Research paper

Sociodemographic predictors of depression and anxiety symptomatology among parents in rural Côte d'Ivoire

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ABSTRACT

Background: In Côte d'Ivoire, cocoa farming is a widespread practice in rural households, an occupation with increased risks of depression and anxiety exacerbated by economic instability. We used the Goldberg-18 Depression and Anxiety diagnostic tool to identify predictors of depressive and anxiety symptomatology among a sample of parents in rural cocoa farming communities.

Methods: In a cross-sectional survey, the Goldberg-18 was administered to Ivorian parents (N = 2471). Confirmatory factor analysis (CFA) was conducted to confirm the factor structure of the assessment tool, and Ordinary Least Squares (OLS) regression with clustered standard errors was used to identify sociodemographic predictors of symptomatology.

Results: CFA showed adequate fit statistics for a two-factor model measuring depressive and anxiety symptoms. Among respondents, 87 % screened positive for requiring further referral for clinical diagnosis. Sociodemographic predictors of depressive and anxiety symptoms were similar for males and females. For the total sample, higher monthly income, more years of education, and belonging to the Mandinka ethnic group predicted fewer depressive and anxiety symptoms. In contrast, higher depressive and anxiety symptomatology were associated with age. Single marital status predicted increased anxiety but not depressive symptoms for the full sample model and the female only sample, but not the male sample.

Limitations: This is a cross-sectional study.

Conclusions: The Goldberg-18 measures distinct domains of depressive and anxiety symptoms in a rural Ivorian sample. Age and single marital status are predictors of increased symptoms. Higher monthly income, higher education, and certain ethnic affiliations are protective factors.

1. Introduction

Depression and anxiety are psychopathologies that have deleterious effects on adults and their families in multiple and compounded pathways. Despite high prevalence in West Africa, they have been relatively underexplored for parent populations in many West African countries (Gbadamosi et al., 2022; Razzouk et al., 2010). Depression is the most common psychopathology, with an estimated 350 million people living with depression worldwide (World Health Organization, 2016). Among persons 15–49 years of age, the years lived with disability in sub-Saharan Africa (SSA) attributable to depression ranks higher than any other disease, including HIV (Institute for Health Metrics and Evaluation (IHME), 2021; Whiteford et al., 2013). As of 2020, 17 % of the world's population lives in Africa, and more than half of the global population growth between 2015 and 2050 is expected to occur there, making it the fastest growing continent (World Bank, 2017; United Nations, Department of Economic and Social Affairs, Population Division, 2015).

Despite ample research contrasting clinical depression and anxiety rates across countries and contexts, little has focused on assessing symptomatology prevalence related to these disorders in low-income contexts or rural settings. In addition to the need to explore affective disorders in understudied contexts such as rural and vulnerable parts of the world, there is also the pressing matter of addressing the issue among parent populations. The relevance of parent mental health extends

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beyond the individual parent and affects children's well-being through parent-child relationships. Healthy child development, such as physical, cognitive, and socioemotional development, hinges on healthy parent-child attachment, parental investment, and a safe and stable home environment (Bronfenbrenner and Morris, 2006; Farah et al., 2008; Jeong et al., 2018; Perkins et al., 2013). Substantial research connects the negative influence of depression and anxiety to employment and financial wellbeing, access to social networks, short and long-term decision making, memory and performance, and the ability to maintain positive interpersonal relationships (Gelaye et al., 2016; Kizilbash et al., 2002; Smythe et al., 2022). While detrimental to the specific individual, these mechanisms also compromise a parent's ability to care for their child, with implications observable into adulthood (Duncan et al., 2010; Shonkoff et al., 2012; Conger and Donnellan, 2007, Barthel et al., 2015). Affective disorders in parents may impact their children's biological sensitivity to social stress well into their adult years, contributing to a cycle of poor mental health conditions within a family (Guo et al., 2013; Barry et al., 2015). This study seeks to make progress in that direction, by examining anxiety and depression symptoms among a relatively understudied population of rural parents in cocoa farming regions of Côte D'Ivoire.

Poverty and mental health are multidimensional, with a bi-directional causal effect (Ridley et al., 2020; Patel and Kleinman, 2003). Poverty is not just a financial indicator of income and savings, but closely influences an individual's socioeconomic status such as class or caste identity, access to social networks, education, and health resources, and social stability (Chaudry and Wimer, 2016; Lund et al., 2010). >60 % of Africans earn their livelihood through farming, a profession with high risks dependent on environmental factors and economic conditions: income shocks from climate-related crisis and environmental vagaries in farming populations is seen as a risk factor for clinical depression in farming communities (Goedde et al., 2019; Christian et al., 2019).

