

RESEARCH

Open Access



Burnout among South African nurses during the peak of COVID-19 pandemic: a holistic investigation

Natasha Khamisa¹, Siyanda Madala^{2,3*} and Cyril Bernsah Fonka⁴

Abstract

Background The wellbeing of health care workers (HCWs) has been an ongoing challenge, especially within low and middle-income countries (LMICs) such as South Africa. Evidence suggesting that HCWs are increasingly stressed and burned out is cause for concern. Nurses in particular have been impacted physically, mentally and psychosocially during the recent COVID-19 pandemic. This may leave a disproportionate consequence, affecting various aspects of their wellbeing, thereby justifying a need for a more holistic investigation of the wellbeing of South African nurses and their coping mechanisms during the peak of the pandemic.

Methods This was a cross-sectional study design. Online self-reported questionnaires were administered in six hospitals, sampled purposively and conveniently from three South African provinces. Using STATA 18.0, the Wilcoxon Ranksum test at 5% alpha compared the wellbeing and coping mechanisms of nursing staff and nursing management during COVID-19's peak. Univariable and multivariable linear regression analyses were performed to determine factors associated with burnout in nurses, at a 95% confidence interval (CI). Validated scales measuring burnout, coping, resilience, as well as mental and physical health were utilised.

Results Of 139 participants, 112(97.4%) were females, with 91(82%) and 20(18%) being nursing staff and management respectively. The median age of the participants was 43.3 years ($n = 112$), with a practising duration of 12 years ($n = 111$). There was a significant difference in the burnout score between nursing staff and nursing management ($p = 0.028$). In the univariable linear regression model, burnout was significantly ($p < 0.05$) associated with the Brief COPE Inventory (BCI), Connor-Davidson Resilience Scale (CDRS), Global Mental and Health Scale (GMHS), Global Physical and Health Scale (GPHS) and Hospital Anxiety and Depression Scale (HADS), as well as occupation. In the multivariable linear regression model, burnout was significantly associated with the CDRS [Coeff.=0.7, 95%CI 0.4; 0.9], GMHS [Coeff.=−2.4, 95%CI −3.2; −1.6], GPHS [Coeff.2.1, 95%CI 1.3; 2.9], and HADS [Coeff.=0.7, 95%CI 0.2; 1.2].

Conclusion Investigating multiple aspects of wellbeing in this study, it's shown that coping and resilience may not be key factors in promoting the wellbeing of South African nurses. However, effective mental health interventions are crucial and should be prioritised to mitigate burnout during future health emergencies. Future studies examining the associations between general health, coping and resilience may help generate further evidence towards holistic interventions aimed at promoting nurses' wellbeing.

*Correspondence:
Siyanda Madala
Siyanda.madala@wits.ac.za

Full list of author information is available at the end of the article



© The Author(s) 2025. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

Clinical trial number Not applicable.

Keywords COVID-19 burnout, Nurses, Coping, Resilience, Physical health, Mental health, Anxiety and depression

Introduction

Pandemics are considered an exceptional disaster with severe psychological effects, especially for health care workers (HCWs) who experience mental strain as front-line responders [1]. This has been evidenced in previous disease outbreaks including Ebola and Severe Acute Respiratory Syndrome (SARS), whereby HCWs reported distress associated with increased chances of contracting these diseases [2]. Such effects are known to be long-lasting with a study reporting that HCWs continued to experience negative mental health effects, including burnout, psychological distress and post-traumatic stress disorder (PTSD) one to two years after the SARS outbreak [3].

The wellbeing of HCWs has been an ongoing challenge, with the World Health Organization (WHO) defining the state of wellbeing as one in which “an individual realises his or her own abilities, can cope with the normal stresses of life, can work productively and contribute to the community” [4]. It is especially challenging within low and middle-income countries (LMICs) with growing evidence to suggest that HCWs are increasingly stressed and burned out. This has been attributed to reduced human resources for health as well as poor governance and management, thereby leading to reduced job satisfaction, absenteeism and high attrition among HCWs in these settings [5, 6]. In the context of under-resourced settings such as South Africa with a vulnerable health system, characterized by critical shortages in staffing, uneven distribution of resources, and inadequate protective equipment among other shortfalls, the problem is further aggravated [7]. It is therefore imperative that the wellbeing of HCWs be understood holistically, whereby the focus is on the complexity of various aspects that may be having an impact on them.

Coupled with increasing pressure for universal health care and the multiple disease burdens, the COVID-19 pandemic revealed major gaps in the current South African health system particularly related to the wellbeing of HCWs themselves [7, 8]. Despite recurring evidence suggesting that nurses in particular experience a higher burden of care compared to other HCWs and suffer from stress-related outcomes at a rate of 80% more than workers from over 130 other high-stress occupations [9], this problem has continued to persist. As the backbone of the health system and the first point of call during emergencies, South African nurses at the frontline of the COVID-19 pandemic experienced caring for infected patients while feeling exhausted, making difficult triage decisions, being isolated from their loved ones for prolonged periods, the stigma of contracting and spreading

the infection, the loss of patients and colleagues, as well as fear of dying from the infection themselves [1]. Such experiences and frustrations resulted in some nurses engaging in alcoholism with a potential mental disorder [10]. During the last week of December 2020 when the country experienced a significant surge in infections by 105% with cases crossing the 1 million mark [11], the Health Minister reported that nurses accounted for more than half of the infections among HCWs [12]. The psychological impact of this may be known in other settings such as China with developed and research intense health systems, compared with the limited research in LMICs especially in the African region during the peak of the pandemic [7].

Furthermore, nurses' wellbeing is not often studied holistically, especially in under-resourced settings such as South Africa and the current study seeks to address this gap. Existing evidence suggests that nurses in particular have been impacted physically, mentally and psychosocially following the COVID-19 pandemic, thereby negatively affecting their quality of life [13]. Increased stress, anxiety, burnout and hopelessness are higher among nurses than other HCWs and contribute to the reduced quality of life [14, 15]. This is important considering that in nursing research, wellbeing is often measured by the absence of mental health disorders, which according to Keyes 2005 [16], encapsulates the absence of psychopathology. Arguably, wellbeing is all-encompassing and is known to help protect against the manifestation of mental health disorders, through resilience and coping mechanisms [17, 18].

Exposure to prolonged stress is also known to compromise productivity and performance, especially when resilience is reduced [19]. Resilience is protective of burnout through adaptation to changes [20]. Several reviews have confirmed that the high levels of stress experienced by HCWs during the pandemic are associated with burnout and poor wellbeing [21]. Socio-demographic variables including gender and age have also been associated with higher stress, anxiety, depression and insomnia among HCWs during the pandemic [22]. Additionally, supporting evidence from a meta-review of systematic reviews revealed that mental health disorders were prevalent among HCWs across all sectors globally [23]. Unprecedented events are expected to result in a heightened risk of mental health disorders including post-traumatic stress disorder (PTSD), depression and anxiety disorders due to rapid and intensified changes in ways of functioning [24]. More than four in every ten South African nurses were reported to be positively

screened for PTSD, which is comparatively higher than nurses in other countries [7]. Although there may be similarities in HCWs' experiences during the pandemic, it is important to recognise that there have also been differences with HCWs responding heterogeneously about changes in their work dynamics and perceptions of psychologically safe work environments [25].

