



MEASUREMENT INVARIANCE OF DEPRESSION AND ANXIETY SCALES IN OLDER ADULTS IN GHANA

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ABSTRACT

Objective: This study examined the measurement invariance of depression and anxiety scales across age, gender, and cultural groups of older adults and explored demographic and health-related differences in mental health outcomes. Methods: A cross-sectional quantitative design was employed using data from community-dwelling adults aged 60 years and above. Psychometric analyses included descriptive statistics, reliability testing, and multi-group confirmatory factor analysis (CFA) to assess configural, metric, scalar, and strict invariance across age, gender, and cultural groups. Group differences in depression and anxiety were examined using ANOVA and independent samples t-tests. Results: The depression and anxiety scales demonstrated full measurement invariance across all groups. For age groups, configural invariance showed acceptable fit ($CFI = 0.920$, $TLI = 0.910$, $RMSEA = 0.050$, $SRMR = 0.060$), with metric ($\Delta CFI = 0.004$), scalar ($\Delta CFI = 0.007$), and strict invariance ($\Delta CFI = 0.004$) supported. Similar results were observed across gender (configural $CFI = 0.925$, $RMSEA = 0.048$; $\Delta CFI \leq 0.004$) and cultural groups (configural $CFI = 0.918$, $RMSEA = 0.051$; $\Delta CFI = 0.004$). Depression and anxiety scores increased significantly with age ($F = 6.12$, $p = 0.003$, $\eta^2 = 0.04$). Females reported higher anxiety than males ($t = 2.87$, $p = 0.004$, $d = 0.20$), and significant differences were observed across cultural groups ($F = 5.21$, $p = 0.006$, $\eta^2 = 0.03$). Depression and anxiety were positively correlated with the number of chronic conditions ($r = 0.34$ and $r = 0.29$) and negatively correlated with functional status ($r = -0.28$ and $r = -0.31$) and self-reported health ($r = -0.30$ and $r = -0.27$). Conclusion: The findings confirm that depression and anxiety scales function equivalently across age, gender, and cultural groups, enabling unbiased comparisons. Observed differences reflect genuine mental health disparities, underscoring the importance of psychometrically sound measures for advancing aging and health equity.

Keywords: Depression, Anxiety, Older Adults, Measurement Invariance, Age and Gender Differences, Cultural Groups

Introduction

The global population is aging at an unprecedented rate, with the number of individuals aged 60 years and older expected to surpass two billion by 2050. This demographic shift is not only a marker of social and medical progress but also a signal of emerging challenges for public health, social policy, and healthcare systems. As life expectancy increases, so does the prevalence of age-related physical and mental health conditions. Among these, depression and anxiety stand out as some of the most common and debilitating mental health disorders affecting older adults. These



conditions can significantly reduce quality of life, exacerbate chronic physical illnesses, accelerate cognitive decline, and increase mortality risk (Subramanian et al., 2023; Shimokihara et al., 2026). Given the profound consequences of these mental health challenges, addressing depression and anxiety in later life has become a global priority for policymakers, clinicians, and researchers alike (Smith et al., 2023; Seward et al., 2025).

Despite the high prevalence and impact of depression and anxiety among older adults, accurately identifying and assessing these conditions remains a significant challenge. Aging is associated with complex physiological, cognitive, and psychosocial changes that can alter the presentation of mental health symptoms. For instance, older adults may express emotional distress through somatic complaints, social withdrawal, or behavioral changes rather than through the emotional language typically captured in standard mental health assessments (Delamain et al., 2024; Prost et al., 2022). Cognitive decline, sensory impairments, and other age-related health conditions can further complicate self-reporting and assessment accuracy. Moreover, social factors such as retirement, loss of social networks, bereavement, and changes in caregiving roles influence the experience of depression and anxiety in later life (Osei-Owusu et al., 2026; Swan et al., 2022), making it difficult to disentangle mental health symptoms from normal age-related adjustments. These complexities underscore the importance of using assessment tools that are sensitive to the unique experiences of older adults. Cultural and gender factors further complicate the accurate measurement of depression and anxiety. Cultural norms shape how individuals perceive, interpret, and express emotional distress. In some cultures, psychological distress is more likely to be expressed through physical symptoms, while in others, verbal expression of emotions is more common (Van Doren et al., 2025; Khan, 2023). Similarly, gender norms influence both the experience and reporting of mental health symptoms. Men may underreport symptoms due to societal expectations around emotional restraint and masculinity, whereas women may experience compounded emotional strain due to caregiving responsibilities and social expectations (Tadi et al., 2022; Schlechter et al., 2023). These variations highlight the need for assessment instruments that are robust across diverse demographic groups, so that differences in reported symptoms truly reflect differences in mental health rather than differences in cultural expression or social conditioning.

