p = 0.029$ and $p = 0.002$ respectively). Lastly, participants who felt the need to drink alcohol to manage WRS had significantly lower resilience scores amongst doctors ($p = 0.034$), ambulance personnel ($p = 0.048$) and overall sample ($p = 0.002$).

Unadjusted (see **Supplementary Table 3**) and adjusted logistic regression analysis was also performed. **Table 4** provides a summary of the statistically significant results for the adjusted logistic regression analysis, and **Supplementary Table 4** shows the complete results for the analysis performed. Current smoker status significantly reduced the odds of having low resilience for doctors (aOR: 0.21, 95%CI: 0.03 – 0.77, $p = 0.042$). Interestingly, previous alcohol use was also found to be protective against low resilience for ambulance personnel (aOR: 0.39, 95%CI: 0.18 - 0.78, $p = 0.010$). Being diagnosed with a mental health condition (aOR: 1.77, 95%CI: 1.15 - 2.70, $p = 0.009$) and being currently on treatment for a mental health condition (aOR: 1.70, 95%CI: 1.03 - 2.80, $p = 0.037$) significantly increased the odds of having low resilience for the overall sample.

The three multivariable linear regression CD-RISC-10 models were found to be statistically significant with $p < 0.050$ (F-statistic) (**Table 5**). However, their predictors only explained between 3.7% and 10.0% of the variation in the CD-RISC-10 score.

Table 3: Comparison of CD-RISC-10 across independent variables

			Doctors		Ambulance personnel		Overall	
Variable	**Group**	**N**	**Mean***	**P-value***	**Mean***	**P-value***	**Mean***	**P-value***
Gender	Female	325	**25.84**	**<0.001** [a]	28.29	0.595[a]	**27.16**	**0.035** [a]
	Male	322	**28.73**		27.79		**28.11**	
Age	20 – 29	169	26.53	0.337 [b]	29.34	0.150 [b]	27.51	0.309 [b]
	30 – 39	240	27.04		28.45		28.02	
	40 – 49	169	27.14		26.78		26.89	
	> 50	69	29.19		27.93		28.41	
Home language	English	293	27.22	0.748 [b]	27.67	0.478 [b]	27.41	0.152 [b]
	Afrikaans	232	27.50		28.47		28.24	
	IsiXhosa	115	25.90		27.54		27.10	
	Other	7	22.00		28.50		25.71	
Relationship Status	Married	291	27.80	0.143 [b]	27.65	0.374 [b]	27.71	0.743 [b]
	Never married	299	26.29		28.30		27.44	
	Divorced/ Separated/ Widowed	57	27.73		28.38		28.21	
Professional health qualification	Yes	581	27.06	N/A	27.92	0.775 [a]	27.54	0.276 [a]
	No	66	N/A		28.48		28.48	
Job category	Operational services/ EMS	277	N/A	0.159 [b]	27.78	0.561 [b]	**27.78**	**0.019** [b]
	Support staff/ EMS	111	N/A		28.60		**28.60**	
	Junior doctors	85	26.40		N/A		**26.40**	
	Senior doctors	174	27.38		N/A		**27.38**	
Over-time work	Yes	517	26.98	0.257 [a]	27.97	0.942 [a]	27.49	0.186 [a]
	No	130	29.50		28.11		28.19	
Monthly Salary (ZAR)	R0 - R15 000	165	**N/A**	**0.020** [b]	27.65	0.945 [b]	27.65	0.054[b]
	R15 001 - R30 000	193	**N/A**		28.22		28.22	
	R30 001- R50 000	118	**25.91**		28.73		26.63	
	> R50 001	171	**27.65**		N/A		27.65	

Variable	Group	N	Doctors		Ambulance personnel		Overall	
			Mean*	P-value*	Mean*	P-value*	Mean*	P-value*
Smoking history	Never used	448	**26.65**	**0.012** [b]	28.07	0.806 [b]	27.39	0.079 [b]
	Previous smoker	58	**27.17**		27.17		27.17	
	Current smoker	141	**30.74**		28.16		28.58	
Alcohol history	Never used	164	26.67	0.618 [b]	**27.11**	**0.002** [b]	**26.96**	**0.020** [b]
	Previous alcohol user	117	26.59		**30.47**		**29.18**	
	Current drinker	366	27.30		**27.56**		**27.44**	
Illicit drug use	Never used	581	26.94	0.607 [b]	28.02	0.431 [b]	27.57	0.475 [b]
	Previous illicit drug user	48	28.00		28.34		28.25	
	Current illicit drug user	18	29.43		26.91		27.89	
Ever diagnosed with a mental health condition	Yes	108	**25.66**	**0.037** [a]	**25.47**	**0.010** [a]	**25.58**	**<0.001** [a]
	No	539	**27.47**		**28.33**		**28.02**	
Currently on treatment for mental health condition	Yes	73	25.58	0.088 [a]	**25.54**	**0.029** [a]	**25.56**	**0.002** [a]
	No	574	27.37		**28.21**		**27.90**	
Substance use to manage work WRS								
Feel need to smoke to manage WRS	Yes	148	28.44	0.194 [a]	27.56	0.286 [a]	27.83	0.765 [a]
	No	499	26.77		28.18		27.57	
Feel need to drink alcohol to manage WRS	Yes	97	25.36	**0.034** [a]	**26.36**	**0.048** [a]	**25.81**	**0.002** [a]
	No	550	27.45		**28.23**		**27.94**	
Feel need to use illicit drugs to manage WRS	Yes	29	26.00	0.488 [a]	28.44	0.875 [a]	27.34	0.570 [a]
	No	618	27.16		28.00		27.67	

* Statistically significant results indicated in bold, [a] Mann–Whitney, [b] Kruskal–Wallis

EMS: Emergency medical services; N/A: not applicable; WRS: work-related stress; ZAR: South African Rand

Table 4: Adjusted multivariable regression analysis of the predictors of CD-RISC-10 (significant variables only)

	Doctors				Ambulance personnel				Overall			
Predictors	**aOR** †*	**95%**	**CI**	**P value** *	**aOR** †*	**95%**	**CI**	**P value** *	**aOR** †*	**95%**	**CI**	**P value** *
Smoking history (Never used)												
Previous smoker	1.68	0.66	4.25	0.273	1.06	0.48	2.27	0.873	1.26	0.69	2.24	0.442
Current Smoker	**0.21**	**0.03**	**0.77**	**0.042**	0.91	0.55	1.49	0.714	0.77	0.45	1.09	0.127
Alcohol history (Never used)												
Previous alcohol user	0.78	0.32	1.84	0.568	**0.39**	**0.18**	**0.78**	**0.010**	**0.52**	**0.30**	**0.88**	**0.015**
Current drinker	0.64	0.33	1.23	0.180	1.12	0.68	1.88	0.657	0.91	0.62	1.36	0.654
Ever diagnosed with a mental health condition (No)												
Yes	1.56	0.87	2.81	0.136	1.75	0.90	3.35	0.095	**1.77**	**1.15**	**2.70**	**0.009**
Currently on treatment for mental health condition (No)												
Yes	1.38	0.70	2.69	0.348	1.80	0.80	3.95	0.145	**1.70**	**1.03**	**2.80**	**0.037**

*Statistically significant results indicated in bold; †Data adjusted for age and genders
Note: Content in brackets is the reference or base group

Table 5: Multivariable linear regression models for predictors of CD-RISC-10 score

	Doctors				Ambulance personnel				Overall			
Predictor	**B***	**95%**	**CI**	**P value ***	**B***	**95%**	**CI**	**P value ***	**B***	**95%**	**CI**	**P value ***
Gender (Male)												
Female	**-1.77**	**-3.39**	**-0.15**	**0.032**	-0.23	-1.80	1.33	0.769	-0.88	-2.01	0.24	0.124
Age (20 - 29)												
30 – 39	0.38	-1.87	2.64	0.737	-0.74	-2.87	1.38	0.490	-0.11	-1.67	1.45	0.889
40 – 49	-0.26	-2.98	2.45	0.850	-2.12	-4.47	0.22	0.076	-1.29	-3.07	0.48	0.152
> 50	1.18	-2.87	5.23	0.567	-0.55	-3.75	2.66	0.737	0.51	-1.94	2.96	0.682
Home language (English)												
Afrikaans	1.09	-0.75	2.92	0.244	0.34	-1.29	1.96	0.685	0.34	-0.86	1.55	0.573
IsiXhosa	-1.37	-3.69	0.95	0.247	-0.24	-2.29	1.81	0.819	-0.40	-1.90	1.11	0.606
Other	-5.63	-12.38	1.13	0.102	0.81	-6.05	7.66	0.817	-1.33	-6.17	3.52	0.591
Job category (Operational services/ EMS)												
Support staff/ EMS					0.47	-1.17	2.12	0.572	0.71	-0.80	2.23	0.357
Junior doctors †									-2.18	-5.23	0.87	0.161
Senior doctors	**-4.45**	**-8.54**	**-0.36**	**0.033**					**-4.99**	**-9.59**	**-0.39**	**0.034**
Years employed in current role	-0.02	-0.22	0.18	0.851	-0.11	-0.24	0.02	0.093	-0.08	-0.19	0.02	0.124
Over-time work (No)												
Yes	-5.11	-9.42	0.80	0.020	-0.10	-1.46	1.65	0.901	-0.04	-1.42	1.35	0.958
Monthly Salary (ZAR) (R0 - R15 000)												
R15 001 - R30 000					0.79	-0.83	2.41	0.336	0.35	-1.11	1.82	0.636
R30 001 - R50 000 †					1.27	-1.65	4.18	0.393	0.68	-1.97	3.34	0.614
> R50 001	**5.11**	**1.46**	**8.77**	**0.006**					**5.24**	**0.45**	**10.03**	**0.032**
Smoking history (Never used)												
Previous smoker	-0.21	-2.93	2.52	0.882	-0.81	-3.36	1.75	0.536	-0.34	-2.22	1.54	0.721
Current smoker	**3.52**	**0.89**	**6.16**	**0.009**	-0.06	-1.82	1.70	0.947	0.53	-0.88	1.94	0.460
Alcohol history (Never used)												
Previous alcohol user	0.45	-2.03	2.93	0.719	**3.22**	**1.10**	**5.34**	**0.003**	**2.32**	**0.70**	**3.93**	**0.005**
Current drinker	0.89	-1.08	2.85	0.375	0.15	-1.73	2.03	0.876	0.45	-0.92	1.83	0.516

	Doctors				Ambulance personnel				Overall			
Predictor	**B***	**95%**	**CI**	**P value ***	**B***	**95%**	**CI**	**P value ***	**B***	**95%**	**CI**	**P value ***
Illicit drug use (Never used)												
Previous illicit drug user	-0.31	-3.70	3.07	0.855	0.49	-2.04	3.02	0.703	0.19	-1.83	2.20	0.855
Current illicit drug user	2.33	-2.26	6.93	0.318	-0.55	-4.95	3.86	0.808	0.86	-2.33	4.05	0.597
Substance use to manage WRS												
Feel need to drink alcohol to manage WRS (No)												
Yes	-1.87	-3.81	0.06	0.058	-0.43	-2.82	1.97	0.728	-1.22	-2.76	0.32	0.120
Mental health												
Ever diagnosed with a mental health condition (No)												
Yes	-0.99	-3.73	1.75	0.477	-2.57	-5.31	0.17	0.066	-1.87	-3.81	0.07	0.059
Currently on treatment for mental health condition (No)												
Yes	-0.45	-3.53	2.63	0.773	-1.41	-4.66	1.85	0.396	-0.94	-3.15	1.27	0.405
F-statistic	**2.413**				**1.690**				**2.227**			
P-Value	**<0.001**				**0.030**				**<0.001**			
Adjusted R-squared	0.100				0.037				0.044			

*Statistically significant results indicated in bold; †Reference or base group for doctor

EMS: Emergency medical services; Ref = Reference level; WRS: work-related stress, ZAR/ R: South African Rand

Note: Content in brackets is the reference or base group

It should also be noted that the statistically significant regression coefficients reported in **Table 5** are consistent with the average CD-RISC-10 scores from the bivariable analysis in **Table 3**, except for job category (**Supplementary Table 5**). Job category was statistically significant, with senior doctors negatively impacting on resilience scores of doctors, after adjusting for other predictors (β: -4.45, 95%CI: -8.54 - -0.36, p = 0.033). Conversely, being in the highest salary bracket was significantly and positively associated with resilience scores for doctors and overall sample (β: 5.11, 95%CI: 1.46 - 8.77, p = 0.006 and β: 5.24, 95%CI: 0.45 - 10.03, p = 0.032 respectively). For doctors, female gender and over-time work were statistically significant predictors for CD-RISC-10 score, with a negative impact on resilience (β: -1.77, 95%CI: -3.39 - -0.15, p = 0.032 and β: -5.11, 95%CI: -9.42 - -0.80, p = 0.020 respectively); while current smoker status had a positive impact on resilience (β: 3.52, 95%CI: 0.89 - 6.16, p = 0.009). In addition, for ambulance personnel and overall sample, only previous alcohol use was a statistically significant predictor for CD-RISC-10 score, with a positive impact on resilience (β: 3.22, 95%CI: 1.10 - 5.34, p = 0.003 and β: 2.32, 95%CI: 0.70 - 3.93, p = 0.005 respectively).