Cocoa farming is widespread in rural Côte d'Ivoire and neighboring West African countries (along with Ghana, Côte d'Ivoire produces two-thirds of the world's cocoa production), involving all generations of a household from young children to their parents and grandparents in farming labor (NORC, 2020; ILO and UNICEF, 2021). Farming families in Côte d'Ivoire may be particularly susceptible to the deleterious effects of depression and anxiety, with women as a vulnerable group. Women in rural SSA bear a disproportionate burden of household chores such as cooking, cleaning, daily childcare, and cultivating subsistence farmland, and a wide gender gap in unpaid labor (United Nations, Department of Economic and Social Affairs, Population Division, 2015). Furthermore, women generally carry the burden of mental health disorders at more than double the rate of men (Kessler, 2003; Kessler et al., 2005; Bromet et al., 2011; Burt and Stein, 2002). Depression is the leading cause of disease-related disability among women in the world today, affecting about 20 % of women in low- and middle-income countries (LMICs) during their lifetime, with pregnancy being a period of high vulnerability, and the prevalence of depression during pregnancy ranging from 10 % to 47 % (Kessler, 2003; Ajinkya et al., 2013; Bindt et al., 2012; Sawyer et al., 2010). In Ghana, 26.6 % of women showed a substantially depressed mood. In Côte d'Ivoire, this figure was even higher at 32.9 % (Bindt et al., 2012; Guo et al., 2014).

Recognizing sociodemographic predictors of depression and anxiety provides a map to diagnosis and treatment, and crucial population characteristics for targeted policy and practice. Research from rural SSA has identified certain sociodemographic predictors of depression, particularly in the female population: higher maternal age, higher maternal education, perceived economic hardship, higher levels of family stress, increased anxiety symptoms, farther geographical access to a clinic, and single marital status (Audet et al., 2018; Saeed and Wemakor, 2019; Barthel et al., 2015). Considering these potential risk factors, increased research and investigation in this topic is an important policy issue. This need has been consistently pushed for in mental health

research, with a growing focus due to the increasing population trends in SSA (Kessler et al., 2005; Stein and Seedat, 2007; Gberie, 2016).

1.1. Operationalizing depressive and anxiety symptoms

The Goldberg and Anxiety Depression Scale is an 18-item self-report symptom inventory developed (Goldberg et al., 1988). The short scale reduces the amount of time spent measuring depression and anxiety by medical providers and is particularly useful where non-psychiatrists are available (Goldberg et al., 1988). The scale emphasizes symptomatology and not clinical diagnosis in its respondents. Considering its ease of implementation, as it can be administered by a trained enumerator without medical or psychiatry training, it is a practical measure for remote and under-resourced areas.

Clinical cut-offs for affective disorders identify individuals requiring immediate clinical intervention. However, a broader approach is necessary to capture the presence of affective disorders in community settings. The use of binary scales in self-reported questionnaires is being challenged by a dimensional approach advocated by the National Institute for Mental Health's Research Domain Operating Criteria (Cuthbert and Insel, 2013). Likert responses, especially for sensitive questions in communities lacking clear definitions of affective symptomatology, can capture cultural nuances (Isaac et al., 2007; Stein and Seedat, 2007).

1.2. The present study

Using data from a large sample of parents in two regions in rural Côte d'Ivoire, we explore the following questions:

1. Does the Goldberg Anxiety and Depression Scale's two-factor structure of depressive and anxiety symptoms have adequate model fit in a sample of parents living in cocoa-farming communities in rural Côte d'Ivoire?
2. What sociodemographic characteristics predict depressive and anxiety symptoms?
3. Are these predictors different for male and female parents?