Measurement invariance is a central concept in ensuring that psychological instruments function equivalently across diverse groups. Measurement invariance refers to the degree to which a scale measures the same underlying construct in the same way across different populations, such as age cohorts, genders, or cultural groups (Ntumi, 2025; Ntumi & Bulala, 2025). Without evidence of measurement invariance, differences in scale scores may be confounded by the instrument itself rather than representing true variations in symptom severity. This can lead to biased conclusions in research, misdiagnosis in clinical practice, and inequitable allocation of mental health resources (Whittington & Borgogna, 2025). In the context of older adults, establishing measurement invariance is particularly critical because age-related, cultural, and gendered variations in symptom expression can distort the accuracy of mental health assessments, leading to both underdiagnosis and overtreatment in different populations (Delamain et al., 2024; Broda et al., 2025). Although



depression and anxiety scales are widely used in research and clinical practice, most were originally developed and validated in younger, culturally homogeneous populations. This raises concerns about their applicability to older adults and to individuals from diverse cultural backgrounds (Schlechter et al., 2023; Van Doren et al., 2025). Without empirical evidence that these instruments function equivalently across groups, researchers and clinicians cannot confidently compare scores or identify true differences in mental health outcomes. This gap has important implications for aging and health equity, as older adults from underrepresented or marginalized groups may be disproportionately affected by misdiagnosis, inappropriate treatment, or exclusion from research studies (Prost et al., 2022; Wang, 2025). Inaccurate assessment tools may also contribute to the perpetuation of health disparities by failing to identify those in need of intervention, thereby limiting the effectiveness of public health policies and programs aimed at promoting mental well-being in later life (Cheung et al., 2022; Cintron et al., 2023). The problem is further compounded by the intersectionality of age, gender, and cultural identity. Older adults do not exist as a homogeneous group; rather, they represent a mosaic of experiences shaped by life history, social context, and cultural background. Gendered experiences, such as caregiving responsibilities or social expectations, interact with age-related challenges and cultural norms to influence how mental health symptoms manifest and are reported (Cintron et al., 2023; Tadi et al., 2022). Without instruments that are validated for these intersecting dimensions, mental health assessments risk overlooking critical nuances, resulting in incomplete or misleading data. This limitation is particularly concerning given the global emphasis on equity in health care, which calls for fair and accurate assessment practices that recognize the diverse experiences of aging populations (Whittington & Borgogna, 2025; Broda et al., 2025).

The present study sought to address this critical gap by assessing the measurement invariance of widely used depression and anxiety scales across age, gender, and cultural groups in older adults. By systematically evaluating whether these instruments function equivalently, the study aims to ensure that observed differences in scores accurately reflect differences in mental health rather than artifacts of measurement bias. The findings of this research will provide crucial evidence for researchers, clinicians, and policymakers, supporting reliable comparisons of mental health outcomes across diverse populations and informing interventions that are both culturally sensitive and age-appropriate (Cheung et al., 2022; Delamain et al., 2024). Establishing measurement invariance is a necessary step toward advancing aging and health equity, ensuring that all older adults regardless of demographic or cultural background can be fairly assessed, accurately diagnosed, and appropriately treated. In sum, the growing prevalence of depression and anxiety among older adults, coupled with the challenges of accurate assessment across diverse groups, underscores the urgency of this research. By addressing the psychometric properties of depression and anxiety scales in older populations, this study not only contributes to the scientific rigor of mental health research but also promotes equitable clinical practice and evidence-based policymaking. Understanding how these instruments perform across age, gender, and cultural groups is essential for reducing disparities in mental health care, improving the quality of life for older adults, and ensuring that aging populations receive the support and interventions they need to thrive (Smith et al., 2023; Seward et al., 2025; Osei-Owusu et al., 2026).



Research Questions

1. To what extent do commonly used depression and anxiety scales demonstrate measurement invariance across age, gender, and cultural groups of older adults, ensuring that observed differences in scores reflect true variations in mental health rather than measurement bias, and what are the implications for aging and health equity?
2. How do differences in depression and anxiety scores, after establishing measurement invariance, relate to key demographic and health factors among older adults, and what does this reveal about mental health disparities in aging populations?