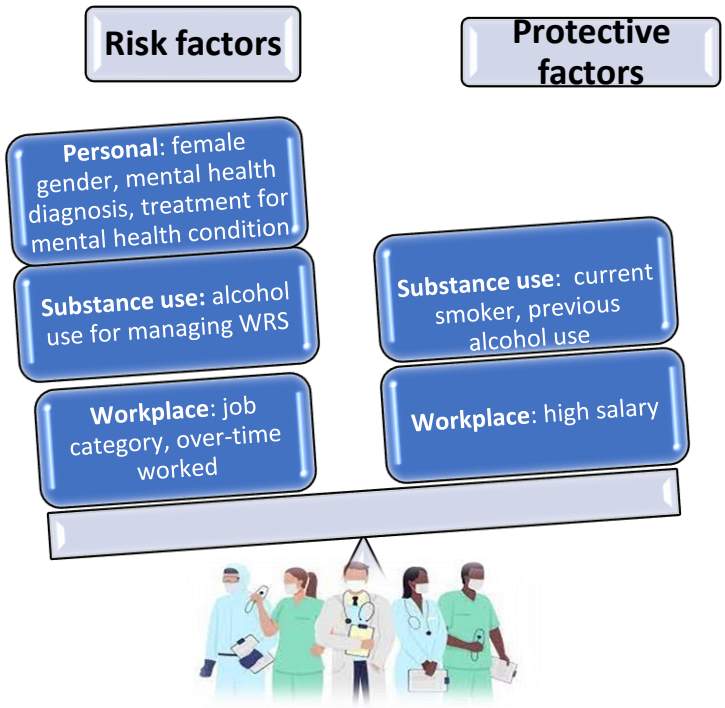

Figure 1: Summary of identified protective and risk factors associated with psychological resilience of healthcare workers

DISCUSSION

This study aimed to estimate the prevalence and the determinants of psychological resilience amongst a group of healthcare workers in South Africa, comprising of doctors and ambulance personnel. A summary of the factors associated with psychological resilience in participants who formed part of this study is provided in **Figure 1**.

The study found the prevalence of psychological resilience amongst the healthcare workers to be relatively low at 27.6 (±6.6). The average score of ambulance personnel (28.0 ±6.9) was higher than that of doctors (27.1 ± 6.0). Kang et al. (2018) reported an overall average score of 29.0 (±6.8) for a group of ambulance personnel in China, which is higher than the overall average score obtained in this study.[23] Mantas-Jiménez et al. (2022) in their study comparing doctors and ambulance technicians in Spain reported an overall average score of 30.6 (±5.0), which was higher than that obtained in the present study.[24] Cook et al. (2021) in their longitudinal study on healthcare workers in South Africa reported an average score of 26.7 (±8.8) and 30 (±6.7) for the two time points considered.[6] The average resilience score for the second time point of the longitudinal study was higher than those in the present study. Xuan et al. (2021) and Elkudssiah Ismail et al. (2022) reported an overall average score of 28.6 (±6.3) and 30.0 (±6.3) respectively in their study on Malaysian healthcare workers, which were both higher than in the present study.[20,25] Zhou et al. (2022) however reported an overall average score of 23.2 (±9.3) in their study of Chinese resident doctors, which is lower than that obtained in the present study.[26] This variability in the level of resilience observed may be due to differences in the study context (population sampled, time when study was conducted), resources available in the healthcare system and differences in cultural values and norms which may result in different coping styles amongst healthcare workers.[1] Overall, the results from this study were consistent with results from comparative studies on resilience of healthcare workers when taking into account the standard deviations reported.

The study revealed a statistically significant association between psychological resilience and gender, with females having significantly lower resilience than males. These results are aligned with previous studies on psychological resilience which found that female sex is associated with lower resilience scores.[10,20,27,28] This could be attributed to females assuming multiple

roles at home and in the workplace, experiencing more emotional exhaustion and being more sensitive and susceptible to stress.[10,27] The difference could also be due to social desirability bias, with males answering in a way that portrays an image of being able to manage pressure better.[20]

We observed that doctors who were current smokers had higher average resilience score compared to previous smokers and those that had never smoked before. These results are contrary to results from previous studies, where current smokers were found to have significantly lower psychological resilience.[29] It is probable that current smoking may be reflective of a coping mechanism and could be masking low levels of resilience amongst the current smokers. Substance use and medication use have been used as a maladaptive coping mechanism to deal with mental health issues and work-related stress.[12,30]

Similarly, in ambulance personnel and overall sample, a significant relationship was found between psychological resilience and alcohol history, with previous alcohol use being protective against low resilience. These results are in line with guidelines followed by rehabilitation programs (alcohol and smoking), which consider improving resilience as necessary to preventing substance use onset, abuse problems and relapse.[29,31,32] In addition, Yamashita et al. (2021) in their study found that lower relapse risk was associated with higher resilience ($p < 0.010$).[33]

This study found no significant association between psychological resilience and other sociodemographic and lifestyle factors such as age, home language and relationship status. This is consistent with results found by Rossouw et al. (2013), Wang et al. (2021) and Yue et al. (2022).[16,34,35] Herman et al. (2011) noted that these inconsistences observed between psychological resilience and predictive factors may be due to differences in study methodologies and the definition of resilience used by the investigators.[2]

Results were somewhat contradictory for job category. The initial bivariable analysis and logistic regression analysis suggested that job category was protective, with senior doctors

having higher average resilience than junior doctors. However, the multivariable linear regression found job category to be a risk factor. This can also be observed when looking at the average resilience score of the healthcare workers by job category, salary and over-time work (see **Supplementary Table 5**). This suggests that, once salary and over-time work is adjusted for, junior doctors have higher resilience than senior doctors in this sample. This is contradictory to prior research which suggests that greater experience and professional training results in higher resilience.[19,36]

In addition, years in the current role and professional qualification was not found to be significant predictors for the CD-RISC-10 score in the present study. Wang et al. (2020) argued that senior healthcare workers have better experience and professional skills to deal with the complex situations that arise in the workplace.[19] Wang et al. (2020) and Hamdan et al. (2023) found that years in practice was positively associated with psychological resilience in their studies ($p < 0.050$ and $p = 0.013$ respectively).[19,21] Afshari et al. (2021) noted that increase in healthcare workers' education and work experience may be linked to the progression of skills, which results in the development of positive coping strategies, leading to higher resilience.[36] Of note, ambulance personnel had significantly higher average resilience than doctors in this study, similar to the findings by Mantas-Jiménezet al. (2022) in their study which compared doctors and ambulance technicians in Spain ($p = 0.039$).[24]

Over-time work was found to be a significant negative predictor of resilience amongst doctors in the present study. These results are in line with the interventions recommended by the healthcare workers in the present study to reduce WRS, with most of the participants indicating that addressing staff shortage was important for reducing WRS. Zhao et al. (2023) in their study on nurses in China also found that working longer hours a day resulted in significantly lower psychological resilience ($p = 0.008$).[37] However, Rossouw et al. (2013) did not find any significant relationship between resilience and over-time hours in their study on healthcare workers in Cape Town.[16] Alameddine et al. (2021) observed that high workload and occupational stressors were likely to lead to low job satisfaction, poor work performance and high job turnover for healthcare workers, as such, resulting in a vicious cycle, ultimately leading to burnout and low resilience.[28]

The present study found a significant negative association between psychological resilience and self-reported mental health condition and being on treatment for a mental health condition for the overall sample. Keragholi et al. (2022) and Liang et al. (2023) noted that psychological resilience has been identified to have a protective role against mental health issues.[38,39] Ramadianto et al. (2022) in their study of Indonesian medical students found higher resilience was moderately correlated with lower scores of depressive and anxious symptoms ($p < 0.001$).[40] In addition, Keragholi et al. (2022) in their study of Iranian ambulance personnel also found that mental health status was negatively associated with resilience ($p = 0.001$).[39] Rossouw et al. (2013) found that healthcare works using medication or other forms of treatment for their anxiety or depression symptoms had significantly lower resilience than those not using medication ($p = 0.030$).[16] Furthermore stigma and denial related to mental health might impact on the ability of healthcare workers to seek help, which could also lead to underreporting in research studies.[16]

The resilience score of participants who reported needing to use alcohol to manage WRS was significantly lower than those reporting not needing to use alcohol. In addition, the preference by most participants (76.7%) was for the provision of psychological counselling as an intervention that could be provided by institutions to assist with reducing WRS. This would be a positive coping strategy compared to substance use, which is recognized as a maladaptive coping mechanism used by those with mental health issues or WRS.[30] In addition, Alim et al. (2012) found that resilience interacts with stress to impact the development of addiction and relapse.[31] Other studies have also identified the protective role that psychological resilience has on WRS.[41]

STRENGTHS AND LIMITATIONS

The primary strength of this study was that it included a large population of healthcare workers in South Africa. In addition, both previous surveys used to collect data for this study had good response rates. The study also used a popular validated questionnaire to measure the outcome variable, which provides an opportunity to compare the results of this study with previous studies.

The study had several limitations. Firstly, as a secondary data analysis was undertaken, the information available was limited to what had been provided and collected from the previous two studies. Secondly, causation cannot be inferred via a cross-sectional study design, and the risk factors identified need to be interpreted accordingly. Thirdly, as self-reported data was used, the risk of social desirability bias is high, as respondents may be influenced by stigma associated with substance use and mental health. In addition, recall bias may have occurred during the initial data collection phase where participant's memory was relied upon. Most questions used in this study however did not require recall over many months.

Fourthly, selection bias was largely unavoidable as participation in the initial surveys was on a voluntary basis, and those who had been experiencing problems such as PTSD or burnout may have been more likely to complete the survey. In addition, concerns related to confidentiality may also affect participation and contribute to bias. The initial investigators had put in place measures to mitigate this bias, including introductory letters to explain data handling procedure and preservation of confidentiality. Lastly, the healthy worker effect may result in overestimation of the healthcare workers' resilience status since those with low levels of resilience may have already left active work.

CONCLUSION AND RECOMMENDATIONS

Resilience was relatively low in this group of South African healthcare workers compared to similar studies globally, highlighting the need to build resilience amongst healthcare workers in South Africa. This study demonstrates that resources need to be directed towards building resilience amongst female healthcare workers, and those working long hours and earning lower income. In addition, support such as psychological counselling should be offered to healthcare workers that have been diagnosed with mental health conditions. Further research is needed to better characterise the sociodemographic and work-related factors impacting the psychological resilience of healthcare workers in South Africa to enable improved support of healthcare workers. This will assist in building psychological resilience in the healthcare workforce in

South Africa and may protect against burnout, whilst supporting the delivery of healthcare services.

COMPETING INTERESTS

The authors declare that there are no conflicting interests.

AUTHORS' CONTRIBUTIONS

T.M. conceptualised the study, was responsible for data analysis, initial writeup and subsequent manuscript revisions. I.N. provided part of the dataset, and assisted with study conceptualisation, data analysis and write-up of this study. S.A. assisted with study conceptualisation and write-up of this study. S.K provided part of the dataset and made editorial manuscript revisions.

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DISCLAIMER

The views and opinions expressed in this manuscript are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors.

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PART C: APPENDICES

1. RESEARCH PROTOCOL APPENDICES

APPENDIX 1: SUMMARY OF THE QUALITY ASSESSMENT OF MEASUREMENT SCALES FOR MEASURING RESILIENCE

Table S1: Description and summary of quality assessment of psychological resilience measurement scales

Name	Author	Target audience	Number of dimensions (items)	Internal consistency (Cronbach Alphas)	Reproducibility reliability	Interpretability
Resilience Scale for Adults	Friborg et al., 2003	Adult	5 (37)	0.90, 0.83, 0.87, 0.83 and 0.67 for respective dimensions	> 0.69 test-retest correlation for all subscales	Information on how subgroups expected to differ was available
Brief Resilience Scale	Smith et al., 2008	Adult	1 (6)	0.8 to 0.91	0.62 (n = 61); 0.69 (n = 48) test-retest reliability (ICC)	Information on how subgroups expected to differ was available
Connor-Davidson Resilience Scale	Connor & Davidson, 2003	Adult	5 (25)	0.89 (n = 577)	ICC was 0.87 (n = 24) type unspecified	Information on how subgroups expected to differ was available

ICC: intraclass correlation coefficient

(Windle et al., 2011)

APPENDIX 2: CONNOR–DAVIDSON RESILIENCE SCALE (CD-RISC)

Connor-Davidson Resilience Scale 10 (CD-RISC-10) ®

initials ☐☐☐ *ID#* ☐☐☐☐☐☐☐ *date* ☐☐/☐☐/☐☐☐☐ *visit* ☐☐ *age* ☐☐

Please indicate how much you agree with the following statements as they apply to you over the last month. If a particular situation has not occurred recently, answer according to how you think you would have felt.