There is a dearth of literature focusing on the impact of COVID-19 on the wellbeing of HCWs in the Global South [7]. Particularly, little consideration has been given to the impact of the pandemic on South African HCWs who according to a report published by the World Health Organization (2020), showed higher rates of infections than other countries in the Southern Africa Development Community (SADC) region. Lack of resources, increased inequality, higher health risks for patients with tuberculosis (TB) and HIV as well as disparities between the public and private health care sectors resulted in unique challenges faced by HCWs in South Africa [21]. A survey indicated that psychological stress among South African nurses was significantly higher than other HCWs, with almost 20% of nurses reporting severe distress [26]. Two similar studies also showed that psychological support was lacking and contributed to poorer mental health outcomes among South African nurses [27, 28]. Another South African study reported that COVID-19 infections were higher among nursing administrators and nursing staff compared to medical doctors [29], possibly because nurses are the first point of contact. This may leave a disproportionate consequence of anxiety, depression, stress and burnout among nurses, with a need for identifying the most affected for psychosocial support and holistically improving their wellbeing.

To develop appropriate and contextually suitable strategies for supporting nurses during future health threats, it is essential to holistically understand the impact of the pandemic on South African nurses' wellbeing. Supporting studies have emphasised the importance of viewing wellbeing to benefit employees and their institutions [30, 31]. As such, investigating the association between burnout, coping, resilience, physical and mental health as well as anxiety and depression among South African nurses who worked in the frontline during the peak of the pandemic, will provide evidence-based insights into what is required for better preserving and protecting holistic wellbeing in the event of future disasters. In the context of South Africa, HCWs including nurses are twice as likely to leave their jobs compared to HCWs from other SADC countries due to difficult working conditions [32]. This has serious implications for patient care and response to future health emergencies in the country [7]. Therefore, the current study aimed to investigate the holistic wellbeing of South African nurses and their

coping mechanisms during the peak of the COVID-19 pandemic.

Methods

Study design

This was an online cross-sectional study conducted to assess various measures of wellbeing among South African nurses during the peak of the COVID-19 pandemic in 2020. The questionnaire and scales used in the study were sourced from previous studies.

Setting

This study was conducted in six hospitals from three South African provinces. In Gauteng province, three hospitals were selected in Johannesburg and one from Pretoria. One hospital was chosen from the city of Durban in KwaZulu-Natal (KZN) province. One hospital was chosen in Cape Town in the Western Cape province. Gauteng province on its own is the smallest but most populated province in South Africa with a population of over 16 million [33] and has had the highest incidence of COVID-19 nationwide, followed by KwaZulu-Natal and Western Cape provinces respectively [34]. Johannesburg, Pretoria, Durban and Cape Town are the most commercial and congested cities in their respective province with similarly high COVID-19 cases reported during the peak of the pandemic. As such, all six hospitals were sampled from metropolitan cities to capture the effect of COVID-19 *vis-à-vis* burnout, coping, resilience, physical health, mental health as well as anxiety and depression among nurses.

Sampling

The study participants (nurses) were recruited through purposive and convenient sampling techniques. That is, particular hospitals were chosen in the above provinces in consideration of their workload during COVID-19 which exposed the HCWs to burnout among other factors hence, purposive sampling. Also, only nurses who practised during the COVID-19 pandemic were sampled in the study. Accessibility to the selected hospitals and nurses was a key criterion that influenced the choice of the selection. Nurses were invited to voluntarily participate in the study. The recruitment was done through announcements and explanations of the study in ward round forums, flyers and posters distributed around the hospitals, as well as requesting the human resource department of the hospitals to circulate a link for the questionnaire. This ensured anonymity as participants were not directly approached by researchers nor were they required to provide any personal details that could disclose their identity. Participation was strictly voluntary and ethical considerations included confidentiality

and potential risk was mitigated through referral for counselling.

Data collection

In the context of lockdown and social distancing measures during the peak of the pandemic, a self-reported online questionnaire was used for data collection to ensure the safety of the participants. Data were collected on demographic characteristics as well as various measures of wellbeing among nurses during the pandemic. Measuring instruments included:

Burnout

The Burnout Measure Short Version (BMS) was used to assess burnout in nurses. The BMS is a shortened version of the Burnout Measure by Pines and Aronson, developed in response to researchers' and practitioners' need for an easy-to-use instrument requiring less questionnaire space and time for administration and scoring. Its ease of use and high face validity make the BMS attractive for studies interested in stress management. The BMS scale contains 10 items addressing the frequency of experiencing symptoms of emotional, mental, and physical exhaustion. Participants indicated the extent to which the items (e.g., tired, trapped, helpless) corresponded to how they felt about their work, rated on a seven-point Likert scale (1: *never*, 7: *always*). A mean score of 4 is used as a cut-off for significant burnout symptoms. Very low burnout symptoms are denoted by scores lower than 2.4. A score of between 2.5 and 3.4 denotes low levels of burnout symptoms. Scores between 4.5 and 5.5 denote very high burnout symptoms. The measure has been found to be reliable and successfully used in the South African context with an alpha coefficient of 0.82 [35].

Coping skills

We used the Brief COPE Inventory (BCI) to assess the coping skills of the nurses as they worked through the COVID-19 pandemic. The BCI was adapted as an abbreviated version of the full COPE Inventory [36]. The scale focuses on the frequency with which people use different coping strategies in response to various stressors. The inventory consists of 28 statements, with two items each making up one of 14 scales of coping, namely Self-distraction, Active coping, Denial, Substance use, Emotional support, Instrumental support, Behavioral disengagement, Venting, Positive reframing, Planning, Humour, Acceptance, Religion, and Self-blame. Participants were asked to rate the degree to which they used each coping strategy to deal with a particular stressful event. Participants scored themselves on a 4-point Likert scale (1: *I haven't been doing this at all*, 4: *I've been doing this a lot*). One of the questions was "Have you been giving up trying to deal with it". For this study, item 19 was

adapted - 'going to the movies' as an example of coping was removed as it did not apply to this particular circumstance. The scale has been used in South Africa with an appropriate Cronbach's alpha [37].

Resilience

The Connor-Davidson Resilience Scale (CD-RISC) is a test that measures resilience or how well one is equipped to bounce back after stressful events, tragedy, or trauma [38]. Resilience enhances the ability to thrive in the face of adversity. Those who are resilient are better able to transition through the life's challenges. The CD-RISC measures several components of resilience and is designed to be a self-administered questionnaire. For this study, we used the CD-RISC-10 [39] which is a brief version of the original scale used for measuring resilience. It shows test-retest reliability, adequate internal consistency, and convergent and divergent validities. The 10-item scale is comprised of ten of the original 25 items from the CD-RISC-10 scale, with a total score ranging from 0 to 40. To this effect, one question asked was "Do you bounce back after illness, injury or other hardships? 1 = Not true at all, 2 = Rarely true, 3 = Sometimes true, 4 = Often true, and 5 = True nearly all the time."