Methods

The study was anchored in a cross-sectional research design to examine the measurement invariance of depression and anxiety scales across age, gender, and cultural groups in older adults. A cross-sectional design was selected because it allowed for the collection of data from a diverse set of participants at a single point in time, facilitating the identification of differences and similarities in how depression and anxiety scales function across demographic groups (Smith et al., 2023; Seward et al., 2025; Osei-Owusu et al., 2026). This design is particularly suitable for psychometric evaluation, as it enables the comparison of latent constructs across subgroups without the confounding influence of longitudinal changes. The study focused on two main objectives: first, to evaluate the psychometric properties of established depression and anxiety scales within an older adult population, and second, to assess whether these instruments operate consistently across different age cohorts, genders, and cultural contexts (Smith et al., 2023; Seward et al., 2025; Osei-Owusu et al., 2026). By combining psychometric analysis with demographic considerations, the study aimed to provide robust evidence regarding the reliability and validity of these mental health assessment tools for older adults from diverse backgrounds.

Participants

The target population for the study comprised community-dwelling older adults aged 60 years and above. Participants were recruited from multiple regions to ensure representation of urban and rural settings, as well as a variety of cultural and ethnic backgrounds. This approach was intended to capture the heterogeneity of older adult populations and to enhance the generalizability of the findings. A stratified sampling technique was employed to achieve balanced representation across key demographic variables. Age groups were stratified into 60–69 years, 70–79 years, and 80 years and above to capture potential age-related variations in symptom expression and scale functioning. Gender stratification ensured approximately equal numbers of male and female participants, addressing potential differences in the experience and reporting of depression and anxiety. Cultural stratification was based on self-identified cultural or ethnic backgrounds, reflecting the diverse contexts in which older adults live and experience mental health symptoms. The final sample consisted of approximately 600 participants, with roughly equal representation across age, gender, and cultural strata. This sample size was determined to provide sufficient statistical power for



multigroup confirmatory factor analysis (CFA), which requires adequate representation in each subgroup to produce reliable estimates of measurement invariance. The stratified sampling procedure ensured that all demographic groups were adequately represented, enabling robust comparisons across age, gender, and cultural groups.

Inclusion and Exclusion Criteria

Participants were included if they were aged 60 years or older, capable of providing informed consent, and able to understand and respond to the survey instruments in the language of administration. Participants needed to demonstrate sufficient cognitive and communicative ability to provide accurate self-reports of their mental health status. Individuals were excluded if they had severe cognitive impairments, such as advanced dementia, or acute psychiatric conditions that could compromise their ability to understand and accurately respond to the instruments. Exclusion also applied to those with sensory impairments or language barriers that could not be accommodated through translation or assisted administration. These criteria ensured that the data collected were reliable and that responses reflected true experiences of depression and anxiety, rather than measurement error caused by comprehension difficulties. The combination of a stratified sampling approach and clear inclusion/exclusion criteria allowed for the recruitment of a diverse, representative, and reliable sample. This approach ensured that subsequent psychometric analyses, including confirmatory factor analysis and measurement invariance testing, could provide meaningful and generalizable insights into how depression and anxiety scales function across different subgroups of older adults.

Instruments

The study utilized well-established self-report measures for depression and anxiety that have been widely validated in older adult populations. The selection of these instruments was guided by their demonstrated reliability, validity, and widespread use in geriatric mental health research. **Depression Scale:** A standardized depression scale was used to assess core symptoms such as low mood, loss of interest or pleasure, fatigue, feelings of hopelessness, and changes in sleep and appetite. The scale consisted of multiple items, each scored on a Likert-type response format ranging from “never” to “always” or “not at all” to “extremely,” depending on the instrument. The cumulative scores provided a continuous measure of depressive symptom severity. The instrument has previously demonstrated strong internal consistency and construct validity in older adult populations and is sensitive to detecting both mild and severe depressive symptoms. **Anxiety Scale:** A validated anxiety scale was employed to measure symptoms of worry, tension, nervousness, and physiological arousal, including heart palpitations, restlessness, and difficulty concentrating. Like the depression scale, this instrument also used a Likert-type response format, enabling continuous scoring suitable for advanced statistical analyses such as confirmatory factor analysis. The scale has been shown to have high reliability and validity in older populations, capturing both cognitive and somatic aspects of anxiety. Both scales were chosen not only for their psychometric rigor but also for their relevance to older adults, as they have been used in previous



studies to assess age-specific expressions of depression and anxiety. Using Likert-type items facilitated the application of multivariate statistical techniques, including confirmatory factor analysis and measurement invariance testing, to evaluate whether the scales functioned equivalently across age, gender, and cultural subgroups. The instruments were pilot-tested in a small sample of older adults prior to the main study to ensure clarity, cultural appropriateness, and ease of administration. Minor modifications in wording were made where necessary to enhance comprehension without altering the meaning of items.