---

		not true at all (0)	rarely true (1)	sometimes true (2)	often true (3)	true nearly all the time (4)
1.	I am able to adapt when changes occur.	☐	☐	☐	☐	☐
2.	I can deal with whatever comes my way.	☐	☐	☐	☐	☐
3.	I try to see the humorous side of things when I am faced with problems.	☐	☐	☐	☐	☐
4.	Having to cope with stress can make me stronger.	☐	☐	☐	☐	☐
5.	I tend to bounce back after illness, injury, or other hardships.	☐	☐	☐	☐	☐
6.	I believe I can achieve my goals, even if there are obstacles.	☐	☐	☐	☐	☐
7.	Under pressure, I stay focused and think clearly.	☐	☐	☐	☐	☐
8.	I am not easily discouraged by failure.	☐	☐	☐	☐	☐
9.	I think of myself as a strong person when dealing with life's challenges and difficulties.	☐	☐	☐	☐	☐
10.	I am able to handle unpleasant or painful feelings like sadness, fear, and anger.	☐	☐	☐	☐	☐

Add up your score for each column 0 + ____ + ____ + ____ + ____

Add each of the column totals to obtain CD-RISC score = _____

APPENDIX 3: PREVALENCE LEVEL OF NURSES OR NURSING STUDENTS IN LMICS AS MEASURED BY CD-RISC SCORES

Table S2: Prevalence level of nurses or nursing students in LMICs as measured by CD-RISC Scale

Author/ Year	Country	Study Population	Diagnostic tools used	Prevalence/Overall Resilience Score
Afshari et al., 2021	Iran	387 nurses	CD-RISC-25	61.8 (SD=14.8)
Al Hadid et al., 2022	Jordan	300 new nurses	CD-RISC-25	74.98 (SD=14.01)
Alameddine et al., 2021	Lebanon	511 nurses	CD-RISC-25	72 (SD=13.5)
Alan et al., 2022	Turkey	489 nurses	CD-RISC-25	66.31 (SD=18.16)
Alhawatmeh et al., 2021	Jordan	550 nurses	CD-RISC-25	61.57 (SD=17.43)
Areshtanab et al., 2022	Iran	280 student nurses	CD-RISC-25	95.51 (SD=14.11)
Askarpour et al., 2023	Iran	80 nurses	CD-RISC-25	36.7 (SD=16.65)
Atay et al., 2023	Turkey	263 nurses	CD-RISC-25	66.16 (SD=12.72)
Berdida et al., 2023	Philippines	776 student nurses	CD-RISC-10	38.24 (SD=6.79)
Cao et al., 2020	China	582 haemodialysis nurses	CD-RISC-10	Not reported
Cao et al., 2021	China	243 graduate nurses	CD-RISC-10	Not reported
Chen et al., 2022	China	413 psychiatric nurses	CD-RISC-25	79.35 (SD=15.68)
Dahka et al., 2022	Iran	432 nurses	CD-RISC-10	25.97 (SD=6.88)
Devi et al., 2021	Indonesia	336 nursing students	CD-RISC-25	68.61 (SD=15.08)
Ding et al., 2023	China	1 774 nurses	CD-RISC-10	21.85 (SD=8.28)
Diño et al., 2022	Philippines	50 nurses	CD-RISC-10	32 (2 (SD=38.8)
Froutan et al., 2018	Iran	252 nurses	CD-RISC-25	73.8 (SD=15.1)
Georges et al., 2022	Haiti	179 nurses	CD-RISC-10	26.68 (SD=5.86)
Guo et al., 2017	China	1 061 nurses	CD-RISC-25	63.77 (SD=12.80)
Guo et al., 2018	China	1 061 nurses	CD-RISC-25	63.77 (SD=12.80)
Hu et al., 2020	China	2 014 nurses	CD-RISC-10	26.14 (SD=7.33)
Hou et al., 2021	China	701 nurses	CD-RISC-25	59.76 (SD=21.15)
Huang et al., 2022	China	197 rescue nurses	CD-RISC-25	70.85 (SD=13.21)

Author/ Year	Country	Study Population	Diagnostic tools used	Prevalence/Overall Resilience Score
Jamebozorgi et al., 2022	Iran	364 nurses	CD-RISC-25	56.93 (SD=11)
Jose et al., 2022	India	137 nurses	CD-RISC-10	31.23 (SD=4.68)
Jose et al., 2020	India	120 nurses	CD-RISC-25	77.77 (SD=12.41)
Karamizade et al., 2021	Iran	1 857 nurses	CD-RISC-25	73.09 (SD=15.76)
Karimi Khordeh et al., 2022	Iran	295 emergency nurses	CD-RISC-25	55.07 (SD=19.82)
Kong et al., 2016	China	377 student nurses	CD-RISC-10	28.20 (SD=5.61)
Leng et al., 2020	China	2 981 nurses	CD-RISC-25	61.35 (SD=13.12)
Li J et al., 2022	China	318 palliative care nurses	CD-RISC-25	Not reported
Li et al., 2023	China	307 nurses	CD-RISC-10	24.49 (SD=6.64)
Li et al., 2021	China	471 student nurses	CD-RISC-25	Not reported
Li et al., 2015	China	202 student nurses	CD-RISC-10	23.96 (SD=6.56)
Lyu et al., 2022	China	1 223 nurses	CD-RISC-2	5.07 (SD=1.53)
Ma, 2023	China	331 graduating nursing students	CD-RISC-10	31.35 (SD=6.02)
Mathad et al., 2017	China	194 nursing students	CD-RISC-10	26.31 (SD=6.28)
Menezes et al., 2023	Brazil	230 nurses	CD-RISC-25	77 (SD=10.51)
Mesri, 2022	Iran	91 nurses	CD-RISC-25	72.75 (SD= 11.88)
Mirzaei Dahka et al., 2022	Iran	432 nurses	CD-RISC-10	25.97 (SD=6.88)
Mohammadi et al., 2022	Iran	420 student nurses	CD-RISC-25	71.65 (SD=2.12)
Nourollahi-Darabad et al., 2021	Iran	386 nurses	CD-RISC-25	61.8 (SD=14.8)
Ou et al., 2021	China	92 nurses in isolation wards	CD-RISC-25	87.04 (SD=22.78)
Pang et al., 2019	China	282 nurses	CD-RISC-25	Median=81 (IQR=72, 88)
Parizad et al., 2022	Iran	250 nurses	CD-RISC-25	63.8 (SD=16.2)
Qin et al., 2023	China	709 nursing students	CD-RISC-10	27.32 (SD=3.95) (Score: 10-50)
Rahmat et al., 2023	Indonesia	101 nurses	CD-RISC-25	Median =81
Rashnuodi et al., 2022	Iran	200 nurses	CD-RISC-25	61.11 (SD=5.06)

Author/ Year	Country	Study Population	Diagnostic tools used	Prevalence/Overall Resilience Score
Sahu et al., 2019	India	102 student nurses	CD-RISC-25	71 (SD=11.5)
Soltanian et al., 2023	Iran	78 nurses	CD-RISC-25	78.78 (SD=4.73)
Sukut et al., 2022	Turkey	100 psychiatric nurses	CD-RISC-25	67.33 (SD=2.96)
Talebian et al., 2022	Iran	144 critical care nurses	CD-RISC-25	90.66 (SD=0.92)
Üzar-Özçetin et al., 2019	Turkey	66 nurses in oncology	CD-RISC-25	64.51 (SD=5.32)
Wan et al., 2023	China	683 nursing students	CD-RISC-25	86.168 (SD=12.27)
Wang X et al., 2022	China	1 582 nurses	CD-RISC-10	25.97 (SD=6.14)
Wang Y et al., 2022	China	355 ICU nurses	CD-RISC-25	77.59 (SD=5.43)
Wang YR et al., 2022	China	303 midwifery students	CD-RISC-10	26.71 (SD=6.11)
Yan et al., 2022	China	1 536 nurses	CD-RISC-25	56.0 (SD=4.19)
Yan et al., 2023	China	1292 nurses	CD-RISC-25	55.75 (SD=4.96)
Yang et al., 2018	China	536 transplant nurses	CD-RISC-25	59.07 (SD=1.57)
Yusefi et al., 2021	Iran	312 nurses	CD-RISC-25	72.38 (SD=7.11)
Zahednezhad et al., 2021	Iran	202 nurses	CD-RISC-10	Not reported
Zakeri et al.,2021	Iran	185 nurses	CD-RISC-25	64.07 (SD=15.74)
Zhang J et al., 2022	China	978 nurses	CD-RISC-25	60.34 (SD=5.975)
Zhang X et al., 2021	China	180 front-line nurses	CD-RISC-25	67.66 (SD=67.66)
Zhang et al., 2023	China	319 palliative nurses	CD-RISC-25	57.12 (SD=14.60)
Zhang Y et al., 2022	China	143 nurses	CD-RISC-10	28.45 (SD=7.05)
Zhang Z et al., 2021	China	6 348 student nurses	CD-RISC-10	35.41 (SD=8.29) (Score: 10–50)
Zhao et al., 2023	China	374 ED nurses	CD-RISC-10	27.73 (SD=6.52)
Zhou S et al., 2022	China	511 student nurses	CD-RISC-25	92.96 (SD=14.85)
Zhou Z et al., 2022	China	757 nurses	CD-RISC-10	25.29 (SD=6.95)
Zou et al., 2016	China	366 nurses	CD-RISC-10	26.03 (SD=6.49)

CD-RISC: Connor-Davidson Resilience Scale; ED: Emergency department; ICU: Intensive care unit; SD: Standard Deviation

APPENDIX 4: SUMMARY OF ANALYSIS IN JOURNAL ARTICLES ON RESILIENCE AS MEASURED BY CD-RISC SCORES AMONG HEALTHCARE WORKERS IN LMICS

Table S3: Summary of analysis on journal articles on resilience as measured by CD-RISC Scale among healthcare workers in LMICs

Author/ Year	Country	Study design	Study Population (Mean age, SD)	Diagnostic tools used	Main outcome	Prevalence/Overall Resilience Score
Alameddine et al., 2022	Lebanon	Cross-sectional	459 CPs	CD-RISC-25	Resilience, Burnout.	68.0 (SD=13.37)
Ampon-Wireko et al., 2022	Ghana	Cross-sectional	549 frontline HCWs (average=39)	CD-RISC-10	COVID-19 stigmatisation, Job performance, Anxiety, Resilience.	Not reported
An et al., 2021	China	Cross-sectional	162 frontier-line HCWs (31.22 (SD=5.73)) ;163 non-frontier-line HCWs (30.52 (SD=7.07))	CD-RISC-25	Depression, Anxiety, Post Traumatic Stress Disorder, Resilience.	Not reported
Cai et al., 2020	China	Cross-sectional	1 521 HCWs	CD-RISC-25	Psychological abnormality.	New staff: 67.73 (SD=14.85); Experienced staff: 75.36 (SD=13.27)
Cook et al., 2021	South Africa	Longitudinal study Cross-sectional	HCWs: First study: 31 (40.7 (SD=10.14)); Second study: 15 (43.6 (SD = 10.8))	CD-RISC-10	Depression, Anxiety, Burnout, Resilience, Coping mechanisms.	First study: 26.733 (SD=8.82); Second study: 30.0 (SD=6.680)
Elkudssiah Ismail et al., 2022	Malaysia	Cross-sectional	164 GPs (45 (SD=12.71)); 87 CPs (35 (SD=9.08))	CD-RISC-10	Resilience.	GPs: 30.93 (SD=6.25); CPs: 28.20 (SD=6.12)
Fu et al., 2022	China	Cross-sectional	1 602 HCWs	CD-RISC-10	Burnout.	Not reported

Author/ Year	Country	Study design	Study Population (Mean age, SD)	Diagnostic tools used	Main outcome	Prevalence/Overall Resilience Score
Ghaedi-Heidari et al., 2022	Iran	Cross-sectional	235 medical students	CD-RISC-25	Anxiety, Resilience, Posttraumatic Growth.	50.60 (SD=15.9)
Hamdan et al., 2023	Jordan	Cross-sectional	135 orthopaedic surgeons (39.10 (SD=11.26))	CD-RISC-10	Resilience, Burnout, Grit.	Not reported
Hatami et al., 2022	Iran	Cross-sectional	(50 dental students (23.43 (SD=3.11))	CD-RISC-25	Spiritual health, Resilience, Happiness.	90.19 (SD=15.03) (Score: 25-125)
Hou et al., 2020	China	Cross-sectional	1 472 HCWs	CD-RISC-25	Social support, Resilience, Mental health.	Not reported
Huang et al., 2020	China	Cross-sectional	364 HCWs in radiology department (32 (IQR:27–40))	CD-RISC-25	Anxiety, Resilience.	83.8% High (score>50)
Huang et al., 2020	China	Cross-sectional	587 HCWs in radiology department (33 (IQR:28–43))	CD-RISC-25	Resilience	65.76 (SD=17.26)
Januario et al., 2022	Brazil	Cross-sectional	1 043 HCWs (40.81 (SD=12.41))	CD-RISC-10	Depression.	Not reported
Kang et al., 2018	China	Cross-sectional	227 ambulance personnel (31.76 (SD=6.52))	CD-RISC-10	Vicarious Posttraumatic Growth, Social Support, Resilience.	28.97 (SD=6.75)
Khan et al., 2023	South Africa	Cross-sectional	260 HCWs	CD-RISC-10	Resilience, Burnout.	28.85% low (score<25), 46.15% medium, 25% high (score>=30)
Keragholi et al., 2022	Iran	Cross-sectional	115 emergency personnel (32.63 (SD=7.56))	CD-RISC-25	Mental health, Resilience.	72.25 (SD=12.63)