2. Methods

2.1. Participants and procedures

Data for this study were collected during the baseline interviews of a school-randomized trial testing the impacts of an education intervention program offered to parents and teachers in the Aboisso and Bouaflé regions of Côte D'Ivoire (see Lichand and Wolf, 2023). The program delivered text message nudges directly to parents' and teachers' mobile phones. The messages aimed to encourage parent engagement in their children's school life, focused on socio-emotional development (Lichand and Wolf, 2023). The participating schools were selected by the district education office, and randomly assigned to (1) receive one of four variations of the parent/teacher intervention, and (2) a control group. Classroom rosters were collected from which 25 students and their parents from grades CP2 and CE2 (i.e., grades 2 and 4, respectively) were randomly selected to participate in assessments. Parents were sampled from 100 schools, fifty from each region, with 1248 participants in Aboisso and 1223 in Bouaflé (see Fig. 1). In total, data from 2500 children and 2471 parents (of which 1459 are males and 1012 are females) were collected. Parents were contacted in advance to arrange for an in-person survey to be administered. All parent surveys and interviews were conducted in their homes or place of work based on the parents' preference. All parents received a bar of soap as a small gift for participating in the survey. Interviews were forward-backward translated from French to the relevant local language of the interviewee and administered by a trained enumerator with language fluency.

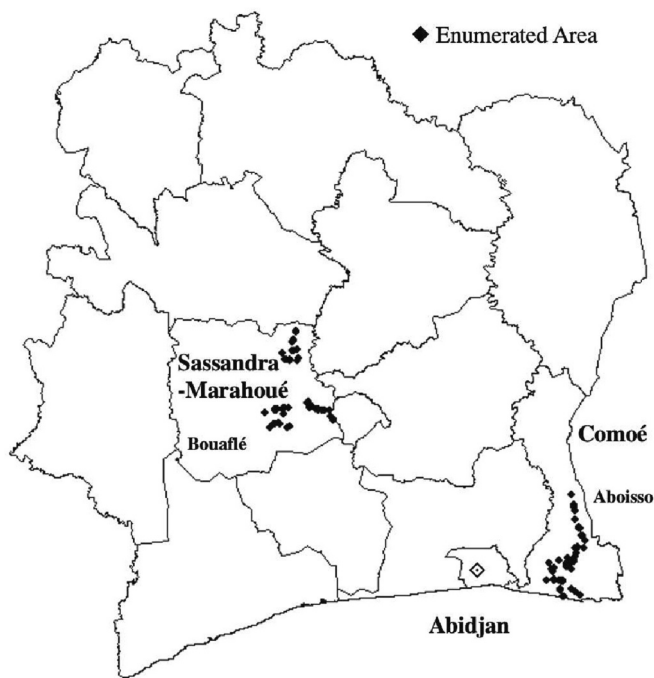Enumerators were hired through an internal roster of the data

Fig. 1. Map of enumerated areas in Côte D'Ivoire.

collection partner requiring they had previous experience working on data collection, held a university degree, were fully proficient in French and the local language of the survey area, and either possessed previous working experience or resided in the Bouaflé and Aboisso regions. They also completed 5 days of training, which included overview of the project and the questionnaire content, followed by a field practical component, where enumerators were sent to an area similar to the study area to test survey instruments.

2.2. Measures

2.2.1. Goldberg-18 Depression and Anxiety Symptoms

We used the Goldberg and Anxiety Depression Scale (collectively known as the GADS), an 18-item self-report symptom inventory (Goldberg et al., 1988), to measure participants' anxiety and depressive symptomatology. The GADS relies on two subscales, one for anxiety and one for depression, of nine binary (i.e., respond 'yes' or 'no') items each (total 18 items) over the past 4 weeks. We kept the two scores for depression and anxiety as continuous because specific cut-points for symptomatology may vary within LMICs (Patel, 2017). A time-based frequency scale was used; respondents were asked: 'how often in the last thirty days have you experienced *xyz* symptoms?' with a time-constrained Likert response of '*never (0), rarely (1), sometimes (2), often (3), always (4)*.' Such a scale captures a symptomatology spectrum (Aminpoor et al., 2012; Kiely and Butterworth, 2015; Patel, 2017). This method has been advocated for more than a decade with emphasis on LMIC settings and has been implemented and validated in LMICs (Aminpoor et al., 2012; Kumar et al., 2022; McGorry et al., 2014). Goldberg-18 is widely validated in binary scale in various cultural contexts (United Kingdom, Ecuador, Australia) but also has been implemented using the time-constrained Likert scale (Denmark, Iran, India) (Aminpoor et al., 2012; Holm et al., 2001; Kiely and Butterworth, 2015; Kinderman et al., 2015; Kumar et al., 2022; Reivan-Ortiz et al., 2019).

