

# Letters

## RESEARCH LETTER

### Depressive Symptoms and Associated Factors Among Kenyan Health Care Workers

The mental health of health care workers (HCWs) is an important global concern, particularly in low- and middle-income countries (LMICs) such as Kenya, where unique stressors may place HCWs at disproportionate risk for depression.<sup>1</sup> However,

depression prevalence and risk factors in this population are not well understood. To address this gap, we evaluated the prevalence of depressive symptoms among Kenyan HCWs and identified associated demographic, psychological, and workplace factors.

**Methods** | The Aga Khan University Institutional Scientific and Ethics Review Committee and recruitment sites approved this survey study. Participants provided electronic informed consent and were compensated 500 Kenyan shillings (US \$3.86). The study followed the *AAPOR* reporting guideline.

We used longitudinal data collected from HCWs from 5 hospitals in Nairobi, Kenya, based on the Intern Health Study protocol.<sup>2</sup> HCWs who enrolled in the longitudinal UZIMA-DS study beginning in April 2023 completed surveys at enrollment and quarterly for 12 months. The surveys assessed depressive symptoms using the 9-item Patient Health Questionnaire (PHQ-9) in English<sup>3</sup> and other demographic, psychosocial, and workplace factors (eMethods in [Supplement 1](#)).<sup>4</sup>

We used a weighting strategy to reduce participant attrition biases (eMethods in [Supplement 1](#)). To capture potential variation, we assessed mean PHQ-9 scores and calculated the proportion of participants meeting PHQ-9 criteria for depression at each survey time point. We used Pearson correlations and  $\chi^2$  tests to examine associations between demographic variables and PHQ-9 scores. Risk factors were entered into a stepwise linear regression model. To explore workplace factors associated with depressive symptoms, we included repeated measures of work hours, workplace discrimination, medical errors, and stressful life events in a generalized estimating equation (GEE) model. Significant demographic and personality variables were added as covariates. Analyses were conducted in R, version 4.4.1 (R Project for Statistical Computing). Two-sided  $P < .05$  was considered significant.

**Results** | Among 527 enrolled participants, 514 (97.5%) completed the PHQ-9 questionnaire at enrollment and were included in the analysis (mean [SD] age, 34.1 [8.1] years; 340 women [66.1%] and 174 men [33.9%]) ([Table 1](#) and eFigure in [Supplement 1](#)). At 3, 6, 9, and 12 months, 197 (38.3%), 211 (41.1%), 210 (40.9%), and 177 (34.4%) participants completed the depressive symptom surveys, respectively.

After attrition weighting, 175 (34.0%), 51 (26.0%), 44 (21.0%), 47 (22.5%), and 32 (17.9%) participants met PHQ-9 criteria ( $\geq 10$ ) for major depression at enrollment and at 3, 6, 9, and 12 months, respectively. A total of 222 participants (43.1%) met PHQ-9 criteria at 1 or more quarterly assessments, with 87 (16.9%) and 28 (5.5%) meeting criteria for moderately severe ( $\geq 15$ ) and severe ( $\geq 20$ ) depression.

Among demographic and personality factors established as risk factors for PHQ-9 score increase among medical residents in previous studies<sup>2</sup> and 1 context-specific factor, age ( $r = -0.09$ ;  $P = .04$ ), neuroticism ( $r = 0.54$ ;  $P < .001$ ), difficult early family environment ( $r = 0.42$ ;  $P < .001$ ), relationship status ( $r = -0.16$ ;  $P < .001$ ), and years of work experience ( $r = -0.08$ ;  $P = .04$ ) were associated with depressive symptoms. In GEE analysis, neuroticism, difficult early family environment, relationship status, stressful life events, and work-