Author/ Year	Country	Study design	Study Population (Mean age, SD)	Diagnostic tools used	Main outcome	Prevalence/Overall Resilience Score
Li M et al., 2022	China	Cross-sectional	938 frontline healthcare workers (31.10 (SD=5.77))	CD-RISC-10	Post Traumatic Stress Disorder, Perceived stress, Somatization, Resilience.	26.49 (SD=8.13)
Li W et al., 2022	China	Cross-sectional	309 HCWs in isolation wards (33.5 (SD=9.5))	CD-RISC-25	Resilience, Coping style, COVID-19 stress, Quality of life.	60.8 (SD=15.7)
Liang et al., 2020	China	Cross-sectional	899 frontline HCWs and 1 104 general population	CD-RISC-10	Depression, Anxiety, Insomnia, Resilience.	HCWs: Hubei Province: 26.36 (SD=7.99); Outside region: 27.47 (SD=8.80)
Liang et al., 2023	China	Cross-sectional	245 HCWs (37.5 (SD=8.2))	CD-RISC-10	Depression symptoms, Anxiety symptoms.	26.1 (SD=6.1)
Lin et al., 2020	China	Cross-sectional	114 non-local medical workers sent to Wuhan.	CD-RISC-25	Resilience	67.03 (SD=13.22)
Liu et al., 2020	China	Cross-sectional	606 HCWs (35.77 (SD=8.13))	CD-RISC-10	Insomnia.	27.05 (SD=8.71)
Liu et al., 2022	China	Cross-sectional	390 HCWs	CD-RISC-25	Resilience, Anxiety.	63.28 (SD=14.83)
Ntatamala & Adams, 2022	South Africa	Cross-sectional	388 ambulance Personnel (38 (IQR:31-44))	CD-RISC-10	Current Post Traumatic Stress Disorder, Resilience.	28 (SD=6.9)
Pan et al., 2020	China	Cross-sectional	423 central sterile supply department HCWs	CD-RISC-25	Mental state.	64.26 (SD=15.129)
Qui et al., 2020	China	Cross-sectional	866 doctors	CD-RISC-25	Resilience, Organizational Support, Fatigue.	53.69 (SD=18.76)
Ramadianto et al., 2022	Indonesia	Cross-sectional	532 medical students (20.65 (SD=1.98))	CD-RISC-25	Anxiety, Depression.	68 (IQR: 58–77)

Author/ Year	Country	Study design	Study Population (Mean age, SD)	Diagnostic tools used	Main outcome	Prevalence/Overall Resilience Score
Rayani et al. 2022	Iran	Cross-sectional	184 HCWs (35.54 (SD=7.11))	CD-RISC-25	Anxiety, Resilience.	63.10 (SD=15.84)
Rossouw et al.,2013	South Africa	Cross-sectional	132 doctors	CD-RISC-25	Burnout, Depression, Resilience.	71.51 (SD=12.77)
Setiawati et al., 2021	Indonesia	Cross-sectional	227 HCWs (39.67 (SD=9.43)	CD-RISC-25	Resilience, Anxiety.	69 (SD=15.823)
Song et al., 2023	China	Cross-sectional	138 paediatric residents (26.25 (SD=2.61))	CD-RISC-25	Burnout, Social support, Resilience, Anxiety, Depression.	58.26 (SD=15.66)
Tam et al., 2021	China	Cross-sectional	1 029 HCWs in HIV clinics (38.39 years (SD=9.20))	CD-RISC	Resilience, COVID-19 stressors, Psychological Distress, Institutional Support.	Not reported
Unjai et al., 2023	Thailand	Cross-sectional	178 ICU HCWs (mean 32.10 years (SD=8.91))	CD-RISC-25	Compassion satisfaction, Resilience, Flourishing, Passion for work.	67.48 (SD=11.1)
van der Merwe et al., 2020	South Africa	Cross-sectional	270 pre-clinical; 230 clinical	CD-RISC-25	Resilience.	Pre-clinical: 72.5 (SD=14.0); Clinical: 75.4 (SD=11.7)
Wang et al., 2020	China	Cross-sectional	274 HCWs (37 (IQR:22–64))	CD-RISC-10	Anxiety, Depression, Sleep quality, Stress.	28
Wang et al., 2021	China	Cross-sectional	115 military medical staff (32.89 (SD=5.8))	CD-RISC-25	Resilience, Fatigue, Physical burden, Anxiety.	66.45 (SD=13.27)
Xuan et al., 2021	Malaysia	Cross-sectional	524 medical interns (median=26 (IQR: 11))	CD-RISC-10	Resilience, Emotional quotient, Coping style.	28.6 (SD=6.33)
Yang et al., 2021	China	Cross-sectional	9 322 HCWs (average 31.65)	CD-RISC-25	Career choice regret, Resilience.	Not reported

Author/ Year	Country	Study design	Study Population (Mean age, SD)	Diagnostic tools used	Main outcome	Prevalence/Overall Resilience Score
Yue et al., 2022	China	Cross-sectional	2 217 medical postgraduates	CD-RISC-25	Mental health, Physical activity.	85.35 (SD=15.49)
Zhang B et al., 2021	China	Cross-sectional	337 HCWs (33.29 (SD=7.16)) in oncology department	CD-RISC-25	Compassion satisfaction, Compassion fatigue, Coping style, Resilience	Not reported
Zhang Q et al., 2022	China	Cross-sectional	1 064 HCWs (33.3 (SD=8.2))	CD-RISC-10	Psychological distress.	27.31 (SD=6.98)
Zhou et al., 2022	China	Cross-sectional	1877 resident doctors (24.65 (SD=1.47))	CD-RISC-10	Workplace bullying, Insomnia severity, Subjective wellbeing.	23.24 (SD=9.267)

CD-RISC: Connor-Davidson Resilience Scale; CPs: Community pharmacists; ER: Emergency Room; GPs: General practitioners; HCWs: Healthcare Workers; IQR: Interquartile range; SD: Standard Deviation; SEM: Structural Equation Modelling

APPENDIX 5: QUESTIONNAIRE FROM STUDY 1

Author generated questionnaire from Study 1 (Ntatamala & Adams, 2022)

UCT STUDY ON THE PREDICTORS OF PTSD AMONGST AMBULANCE PERSONNEL IN THE WESTERN CAPE, SOUTH AFRICA - 2019

ENGLISH QUESTIONNAIRE

Survey Number _____ | | | |

A. IDENTIFICATION DATA

1. Staff number _____ | | | | | | |

2. Date of birth: Day_____Month_____Year____ | | | | | | |

3. Gender:
Male (1) | |
Female (2)
Prefer not to state (3)

4.Language:
English (1) | |
Afrikaans (2)
IsiXhosa (3)
Other (4)

5. What is your highest level of education? | |
Primary school (1)
High school Grade 8 - 9 (2)

High school Grade 10 - 12 (3)

Certificate (4)

Diploma (5)

Degree (6)

6. What is your marital status? ☐

Married for first time (1)

Married with previous marriages (2)

Never married (3)

Widowed (4)

Divorced or separated (5)

7. What is your living status? ☐

Alone (1)

Family or friends (2)

8. Where do you live? ☐

Rural (1)

Urban (2)

B. EXPOSURE FACTORS

General occupational factors

1. What is your current job title?

_____

2. How long have you been employed in this position? ☐☐☐☐☐☐

Month _____ Year _____

3. Which department/ section are you working in?

_____

4. Where is your area of work located or stationed?

_____

5. How many hours on average do you work per week? ☐

30 - 40 hours (1)

41 - 50 hours (2)

51 - 60 hours (3)

61 - 70 hours (4)

6. How long have you been employed in a healthcare environment? ☐☐☐☐

Year _____ Months _____

7. Have you had to change your job or role at work in the past 5 years? ☐

Yes (1)

No (2)

7.1 If yes, what were the reasons for changing your job or role?

_____

8. Do you have a professional health qualification? ☐

Yes (1)

No (2)

8.1 If yes, when did you obtain your qualification?

Year _____ Months _____

8.2 Could you please specify what your qualification is?

_____

9. What is your monthly salary?

R0 - R5,000 (1)

R5,001 - R10,000 (2)

R10,001 - R15,000 (3)

R15,001 - R20,000 (4)

R20,001 - R25,000 (5)

R25,001 - R30,000 (6)

R30,001 and above (7)

Mental health and medical history

1. Have you ever been diagnosed with a mental health or psychiatric condition?

Yes (1)

No (2)

1.1 If yes, could you please specify what the condition/s is/are?

_____

1.2 Are you on any treatment for a mental health or psychiatric condition? ☐

Yes (1)

No (2)

2. Do you have any other condition or disease which requires medical treatment? ☐

Yes (1)

No (2)

2.1 If yes, could you please specify what the condition/s is/are?

_____

Family history

1. Do you have a family member who has ever been diagnosed with a mental health or psychiatric condition? ☐

Yes (1)

No (2)

1.1 If yes, could you please specify what the condition/s is/are?

_____

C. SMOKING HISTORY

1. Have you ever smoked tobacco (cigarettes or pipe) for as long as a year?

'YES' means at least 20 packs of cigarettes or 360 grams of tobacco in a lifetime or at least one cigarette per day for one year

Yes (1) ☐

No (2)

If YES, go on to Question 1.1

If NO, skip to Question 2

1.1 How old were you when you started smoking? ☐☐

_____ years old

1.2 Do you now smoke? ☐

'YES' means smoking tobacco in the last month or more

Yes (1)

No (2)

If YES, go on to Question 1.3

If NO, skip to Section D

1.3 Do you ever feel the need to smoke to manage work related stress or problems in the workplace? ☐

Yes (1)

No (2)

D. ALCOHOL USE HISTORY

1. Have you ever drunk alcohol? ☐

Yes (1)

No (2)

2 Do you drink alcohol now? ☐

Yes (1)

No (2)

‘If yes, go to question 2

If no, go to section D

2.1 Have you felt the need to cut down your drinking? ☐

Yes (1)

No (2)

2.2 Have you felt annoyed by criticism of your drinking? ☐

Yes (1)

No (2)

2.3 Have you had guilty feelings about drinking? ☐

Yes (1)

No (2)

2.4 Have you taken a drink as a morning eye opener? ☐

Yes (1)

No (2)

2.5 Do you ever feel the need to drink alcohol to manage work related stress or problems in the workplace? ☐

Yes (1)

No (2)

E. DRUG AND SUBSTANCE USE HISTORY

1. Have you ever used illicit or non-prescription drugs? ☐

Yes (1)

No (2)

If YES, go on to Question 1.1

If NO, skip to Question 1.3

1.1 How old were you when you started using illicit drugs? ☐☐

_____ years old

1.2 Do you now use illicit or prescription drugs? ☐

'YES' means using illicit drugs in the last month or more

Yes (1)

No (2)

If YES, go on to Question 1.3

If NO, skip to Question 1.4

1.3 Do you ever feel the need to use illicit drugs to manage work related stress or problems in the workplace? ☐

Yes (1)

No (2)

1.4 Do you ever use prescription drugs to manage work related stress or problems in the workplace? ☐

Yes (1)

No (2)

F. WORK RELATED STRESS

1. Are you aware of any services offered by the employer to help you manage work related stress? ☐

Yes (1)

No (2)

If YES, go on to Question 1.1

If NO, skip to Question 2

1.1 What services or forms of support are you aware of?

_____

2. What are some of the barriers or reasons for not seeking help for work related stress? Please select all that apply.

Do not know where to get help (1) ☐

Difficult to get time off from work (2) ☐

Difficult to schedule appointment (3) ☐

Lack finances or medical aid (4) ☐

Lack transport to access help (5) ☐

Fear that services are not confidential (6) ☐

Fear that my career will be negatively (7) ☐

affected

Others (please specify) _____ (8)

3. How likely are you to seek help from the following if suffering from work related stress?

Likert scale: very unlikely (1) to very likely (7)

A family member or friend

Your spouse or partner

Spiritual or religious leader

A colleague or co-worker

Employee Assistance Programme

ICAS telephonic counsellors

A supervisor

An occupational health coordinator

Union or Labour representative

4. What would be the best way to improve services and support for work related stress (WRS)? Select all that apply.

Train staff to recognize when stressed (1)

Train supervisors to detect WRS (2)

Provide group coaching (3)

Provide accessible treatment services (4)

Provide counselling on premises (5)

Provide counselling telephonically (6)

Allow for debriefing or discussion (7)

Rotate shifts to allow enough rest (8)

Rotate shifts to allow working in high (9

and low trauma settings (10)

Address staff shortages (11)

Lessen work load (12)

Improve culture within service (13)

Have more supportive management (14)

4. In the past 4 weeks, have you had any of the following with your regular work as a result of any emotional problems (stress, anxiety, depression etc)?