Item 7, '*How often, in the past month, have you been waking up early?*' was detected as a nuisance item: item mean score was 3.11 (on a scale of 0–4), while all other item means were around 1.7, had low-item correlation, and did not load onto any factor (see Appendix). This may be due

to the agricultural background of the community sampled: farmers may require waking up early due to their profession. The nuisance item was omitted from the final model in Table 2. There was adequate internal reliability for both depressive ($\alpha = 0.82$; 9 items) and anxiety symptom scales ($\alpha = 0.79$; 8 items). We extracted factor scores (hereafter referred to as f-scores) for all participants by conducting a confirmatory factor analysis, which are more advantageous than unjustified sum scores (McNeish and Wolf, 2020).

2.2.2. Female (gender)

Gender was reported by respondents during their in-person interviews. These data were transformed into a binary variable (female) where a 1 indicates the respondent is a female and a 0 indicates the respondent is a male.

2.2.3. Sociodemographic characteristics

Sociodemographic variables include highest level of completed schooling, age, child age, marital status, monthly income, and languages spoken in the household. Participants' education level, from primary to tertiary schooling, was reported by respondents and then re-coded to reflect years of education. If participants did not complete a level of education, the median number of education years within that level was added to the sum of years of education completed. Years of education ranged from 3 years (some primary schooling) to 19 years (completed tertiary schooling). Respondents' ages and their respective child ages are continuous variables ranging from 14 to 83 years and 4 to 15 years respectively. Respondents' marital status data were operationalized as 'married', 'divorced', 'separated', 'single', and 'widowed', but were simplified to a binary variable indicating 1 if the respondent was single, and 0 for all other options (about 5.6 % of the total sample was divorced, separated, or widowed, and 81.3 % were married). Respondents' monthly income data were collected as categorical options, where 1 indicates a salary of <10,000 West African Francs (XOF)/month, 2 indicates a salary between 10,000 and 20,000 XOF/month, 3 indicates a salary between 20,000 and 30,000 XOF/month, 4 indicates a salary between 30,000 and 50,000 CFA/month, 5 indicates a salary between 50,000 and 100,000 XOF/month, 6 indicates a salary between 100,000 and 200,000 XOF/month, and 7 indicates a salary over 200,000 XOF/ month. To treat this variable as continuous, we assigned participants the median value of their reported income range (for instance, if a participant reported receiving a salary between 30,000 and 50,000 XOF/ month, her income was re-coded as 40,000 XOF).

Lastly, respondents reported on the two most common household languages (French, Senoufo, Malinke, Agni, Baoule, Mande, and others). 73.8 % of the respondents reported speaking 2 or more languages. We grouped speakers of these languages into ethnic groups and used binary variables to indicate if a respondent spoke an ethnicity within each group (1 if they were a speaker, 0 if not): Mandinka (made up of Malinke, Mande, and Gouro speakers), Northern (Moore and Senoufo speakers), Eastern Central (Agni and Baoule speakers), and Other (those who speak a language other than those listed). The languages in the 'Other' category were Bété, Apolo, Anyin, Abure, Burkinabé, Ghanaian, and Benin languages. Notably, these groups belong to immigrant communities (Eberhard et al., 2022).

2.3. Statistical methods

We first used a confirmatory factor analysis to examine whether the two-factor structure of the GADS could be replicated in our sample of rural Ivorian parents, with the extracted factor scores to be used in our analytic models. We use observed data with no imputation for describing the participant referral statistics (Table 1). We used multiple imputation to handle missing data in the analytic models examining sociodemographic predictors (Table 2) specifically for the variables: respondent age (7.7 % missing), child age (13.0 % missing), and monthly income (11.9 % missing). Multiple imputation was completed

Table 1
Participant referral statistics based on sociodemographic characteristics.