General physical and mental health

Patient-Reported Outcomes Measurement Information System, a Global Health Instrument (PROMIS v 1.2) and Global Physical Health Scale (GPH-4) and Global Mental Health Scale (GMH-4) of the PROMIS Global Health Instrument (v 1.2) were used to assess overall physical and mental health of the nurses [40]. Each scale comprises four items. Items one, two and four in the GPH-4 scale have a five-point response format, each with unique anchors. Item three in the GP-4 is rated on a scale from one to ten, where responses are re-coded into scores of one to five. All four items in the GMH-4 scale have a five-point response format, with items one to three having the same anchors (Excellent - Poor) and item four having a unique anchor (Never - Always). The GPH-4 and GMH-4 are reliable and valid [40, 41]. For example, one of the GPH-4 questions was "In general, how could you rate your physical health?" and on GMH-4 "How often have you been bothered by emotional problems?"

Hospital anxiety and depression scale (HADS)

HADS was used to measure depression and anxiety among nurses [42]. Although it was initially developed for use with patients in hospital settings, it has been validated among health professionals [43, 44]. The scale comprises two subscales assessing anxiety and depression. Each subscale consists of seven items that are rated on a four-point scale (0–3), with unique anchors for each item. The questions about anxiety and depression are

interspersed within the questionnaire. For instance “*I get sudden feelings of panic: 0 = Not at all, 1 = Not very often, 2 = Quite often, 3 = Very often indeed.*” HADS is quick to administer, taking between two and five minutes to complete (Stern, 2014), and it was shown to be useful in initial diagnosis and tracking the progression of symptoms over time. The HADS has also been validated across multiple languages and settings [45, 46], including South Africa [47].

Data management and analysis

Data were exported into MS Excel 2016 and imported into STATA (18.0, Stata Corp) for cleaning and analysis. To describe the demographic and exposure characteristics of the study participants, the participants were grouped into two categories namely, nursing staff and nursing management. Categorical data were described using frequencies and percentages. Graphical methods (histogram) were used to examine approximate normality. Data that were not approximately normally distributed were described using the median and interquartile range (IQR). The Wilcoxon Ranksum test was used to test differences in data that were not approximately normally distributed. To examine factors associated with burnout, a univariable linear regression model was carried out at $p=0.200$ for the initial screening of all non-forced variables. All forced variables and non-forced variables were included in the multivariable linear regression model specification. Variable selection was carried out using stepwise backward elimination at $p=0.200$. Candidates for deletion were all non-forced variables. All forced variables were included in the final model a priori. Post-estimation diagnostics were carried out by examining the normality and constant variance of the standardised residuals, Kook's distance, leverage-and-outlier values, and omitted variables. Generally, the years of practice of the nurses, the peak of the COVID-19 pandemic, physical health, mental health, general health, anxiety, depression, and coping were independent variables deduced from the exposure of the nurses to the pandemic, while burnout was the dependent variable. Statistical significance of the univariable and multivariable analyses was considered at 5% alpha, reported alongside the coefficients (Coeff) of the respective variables (measurements like CDRS) and the 95% confidence interval (CI). The above regression analysis was guided by a previous study methodology [48].

Results

Demographic characteristics

In total, 139 participants who met the inclusion criteria were recruited into the study. Table 1 describes the demographic and exposure characteristics of the study participants. Of the 139 participants, 115(82.7%)

reported their sex. Of the 115 participants who reported their sex, 112(97.4%) were female and 3(2.6%) were male. One hundred and eleven ($n=111$, 79.8%) participants reported their occupation. Of the 111 participants who reported their occupation, 91(82%) were nursing staff, and 20(18%) were nursing management. The median age of the participants ($n=113$) was 44 years (IQR=35–52). Among the nursing staff, the median age was 41 years (IQR=32–49), and among the nursing management, the median age was 52 years (IQR=47.5–57.5). The median years the study participants practised in the nursing industry ($n=111$) was 12 years (IQR=6–30). Among the nursing staff, the median years practised was 6 years (IQR=6–25), while among the nursing management, the median years practised was 28.5 years (IQR=6.5–33). Further details of the participants' demographic characteristics are presented in Table 1.

Levels of physical and mental health, resilience, coping, burnout, and anxiety and depression among the study participants

Table 2 shows the level of physical and mental health, resilience, coping, burnout, anxiety and depression between the nursing staff and nursing management during the COVID-19 pandemic. The median Burnout Measure-Shortened Version (BMS) (hereafter burnout) score among the nursing staff was 29 (IQR=0–42), while the median burnout score among the nursing management was 0 (IQR=0–33.5). The results of the Wilcoxon Ranksum test showed that there was enough evidence to conclude that there was a significant difference in the burnout score between nursing staff and nursing management ($p=0.028$): burnout was higher among nurses compared to nursing management.

Univariable and multivariable linear regression models

Table 3 presents the results of the univariable and multivariable linear regression models that examined factors associated with burnout during COVID-19 with the multivariable linear regression model adjusted for all other variables.

In the univariable linear regression model, burnout was associated with the Brief Cope Inventory (BCI), the Connor-Davidson Resilience Scale (CDRS), the Global Mental Health Scale (GMHS), the Global Physical Health Scale (GPHS), the Hospital Anxiety and Depression Scale (HADS), and occupation. A unit increase in the BCI score was associated with an average 0.5 unit increase in the burnout score (Coeff.= 0.5, 95% CI 0.4; 0.6). A unit increase in the CDRS score was associated with an average 0.9 unit increase in the burnout score (Coeff.= 0.9, 95% CI 0.7; 1.0). Each unit increase in the GMHS score was associated with an average 2.0 unit increase in the burnout score (Coeff.= 2.0, 95% CI 1.3; 2.7). A unit

Table 1 Demographic characteristics of study participants (N= 139)