If yes, did this cause you to:

5.1 Cut down on the amount of time you spent

on work or other activities Yes (1) No (2)

5.2 Accomplished less than you would like Yes (1) No (2)

5.3 Not do work or other activities as carefully

as usual Yes (1) No (2)

G. HEALTH AND SAFETY EDUCATION AND TRAINING

1. How much training have you had on how

to manage work related stress you may encounter?

a) no training 1

b) some training 2

c) extensive training 3

2. How much training have you received

on services available to manage work related stress?

a) no training 1

b) some training 2

c) extensive training 3

3. Do you have any concerns and/or recommendations regarding your risk of developing work related stress?

_____

_____

_____

APPENDIX 6: QUESTIONNAIRE FROM STUDY 2

Questionnaire from Study 2 (Khan et al., 2023)

UCT STUDY ON THE PREVALENCE AND DETERMINANTS OF BURNOUT AMONGST MEDICAL DOCTORS AT PUBLIC HOSPITALS IN GQEBERHA DURING THE COVID 19 PANDEMIC

Note: Answer ALL questions. Insert a cross (X) where appropriate
Do not put your name on any of the forms provided. The information which you provide will be confidential and will be combined with other answers and presented as group data only with no individual identification data included.

PART ONE
Identification data

1.1 Age:

a) 20-29
b) 30-39
c) 40-49
d) 50-59
e) >60

1.2 To which gender do you most identify?

a) Man
b) Woman
c) Trans
d) Gender Non-conforming

1.3 Language:

a) English
b) Afrikaans
c) isiXhosa
d) other

1.4 Relationship status

a) Married
b) Single, Never married
c) Single, Divorced
d) Single, Widowed
e) In a committed relationship

1.5 If you have children living at home, how many are in each of the following age groups:

a) Less than 4 years old
b) 4 through 12 years old

c) 13 through 20 years old
d) 21 and over

1.6.1 Are you the primary caregiver of the children?

Yes

No

1.6.2 Are you the primary caregiver of elderly or disabled family members?

a) Yes
b) No

Occupational data

1.7 What is your current job title?

a) Intern
b) Medical Officer
c) Registrar
d) Consultant
e) Clinical Manager
f) Other (please specify)

1.8 Which department are you working in?

a) Internal Medicine
b) Surgical
c) Anaesthetics
d) Family Medicine
e) Emergency Medicine
f) Obstetrics and gynaecology
g) Paediatrics
h) Other

1.9 Are you employed full-time or part-time?

1.10 How many hours OVERTIME do you work per month, on average?

a) 0-60 hours
b) 60-80 hours
c) 80-100 hours
d) 100-120 hours
e) >120 hours

1.11 How long is your average overtime call?

a) 8 hours
b) 8-12 hours
c) 12-16 hours

d) 16-20 hours
e) 20-24 hours
f) >24 hours

1.12 Where is the majority of your overtime done?

a) On-site
b) Off-site

1.13 How many years have you been employed in this post?

1.14 What is your monthly salary (after tax)?

a) R30 000-R50 000
b) R50 000-R100 000
c) R100 000-R150 000
d) >R150 000

1.15 Have you had to change your job/role in the past 2 years?

a) Yes
b) No

1.16 What were the reasons for changing your job/role?

Below is a series of statements with which you may agree or disagree. Indicate the degree of your agreement by selecting Yes or No.

Smoking History

1.17 Have you ever smoked cigarettes for as long as a year?
("Yes" means at least 20 packs of cigarettes in a lifetime or at least one cigarette per day for one year)

a) Yes
b) No

If YES, go on to Question 1.17.1
If NO, skip to Question 1.17.2

1.17.1 How old were you when you started smoking?

1.17.2 Do you now smoke? ("Yes" means smoking cigarettes in the last month or more)

a) Yes
b) No

If YES, go on to Question 1.17.3
If NO, skip to Question 1.18

1.17.3 Do you ever feel the need to smoke to manage work-related stress or problems in the workplace?

a) Yes
b) No

Alcohol History

1.18 Have you ever drunk alcohol?

a) Yes
b) No

1.19 Do you drink alcohol now?

a) Yes
b) No

If YES, go on to Question 1.19.1
If NO, skip to Question 1.20

1.19.1 How frequently do you consume alcohol?

a) Daily
b) Over weekends
c) Weekly
d) Monthly

1.19.2 How many units per week do you consume?

1.19.3 Do you ever feel the need to drink alcohol to manage work related stress or problems in the workplace?

a) Yes
b) No

Drug and Substance use History

1.20 Have you ever used illicit or non-prescription drugs?

a) Yes
b) No

If YES, go on to Question 1.20.1
If NO, skip to Question 1.21

1.20.1 How old were you when you started using illicit drugs?

1.20.2 Do you now use illicit or non-prescription drugs?

a) Yes

b) No

If YES, go on to Question 1.20.3
If NO, skip to Question 1.21

1.20.3 Do you ever feel the need to use illicit drugs to manage work-related stress or problems in the workplace?

a) Yes
b) No

1.20.4 Do you ever use non-prescription drugs to manage work-related stress or problems in the workplace?

a) Yes
b) No

Mental Health History

1.21 Have you ever been diagnosed with a mental health condition?

a) Yes
b) No

1.22 Have you been diagnosed with a mental health condition in the last 12 months?

a) Yes
b) No

1.23 If you have answered "Yes" to either 1.21 or 1.22, could you specify what your mental health condition/s is/are?

1.24 Are you on any treatment for a mental health condition?

a) Yes
b) No

PART TWO

The following statements refer to your feelings and attitudes during work.
Please indicate to what extent you agree with each of the following statements by selecting the category that corresponds with the statement.

2.1 I always find new and interesting aspects in my work.

a) Strongly agree
b) Agree
c) Disagree
d) Strongly Disagree

2.2 There are days when I feel tired before I arrive at work

a) Strongly agree
b) Agree
c) Disagree
d) Strongly Disagree

2.3 It happens more and more often that I talk about my work in a negative way

a) Strongly agree
b) Agree
c) Disagree
d) Strongly Disagree

2.4 After work, I tend to need more time than in the past in order to relax and feel better

a) Strongly agree
b) Agree
c) Disagree
d) Strongly Disagree

2.5. I can tolerate the pressure of my work very well

a) Strongly agree
b) Agree
c) Disagree
d) Strongly Disagree

2.6 Lately, I tend to think less at work and do my job almost mechanically

a) Strongly agree
b) Agree
c) Disagree
d) Strongly Disagree

2.7 I find my work to be a positive challenge

a) Strongly agree
b) Agree
c) Disagree
d) Strongly Disagree

2.8 During my work, I often feel emotionally drained

a) Strongly agree
b) Agree
c) Disagree
d) Strongly Disagree

2.9 Over time, one can become disconnected from this type of work

a) Strongly agree

b) Agree
c) Disagree
d) Strongly Disagree

2.10 After working, I have enough energy for my leisure time activities

a) Strongly agree
b) Agree
c) Disagree
d) Strongly Disagree

2.11 Sometimes, I feel sickened by my work tasks

a) Strongly agree
b) Agree
c) Disagree
d) Strongly Disagree

2.12 After work, I usually feel worn out and weary

a) Strongly agree
b) Agree
c) Disagree
d) Strongly Disagree

2.13 This is the only type of work I can imagine myself doing

a) Strongly agree
b) Agree
c) Disagree
d) Strongly Disagree

2.14 Usually, I can manage the amount of work well

a) Strongly agree
b) Agree
c) Disagree
d) Strongly Disagree

2.15 I feel more engaged in my work

a) Strongly agree
b) Agree
c) Disagree
d) Strongly Disagree

2.16 When I work, I usually feel energised

a) Strongly agree
b) Agree
c) Disagree

d) Strongly Disagree

PART THREE

The next few items are concerned with various aspects of your work activities.
Please insert a cross where appropriate.

Workload and Responsibility

3.1. How much workload do you have in your present (clinical/administrative) role?

a) Hardly
b) A little
c) Some
d) A lot
e) A great deal

3.2 How much time do you have to do all your (clinical/administrative) work?

a) Hardly
b) A little
c) Some
d) A lot
e) A great deal

3.3 How much responsibility do you have for the morale of patients and colleagues?

a) Hardly
b) A little
c) Some
d) A lot
e) A great deal

3.4 How much responsibility do you have for the welfare and lives of patients and colleagues?

a) Hardly
b) A little
c) Some
d) A lot
e) A great deal

Conflict at work

3.5 There is harmony within my group.

a) Strongly disagree
b) Moderately disagree
c) Neither agree nor disagree
d) Moderately agree
e) Strongly agree

3.6 The members of my group are supportive of each other's ideas

a) Strongly disagree
b) Moderately disagree
c) Neither agree nor disagree
d) Moderately agree
e) Strongly agree

3.7 There is agreement between my group and other groups

a) Strongly disagree
b) Moderately disagree
c) Neither agree nor disagree
d) Moderately agree
e) Strongly agree

3.8 The relationship between my group and other groups is harmonious in attaining the overall organisational goals

a) Strongly disagree
b) Moderately disagree
c) Neither agree nor disagree
d) Moderately agree
e) Strongly agree

Role Conflict and Role Ambiguity

3.9 I feel certain about how much authority I have

a) Very inaccurate
b) Mostly inaccurate
c) Slightly inaccurate
d) Uncertain
e) Slightly accurate
f) Mostly accurate
g) Very accurate

3.10 There are clear, planned goals and objectives for my job

a) Very inaccurate
b) Mostly inaccurate
c) Slightly inaccurate
d) Uncertain
e) Slightly accurate
f) Mostly accurate
g) Very accurate

3.11 I receive an assignment without the help I need to complete it

a) Very inaccurate
b) Mostly inaccurate
c) Slightly inaccurate
d) Uncertain
e) Slightly accurate
f) Mostly accurate
g) Very accurate

3.12 I have to bend or break a rule or policy in order to carry out an assignment

a) Very inaccurate
b) Mostly inaccurate
c) Slightly inaccurate
d) Uncertain
e) Slightly accurate
f) Mostly accurate
g) Very accurate

Job Satisfaction

3.13 Knowing what you know now, if you had to decide all over again whether to take the type of job you now have, what would you decide?

a) I would decide without hesitation to take the same job
b) I would have some second thoughts
c) I would decide definitely not to take this type of job

3.14 If you were free right now to go into any type of job you wanted, that would your choice be?

a) I would take the same job
b) I would take a different job
c) I would not want to work

3.15 If a friend of yours told you he/she was interested in working in a job like yours, what would you tell him/her?

a) I would strongly recommend it
b) I would have some doubts about recommending it
c) I would advise against it

3.16 All in all, how satisfied would you say you are with your job?

a) I am satisfied
b) I am somewhat satisfied
c) I am not too satisfied
d) I am not at all satisfied

Support at work

3.17 How easy is it to talk with each of the following people?

3.17.1 Your immediate supervisor

a) Very Much
b) Somewhat
c) A little
d) Not at all
e) Don't have any such person

3.17.2 Other people at work

a) Very Much
b) Somewhat
c) A little
d) Not at all
e) Don't have any such person

3.18 How much can each of these people be relied on when things get tough at work?

3.18.1 Your immediate supervisor

a) Very Much
b) Somewhat
c) A little
d) Not at all
e) Don't have any such person

3.18.2 Other people at work?

a) Very Much
b) Somewhat
c) A little
d) Not at all
e) Don't have any such person

PART FOUR

Please indicate how much you agree with the following statements as they apply to you over last month. If a particular situation has not occurred recently, answer according to how you think you would have felt.