Participant characteristics		% (total sample)	Requires Referral (%) *Goldberg-18 score > 21*	*p*-value
Sex	Male	59.0	85.2	< 0.001
	Female	41.0	90.5	
Age	Above mean age	43.8	86.8	< 0.001
	Below mean age	56.2	87.2	
Region	Aboisso	50.5	83.8	< 0.001
	Bouaflé	49.5	91.0	
Caregiver role	Mother	28.2	90.0	< 0.01
	Father	44.5	84.9	
	Grandparent	8.4	90.8	
	Sibling	5.6	84.6	
	Uncle/Aunt	13.3	89.6	
Education	Never been to school	41.2	91.9	< 0.001
	Primary	31.2	86.5	
	Lower Secondary	14.1	86.5	
	Upper Secondary	5.4	79.9	
	Post-Secondary	3.7	79.4	
	Tertiary	4.5	70.0	
Marital status	Married/Civil Partner	81.3	87.7	< 0.001
	Single	13.1	83.3	
	Divorced	0.9	95.2	
	Separated	1.2	83.3	
	Widowed	3.5	94.3	
Main source of income	Agriculture	46.3	90.7	< 0.001
	Fishing	0.6	60.0	
	Business Owner	3.2	88.8	
	Employed	7.2	8.4	
	Relies on Others	3.6	87.8	
	Miscellaneous	39.0	84.2	
Monthly income (XOF)	< 10,000	6.4	93.5	< 0.01
	10,000-20,000	15.9	92.2	
	20,000-30,000	15.8	90.7	
	30,000-50,000	20.8	89.9	
	50,000-100,000	22.6	85.7	
	100,000–200,000	11.0	82.9	
	> 200,000	7.5	76.1	
Ethnic origin[a]	Mandinka	69.5	85.1	< 0.05
	Northern	29.0	88.6	
	East Central	37.6	90.2	
	Other	16.6	82.2	
N = 2471			87.4	< 0.001

[a] Respondents may identify with more than one ethnic group, therefore total is over 100.

with Stata's chained regression imputation command using all other covariates and outcome variables. All estimates were computed using 20 data sets product of the multiple imputation procedure (using the "mi" command). This imputation approach meets the standards of the *What Works Clearinghouse Version 4.0 Standards Handbook* (Institute for Education Science (IES), 2017).

We used ordinary least squares (OLS) regressions with clustered standard errors within children's schools to examine the associations between sociodemographic characteristics and anxiety and depression symptomatology. To increase the ease of coefficient interpretation, we standardized the anxiety and depression factor scores. Our two main models predicted depression and anxiety symptomatology, separately. We then re-ran both models for males and females separately to examine differences in sociodemographic predictors for each group separately (total six regression models). To test for statistical differences in the coefficients for males and females, we also ran fully interacted models, which included an interaction with an indicator for female with all model predictors.

3. Results

3.1. Sample descriptives

Survey respondents were aged 40.4 years on average (*range = 14–83*). Fifty-nine percent were male, 81.3 % were legally married or in a common law relationship, and 41.2 % never attended formal schooling. The most reported primary source of income was agriculture (N = 46.3 %). In total, 26.8 % of respondents were mothers and 42.4 % were fathers. Additionally, 73.8 % reported speaking two or more languages, and the most spoken single language was Mandinka (N = 69.5 %).

3.2. Sample descriptive statistics and referral requirements

Table 1 displays descriptive statistics, as well as how different subgroups meet criteria requiring clinical referral based on the Goldberg-18. The cut-off for at-risk of a diagnosis of clinical depression was defined as the respondent scoring >21 out of 72 on the Goldberg-18 questionnaire. This cut-off is based on studies implementing this scale with Likert-scale responses replacing the binary yes/no responses in Iran and India (Aminpoor et al., 2012; Kumar et al., 2022).[1] Among respondents from the Aboisso region, 83.8 % screened as requiring further referral for depressive and anxiety symptoms, and in Bouaflé it was 91.0 %. Women were more likely to need referral than men (90.5 % vs. 85.2 %, *p* < 0.001), parents who have never been to school were at higher risk than those that completed primary school (91.9 % vs. 86.5 %, *p* < 0.001), earned lesser income (*p* < 0.01), relied on agriculture as a main source of income, or relied on others, as opposed to employed (90.7 %, 87.8 % vs 8.4 %, *p* < 0.001). The 40 % of respondents who defined their source of income as "miscellaneous" were primarily involved in various commercial activities (this could entail the sale of farming goods), and described their source of income as "commerce", or work in transport or technical services. Participants were more likely to require further referral if they belonged to the East Central ethnic group, as opposed to the "Other" ethnic group (90.2 % vs. 82.15 %, *p* < 0.05; Table 1).

3.3. Confirmatory factor analysis

Based on the prespecified subscales, we conducted a confirmatory factor analysis to assess the model fit in our sample for a two-factor model measuring depressive and anxiety symptoms. The final model showed acceptable fit based on recommended statistics (Hu and Bentler, 1999): CFI = 0.94, TLI = 0.93, RMSEA = 0.040, and SRMR = 0.035. The final factor scores for each domain were extracted and used in subsequent analyses and standardized.