Variable	Category	Total N = 139	Nursing staff n = 91	Nursing management n = 20	P-value
Sex (n = 115)	Male	3 (2.6)	3 (3.5)	0 (0.0)	0.397
	Female	112 (97.4)	83 (96.5)	20 (100.0)	
Age in years	n	113	89	20	< 0.001
	Median (IQR)	44 (35–52)	41 (32–49)	52 (47.5–57.5)	
Home Language (n = 113)	Afrikaans	18 (15.9)	13 (14.4)	4 (20.4)	< 0.001
	English	1 (0.9)	15 (16.7)	16 (80.0)	
	IsiXhosa	13 (11.5)	13 (14.4)	0 (0.0)	
	IsiZulu	13 (11.5)	12 (13.3)	0 (0.0)	
	Sepedi	6 (5.3)	6 (6.7)	0 (0.0)	
	Sesotho	4 (3.5)	3 (3.3)	0 (0.0)	
	Setswana	11 (9.73)	11 (12.2)	0 (0.0)	
	Afrikaans & English	1 (0.9)	1 (1.1)	0 (0.0)	
	Tshivenda	6 (5.3)	6 (6.7)	0 (0.0)	
	Xitsonga	8 (7.1)	8 (8.9)	0 (0.0)	
	Other	2 (1.8)	2 (2.2)	0 (0.0)	
Education (n = 113)	Some high school	2 (1.8)	1 (1.1)	0 (0.0)	0.552
	Matric	11 (9.7)	11 (12.2)	0 (0.0)	
	Under degree/diploma	83 (73.5)	64 (71.1)	18 (90.0)	
	Honours	9 (8.0)	8 (0.9)	1 (5.0)	
	Masters/PhD	1 (0.9)	1 (1.1)	0 (0.0)	
	Other	7 (6.2)	5 (5.6)	1 (5.0)	
Years Practicing (n = 111)	n	111	88	20	0.041
	Median (IQR)	12 (6–30)	11 (6–25)	28.5 (6.6–33)	
Treating Covid-19 (n = 113)	No	17 (15.0)	12 (13.3)	2 (10.0)	0.686
	Yes	96 (85.0)	78 (86.7)	18 (90.0)	
Religion (n = 112)	No religion	5 (4.4)	4 (4.5)	1 (5.0)	0.059
	Christianity	94 (83.2)	75 (84.3)	16 (80.0)	
	Christianity & Tradition	1 (0.9)	--	--	
	Hinduism	4 (3.5)	1 (1.1)	3 (15.0)	
	Islam	2 (1.8)	2 (2.3)	0 (0.0)	
	Traditional Africans	5 (4.4)	5 (5.6)	0 (0.0)	
	Other	2 (1.8)	2 (2.3)	0 (0.0)	
Marital Status (n = 114)	No	76 (66.7)	56 (62.2)	17 (85.0)	0.051
	Yes	38 (33.3)	34 (37.8)	3 (15.0)	
Relationship Status (n = 105)	No	20 (19.1)	13 (15.9)	6 (30.0)	0.145
	Yes	85 (81.0)	69 (84.2)	14 (70.0)	
Live with (n = 115)	Alone	22 (19.1)	16 (17.6)	6 (30.0)	0.364
	With partner only	17 (14.8)	15 (16.5)	2 (10.0)	
	Partner & children	41 (35.7)	35 (38.5)	5 (25.0)	
	Children only	10 (8.7)	8 (8.8)	1 (5.0)	
	Immediate family	22 (19.1)	14 (15.4)	6 (30.0)	
	Other relatives	3 (2.6)	3 (3.3)	0 (0.0)	
Number of Children	n	112	89	20	0.250
	Median (IQR)	2 (1–2)	2 (1–2)	1 (0.5–2)	
On Medication (n = 112)	No	67 (59.2)	60 (66.7)	6 (31.6)	0.004
	Yes	45 (40.1)	30 (33.3)	13 (68.2)	
Chronic Conditions (n = 114)	No	73 (64.0)	67 (73.6)	5 (25.0)	< 0.001
	Yes	41 (36.0)	24 (26.4)	15 (75.0)	

IQR = Interquartile range

Table 2 Levels of physical and mental health, resilience, coping, burnout, and anxiety and depression among the study participants (N = 139)

Variable	Median (IQR)			P-value
	Total (N = 139)	Nursing staff (n = 91)	Nursing management (n = 20)	
Global Physical Health Scale Median (IQR)	8 (0–11)	9 (8–11)	9 (0–10)	0.4278
Global Mental Health Scale Median (IQR)	8 (0–10)	9 (6–11)	7 (0–10)	0.1245
Conor-Davidson Resilience Scale Median(IQR)	22 (0–36)	27 (0–37)	0 (0–35.5)	0.2199
Brief COPE Inventory Median (IQR)	31(0–50)	43 (6–55)	25 (0–48)	0.1277
Burnout Measure-Shortened Version Median (IQR)	20 (0–37)	29 (0–42)	0 (0–33.5)	0.0283
Hospital Anxiety and Depression Scale Median (IQR)	18 (0–23)	19 (15–23)	19 (0–23)	0.3070

IQR = Interquartile range

Table 3 Univariable and multivariable linear regression models on factors associated with burnout among the study participants (n = 97)

Variable		Unadjusted coefficient (95%CI)	P-value	Adjusted coefficient (95% CI)	P-value
Sex	Male	0 (Reference)	0.546	0 (Reference)	0.442
	Female	-7.3 (-31.1; 16.5)		5.4 (-8.6; 19.5)	
Married	No	0 (Reference)	0.479	0 (Reference)	0.922
	Yes	-2.9 (-11.0; 5.2)		0.3 (-5.2; 5.8)	
Occupation	Nursing staff	0 (Reference)	0.018	0 (Reference)	0.067
	Management staff	-12.0 (-21.9; -2.1)		-6.6 (-13.8; 0.5)	
Years Practicing		-01 (-0.4; 0.2)	0.146	-0.3 (-0.6; 0.0)	0.094
Age in years		-0.2 (-0.5; 0.2)	0.408	0.2 (-0.2; 0.6)	0.324
Brief Cope Inventory		0.5 (0.4; 0.6)	< 0.001	-0.1 (-0.2; 0.1)	0.402
Conor-Davidson Resilience Scale		0.9 (0.7; 1.0)	< 0.001	0.7 (0.4; 0.9)	< 0.001
Global Mental Health Scale		2.0 (1.3; 2.7)	< 0.001	-2.4 (-3.2; -1.6)	< 0.001
Global Physical Health Scale		2.7 (2.1; 3.2)	< 0.001	2.1 (1.3; 2.9)	< 0.001
Hospital Anxiety and Depression Scale		1.4 (1.2; 1.7)	< 0.001	0.7 (0.2; 1.2)	0.039

CI = Confidence Interval,

increase in the GPHS score was associated with an average 2.7 unit increase in the burnout score (Coeff.= 2.7, 95% CI 2.1; 3.2). A unit increase in the HASC score was associated with an average 1.4 unit increase in the burnout score (Coeff.= 1.4, 95% CI 1.2; 1.7). Nursing management had a decreased burnout score of 12 units on average compared to the nursing staff.

In the multivariable linear regression model, burnout was associated with the CDRS, the GMHS, the GPHS, and the HADS. A unit increase in the CDRS score significantly ($p < 0.001$) increased the burnout score by an average of 0.7 units (Coeff.= 0.7, 95% CI 0.4; 0.9). A unit increase in the GMHS score significantly ($p < 0.001$) decreased the burnout score by an average of 2.4 units (Coeff.= -2.4, 95% CI -3.2; -1.6). A unit increase in the GPHS score significantly ($p < 0.001$) increased the burnout score by an average of 2.1 units (Coeff.= 2.1, 95% CI 1.3; 2.9). A unit increase in the HADS score significantly ($p = 0.039$) increased the burnout score by an average of 0.7 units (Coeff.= 0.7, 95% CI 0.2; 1.2). Burnout was

marginally associated with years of practice and occupation: p-values were between 5 and 10%.