4.1 I am able to adapt when changes occur.

a) Not true at all
b) Rarely true
c) Sometimes true
d) Often true
e) True nearly all the time

4.2 I can deal with whatever comes my way.

a) Not true at all
b) Rarely true
c) Sometimes true
d) Often true
e) True nearly all the time

4.3 I try to see the humorous side of things when I am faced with problems.

a) Not true at all
b) Rarely true
c) Sometimes true
d) Often true
e) True nearly all the time

4.4 Having to cope with stress can make me stronger.

a) Not true at all
b) Rarely true
c) Sometimes true
d) Often true
e) True nearly all the time

4.5 I tend to bounce back after illness, injury, or other hardships.

a) Not true at all
b) Rarely true
c) Sometimes true
d) Often true
e) True nearly all the time

4.6 I believe I can achieve my goals, even if there are obstacles.

a) Not true at all
b) Rarely true
c) Sometimes true
d) Often true
e) True nearly all the time

4.7 Under pressure, I stay focused and think clearly.

a) Not true at all
b) Rarely true
c) Sometimes true
d) Often true
e) True nearly all the time

4.8 I am not easily discouraged by failure.

a) Not true at all

b) Rarely true
c) Sometimes true
d) Often true
e) True nearly all the time

4.9 I think of myself as a strong person when dealing with life's challenges and difficulties.

a) Not true at all
b) Rarely true
c) Sometimes true
d) Often true
e) True nearly all the time

4.10 I am able to handle unpleasant or painful feelings like sadness, fear, and anger.

a) Not true at all
b) Rarely true
c) Sometimes true
d) Often true
e) True nearly all the time

PART FIVE

The next few items are concerned with various aspects of COVID 19 and workplace interventions. Please insert a cross where appropriate.

5.1 Were you infected with COVID 19?

a) Yes
b) No

If YES, go on to Question 5.1.1
If NO, skip to Question 5.2

5.1.1 Have you fully recovered?

a) Yes
b) No

5.1.2 If no, are you still experiencing symptoms?

a) Yes
b) No

5.1.3 Did you transmit COVID 19 infection to your family member?

a) Yes
b) No

5.2 Did you have to care for any of your family members who contracted COVID 19?

a) Yes

b) No

5.3 Were you given adequate supply of personal protective equipment (PPE) during the COVID 19 pandemic?

a) Yes
b) No

5.4 Were infection prevention and control (IPC) measures and policies (e.g. staff symptom screening and workplace cleaning) adequately implemented during the Covid 19 pandemic?

a) Yes
b) No

5.5 Were you redeployed to another department during the COVID 19 pandemic?

a) Yes
b) No

5.6 Did you have to change your annual leave because of the COVID 19 pandemic?

a) Yes
b) No

5.7 Have you received vaccination against COVID 19?

a) Yes
b) No

5.8 Interventions

Which interventions will assist most with reducing stress at work? (Choose one or more)

a) Employing more staff
b) Reducing workload
c) Reducing overtime
d) Increasing my salary
e) Improving working conditions
f) Provision of psychological counselling
g) Provision of a doctor's restroom
h) Provision of more time off work
i) Provision of skills training
j) Improving equipment
k) Improving supervision
l) Improving management support

5.9 Specify any other interventions which will reduce your stress at work.

PART SIX
Further Assistance

Should this study identify that you are at risk of burnout or raise any other concerns, would you like to be contacted?
If so, please provide your contact details below.

1. Surname:
2. First Name:
3. Address:
4. Contact Number:

If you do not wish to be contacted, please find attached a list of service providers where an assessment can be made and assistance offered, if required.
THANK YOU FOR ANSWERING THE QUESTIONNAIRE!

APPENDIX 7: TABLE OF VARIABLES

Table S4: Table of variables

	Field name				
No	**Resilience**	**Study 1**	**Study 2**	**Definition to be used in current study**	**Field attributes (for combination)**
A. Personal characteristics					
1	Gender	Gender	gender1	To which gender do you most identify? Consider removing non-conforming and trans individuals.	Female 0 Male 1 Trans 2 Non-conforming 2
2	Age	AgeYears	age1	Age in age brackets.	20-29 1 30-39 2 40-49 3 50-59 4 >60 5
3	Language	Language	language1		English 1 Afrikaans 2 isiXhosa 3 Other 4
4	Relationship Status	MaritalStatus	relationship1	To collapse some relationship status of two surveys into 4 categories: Married (1); never married (2); divorced or separated (3); Widowed (4).	Married for first time 1 Married with previous marriages 1 Never married 2 Widowed 3 Divorced or separated 3 In a committed relationship 2
B. Occupational and behavioural factors					
5	JobCategory	JobCategory	job_title1	To collapse job categories into: Operations (1); support staff (2); other doctors (3);	Operations 1 Support 2 EMS Lecturer 2 Intern 3 Medical Officer 4 Registrar 4

				clinical managers/ support (4).	Other 3 Consultant 4 Clinical Manager 4
6	ProfQualification	ProfQualification	*All doctors	Do you have a professional qualification?	Yes 1 No 0
7	YrsCurrentJob	YearsEmployed	employment_years	How many years have you been employed in this current post?	Years numerical
8	work_overtime	HrsWorked	work_overtime	Do you work overtime? Collapse categories into yes/no: Yes, if individual worked more than 40 hours a week in Study 1.	Yes 1 No 0 30 - 40 hours 0 41 - 50 hours 1 51 - 60 hours 1 61 - 70 hours 1
9	Salary	Salary	monthly_salary	What is your monthly salary (after tax)?	R0 - R5 000 1 R5 001 - R10 000 1 R10 001 - R15 000 1 R15 001 - R20 000 2 R20 001 - R25 000 3 R25 001 - R30 000 3 R30 000-R50 000 4 R50 000-R100 000 5 R100 000-R150 000 5 >R150 000 5
10	MentalHealthDxOwn	MentalHealthDxOwn	mentalhealth_dx_ever	Have you ever been diagnosed with a mental health condition?	Yes 1 No 0
11	mentalthhealth_treatment	RxMentalHealth	mentalthhealth_treatment	Are you on treatment for a mental health condition?	Yes 1 No 0
12	EverSmoker	EverSmoker	smoke_ever	Have you ever smoked cigarettes for as long as a year? ("Yes" means at least 20 packs of cigarettes in a lifetime or at least one cigarette per day for one year)	Yes 1 No 0

13	AgeSmoker	AgeSmoker	smoking_age	How old were you when you started smoking?	Years numerical
14	SmokeNOW	SmokeNOW	smoke_now	Do you now smoke? ('Yes" means smoking cigarettes in the last month or more)	Yes 1 No 0
15	EverFeelNeedSmokeWRS	EverFeelNeedSmokeWRS	smoke_manage_stress	Do you ever feel the need to smoke to manage work-related stress or problems in the workplace?	Yes 1 No 0
16	alcohol_ever_drunk	EverDrinkAlch	alcohol_ever_drunk	Have you ever drunk alcohol?	Yes 1 No 0
17	DrinkNow	DrinkNow	alcohol_drink_now	Do you drink alcohol now?	Yes 1 No 0
18	EverFeelNeedDrinkWRS	EverFeelNeedDrinkWRS	alcohol_manage_stress	Do you ever feel the need to drink alcohol to manage work-related stress or problems in the workplace?	Yes 1 No 0
19	EverUseIllDrugs	EverUseIllDrugs	illicit_drugs_use	Have you ever used illicit or non-prescription drugs?	Yes 1 No 0
20	AgeDrugUse	AgeDrugUse	illicit_drugs_age	How old were you when you started using illicit drugs?	Years numerical
21	UseDrugsNOW	UseDrugsNOW	illicit_drugs_now	Do you now use illicit or non-prescription drugs?	Yes 1 No 0
22	FeelNeedDruges4WRS	FeelNeedDruges4WRS	illicit_drugs_feel_need	Do you ever feel the need to use illicit drugs to manage work-related stress or problems in the workplace?	Yes 1 No 0
23	Employing_more _staff	Improve11	interventions_1	Would intervention assist most with reducing stress at work?	Yes 1 No 0
24	Reducing_workload	Improve12	interventions_2		Yes 1 No 0

25	Improving_management_support	Improve14	interventions_13		Yes 1 No 0
26	Provision_more_time_off_work	Improve8	interventions_8		Yes 1 No 0
27	Provision_psychological_counselling	Improve3, Improve4, Improve5, Improve6	interventions_6		Yes 1 No 0
C. Outcome variable					
28	adapt_changes	CD-RISC1a	adapt_changes	Connor Davison Resilience Scale	See Appendix 2 for scale
29	deal_with	CD-RISC2a	deal_with		See Appendix 2 for scale
30	see_humour	CD-RISC3a	see_humour		See Appendix 2 for scale
31	cope_strong	CD-RISC4a	cope_strong		See Appendix 2 for scale
32	bounce_back	CD-RISC5a	bounce_back		See Appendix 2 for scale
33	achieve_goals	CD-RISC6a	achieve_goals		See Appendix 2 for scale
34	stay_focus	CD-RISC7a	stay_focus		See Appendix 2 for scale
35	easy_failre	CD-RISC8a	easy_failre		See Appendix 2 for scale
36	strong_person	CD-RISC9a	strong_person		See Appendix 2 for scale
37	handle_feelings	CD-RISC10a	handle_feelings		See Appendix 2 for scale
38	CD-RISCcrude	CD-RISCcrude	CD-RISCcrude		See Appendix 2 for scale

2. ETHICS APPROVAL AND RENEWAL DOCUMENTS

2a. UCT Ethics Approval of Current Study

UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee

Room 45 E-52-E-Floor- Old Main Building
Groote Schuur Hospital
Observatory 7925
Telephone [021] 406 6492
Email: hrec-submissions@uct.ac.za
Website: www.health.uct.ac.za/home/human-research-ethics

02 November 2023

HREC REF: 712/2023

Dr I Ntatamala
Division of Occupational Medicine
Public Health & Family-
Email: Itumeleng.ntatamala@uct.ac.za
Student: Thandi.mcizana@gmail.com

Dear Dr Ntatamala

PROJECT TITLE: SOCIODEMOGRAPHIC AND WORK-RELATED FACTORS ASSOCIATED WITH PSYCHOLOGICAL RESILIENCE IN SOUTH AFRICAN HEALTHCARE WORKERS- (MASTERS CANDIDATE-THANDOKAZI MCIZANA)

Thank you for your response letter dated 17 October 2023, addressing the issues raised by the Faculty of Health Sciences Human Research Ethics Committee (HREC).

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30 November 2024.

You are required to submit a progress report form, using the standardised Annual Report Form (FHS016) or (FHS017) if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

The HREC acknowledge that the student: Thandi Mcizana will also be involved in this study.

Please quote HREC REF 712/2023 in all your correspondence.

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, FACULTY OF HEALTH SCIENCES HUMAN RESEARCH ETHICS COMMITTEE

Federal Wide Assurance Number: FWA00001637. Institutional Review Board (IRB) number: IRB00001938 NHREC-registration number: REC-210208-007
This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to the Ethics Standards for Clinical Research with a new drug in patients, based on the Medical Research Council (MRC-SA), Food and Drug Administration (FDA-USA), International Council for Harmonisation of

Technical Requirements for Pharmaceuticals for Human Use: Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2020), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helsinki (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: Note for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

HREC/ref 712.2023

2b. UCT Ethics Approval of Parent Study: HREC517/2019

UNIVERSITY OF CAPE TOWN
IYUNIVESITHI YASEKAPA • UNIVERSITEIT VAN KAAPSTAD

FACULTY OF HEALTH SCIENCES
Human Research Ethics Committee

HUMAN RESEARCH ETHICS COMMITTEE
27 OCT 2023
HEALTH SCIENCES FACULTY
UNIVERSITY OF CAPE TOWN

FHS016: Annual Progress Report / Renewal

HREC office use only (FWA00001637; IRB00001938)			
This serves as notification of annual approval, including any documentation described below.			
☑ Approved	Annual progress report	Approved until/next renewal date	30.11.2024
☐ Not approved	See attached comments		
Signature Chairperson of the HREC/ Designee		Date Signed	2/11/2023

Note: Please email this form and supporting documents (if applicable) in a combined pdf-file to hrec-enquiries@uct.ac.za.
Please clarify your plan for research-related activities during COVID-19 lockdown.
Please use the latest form found on our website:
http://www.health.uct.ac.za/fhs/research/humanethics/forms

Comments to PI from the HREC
Thank you for your Study Deviation HREC Chair Signature 2/11/2023 Date:

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	22023/10/26		
HREC REF Number	517/2019	Current Ethics Approval was granted until	30.08.2020
Protocol title	Predictors of post-traumatic stress disorder among ambulance personnel in the Western Cape province		
Protocol number (if applicable)	N/A		
Are there any sub-studies linked to this study?		☐ Yes	✓ No
If yes, could you please provide the HREC Reference number for all sub-studies? **Note:** A separate FHS016 must be submitted for each sub-study.	N/A		
Principal Investigator	Associate Professor Shahieda Adams		
Department / Office Internal Mail Address	shahieda.adams@uct.ac.za		

(Note: Please complete the Closure form (FHS010) if the study is completed within the approval period)

Form FHS011: Study deviation

HREC office use only (FWA00001637; IRB00001938)			
This serves as acknowledgement of a protocol deviation as described below.			
Chairperson of the HREC signature		Date	2/11/2023

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	2023/10/26
HREC REF Number	517/2019
Project Title	Predictors of post-traumatic stress disorder among ambulance personnel in the Western Cape province
Protocol number (if applicable)	N/A
Principal Investigator	Associate Professor Shahieda Adams
Department / Office Internal Mail Address	shahieda.adams@uct.ac.za

2. Protocol deviation description

Please describe the deviation below, including the reason why the deviation occurred.
No deviation to original protocol. In addition, no additional research has been done since the study was completed and Ethics approval expired. The topic of resilience has becoming important in the context of healthcare workers and other professions following COVID-19. The need to perform more research in this topic, particularly with respect to LMIC, was recognized by the PI. As quality data on resilience amongst healthcare workers in South Africa was collected in this previous study, the need to perform this sub-study was recognized (so as not to duplicate efforts).