3.4. Sociodemographic predictors of anxiety and depressive symptoms

The results suggest that anxiety and depression were largely associated with similar predictors. Table 2 presents the results from six OLS models predicting anxiety and depression scores.

All statistically significant predictors had similar associations with both depressive and anxiety symptom scores, except for single marital status (increased anxiety symptoms in women). Notably, belonging to certain ethnic groups had a strong association with experiencing the measured symptomatology. Belonging to the Mandinka ethnic group negatively predicted both depressive and anxiety symptom scores

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[1] This larger category has been emphasized to be inclusive of the dimensional approach: while clinical diagnoses help recognize which individuals require urgent care, the cut-off for requiring further referral includes those that may not be on the clinical spectrum but experience the deleterious effects of depression and anxiety symptoms in their daily life, thus compromising their caregiving abilities.

Table 2
OLS regression output for models predicting standardized anxiety and depressive symptomatology across full sample and sample subsets.

	Full sample		Female sample		Male sample	
	Anxiety	Depression	Anxiety	Depression	Anxiety	Depression
Characteristics						
Education	−0.03***	−0.03***	−0.03***	−0.03***	−0.03***	−0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Parent's age	0.01***	0.01***	0.01***	0.01***	0.01***	0.01***
	(0.002)	(0.002)	(0.00)	(0.003)	(0.003)	(0.002)
Child age	−0.01	−0.01	−0.002	−0.00	−0.01	−0.01
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
Single marital status	0.12*	0.10	0.13*	0.12	−0.10	−0.09
	(0.06)	(0.06)	(0.08)	(0.08)	(0.08)	(0.08)
Monthly income	−0.02***	−0.02***	−0.02***	−0.02***	−0.02***	−0.02***
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Ethnic groups						
Mandinka	−0.23***	−0.23***	−0.27***	−0.24***	−0.23***	−0.24***
	(0.05)	(0.05)	(0.08)	(0.08)	(0.07)	(0.06)
Northern	−0.09	−0.09	−0.11	−0.12	−0.01	−0.01
	(0.07)	(0.07)	(0.09)	(0.1)	(0.08)	(0.08)
East Central	0.02	0.00	0.03	0.02	0.07	0.05
	(0.06)	(0.06)	(0.08)	(0.08)	(0.07)	(0.07)
Other Language	−0.17***	−0.17***	−0.15*	−0.18**	−0.17**	−0.13*
	(0.06)	(0.06)	(0.09)	(0.08)	(0.07)	(0.07)
Constant	0.19***	0.21***	0.15	0.14	−0.01	0.04
	(0.13)	(0.13)	(0.20)	(0.20)	(0.18)	(0.18)
Observations (N)	2471	2471	1012	1012	1459	1459

Notes: Columns present the coefficients and robust standard errors (in parentheses) for all variables included in the respective regression models. Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Monthly income coefficient represents a unit increase per a 10,000 XOF increase.

(−0.24 SD), while belonging to the 'Other' ethnic group negatively predicted anxiety (−0.17 SD) and depressive symptoms (−0.16 SD). Monthly income had a similar protective effect for both, leading to a 0.02 SD decrease in anxiety symptomatology and a 0.02 SD decrease in depressive symptomatology per a salary increase of 10,000 XOF. Education (per year of schooling) also had a strong protective effect for both domains of interest. Having completed one additional year of schooling led to a 0.03 SD decrease in anxiety symptomatology and a 0.03 SD decrease in depressive symptomatology. In contrast, respondent age in years predicted increased anxiety and depressive symptom scores by 0.01 SDs per year. Lastly, single marital status was positively associated only with anxiety symptomatology scores for women (0.13 SD relative to married status).

3.5. Subgroup differences

Sociodemographic characteristics predicted depressive and anxiety symptomatology for both males and females similarly, with noteworthy differences in the association of single marital status and increased anxiety in women ($p < 0.01$). We ran two fully interacted models to test differences in predictors for males and females (Appendix Table A1). Only one interaction effect reached statistical significance, which was single marital status, for both depressive (b = 0.137, $p < 0.05$) and anxiety symptoms (b = 0.134, $p < 0.05$). The results suggest that being single has a negative association with both depressive and anxiety symptoms for females, but not for males. Examining the coefficients of the predictor for each subgroup separately (Table 2) suggests that being single was associated with fewer depressive and anxiety symptoms for males (p = n.s.).