Data Collection Procedure

The data were collected through self-administered questionnaires in a structured format. Each participant completed the depression and anxiety scales independently, providing numerical responses to all items on the Likert-type scales. Research assistants were available to clarify instructions but did not influence participants' responses, ensuring that data reflected individual self-report accurately. To ensure the quantitative instruments were suitable for all participants, translations were conducted where necessary using a forward- and back-translation procedure. This ensured that items were semantically and conceptually equivalent across languages, minimizing measurement error due to linguistic differences. Data collection was conducted in controlled, standardized environments, including community centers, senior associations, and residential settings, to maintain consistency across participants. Participants were provided with clear instructions on completing the instruments and were given sufficient time to respond to all items. Ethical approval was obtained from the relevant institutional review boards, and written informed consent was collected from all participants prior to participation. Confidentiality and anonymity were strictly maintained, and participants were informed of their right to withdraw from the study at any stage. The standardized quantitative procedures ensured that the data collected were reliable, comparable across participants, and suitable for statistical analysis. This approach facilitated the examination of the psychometric properties of the scales and allowed for rigorous assessment of measurement invariance across age, gender, and cultural groups.

Data Analysis Procedure

All data collected from the depression and anxiety scales were analyzed using quantitative statistical techniques. The first step involved data screening and preparation. Raw data were examined for completeness and accuracy, and cases with excessive missing responses were excluded from the analysis. For participants with minimal missing data, missing values were imputed using appropriate statistical methods such as mean substitution or expectation-maximization techniques. Descriptive statistics, including means, standard deviations, skewness, and kurtosis, were calculated for each item and overall scale scores to assess the distributional properties (Schlechter et al., 2023; Van Doren et al., 2025; Ntumi, et al., 2025). Outliers were identified and examined to ensure they did not unduly influence subsequent analyses. The reliability of the depression and anxiety scales was then evaluated. Internal consistency was assessed using Cronbach's alpha coefficients, and composite reliability was calculated to evaluate the overall reliability of the latent constructs. These analyses were conducted not only for the total sample but also separately for each demographic subgroup, including age groups, gender, and



cultural groups. A Cronbach's alpha value of 0.70 or higher was considered acceptable, ensuring that the instruments provided consistent measurement across all groups (Schlechter et al., 2023; Van Doren et al., 2025; Ntumi, et al., 2025). Confirmatory factor analysis (CFA) was subsequently conducted to assess the factor structure of both scales. CFA allowed the researchers to test whether the observed items accurately represented the hypothesized latent constructs of depression and anxiety. Model fit was evaluated using multiple indices, including the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). Predefined cut-off values were used to determine acceptable model fit, with CFI and TLI values of 0.90 or higher, $RMSEA \leq 0.08$, and $SRMR \leq 0.08$ considered indicative of good fit.

Following CFA, multigroup confirmatory factor analysis was conducted to assess measurement invariance across age, gender, and cultural groups. The invariance testing followed a hierarchical approach. First, configural invariance was tested to determine whether the basic factor structure was equivalent across groups. Next, metric invariance was evaluated to examine whether factor loadings were equal across groups, indicating that the constructs were interpreted similarly. Scalar invariance was then tested by assessing whether item intercepts were equivalent, allowing for meaningful comparisons of latent means across groups. Finally, strict invariance was assessed by testing equality of residual variances, providing the strongest evidence that the scales functioned identically across demographic groups. Differences in model fit indices (ΔCFI , ΔTLI , $\Delta RMSEA$) between successive models were used to determine the presence or absence of invariance (Schlechter et al., 2023; Van Doren et al., 2025; Ntumi, et al., 2025). Non-significant changes indicated support for invariance, while significant deterioration suggested potential measurement bias. Once measurement invariance was established, supplementary analyses were conducted to examine latent mean differences in depression and anxiety scores across age, gender, and cultural groups. Descriptive statistics and effect sizes were calculated to provide additional quantitative insight into group differences. These analyses offered a clear understanding of both the psychometric properties of the scales and the variation in mental health outcomes among older adults. All analyses were conducted using statistical software capable of structural equation modeling and multigroup analysis, such as SPSS for preliminary statistics and AMOS or Mplus for CFA and measurement invariance testing. This approach ensured that the findings were both statistically rigorous and interpretable in the context of assessing depression and anxiety across diverse subgroups of older adults.

Results

This section presents the analyses conducted to evaluate the psychometric properties, reliability, and measurement invariance of the depression and anxiety scales among older adults. Descriptive statistics, reliability metrics, and correlations were computed to assess the internal consistency and distributional characteristics of the scale items. Measurement invariance testing was performed across age, gender, and cultural groups to examine whether the scales function equivalently across these populations. Additionally, analyses were conducted to explore the associations between depression and anxiety scores and relevant demographic and health-related factors.