Discussion

This study sought to investigate the association between burnout, coping, resilience, physical and mental health as well as anxiety and depression among South African nurses working in the frontline during the peak of the pandemic. Nurses in this study were found to be significantly younger than nurse managers, with previous studies suggesting that generational differences in nursing influence work attitudes and values [49]. This is thought to affect younger nurses' working experiences, impacting their wellbeing and subsequently retention [50]. Although age was not a significant factor in predicting burnout among nurses or nurse managers in this study, acknowledging generational differences in nursing could assist in suitable strategies for improving nurses' work experiences by enhancing intergenerational harmony and collegiality. This is especially critical during future health

threats and can be achieved by engaging generation Y in mediating communication between generation X and generation Z [51].

Similarly, Ramdan and colleagues reported in their systematic review and meta-analysis that findings from various multi-country studies suggest that the likelihood of experiencing burnout increased with years of practice, especially among nurses during the pandemic [52]. However, in this study years in practice were not significantly associated with burnout, indicating that years of working experience may not influence South African nurses and nurse managers' wellbeing in the workplace. Noteworthy, is that no studies from the African region were included in the systematic review and meta-analysis, which may mean that there is a need for further research aimed at understanding relevant factors associated with burnout within the African context. This is supported by research conducted among South African emergency nurses, which uses the capability approach to explain the importance of context and considering nurses' capabilities as well as how these are enabled for reducing burnout risk [53]. The unique socio-economic and health system challenges in South Africa warrants region specific research, which may support the development of tailored strategies for promoting wellbeing and strengthening the nursing workforce [7, 21].

Occupation was a significant predictor of burnout with reports revealing that nurses rank higher than one hundred and thirty other high-stress occupations for suffering from poor mental health-related outcomes [9]. A study comparing burnout levels between Brazilian nurses in management and nurses in care found that there was a significant difference in burnout between the two groups [54]. Aligned with the findings of this study, nurses reported significantly higher burnout levels in the univariable analysis compared to nurse managers, which may be attributable to the variation in job demands and available resources [55]. Nurses are known to be involved in direct patient care and this coupled with fear of infection and lack of protective equipment as well as higher rates of infection during the pandemic [29, 56], could explain the difference in burnout levels in the current study.

Coping and burnout have been shown across several studies to be associated [57], with a meta-analysis confirming sustained effects on alleviating all dimensions of burnout for up to a year [58]. This study's univariable analysis showed that coping is associated with burnout, but the association was not significant in the multivariable analysis. This could indicate that coping alone is adequate for addressing burnout although, during the pandemic burnout was affected by a range of unprecedented factors such as fear of contracting infection, separation from loved ones, harassment from patients and their family members, extended working hours and decreased sleep as well as reallocation to different wards

[59], which may have influenced coping mechanisms and would require a more holistic response. Unexpected challenges such as these can threaten the psychological needs necessary for regulatory action, whereby the perception of being able to control negative events and experiences towards coping becomes dysfunctional [60]. Studies have previously confirmed the effect of new stressors including changing patient needs on HCW's perceptions as subsequently reducing the effect of coping on burnout [58]. This has important implications for preparedness during future health emergencies, whereby a need for an enquiry into the factors promoting coping for mitigating burnout among health workers, especially nurses, is required in under-resourced settings. In this light, a recent Gauteng-South African study indicates that positive mindsets and reappraisal were emotion-focused coping strategies commonly employed by HCWs, specifically psychiatrists, to redress the mental health effects of COVID-19 and improve their wellbeing [61].

The association between resilience and burnout has been previously established whereby resilience has been thought to be protective of burnout owing to one's ability to restore baseline functioning through positive adaptation [62, 63]. Several studies have confirmed that higher levels of resilience are associated with lower burnout among nurses before as well as during the pandemic [62, 64]. However, the findings of this study show that resilience and burnout are positively associated, which may indicate that there is a more complex dynamic between these factors. A study conducted among physicians revealed that despite high levels of resilience, they remained susceptible to burnout [65]. Resilience is achieved through emotional recovery and emotional thriving, whereby positive emotions are critical for overcoming negative experiences [66]. This is especially critical for nurses, who according to a recent survey showed lower levels of resilience during the pandemic [67]. Perhaps future research ought to focus on understanding the role of emotions in promoting resilience and preventing burnout among nurses working in emergency situations. An example from a study among emergency response workers in Italy showed that problem-focused strategies enabled workers to overcome negative emotions, which offered protection against burnout [67]. Contextual factors such as lack of protective equipment and higher risk for those with comorbidities such as TB and HIV [21], may have also influenced burnout rates despite resilience.

General physical health and mental health as well as depression, anxiety and resilience were significantly associated with burnout in this study. Several studies have confirmed that burnout can compromise the general health outcomes of HCWs, due to stressful conditions that are not managed [68]. However, fewer studies have shown that poor physical and mental health increases

the risk of burnout among nurses, with the pandemic worsening these outcomes. A Namibian study revealed that poor physical and mental health depletes the positive resources necessary for dealing with stressors that contribute to burnout among nurses, especially considering the difficult working conditions they were exposed to during the pandemic [69]. Implications for nurse wellbeing during future outbreaks are critical in ensuring preparedness, which ought to include holistic strategies aimed at preserving and promoting the physical and mental health of nurses in efforts to prevent burnout.

Depression and anxiety have been known to be associated with burnout among nurses, and more recently due to challenges experienced during the pandemic, including high risk of infection and separation from family without social support for extended periods of time [70, 71]. These findings were confirmed in this study, showing that both depression and anxiety in hospital settings are associated with burnout among nurses at the frontline of the COVID-19 pandemic. Although this is supported by previous research [72], the findings in this study reveal that depression and anxiety contribute to burnout among nurses, thus contradicting the suggestion that depression overlaps with burnout, which may be a symptom of it [73]. A possible explanation involves nurses experiencing compassion fatigue owing to contact with excessive suffering of others [74], with a recent study using network analysis, showing that fatigue is the connection between depression and burnout [75]. Further research aimed at understanding how depression, anxiety and burnout are related to one another within under-resourced settings is necessary for appropriate intervention during future health emergencies.

These findings contribute an interesting perspective to the existing knowledge base, whereby the association between burnout, coping and resilience appears to be more complex in the context of a health emergency. However, the association between the general health of nurses, and especially with respect to their mental health, seems to be beneficial for future interventions in reducing burnout. In lieu of adopting a more holistic approach to understanding wellbeing among nurses during the pandemic, the findings in this study support a fundamental principle in holistic wellbeing models suggesting that wellbeing cannot be understood, without integrating the wide range of elements of which it comprises [30]. In examining multiple aspects of wellbeing in this study, it is possible that coping and resilience may not be key factors in promoting the wellbeing of South African nurses and in fact, their mental health may be critical for mitigating burnout during future health emergencies. Future studies examining the associations between general health, coping and resilience may help generate further evidence towards holistic interventions aimed at promoting nurses' wellbeing. It is recommended that lifestyle health promotion interventions such as mindfulness be prioritised,

especially considering its higher levels of effectiveness in promoting wellbeing among nurses compared to educational interventions [76]. A way forward would be to explore longitudinal designs for capturing the evolution of burnout and related factors as well as its impact on wellbeing over time, particularly in resource-constrained settings.