4. Discussion

We assessed the prevalence and predictors associated with depressive and anxiety symptoms among parents in rural Côte d'Ivoire. The sample exhibits extremely high rates of symptomatology prevalence: 90.5 % of females and 85.2 % of males screened positive for requiring further referral for clinical diagnosis. Since this is a very high figure, it is important to note that we measure the prevalence of symptoms in the sample, and not clinical diagnoses. Such a generous understanding of symptomatology presence in a population helps in defining affective disorders across the spectrum of wellness through distress and disorder (Patel, 2017). This liberal approach casts a wide net and points to a trend of a disturbance in the general quality of life affecting almost everybody in the study sample. These are also reflective of how SSA has the highest rate of depression in the world, ranging from 17 to 35 %, with women being at double the risk than men; unsurprisingly our findings point to a very high prevalence of symptomatology in a socioeconomically vulnerable group as included in this study (World Health Organization, 2016; Ferrari et al., 2013). Currently, the inclusion of clinically relevant symptoms is limited in mental health research in SSA. Therefore, future research can incorporate a similar model of symptomatology prevalence, in addition to clinical diagnosis, so that comparative studies can shed light on broader geographic trends.

We also find that most of the sociodemographic predictors examined align with the current literature. Generally, education level and monthly income serve as protective factors against depression and anxiety, while symptomatology increases with age ($p < 0.01$). Less formal education has commonly been associated with increased risk of depression (e.g., Araya et al., 2003; Patel and Kleinman, 2003; Lund et al., 2010; Peele and Wolf, 2020). Studies in LMICs consistently find relationships between socioeconomic status (education or poverty) and depression and anxiety symptoms (e.g., Das et al., 2007; Patel and Kleinman, 2003), with age also positively associated with women's depressive symptoms (e.g., Das et al., 2007; Guerra et al., 2016). The protective effects of income and education highlight the need for investing in education and poverty alleviation programs and further exploring these bi-directional mechanisms.

We also considered ethnic groups as a potential source of variation in depressive and anxiety symptomatology. Our results suggest that belonging to certain ethnic groups may predict protection against anxiety and depressive symptoms. Specifically, belonging to the Northern Mandinka, and immigrant ethnic group, was associated with lower incidence of symptomatology. These protective effects may reflect the socioeconomic standing of these ethnic groups in Ivorian society or ways

of life that are intrinsically associated with their belief systems. For instance, individuals belonging to the Southern ethnicity (identified in the "Other" group in this sample) are also more likely to be of higher socioeconomic class (Amponsah and Koga, 2022; Kiyaga-Mulindwa, 1980; Joshi et al., 1975). Elevated status and geopolitical power may contribute to lower depressive and anxiety symptoms for both men and women in this group ($p < 0.01$). On the other hand, Northern Mandinka tribes originate from neighboring Burkina Faso and have historically been denied equal access to education and employment. However, the Mandinka, prioritize Islamic and spiritual living with an emphasis on a growth mindset highlighted in their rich musical traditions (Thomson, 2012). Islam has played a central role in identifying the Mandinka as a supranational ethnic group that transcended individual tribal affiliations or country boundaries (Thomson, 2012), suggesting they are a group important to consider and study across contexts. These results contribute to a growing literature suggesting that in Africa, a continent with a wide variety of ethnic groups, the consideration of ethnicity and cultural definitions of wellbeing and mental health are particularly relevant to understanding mental disorders in context (e.g., Kirmayer et al., 2017; Kpanake, 2018). Previous research documents that people belonging to certain ethnic groups are more likely to seek health and mental health care in countries in West Africa, like Côte D'Ivoire and Ghana (Read and Doku, 2012). However, attempts to measure mental health and distress still lack consideration for ethnic group belonging (e. g., Ventevogel and Faiz, 2018) and may include items that are not culturally appropriate (Kirmayer et al., 2017).

Our results also suggest that single mothers are at increased risk of experiencing anxiety symptoms in Côte d'Ivoire. This association between single marital status and anxiety aligns with prior research in high-income contexts (Leach et al., 2013; Ta et al., 2017). The research on maternal mental health in LMICs, however, largely focuses on depression (e.g., Atif et al., 2015), especially that of young mothers (Parsons et al., 2012). We find no association between single marital status and depression, which is not congruent with previous findings from LMICs. For instance, both depression and anxiety were associated with being single among pregnant single mothers in Tanzania (Ngocho et al., 2019).