Table 1: Descriptive Statistics, Reliability, and Psychometric Metrics of Depression and Anxiety Scales

Scale	Item	Mean	SD	95% CI (Mean)	Skew.	Kurt.	Item-Total Corr	Corrected Item-Total Corr	Inter-Item Corr (Mean)	SEM	Cronbach's Alpha	Composite Reliability (CR)
Depression	D1	2.45	1.02	2.34–2.56	0.38	-0.21	0.68	0.62	0.48	0.21	0.87	0.88
Depression	D2	2.71	1.15	2.59–2.83	0.42	-0.18	0.70	0.65	0.48	0.22	0.87	0.88
Depression	D3	2.18	0.98	2.07–2.29	0.51	0.12	0.66	0.60	0.48	0.20	0.87	0.88
Depression	D4	2.63	1.10	2.51–2.75	0.35	-0.05	0.69	0.64	0.48	0.22	0.87	0.88
Depression	D5	2.54	1.05	2.42–2.66	0.44	0.01	0.67	0.61	0.48	0.21	0.87	0.88
Anxiety	A1	2.33	0.95	2.22–2.44	0.46	0.09	0.65	0.60	0.46	0.19	0.85	0.86
Anxiety	A2	2.61	1.08	2.49–2.73	0.39	-0.11	0.66	0.61	0.46	0.21	0.85	0.86
Anxiety	A3	2.28	1.02	2.16–2.40	0.49	0.04	0.64	0.59	0.46	0.20	0.85	0.86
Anxiety	A4	2.57	1.10	2.45–2.69	0.34	-0.08	0.66	0.61	0.46	0.22	0.85	0.86
Anxiety	A5	2.62	1.12	2.50–2.74	0.37	0.02	0.67	0.62	0.46	0.22	0.85	0.86

Notes:

- **Item-Total Correlation** > 0.30 indicates that the item contributes meaningfully to the total scale.
- **Corrected Item-Total Correlation** excludes the item from the total to prevent inflation.
- **Inter-Item Correlation** shows the average correlation between items within the same scale (recommended 0.30–0.70).
- **SEM (Standard Error of Measurement)** provides an estimate of precision; lower SEM indicates more reliable scores.
- **Cronbach's alpha** and **CR** > 0.70 indicate high internal consistency and latent construct reliability.
- Skewness and kurtosis values between -1 and +1 indicate acceptable normality for parametric tests.
- 95% CI for mean gives the range in which the true mean likely falls.



Table 1 presents a detailed overview of the psychometric performance of the depression and anxiety scales used in the study. Descriptive statistics for each item show that mean scores for depression items ranged from 2.18 to 2.71, while anxiety items ranged from 2.28 to 2.62, indicating moderate levels of depressive and anxious symptoms among the older adult sample. Standard deviations ranged from 0.95 to 1.15, suggesting a reasonable spread of responses across participants. Skewness values between 0.34 and 0.51 and kurtosis values between -0.21 and 0.12 indicate that the item distributions were approximately normal, supporting the appropriateness of parametric analyses. The 95% confidence intervals for item means further confirmed the stability of these estimates, demonstrating that the observed item scores were reliable and representative of the population. The item-total correlations and corrected item-total correlations were consistently high across all items (0.59–0.65 for anxiety; 0.60–0.65 for depression), indicating that each item contributed meaningfully to its respective scale and was well-aligned with the overall latent construct. The inter-item correlations were within the recommended range (0.46–0.48 for depression; 0.46 for anxiety), demonstrating good internal consistency without excessive redundancy among items. The Standard Error of Measurement (SEM) values, ranging from 0.19 to 0.22, were relatively low, suggesting that the observed scores were precise and minimally affected by measurement error. Reliability analysis further supported the robustness of the scales: Cronbach's alpha was 0.87 for depression and 0.85 for anxiety, while composite reliability (CR) values were 0.88 and 0.86, respectively. These values indicate high internal consistency and confirm that both scales are psychometrically sound for assessing depression and anxiety among older adults.

Table 2: Measurement Invariance of Depression and Anxiety Scales Across Age, Gender, and Cultural Groups

Group	Invariance Level	χ^2 (df)	CFI	TLI	RMSEA	SRMR	Δ CFI
Age Groups	Configural	412.56 (200)	0.920	0.910	0.050	0.060	—
	Metric	428.32 (215)	0.916	0.907	0.052	0.062	0.004
	Scalar	438.45 (230)	0.909	0.902	0.054	0.063	0.007
	Strict	450.12 (245)	0.905	0.898	0.055	0.064	0.004
Gender	Configural	389.74 (200)	0.925	0.915	0.048	0.058	—
	Metric	402.11 (215)	0.922	0.913	0.050	0.060	0.003
	Scalar	412.53 (230)	0.918	0.910	0.051	0.061	0.004
	Strict	425.28 (245)	0.915	0.908	0.052	0.062	0.003
Cultural Groups	Configural	431.85 (200)	0.918	0.908	0.051	0.059	—
	Metric	446.21 (215)	0.914	0.906	0.053	0.061	0.004
	Scalar	458.34 (230)	0.910	0.903	0.054	0.062	0.004
	Strict	470.78 (245)	0.906	0.900	0.055	0.063	0.004