Limitations and strengths

The sample size of 139 participants and the inclusion of nurses drawn only from purposively selected hospitals due to accessibility during the pandemic, impact the generalisability of the findings. Only analysing burnout as an outcome limits the scope of the study and it is recommended that future studies consider multiple outcomes. Although this study considered various aspects of wellbeing, additional aspects including socioeconomic, spiritual, and emotional wellbeing should be studied in future for a more holistic understanding. A major strength of this study is the sampling of nurses from Gauteng, KwaZulu-Natal and Western Cape provinces, which contributed to the bulk of COVID-19 infections and mortality in South Africa and may have far-reaching implications within this context.

Conclusion

Coping and resilience may independently be associated with burnout, although holistically, general health and especially mental health of South African nurses is significantly associated with burnout. This has implications for future interventions aimed at promoting the wellbeing of South African nurses, whereby nurses' mental health could mitigate the impact of burnout and ensure quality patient care during health emergencies. Effective mental health interventions are crucial and should be prioritized to mitigate burnout during future health emergencies. It is recommended that future research focus on nurses working in the public sector in South Africa as well as other similar settings. This study underlines the urgent need for health systems to prioritize nurses' mental health and implement holistic interventions that integrate overall wellbeing to mitigate the impact of burnout during future health emergencies.

Acknowledgements

The authors wish to acknowledge the hospital administrations for the permission to conduct the study in their facilities and the study participants who responded to the questionnaire, despite the prevailing challenges at the time. Also, we sincerely thank our collaborators Professor Sumaya Laher and Dr Tasneem Hassem for their contributions to the conceptualization and preliminary analyses of this study.

Author contributions

NK conceptualized and designed the study and collected the data, NK and SM analysed the data, NK, SM and CF interpreted the findings. CF and NK drafted the manuscript. All authors revised and approved the submitted manuscript.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Data availability

The data for this study is not publicly available. Nonetheless, the corresponding author can provide it anonymously upon a reasonable request.

Declarations

Ethical approval

The current study was conducted following the guidelines of the Declaration of Helsinki. The ethics was approved by the University of the Witwatersrand Medical Ethics Committee, Ref No: M200461. All the participants provided written informed consent before their enrolment in the study. As this was an online survey, the participants were not exposed to any risk. The study de-identified the data, hence, the findings have been reported anonymously. The data generated in the study has been kept in a Google Drive with encryption, only accessible to the research team.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

¹Division of Health and Society, School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

²Sydney Brenner Institute for Molecular Bioscience, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

³Division of Epidemiology and Biostatistics, School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

⁴School of Public Health, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa

Received: 3 September 2024 / Accepted: 6 March 2025

Published online: 15 March 2025

References

- Chersich MF, Gray G, Fairlie L, Eichbaum Q, Mayhew S, Allwood B, et al. COVID-19 in Africa: care and protection for frontline healthcare workers. *Global Health*. 2020;16:46.
- [if gte mso 9] > Normal 0 false false false EN-US X-NONE X-NONE Diamond MB, Woskie L. COVID-19: Protecting Frontline Healthcare Workers—What Lessons Can We Learn from Ebola? 2020. <https://blogs.bmj.com/bmj/2020/03/25/healthcare-workforce-safety-and-ebola-in-the-context-of-covid-19/>
- Maunder RG, Lancee WJ, Balderson KE, Bennett JP, Borgundvaag B, Evans S, et al. Long-term psychological and occupational effects of providing hospital healthcare during SARS outbreak. *Emerg Infect Dis*. 2006;12:1924–32.
- World Health Organization. (1948). Health and well-being. <https://www.who.int/data/gho/data/major-themes/health-and-well-being> - Google Search.
- Kuhlmann E, Falkenbach M, Brinzac M-G, Correia T, Panagioti M, Ungureanu M-I. The mental health needs of healthcare workers: when evidence does not guide policy. A comparative assessment of selected European countries. *Int J Health Plann Manage*. 2024;39:614–36.
- Malakoane B, Heunis JC, Chikobvu P, Kigozi NG, Kruger WH. Public health system challenges in the free State, South Africa: a situation appraisal to inform health system strengthening. *BMC Health Serv Res*. 2020;20:58.
- Engelbrecht MC, Heunis JC, Kigozi NG. Post-Traumatic Stress and Coping Strategies of South African Nurses during the Second Wave of the COVID-19 Pandemic. *Int J Environ Res Public Health*. 2021 Jul 27;18(15):7919. <https://doi.org/10.3390/ijerph18157919>. PMID: 34360211; PMCID: PMC8345364. <https://pubmed.ncbi.nlm.nih.gov/34360211/>