The findings point to several directions for future research. First, qualitative research with interdisciplinary underpinnings is needed to shed light on the mechanisms behind the observed associations. Second, future understanding of the implications of parent mental health on children's development in LMICs with growing child populations is needed. Exploring the effects on parent-child interactions, for example, and subsequent child outcomes, helps to explain the mental health of parents as a dynamic social phenomenon, and not as an isolated clinical condition. Third, future research should explore the comparative implementation of binary versus Likert scale categorization of symptomatology to move away from a "one size fits all" approach of clinical categorization considering the complex social manifestations of symptomatology. Moving forward with more tailored and culturally appropriate tools to capture mental health constructs is a justice-oriented practice, and an underexplored lens in clinical research. Finally, studies examining predictors of symptomatology could consider using a stepwise approach in regression analysis to help disentangle correlations and causal relations among the predictors.

5. Limitations and conclusions

This study's results should be interpreted considering its limitations. First, for pragmatic reasons, the questionnaire was administered in the same original order to all participants as the Goldberg-18. A randomized administration order would have controlled for order effects. Second, we did not include a comparative study of whether the Likert or the traditional Goldberg-18 binary scale administered in the same population would have generated a different factor structure. A comparison of results of the factor structure could further the current knowledge base and is encouraged for future research. Third, this study relied on cross-sectional data, though longitudinal data may be more useful to study these phenomena. There is an existing need for longitudinal studies in this field. Fourth, other than income and education levels, other indicators of socioeconomic status were not included, such as an individual's health, financial or food insecurity, housing conditions, exposure to violence, and social networks. Using a Multidimensional Poverty Index for capturing household poverty is growing in popularity, as it considers the lack of critical assets for human development across multiple domains (OPHI, 2018). This work builds on the Alkire-Foster method of measuring multidimensional poverty recently incorporated in the United Nations Sustainable Development Goals (Alkire and Foster, 2011).

Our study suggests that mental health should be of greater focus for government and non-profit programs targeting rural families in West Africa given its interconnectedness to sociodemographic characteristics and socioeconomic status. Our findings emphasize the need for more investigation on poverty alleviation interventions that target socioeconomic status (Ridley et al., 2020; Zimmerman et al., 2021).

CRediT authorship contribution statement

AK and SW contributed to the design of the research questions. AK lead the analysis and writing with support of SW and GL. BB contributed to data analysis and manuscript writing.

Declaration of competing interest

The authors have no conflicts of interest to declare.

Appendix A

Table A1
Fully interacted OLS regression model output predicting standardized anxiety and depression symptomatology.

	Anxiety	Depression
Female	0.16	0.10

(continued on next page)

Table A1 (*continued*)

	Anxiety	Depression
	(0.28)	(0.28)
Education	−0.02***	−0.02***
	(0.01)	(0.01)
Female × Education	−0.01 (0.01)	−0.01 (0.01)
Age	0.01***	0.01***
	(0.00)	(0.00)
Female × Age	0.00	0.00
	(0.00)	(0.00)
Child Age	−0.01	−0.01
	(0.01)	(0.01)
Female × Child Age	0.01	0.00
	(0.02)	(0.02)
Single	−0.10	−0.09
	(0.08)	(0.08)
Female × Single	**0.23****	**0.22****
	(0.10)	**(0.10)**
Monthly Income	−0.02***	−0.02***
	(0.01)	(0.01)
Female × Monthly Income	−0.01	−0.00
	(0.01)	(0.01)
Mandinka	−0.23***	−0.24***
	(0.07)	(0.06)
Female × Mandinka	−0.04	0.00
	(0.10)	(0.09)
Northern	−0.01	−0.00
	(0.08)	(0.09)
Female × Northern	−0.10	−0.11
	(0.12)	(0.12)
Eastern Central	0.07	0.05
	(0.07)	(0.07)
Female × Eastern Central	−0.04	−0.03
	(0.11)	(0.11)
Other Language	−0.17**	−0.13*
	(0.07)	(0.07)
Female × Other	0.02	−0.05
	(0.10)	(0.10)
Constant	−0.01	0.04
	(0.18)	(0.18)
Observations	2471	2471

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