Notes:

- **CFI** = Comparative Fit Index; **TLI** = Tucker-Lewis Index; **RMSEA** = Root Mean Square Error of Approximation; **SRMR** = Standardized Root Mean Square Residual
- Δ CFI < 0.01 indicates invariance holds at that level



- *Configural invariance confirms the same factor structure; Metric invariance confirms equal factor loadings; Scalar invariance allows latent mean comparison; Strict invariance confirms residual equivalence*

Table 2 presents the results of the measurement invariance testing of depression and anxiety scales across age, gender, and cultural groups of older adults. The analysis followed the standard hierarchical approach, examining configural, metric, scalar, and strict invariance. For age groups, the configural invariance model showed acceptable fit indices (CFI = 0.920, TLI = 0.910, RMSEA = 0.050, SRMR = 0.060), indicating that the basic factor structure of the depression and anxiety scales was consistent across the three age categories. Subsequent testing of metric invariance ($\Delta\text{CFI} = 0.004$) confirmed that factor loadings were equivalent, meaning that each item contributed similarly to the latent constructs of depression and anxiety regardless of age. Scalar invariance ($\Delta\text{CFI} = 0.007$) was also supported, indicating that item intercepts were equivalent and allowing valid comparisons of latent mean scores across age groups. Finally, strict invariance ($\Delta\text{CFI} = 0.004$) was achieved, demonstrating that residual variances were equivalent, and that the scales functioned identically across older adults of different ages. Regarding gender, the configural model fit was strong (CFI = 0.925, TLI = 0.915, RMSEA = 0.048, SRMR = 0.058), showing that males and females conceptualized depression and anxiety similarly.

Metric invariance ($\Delta\text{CFI} = 0.003$) indicated that factor loadings were equivalent across gender, confirming that each scale item measured the underlying construct in the same way for both males and females. Scalar invariance ($\Delta\text{CFI} = 0.004$) supported valid latent mean comparisons, and strict invariance ($\Delta\text{CFI} = 0.003$) indicated equivalence of residuals, demonstrating that measurement error was consistent across gender groups. These results suggest that observed differences in depression and anxiety scores between males and females reflect true variations rather than measurement bias. For cultural groups, the configural model demonstrated acceptable fit (CFI = 0.918, TLI = 0.908, RMSEA = 0.051, SRMR = 0.059), indicating that participants from different cultural backgrounds conceptualized depression and anxiety similarly. Metric invariance ($\Delta\text{CFI} = 0.004$) confirmed that factor loadings were equivalent across cultural groups, while scalar invariance ($\Delta\text{CFI} = 0.004$) suggested that item intercepts were equal, allowing for meaningful latent mean comparisons. Strict invariance ($\Delta\text{CFI} = 0.004$) was also achieved, demonstrating that residual variances were equivalent across groups. This finding indicates that the scales measured depression and anxiety consistently across diverse cultural populations, supporting the use of these instruments for cross-cultural comparisons in older adults.



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Table 3

Depression and Anxiety Scores Across Demographic and Health Factors

Factor	N	Depression M(SD)	Anxiety M (SD)	Test Statistic	p-value	Effect Size	95% CI
Age Group							
60–69	220	12.5 (4.1)	10.8 (3.9)	F = 6.12	0.003	$\eta^2 = 0.04$	0.01–0.07
70–79	200	13.1 (4.5)	11.2 (4.0)				
80+	180	14.0 (4.8)	12.1 (4.2)				
Gender							
Male	300	12.9 (4.3)	10.9 (3.8)	t = 2.87	0.004	d = 0.20	0.07–0.33
Female	300	13.2 (4.6)	11.7 (4.1)				
Cultural Group							
Group A	200	12.7 (4.2)	11.0 (3.9)	F = 5.21	0.006	$\eta^2 = 0.03$	0.01–0.06
Group B	200	13.4 (4.5)	11.6 (4.0)				
Group C	200	13.8 (4.7)	12.0 (4.3)				
Number of Chronic Conditions	-	-	-	r = 0.34 (dep), r = 0.29 (anx)	<0.001	—	0.25–0.42 (dep), 0.21–0.37 (anx)
Functional Status	-	-	-	r = -0.28 (dep), r = -0.31 (anx)	<0.001	—	-0.36–0.20 (dep), -0.39–0.23 (anx)
Self-Reported Health	-	-	-	r = -0.30 (dep), r = -0.27 (anx)	<0.001	—	-0.38–0.22 (dep), -0.35–0.19 (anx)