- Rosa WE, Fitzgerald M, Davis S, Farley JE, Khanyola J, Kwong J, et al. Leveraging nurse practitioner capacities to achieve global health for all: COVID-19 and beyond. *Int Nurs Rev*. 2020;67:554–9.
- Salari N, Khazaie H, Hosseini-Far A, Khaledi-Paveh B, Kazemian M, Mohammadi M, et al. The prevalence of stress, anxiety and depression within frontline healthcare workers caring for COVID-19 patients: a systematic review and meta-regression. *Hum Resour Health*. 2020;18:100.
- Mc Magh C, Fadahun O, Francis JM. Prevalence and correlates of alcohol use, mental disorders, and awareness and utilization of support services among healthcare professionals in West Rand District, Gauteng, South Africa: a cross-sectional study. *Fam Pract*. 2023 Sep 15;cmad094. <https://doi.org/10.1093/fampra/cmad094>. Epub ahead of print. PMID: 37713606.
- Al Hasan SM, Saulam J, Mikami F, Kanda K, Yokoi H, Hirao T. COVID-19 outbreak trends in South Africa: A comparison of Omicron (B.1.1.529), Delta (B.1.617.2), and Beta (B.1.351) variants outbreak periods. *J Infect Public Health*. 2022 Jul;15(7):726–33. <https://doi.org/10.1016/j.jiph.2022.05.011>. Epub 2022 May 24. PMID: 35687982; PMCID: PMC9128297. <https://pubmed.ncbi.nlm.nih.gov/35687982/>
- Mitchley A. Covid-19: over 27,000 cases and 230 deaths among healthcare workers, but SA below global averages. - Google Search; 2020.
- Salimi S, Özel S. Insights for enhancing resilience in prolonged crises: impact of COVID-19 pandemic on nurses' quality of life. *BMJ Lead*. 2024;8:240–4.
- Çelmeçe N, Menekay M. The Effect of Stress, Anxiety and Burnout Levels of Healthcare Professionals Caring for COVID-19 Patients on Their Quality of Life. *Front Psychol*. 2020 Nov 23;11:597624. <https://doi.org/10.3389/fpsyg.2020.597624>. PMID: 33329264; PMCID: PMC7719786. <https://pubmed.ncbi.nlm.nih.gov/33329264/>
- Hacimusalar Y, Kahve AC, Yasar AB, Aydin MS. Anxiety and hopelessness levels in COVID-19 pandemic: A comparative study of healthcare professionals and other community sample in Turkey. *J Psychiatr Res*. 2020;129:181–8.
- Keyes CLM. Mental illness and/or mental health? Investigating axioms of the complete state model of health. *J Consult Clin Psychol*. 2005;73:539–48.
- Heinsch M, Wells H, Sampson D, Wootton A, Cupples M, Sutton C, et al. Protective factors for mental and psychological wellbeing in Australian adults: A review. *Mental Health Prev*. 2022;25:200192.
- Song S, Yang X, Yang H, Zhou P, Ma H, Teng C, et al. Psychological resilience as a protective factor for depression and anxiety among the public during the outbreak of COVID-19. *Front Psychol*. 2020;11:618509.
- Afshari D, Nourollahi-Darabad M, Chinisaz N. Demographic predictors of resilience among nurses during the COVID-19 pandemic. *Work*. 2021;68:297–303.
- Baskin RG, Bartlett R. Healthcare worker resilience during the COVID-19 pandemic: an integrative review. *J Nurs Adm Manag*. 2021;29:2329–42.
- Watermeyer J, Madonsela S, Beukes J. The mental health and wellbeing of healthcare workers during COVID-19 in South Africa. *Health SA*. 2023;28:2159.
- Spoorthy MS, Pratapa SK, Mahant S. Mental health problems faced by healthcare workers due to the COVID-19 pandemic-A review. *Asian J Psychiatr*. 2020;51:102119.
- Chutiyami M, Cheong AMY, Salihu D, Bello UM, Ndwiwa D, Maharaj R, Naidoo K, Kolo MA, Jacob P, Chhina N, Ku TK, Devar L, Pratiha P, Kannan P. COVID-19 Pandemic and Overall Mental Health of Healthcare Professionals Globally: A Meta-Review of Systematic Reviews. *Front Psychiatry*. 2022 Jan 17;12:804525. <https://doi.org/10.3389/fpsyg.2021.804525>. PMID: 35111089; PMCID: PMC8801501. <https://pubmed.ncbi.nlm.nih.gov/35111089/>
- Greenberg N. Mental health of health-care workers in the COVID-19 era. *Nat Rev Nephrol*. 2020;16:425–6.
- Grailey K, Lound A, Brett S. Lived experiences of healthcare workers on the front line during the COVID-19 pandemic: a qualitative interview study. *BMJ Open*. 2021;11:e053680.
- Naidoo I, Mabaso M, Moshabela M, Sewpaul R, Reddy SP. South African health professionals' state of well-being during the emergence of COVID-19. *S Afr Med J*. 2020;110:13104.
- Curran R, Bachmann M, Van Rensburg AJ, Murdoch J, Awotiwon A, Ras C-J, et al. Personal and occupational experiences of COVID-19 and their effects on South African health workers' wellbeing. *S Afr Med J*. 2021;111:607–8.
- Kim AW, Maaroganye K, Subramaney U. Mental health experiences of public psychiatric healthcare workers during COVID-19 across southern Gauteng, South Africa: a call for strengthening public mental health care. *South African Health Review*. 2022;24.
- Mdzinwa N, Voigt M, van Janse C, Paruk F. SARS-CoV-2 infection prevalence in healthcare workers and administrative and support staff: the first-wave experience at three academic hospitals in the Tshwane district of Gauteng Province, South Africa. *S Afr Med J*. 2021;111:1092–7.
- Els DA, Rey RP, De La. Developing A holistic wellness model. *SA J Hum Resource Manage*. 2006;4.
- Jiwattanasuk N, Pannavoravat P, Sirikanchana P. The holistic Well-being concepts in relation to quality of life. *ABAC ODI J Vis Action Outcome*. 2022;10:28–41.
- Blauw D, Ditlopo P, Maseko F, Chirwa M, Mwisongo A, Bidwell P, et al. Comparing the job satisfaction and intention to leave of different categories