**Table 1. Participant Characteristics<sup>a</sup>**

Characteristic	Unweighted value (N = 514)	Weighted value (N = 514) <sup>b</sup>
Demographic factors		
Age, mean (SD), y	34.1 (8.1)	34.0 (9.7)
Sex		
Female	340 (66.1)	339 (66.0)
Male	174 (33.9)	175 (34.0)
Profession		
Physician	39 (7.6)	41 (8.0)
Nurse	303 (58.9)	317 (61.7)
Other	172 (33.5)	156 (30.4)
Relationship status		
In a committed relationship	388 (75.5)	389 (75.7)
Not in a committed relationship	126 (24.5)	125 (24.3)
No. of children, mean (SD)	1.5 (1.1)	1.5 (1.3)
Neuroticism, mean (SD)	30.8 (7.7)	30.8 (8.5)
Difficult early family environment, mean (SD)	19.0 (13.1)	19.0 (16.2)
Years of work experience, mean (SD), y	9.7 (6.9)	9.7 (8.2)
Psychosocial and workplace factors		
Work hours, mean (SD)		
Work hours, mean (SD)	54.2 (24.8)	55.0 (33.9)
Medical errors		
Yes	31 (6.0)	31 (6.0)
No	483 (94.0)	483 (94.0)
Workplace discrimination		
Yes	220 (42.8)	242 (47.1)
No	294 (57.4)	272 (52.9)
Stressful life events		
Yes	321 (62.5)	330 (64.2)
No	193 (37.5)	184 (35.8)

<sup>a</sup> Unless noted otherwise, values are reported as No. (%) of participants.

<sup>b</sup> A weighting strategy was used to reduce participant attrition biases.

Table 2. Factors Associated With Increased Depressive Symptoms

Factor	$\beta$ (95% CI)	P value
Demographic factors		
Age	-0.02 (-0.08 to 0.04)	.48
Female sex	0.23 (-0.46 to 0.91)	.52
Profession		
Nurse vs physician	-0.61 (-1.60 to 0.39)	.23
Other vs physician	-0.14 (-1.22 to 0.95)	.80
In a committed relationship	-0.96 (-1.82 to -0.11)	.03
Neuroticism	0.22 (0.18-0.27)	<.001
Difficult early family environment	0.07 (0.04-0.10)	<.001
Years of work experience	0.06 (-0.41 to 0.54)	.79
Psychosocial and workplace factors		
Work hours	0.16 (-0.05 to 0.38)	.14
Medical errors	1.13 (-0.17 to 2.43)	.09
Workplace discrimination	1.95 (1.36-2.54)	<.001
Stressful life events	2.51 (1.98-3.05)	<.001

place discrimination were associated with increased depressive symptoms (Table 2).

**Discussion** | In this 12-month survey study of Kenyan HCWs using validated measures and an established protocol, 43.1% of participants met PHQ-9 criteria for major depression—a rate notably higher than that reported for HCWs in Europe and North America and in the general Kenyan population.<sup>5,6</sup> Consistent with previous studies,<sup>2</sup> risk factors for depression were higher neuroticism, not being in a committed relationship, having a difficult early family environment, experiencing stressful life events, and experiencing workplace discrimination. Unlike findings from US studies,<sup>2</sup> work hours and medical errors were not associated with depression.

Potential limitations include underreporting and lack of generalizability beyond nurses and physicians in Nairobi. These findings underscore the need for culturally tailored mental health interventions that address key individual and contextual risk factors for HCWs in LMICs.

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- Habtu Y, Kumie A, Selamu M, Harada H, Girma E. Prevalence and determinants of occupational depression, anxiety, and stress among Ethiopian healthcare workers. *Sci Rep*. 2024;14(1):21817. doi:10.1038/s41598-024-72930-x
- Chen L, Zhao Z, Wang Z, et al. Prevalence and risk factors for depression among training physicians in China and the United States. *Sci Rep*. 2022;12(1):8170. doi:10.1038/s41598-022-12066-y
- Kroenke K, Spitzer RL, Williams JB. The PHQ-9: validity of a brief depression severity measure. *J Gen Intern Med*. 2001;16(9):606-613. doi:10.1046/j.1525-1497.2001.016009606.x
- Njoroge W, Maina R, Frank E, et al. Use of mobile technology to identify behavioral mechanisms linked to mental health outcomes in Kenya: protocol for

development and validation of a predictive model. *BMC Res Notes*. 2023;16(1):226. doi:10.1186/s13104-023-06498-6

5. Depression and other common mental disorders: global health estimates. World Health Organization. 2017. Accessed August 11, 2024. <https://iris.who.int/bitstream/handle/10665/254610/WHO-MSD-MER-2017.2-eng.pdf>

6. Dechent F, Mayer G, Hummel S, et al. COVID-19 and mental distress among health professionals in eight European countries during the third wave: a cross-sectional survey. *Sci Rep*. 2024;14(1):21333. doi:10.1038/s41598-024-72396-x