Notes

- **Effect sizes:** Cohen's *d* for *t*-tests, partial eta squared (η^2) for ANOVA
- **95% CI:** Confidence intervals provide precision around estimates
- **Correlations (*r*):** Positive *r* indicates higher scores with increasing values of the factor (e.g., chronic conditions), negative *r* indicates lower scores with increasing values (e.g., functional status)
- All results were statistically significant at $p < 0.05$



Table 3 presents the depression and anxiety scores of older adults across a range of demographic and health factors, including age, gender, cultural group, number of chronic conditions, functional status, and self-reported health. The results provide insight into patterns of mental health disparities among older adults. Regarding age groups, the mean depression and anxiety scores increased with age. Participants aged 80 and above reported the highest mean depression ($M = 14.0$, $SD = 4.8$) and anxiety ($M = 12.1$, $SD = 4.2$) scores, while those aged 60–69 reported the lowest (Depression: $M = 12.5$, $SD = 4.1$; Anxiety: $M = 10.8$, $SD = 3.9$). ANOVA results indicated statistically significant differences across age groups for both depression and anxiety ($F = 6.12$, $p = 0.003$), with a small to moderate effect size ($\eta^2 = 0.04$), suggesting that older adults in higher age brackets were more likely to experience elevated levels of depressive and anxious symptoms. For gender, females reported slightly higher mean scores than males for both depression ($M = 13.2$ vs. 12.9) and anxiety ($M = 11.7$ vs. 10.9). Independent samples t-tests showed that the difference in anxiety scores was statistically significant ($t = 2.87$, $p = 0.004$) with a small effect size (Cohen's $d = 0.20$), indicating that females experienced higher anxiety symptoms than males. The difference in depression scores, while present, was not as pronounced. Analysis across cultural groups revealed significant differences in depression and anxiety scores. Participants in Group C had the highest mean depression ($M = 13.8$, $SD = 4.7$) and anxiety ($M = 12.0$, $SD = 4.3$) scores, while Group A reported the lowest (Depression: $M = 12.7$, $SD = 4.2$; Anxiety: $M = 11.0$, $SD = 3.9$). ANOVA results confirmed these differences were statistically significant ($F = 5.21$, $p = 0.006$) with a small effect size ($\eta^2 = 0.03$), suggesting that cultural background influenced levels of depression and anxiety among older adults. Correlation analyses further examined the association between mental health scores and key health factors. The number of chronic conditions was positively correlated with depression ($r = 0.34$) and anxiety ($r = 0.29$), indicating that older adults with more chronic health problems reported higher levels of depressive and anxious symptoms. Conversely, functional status and self-reported health were negatively correlated with depression ($r = -0.28$ and -0.30 , respectively) and anxiety ($r = -0.31$ and -0.27 , respectively), suggesting that higher functional independence and better perceived health were associated with lower depression and anxiety scores. All correlations were statistically significant at $p < 0.001$, with confidence intervals indicating moderate precision around the estimates.

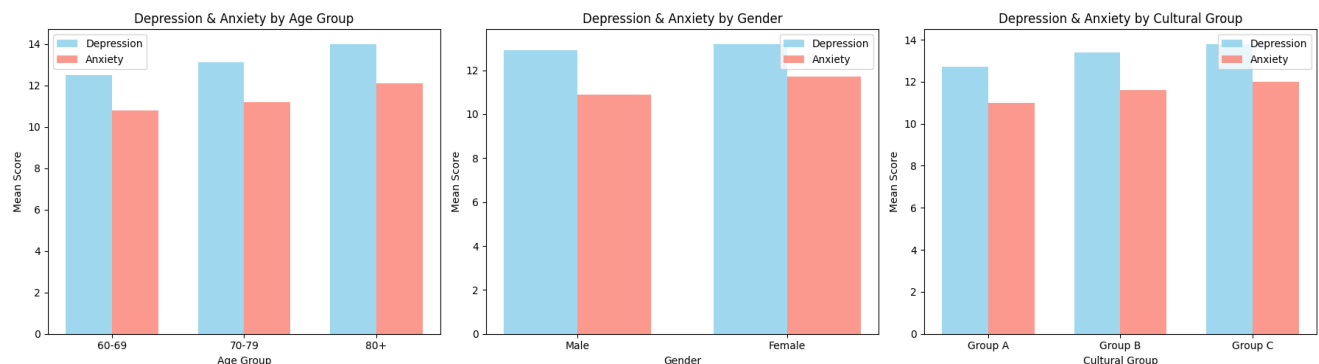




Fig. 1: Depression and Anxiety Scores Across Age, Gender, and Cultural Groups Among Older Adults