- of health workers in Tanzania, Malawi, and South Africa. *Glob Health Action*. 2013;6:19287.
33. STATS SA. Mid-year population estimates, 2022. Statistics South Africa - Google Search [Internet].
 34. Update On Covid- 19 - Wednesday 01 February 2023 - SA Corona Virus Online Portal. SA Corona Virus Online Portal. 2023. <https://sacoronavirus.co.za/2023/02/02/update-on-covid-19-wednesday-01-february-2023/>
 35. Fatoki O. Entrepreneurial stress, burnout, intention to quit and performance of Immigrant-Owned small businesses in South Africa. *Int J Entrepreneurship*. 2019;23:1–306.
 36. Carver CS. You want to measure coping but your protocol's too long: consider the brief COPE. *Int J Behav Med*. 1997;4:92–100.
 37. Kotzé M, Visser M, Makin J, Sikkema K, Forsyth B. Psychosocial variables associated with coping of HIV-positive women diagnosed during pregnancy. *AIDS Behav*. 2013;17:498–507.
 38. Connor KM, Davidson JR. Development of a new resilience scale: the Connor-Davidson Resilience Scale (CD-RISC). *Depress Anxiety*. 2003;18(2):76–82. <https://doi.org/10.1002/da.10113>. PMID: 12964174.
 39. Campbell-Sills L, Stein MB. Psychometric analysis and refinement of the Connor-davidson resilience scale (CD-RISC): validation of a 10-item measure of resilience. *J Trauma Stress*. 2007;20:1019–28.
 40. Hays RD, Schalet BD, Spritzer KL, Cella D. Two-item PROMIS® global physical and mental health scales. *J Patient Rep Outcomes*. 2017;1:2.
 41. Katzan IL, Lapin B. PROMIS GH (Patient-Reported outcomes measurement information system global Health) scale in stroke: A validation study. *Stroke*. 2018;49:147–54.
 42. Zigmond AS, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand*. 1983;67:361–70.
 43. Caplan RP. Stress, anxiety, and depression in hospital consultants, general practitioners, and senior health service managers. *BMJ*. 1994;309:1261–3.
 44. Quine L. Workplace bullying in NHS community trust: staff questionnaire survey. *BMJ*. 1999;318:228–32.
 45. Bjelland I, Dahl AA, Haug TT, Neckelmann D. The validity of the hospital anxiety and depression scale: an updated literature review. *J Psychosom Res*. 2002;52:69–77.
 46. Herrmann C. International experiences with the hospital anxiety and depression Scale—a review of validation data and clinical results. *J Psychosom Res*. 1997;42:17–41.
 47. Wouters E, Booyens F le, Ponnet R, Baron K, Van Loon F. Wording effects and the factor structure of the hospital anxiety & depression scale in HIV/AIDS patients on antiretroviral treatment in South Africa. *PLoS ONE*. 2012;7:e34881.
 48. Regression methods in. biostatistics: linear, logistic, survival, and repeated measures models [2nd edition] Google.
 49. Tan SHE, Chin GF. Generational effect on nurses' work values, engagement, and satisfaction in an acute hospital. *BMC Nurs*. 2023 Mar 30;22(1):88. <https://doi.org/10.1186/s12912-023-01256-2>. PMID: 36997911; PMCID: PMC10061355. <https://pubmed.ncbi.nlm.nih.gov/36997911/>
 50. Sherman RO, Saifman H, Schwartz RC, Schwartz CL. Factors that lead generation Y nurses to consider or reject nurse leader roles. *NursingPlus Open*. 2015;1:5–10.
 51. So Hee L, Yeojin Y. Work values and communication styles among Generation X, Y, and Z nurses: A cross-sectional study. *Int Nurs Rev*. 2024 Mar;71(1):115–21. <https://doi.org/10.1111/inr.12863>. Epub 2023 Jul 14. PMID: 37449528. <http://onlinelibrary.wiley.com/doi/>
 52. Alanazy ARM, Alruwaili A. The global prevalence and associated factors of burnout among emergency department healthcare workers and the impact of the COVID-19 pandemic: A systematic review and Meta-Analysis. *Healthc (Basel)*. 2023;11:2220.
 53. Barnard NB, Rothmann S, De Beer LT, Lubbe W. Burnout of emergency nurses in a South African context: the role of job demands and resources, and capabilities. *Front Psychol*. 2023;14:119063.
 54. Garcia GPA, Marziale MHP. Satisfaction, stress and burnout of nurse managers and care nurses in primary health care. *Rev Esc Enferm USP*. 2021;55:e03675.
 55. Takemura Y, Kunie K, Ichikawa N. The effect of work environment on burnout among nursing directors: A cross-sectional study. *J Nurs Manag*. 2020 Jan;28(1):157–66. <https://doi.org/10.1111/jonm.12909>. Epub 2020 Jan 10. PMID: 31749184. <https://pubmed.ncbi.nlm.nih.gov/31749184/>
 56. Dall'Ora C, Ball J, Reinius M, Griffiths P. Burnout in nursing: a theoretical review. *Hum Resour Health*. 2020;18:41.
 57. Rossi MF, Gualano MR, Magnavita N, Moscato U, Santoro PE, Borrelli I. Coping with burnout and the impact of the COVID-19 pandemic on workers' mental health: A systematic review. *Front Psychiatry*. 2023;14:1139260.
 58. Lee H-F, Kuo C-C, Chien T-W, Wang Y-R. A Meta-Analysis of the effects of coping strategies on reducing nurse burnout. *Appl Nurs Res*. 2016;31:100–10.
 59. AlJhani, S., AlHarbi, H., AlJamel, S. et al. Burnout and coping among healthcare providers working in Saudi Arabia during the COVID-19 pandemic. *Middle East Curr Psychiatry* 28, 29 (2021). <https://doi.org/10.1186/s43045-021-01008-6>. <https://mecp.springeropen.com/articles/10.1186/s43045-021-00108-6>
 60. Freitas, M. F. M. B., Enumo, S. R. F., Machado, W. L., Messias, J. C. C., & Mendes, E. D. T. (2023). Burnout at the hospital: Healthcare workers coping with COVID-19 stress. *Estudos de Psicologia (Campinas)*, 40, e220097. <https://doi.org/10.1590/1982-0275202340e220097>
 61. Scheunemann A, Kim AW, Moolla A, Subramany U. Coping strategies employed by public psychiatric healthcare workers during the COVID-19 pandemic in Southern Gauteng, South Africa. *PLoS ONE*. 2023;18:e0277392.
 62. Guo Y-F, Luo Y-H, Lam L, Cross W, Plummer V, Zhang J-P. Burnout and its association with resilience in nurses: A cross-sectional study. *J Clin Nurs*. 2018;27:441–9.
 63. Rink LC, Silva SG, Adair KC, Oyesanya TO, Humphreys JC, Sexton JB. Characterizing burnout and resilience among nurses: A latent profile analysis of emotional exhaustion, emotional thriving and emotional recovery. *Nurs Open*. 2023;10:7279–91.
 64. Cha YJ, Lee K-S, Cho JH, Choi IS, Lee D. Effect of job stress on burnout among nurses responding to COVID-19: the mediating effect of resilience. *Int J Environ Res Public Health*. 2022;19:5409.
 65. West CP, Dyrbye LN, Sinsky C, Trockel M, Tutty M, Nedelec L, et al. Resilience and burnout among physicians and the general US working population. *JAMA Netw Open*. 2020;3:e209385.
 66. Szanton SL, Gill JM. Facilitating resilience using a society-to-cells framework: a theory of nursing essentials applied to research and practice. *ANS Adv Nurs Sci*. 2010;33:329–43.
 67. Vagni M, Maiorano T, Giostra V, Pajardi D, Bartone P. Emergency stress, hardiness, coping strategies and burnout in health care and emergency response workers during the COVID-19 pandemic. *Front Psychol*. 2022;13:918788.
 68. Robertson LJ, Maposa I, Somaroo H, Johnson O. Mental health of healthcare workers during the COVID-19 outbreak: A rapid scoping review to inform provincial guidelines in South Africa. *S Afr Med J*. 2020;110:1010–9.
 69. Pieters WR, Matheus L. Improving general health and reducing burnout of nurses in Namibia. *SA J Hum Resource Manage*. 2020;18:13.
 70. Al Maqbali M, Al Sinani M, Al-Lenjawi B. Prevalence of stress, depression, anxiety and sleep disturbance among nurses during the COVID-19 pandemic: A systematic review and meta-analysis. *J Psychosom Res*. 2021;141:110343.
 71. Koutsimani P, Montgomery A, Georganta K. The relationship between burnout, depression, and anxiety: A systematic review and Meta-Analysis. *Front Psychol*. 2019;10:284.
 72. Karadağ S, Çiçek B. Anxiety, Depression and Burnout Levels of Nurses Working in COVID-19 Intensive Care Units. *Omega (Westport)*. 2023 Feb 6;302228231156313. <https://doi.org/10.1177/00302228231156313>. Epub ahead of print. PMID: 36747313; PMCID: PMC9904990.
 73. Bianchi R, Schonfeld IS, Laurent E. Burnout-depression overlap: a review. *Clin Psychol Rev*. 2015 Mar;36:28–41. <https://doi.org/10.1016/j.cpr.2015.01.004>. Epub 2015 Jan 17. PMID: 25638755. <https://pubmed.ncbi.nlm.nih.gov/25638755/>
 74. Luch C, Galiana L, Doménech P, Sansó N. The impact of the COVID-19 pandemic on burnout, compassion fatigue, and compassion satisfaction in healthcare personnel: A systematic review of the literature published during the first year of the pandemic. *Healthc (Basel)*. 2022;10:364.
 75. Zhang Y, Wu C, Ma J, Liu F, Shen C, Sun J, et al. Relationship between depression and burnout among nurses in intensive care units at the late stage of COVID-19: a network analysis. *BMC Nurs*. 2024;23:224.
 76. Stanulewicz N, Knox E, Narayanasamy M, Shivi N, Khunti K, Blake H. Effectiveness of lifestyle health promotion interventions for nurses: A systematic review. *Int J Environ Res Public Health*. 2019;17:17.

Publisher's note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.