3. Follow-up actions

3.1 Please describe any follow-up action(s) taken or planned as a result of this deviation e.g. DSMB reporting, report to sponsor, informing participants.
N/A
3.2 Please describe what action(s) have or will be taken to prevent similar deviations in future.
N/A

4. Principal Investigator's acknowledgement of responsibility

UNIVERSITY OF CAPE TOWN
FACULTY OF HEALTH SCIENCES
Human Research Ethics Committee

This signature indicates the PI has reviewed the deviation, taken appropriate follow-up action and implemented or plans to implement preventative steps where possible.			
Signature of PI		Date	27102023

2c. UCT Ethics Approval of Parent Study: HREC616/2021

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FACULTY OF HEALTH SCIENCES
Human Research Ethics Committee

- 2 NOV 2023
HEALTH SCIENCES FACULTY
UNIVERSITY OF CAPE TOWN

FHS016: Annual Progress Report / Renewal

HREC office use only (FWA00001637; IRB00001938)			
This serves as notification of annual approval, including any documentation described below.			
☑ Approved	Annual progress report	Approved until/next renewal date	30.11.2024
☐ Not approved	See attached comments		
Signature Chairperson of the HREC/ Designee		Date Signed	2/11/2023

Note: Please email this form and supporting documents (if applicable) in a combined pdf-file to hrec-enquiries@uct.ac.za.
Please clarify your plan for research-related activities during COVID-19 lockdown.
Please use the latest form found on our website:
http://www.health.uct.ac.za/fhs/research/humanethics/forms

Comments to PI from the HREC
Thank you for your Study Deviation HREC Chair Signature Date: 2/11/2023

Principal Investigator to complete the following

1. Protocol information

Date (when submitting this form)	22023/10/26		
HREC REF Number	2021 616/2020 E	Current Ethics Approval was granted until	30.01.2023
Protocol title	The prevalence and determinants of burnout in medical doctors at public hospitals in Gqeberha during the covid-19 pandemic: A cross-sectional study		
Protocol number (if applicable)	HREC REF: R 011/2022		
Are there any sub-studies linked to this study?		☐ Yes	✓ No
If yes, could you please provide the HREC Reference number for all sub-studies? Note: A separate FHS016 must be submitted for each sub-study.	N/A		
Principal Investigator	Associate Professor Shahieda Adams		
Department / Office Internal Mail Address	shahieda.adams@uct.ac.za		

1.1 Does this protocol receive US Federal funding?	☐ Yes	✓ No

(Note: Please complete the Closure form (FHS010) if the study is completed within the approval period)

Form FHS011: Study deviation

HREC office use only (FWA00001637; IRB00001938)			
This serves as acknowledgement of a protocol deviation as described below.			
Chairperson of the HREC signature		Date	2/11/2023

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	2023/10/26
HREC REF Number	616/2021
Project Title	The prevalence and determinants of burnout in medical doctors at public hospitals in Gqeberha during the covid-19 pandemic: A cross-sectional study
Protocol number (if applicable)	HREC REF: R 011/2022
Principal Investigator	Associate Professor Shahieda Adams
Department / Office Internal Mail Address	shahieda.adams@uct.ac.za

2. Protocol deviation description

Please describe the deviation below, including the reason why the deviation occurred.
No deviation to original protocol. In addition, no additional research has been done since the study was completed and Ethics approval expired. The topic of resilience has becoming important in the context of healthcare workers and other professions following COVID-19. The need to perform more research in this topic, particularly with respect to LMIC, was recognized by the PI. As quality data on resilience amongst healthcare workers in South Africa was collected in this previous study, the need to perform this sub-study was recognized (so as not to duplicate efforts).

3. Follow-up actions

3.1 Please describe any follow-up action(s) taken or planned as a result of this deviation e.g. DSMB reporting, report to sponsor, informing participants.
N/A
3.2 Please describe what action(s) have or will be taken to prevent similar deviations in future.
N/A

4. Principal Investigator's acknowledgement of responsibility

UNIVERSITY OF CAPE TOWN
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FACULTY OF HEALTH SCIENCES
Human Research Ethics Committee

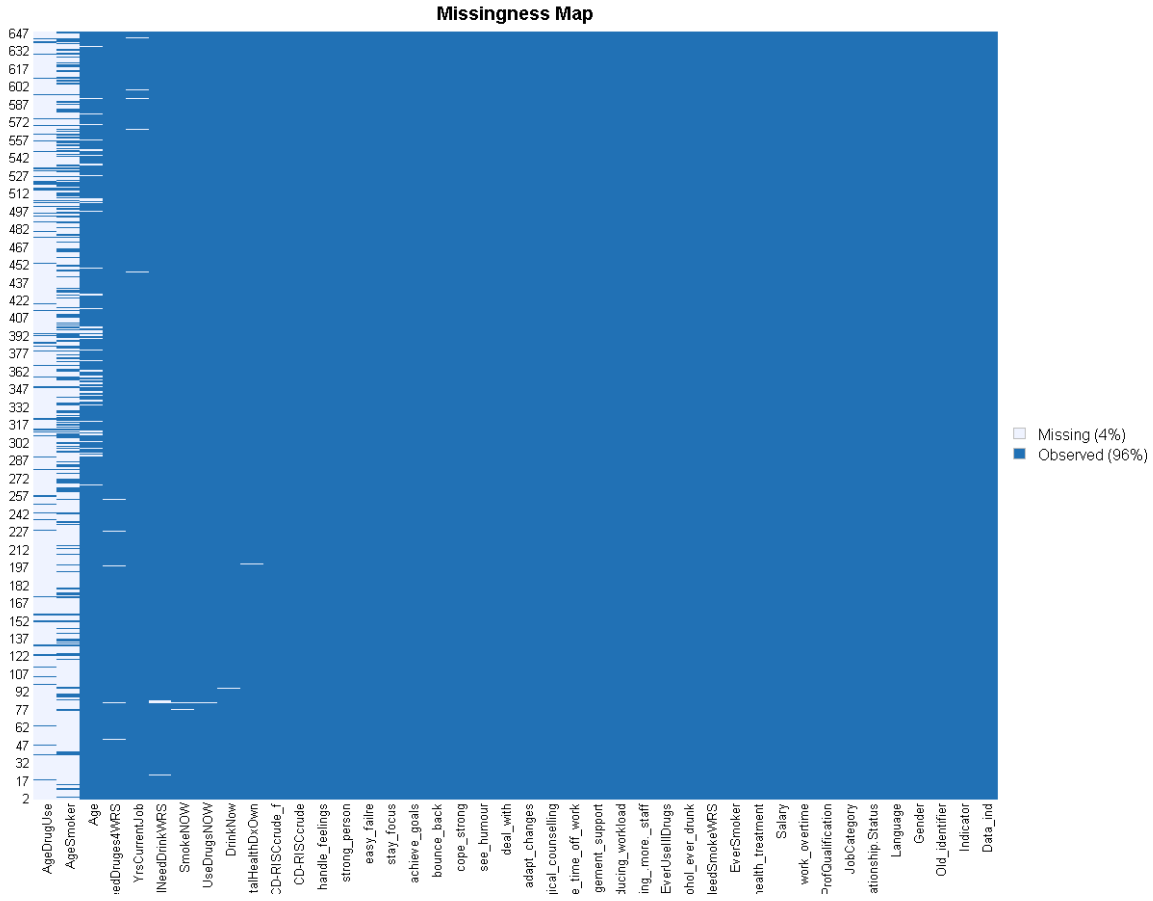
This signature indicates the PI has reviewed the deviation, taken appropriate follow-up action and implemented or plans to implement preventative steps where possible.			
Signature of PI		Date	27102023

3. MANUSCRIPT SUPPLEMENTAL MATERIAL

Supplementary Table 1: Summary of missing data in original data set

Missing data:	**N (%)**
Age	49 (7.6%)
Years employed in current role	5 (0.8%)
Current smoker	2 (0.3%)
Current drinker	1 (0.2%)
Current illicit drug user	1 (0.2%)
Ever diagnosed with a mental health condition	1 (0.2%)
Feel need to use drink to manage WRS	3 (0.5%)
Feel need to use illicit drugs to manage WRS	5 (0.8%)

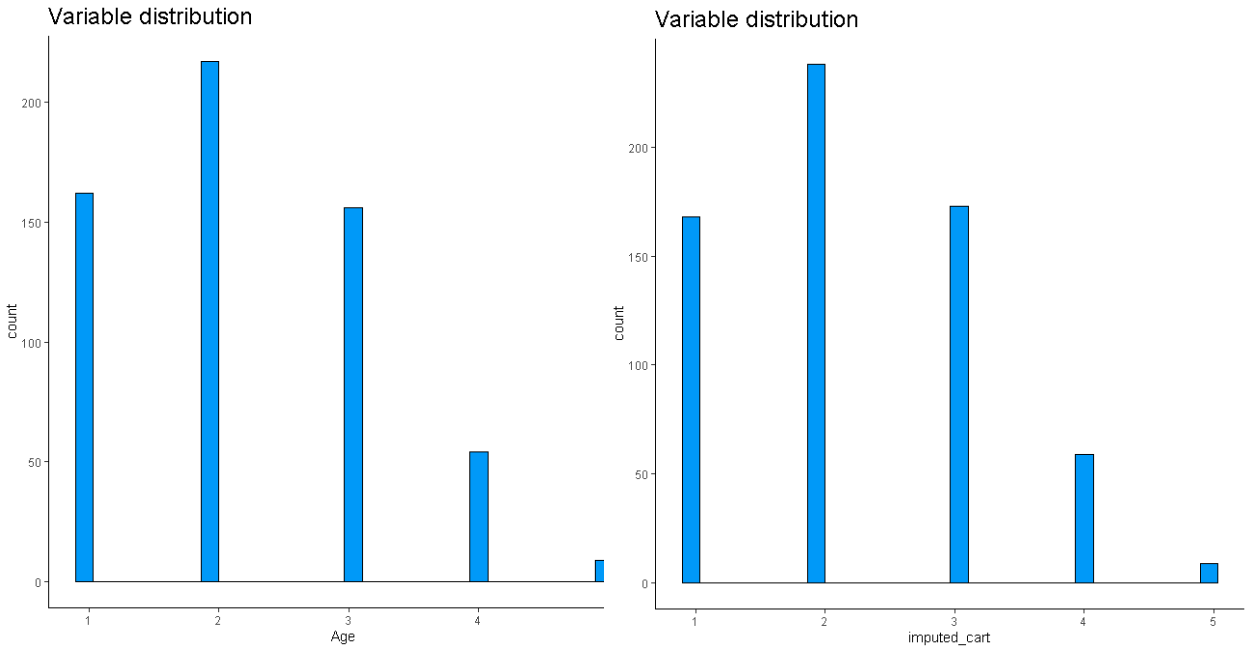
Range of missingness in the dataset is between 0.2% and 7.6%. Age is the only factor with great than 1% of the data missing, as such, the only factor where imputation was performed.



Supplementary Figure 1: Missingness map of dataset

Supplementary Table 2: Summary statistics of Age covariable following imputation

	Missing values	Minimum	First quartile	Median	Mean	Third quartile	Maximum
Original	49	1	1	2	2.216	3	5
Predictive mean matching	0	1	1	2	2.234	3	5
Classification and regression tree	0	1	1	2	2.232	3	5
Lasso linear regression	0	0.574	1	2	2.401	3	5



Supplementary Figure 2: Distribution of Age factor before and after CART imputation

Supplementary Table 3: Unadjusted logistic regression analysis of the predictors of CD-RISC-10 (all variables)

	Doctors				Ambulance personnel				Overall			
Predictors	**OR***	**95%**	**CI**	**P value ***	**OR***	**95%**	**CI**	**P value ***	**OR***	**95%**	**CI**	**P value ***
Gender (Male)												
Female	**2.45**	**1.44**	**4.26**	**0.001**	0.92	0.60	1.42	0.711	**1.40**	**1.01**	**1.95**	**0.045**
Age (20 - 29)												
30 - 39	0.99	0.53	1.82	0.969	1.30	0.66	2.65	0.459	0.94	0.62	1.44	0.782
40 - 49	0.95	0.47	1.89	0.877	1.89	0.95	3.92	0.078	1.20	0.77	1.88	0.424
> 50	0.75	0.29	1.83	0.535	1.39	0.57	3.39	0.463	0.91	0.49	1.65	0.751
Home language (English)												
Afrikaans	0.81	0.41	1.53	0.522	0.84	0.51	1.40	0.498	0.77	0.53	1.11	0.165
IsiXhosa	1.45	0.66	3.14	0.348	1.23	0.68	2.21	0.494	1.20	0.76	1.87	0.432
Other	0.88	0.04	9.36	0.917	2.21	0.26	19.00	0.436	1.45	0.28	6.69	0.633
Relationship Status (Married)												
Never married	1.56	0.92	2.66	0.100	0.82	0.52	1.29	0.389	1.09	0.77	1.53	0.638
Divorced/ Separated/ Widowed	1.50	0.47	4.48	0.472	0.92	0.43	1.87	0.822	1.06	0.57	1.93	0.839
Professional health qualification (No)												
Yes	N/A	N/A	N/A	N/A	1.22	0.69	2.25	0.512	1.35	0.78	2.43	0.304
Job category (Operational services/ EMS)												
Support staff/ EMS					0.69	0.42	1.12	0.142	0.69	0.42	1.12	0.142
Junior doctors †									1.23	0.74	2.04	0.415
Senior doctors	0.92	0.54	1.58	0.752					1.13	0.76	1.68	0.544
Years employed in current role	1.00	0.95	1.04	0.832	1.03	1.00	1.07	0.056	1.01	0.99	1.04	0.379
Overtime (No)												
Yes	4.12	0.72	77.60	0.189	0.92	0.58	1.46	0.708	1.13	0.75	1.73	0.559

Predictors	Doctors				Ambulance personnel				Overall			
	OR*	95%	CI	P value *	OR*	95%	CI	P value *	OR*	95%	CI	P value *
Monthly Salary (ZAR) (R0 - R15 000)												
R15 001 - R30 000					0.84	0.54	1.31	0.440	0.84	0.54	1.31	0.440
R30 001 - R50 000 †					0.61	0.23	1.44	0.283	1.15	0.70	1.88	0.588
> R50 001	0.74	0.44	1.26	0.268					1.03	0.65	1.62	0.910
Age started smoking	1.01	0.93	1.09	0.812	1.01	0.93	1.09	0.812	1.01	0.94	1.08	0.729
Age started illicit drugs	1.24	0.91	1.81	0.193	1.05	0.95	1.16	0.315	1.07	0.97	1.17	0.171
Smoking history (Never used)												
Previous smoker	1.23	0.50	2.92	0.642	1.16	0.53	2.41	0.702	1.16	0.65	2.02	0.617
Current smoker	**0.15**	**0.02**	**0.54**	**0.012**	0.90	0.55	1.45	0.664	**0.65**	**0.42**	**0.98**	**0.046**
Alcohol history (Never used)												
Previous alcohol use	0.73	0.31	1.67	0.452	**0.40**	**0.19**	**0.79**	**0.011**	**0.52**	**0.30**	**0.87**	**0.015**
Current drinker	0.56	0.30	1.05	0.069	1.04	0.64	1.71	0.878	0.83	0.57	1.22	0.349
Illicit drug use (Never used)												
Previous illicit drug use	0.50	0.11	1.67	0.297	0.65	0.27	1.42	0.305	0.58	0.28	1.12	0.124
Current Drug user	0.28	0.01	1.65	0.237	1.26	0.32	4.25	0.722	0.75	0.24	2.02	0.589
Substance use to manage work related stress												
Feel need to smoke to manage WRS (No)												
Yes	0.67	0.32	1.32	0.258	1.16	0.71	1.87	0.548	0.93	0.63	1.38	0.731
Feel need to drink alcohol to manage WRS (No)												
Yes	1.32	0.71	2.44	0.379	1.67	0.86	3.16	0.121	1.53	0.98	2.38	0.060
Feel need to use illicit drugs to manage WRS (No)												
Yes	1.11	0.33	3.42	0.863	1.03	0.32	2.90	0.959	1.08	0.47	2.32	0.850

	Doctors				Ambulance personnel				Overall			
Predictors	**OR***	**95%**	**CI**	**P value ***	**OR***	**95%**	**CI**	**P value ***	**OR***	**95%**	**CI**	**P value ***
Mental health												
Ever diagnosed with a mental health condition (No)												
Yes	1.73	0.97	3.06	0.061	1.74	0.90	3.31	0.094	**1.81**	**1.18**	**2.75**	**0.006**
Currently on treatment for mental health condition (No)												
Yes	1.51	0.78	2.90	0.213	1.77	0.80	3.86	0.151	**1.69**	**1.03**	**2.77**	**0.037**

* Statistically significant results indicated in bolds; † Reference or base group for doctor
N/A: not applicable; ZAR/ R: South African Rand
Note: Content in brackets is the reference or base group

Supplementary Table 4: Adjusted logistic regression analysis of the predictors of CD-RISC-10 (all variables)

	Doctors				Ambulance personnel				Overall			
Predictors	**aOR*†**	**95%**	**CI**	**P value *†**	**aOR*†**	**95%**	**CI**	**P value*†**	**aOR*†**	**95%**	**CI**	**P value *†**
Home language (English)												
Afrikaans	0.78	0.39	1.51	0.477	0.83	0.50	1.38	0.467	0.76	0.52	1.11	0.153
IsiXhosa	1.51	0.67	3.36	0.310	1.31	0.72	2.38	0.384	1.18	0.75	1.85	0.475
Other	0.80	0.04	9.04	0.858	2.21	0.25	19.40	0.442	1.58	0.30	7.40	0.561
Relationship Status (Married)												
Never married	1.39	0.73	2.69	0.318	0.98	0.59	1.65	0.948	1.10	0.74	1.63	0.653
Divorced/ Separated/ Widowed	1.19	0.36	3.72	0.773	0.99	0.46	2.07	0.980	1.00	0.54	1.83	0.991
Professional health qualification (No)									-	-	-	-
Yes	N/A	N/A	N/A	N/A	1.09	0.60	2.06	0.784	1.40	0.80	2.56	0.254
Job category (Operational services/ EMS)												
Support staff/ EMS	-	-	-	-	0.73	0.43	1.22	0.237	0.65	0.39	1.07	0.099
Junior doctors ‡	-	-	-	-	-	-	-	-	1.32	0.69	2.53	0.394
Senior doctors	0.99	0.45	2.17	0.982	-	-	-	-	1.09	0.72	1.64	0.679

	Doctors				Ambulance personnel				Overall			
Predictors	**aOR*†**	**95%**	**CI**	**P value *†**	**aOR*†**	**95%**	**CI**	**P value*†**	**aOR*†**	**95%**	**CI**	**P value *†**
Years employed in current role	1.00	0.93	1.08	0.930	1.03	0.99	1.07	0.184	1.02	0.99	1.05	0.284
Overtime (No)												
Yes	0.21	0.01	1.27	0.155	0.96	0.60	1.56	0.879	1.13	0.74	1.74	0.582
Monthly Salary (ZAR) (R0 - R15 000)												
R15,001 - R30,000	-	-	-	-	0.77	0.48	1.22	0.266	0.83	0.52	1.30	0.409
R30 001- R50 000 ‡	-	-	-	-	0.54	0.19	1.35	0.206	1.22	0.71	2.09	0.475
> R50 001	0.72	0.36	1.44	0.358	-	-	-	-	1.01	0.64	1.61	0.950
Age started smoking	1.11	0.90	1.39	0.315	1.01	0.93	1.08	0.897	1.01	0.94	1.08	0.782
Age started illicit drugs	1.36	0.90	2.80	0.231	1.05	0.94	1.18	0.403	1.07	0.97	1.20	0.195
Smoking history (Never used)												
Previous smoker	1.68	0.66	4.25	0.273	1.06	0.48	2.27	0.873	1.26	0.69	2.24	0.442
Current smoker	**0.21**	**0.03**	**0.77**	**0.042**	0.91	0.55	1.49	0.714	0.77	0.45	1.09	0.127
Alcohol history (Never used)												
Previous alcohol user	0.78	0.32	1.84	0.568	**0.39**	**0.18**	**0.78**	**0.010**	**0.52**	**0.30**	**0.88**	**0.015**
Current drinker	0.64	0.33	1.23	0.180	1.12	0.68	1.88	0.657	0.91	0.62	1.36	0.654
Illicit drug use (Never used)												
Previous illicit drug user	0.73	0.16	2.61	0.651	0.64	0.26	1.42	0.296	0.63	0.30	1.25	0.206
Current illicit drug user	0.31	0.02	1.91	0.283	1.24	0.32	4.22	0.736	0.76	0.24	2.07	0.611
Substance use to manage work related stress												
Feel need to smoke to manage WRS (No)												
Yes	0.76	0.36	1.54	0.449	1.21	0.73	1.97	0.456	1.00	0.66	1.48	0.980
Feel need to drink alcohol to manage WRS (No)												
Yes	1.17	0.61	2.20	0.628	1.73	0.89	3.33	0.100	1.56	0.99	2.43	0.053
Feel need to use illicit drugs to manage WRS (No)												
Yes	1.07	0.31	3.41	0.909	1.06	0.33	3.00	0.921	1.07	0.47	2.30	0.872

	Doctors				Ambulance personnel				Overall			
Predictors	**aOR*†**	**95%**	**CI**	**P value *†**	**aOR*†**	**95%**	**CI**	**P value*†**	**aOR*†**	**95%**	**CI**	**P value *†**
Mental health												
Ever diagnosed with a mental health condition (No)												
Yes	1.56	0.87	2.81	0.136	1.75	0.90	3.35	0.095	**1.77**	**1.15**	**2.70**	**0.009**
Currently on treatment for mental health condition (No)												
Yes	1.38	0.70	2.69	0.348	1.80	0.80	3.95	0.145	**1.70**	**1.03**	**2.80**	**0.037**

* Statistically significant results indicated in bold; † Data adjusted for age and gender; ‡ Reference or base group for doctor
N/A: not applicable; ZAR/ R: South African Rand
Note: Content in brackets is the reference or base group

Supplementary Table 5: Average CD-RISC-10 score by job category, salary and over-time status

Job Category	Over-time work	R30 001-R50 000	> R50 000	Grand Total
Junior doctors	No	29.00	N/A	**29.00**
	Yes	26.28	27.50	**26.34**
	All Junior doctors	26.35	27.50	**26.40**
Senior doctors	No	23.00	33.00	**29.67**
	Yes	20.00	27.52	**27.30**
	All Senior doctors	20.86	27.65	**27.38**
All doctors		**25.91**	**27.65**	**27.06**

N/A: not applicable; R: South African Rand

When considering participants who indicated not working over-time and in the R30 001 - R50 000 salary band, junior doctors have higher average resilience scores than senior doctors. This pattern is seen for each combination of over-time work and salary band.

4. JOURNAL INSTRUCTIONS TO AUTHORS

South African Journal of Psychology: https://journals.sagepub.com/author-instructions/SAP

Overview

The author guidelines include information about the types of articles received for publication and preparing a manuscript for submission. Other relevant information about the journal's policies and the reviewing process can be found under the about section. The **compulsory cover letter** forms part of a submission and must be submitted together with all the required **forms.** All forms need to be completed in English.

Original Research Article

An original article provides an overview of innovative research in a particular field within or related to the focus and scope of the journal, presented according to a clear and well-structured format. Systematic reviews should follow the same basic structure as other original research articles. The aim and objectives should focus on a clinical question that will be addressed in the review. The methods section should describe in detail the search strategy, criteria used to select or reject articles, attempts made to obtain all important and relevant studies and deal with publication bias (including grey and unpublished literature), and how the quality of included studies was appraised, the methodology used to extract and/or analyse data. Results should describe the homogeneity of the different findings, and clearly present the overall results and any meta-analysis.

Submission status	open
Word limit	3000-4000 words (excluding the abstract, tables, figures, graphs, and references)
Abstract	maximum: 250 words requires structural headings: Background, Aim, Setting, Methods, Results, Conclusion and Contribution
Main text	requires structural headings, refer to the full structure 'Ethical considerations' is a sub-section in the manuscript and must include: • Name of the ethical review committee • Study approval number • Manner of consent (written, oral) for human participants • Description of measures taken to maintain the confidentiality of data • If the study was not human or animal research or the study was determined to be non-human subjects research or exempt, the authors must provide a statement with those details in this section.
References	60 or less, adhere to the **Vancouver referencing style**
Tables, figures and graphs	7 or less, adhere to the Illustrations requirements found in the AOSIS House style guide
Formatting requirements	apply the guidelines located on the **Formatting requirements page** and the **AOSIS house style guide**
Compulsory supplementary file(s)	the **Authorship, disclosure statements, copyright, and license agreement form**, **Ethical Clearance/Waiver Documentation** and any other relevant form applicable to your submission
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Acknowledgements structure

Acknowledgements
The acknowledgement section follows the conclusions section and addresses formal, required statements of gratitude and required disclosures. It includes listing those who contributed to the work but did not meet authorship criteria, with the corresponding description of the contribution. Acknowledge anyone who provided intellectual assistance, technical help (including with writing and editing), or special equipment and/or materials. Authors are responsible for ensuring that anyone named in the Acknowledgements agrees to be named.

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