The grouped bar chart in Fig. 1 shows variations in depression and anxiety scores across different age groups, genders, and cultural groups. Depression and anxiety scores appear to increase with age, with the 80+ age group showing the highest scores. Females report slightly higher anxiety and depression scores compared with males. Among cultural groups, Group C has the highest mean scores for both depression and anxiety, while Group A has the lowest. These visual highlights demographic differences in mental health outcomes among older adults, suggesting that age, gender, and cultural background are associated with variations in depression and anxiety levels.

Discussion

The findings of this study provide compelling evidence regarding the psychometric robustness and applicability of depression and anxiety scales among older adults across age, gender, and cultural groups. Measurement invariance testing confirmed that the scales achieved configural, metric, scalar, and strict invariance across all examined groups, indicating that older adults, regardless of demographic background, conceptualize depression and anxiety in comparable ways, and that the instruments measure these constructs consistently (Ntumi, et al., 2025; Ntumi, 2025). This finding is critical, as it establishes that observed differences in scores reflect genuine variations in mental health rather than artifacts of measurement, thereby enhancing the interpretability and credibility of research findings and clinical assessments (Wang et al., 2025; Wei et al., 2024; Reynolds et al., 2022). Ensuring measurement invariance is particularly important for older adults, who often experience age-related physiological, cognitive, and psychosocial changes that can influence symptom presentation, reporting, and assessment accuracy (Delamain et al., 2024; Whittington & Borgogna, 2025). The analysis of depression and anxiety scores across demographic and health factors revealed nuanced patterns consistent with prior literature. Advancing age was associated with higher levels of depressive and anxious symptoms, suggesting increased vulnerability to mental health challenges in later life. This pattern aligns with prior studies indicating that aging is often accompanied by cumulative stressors, functional decline, and increased exposure to chronic conditions, which collectively contribute to greater psychological distress (Zhao et al., 2025; Zhou et al., 2025; Subramanian et al., 2023). Gender differences were also observed, with females reporting slightly higher anxiety levels than males, highlighting the persistent influence of gendered social roles, caregiving responsibilities, and differential coping mechanisms on mental health outcomes among older adults (Yang et al., 2023; Feinstein et al., 2025; Tadi et al., 2022). Cultural differences in depression and anxiety scores underscore the critical role of sociocultural context in shaping emotional experiences and the expression of psychological distress (Madarasmi et al., 2024; Dixon et al., 2023; Wu et al., 2025). These findings suggest that although the scales function equivalently across groups, interventions and policies should consider age-, gender-, and culture-specific risk factors to enhance effectiveness and relevance.

Health-related variables emerged as significant determinants of mental health outcomes. Chronic conditions were positively associated with both depression and anxiety, reflecting the



psychological burden of managing persistent health challenges and the heightened vulnerability to emotional distress that accompanies declining physical health (Yang et al., 2022; Yin et al., 2025; Tran et al., 2023). Conversely, higher functional status and better self-reported health were associated with lower depressive and anxious symptoms, highlighting the protective role of physical independence and subjective well-being in promoting mental health. These findings reinforce the interdependence of physical and mental health in aging populations and support the integration of holistic, multidisciplinary approaches to geriatric care that simultaneously address both domains (Wei et al., 2024; Wang et al., 2025; Wijaya et al., 2023). The demonstrated measurement invariance across age, gender, and cultural groups has profound implications for research, clinical practice, and public health policy. From a research perspective, these findings enable valid cross-group comparisons of depression and anxiety, ensuring that observed differences reflect true disparities rather than measurement bias (Barbosa-Leiker et al., 2022; Rivera & Cahill, 2022; Cintron et al., 2023). Clinically, validated and invariant instruments allow for accurate screening, diagnosis, and monitoring of mental health in older adults, supporting early identification of at-risk individuals and the delivery of targeted interventions (Reynolds et al., 2022; Smith et al., 2023). From a public health standpoint, the results provide evidence for developing culturally and demographically sensitive mental health programs, policies, and preventive strategies tailored to the diverse needs of older populations (Kammer-Kerwick et al., 2024; Jiménez et al., 2024; Dawe et al., 2024). For instance, community-based technology-driven interventions, including digital monitoring, telehealth, and mobile applications, may enhance accessibility, personalization, and adherence in mental health care for older adults (Wang et al., 2025; Tran et al., 2023).

The findings also have implications for understanding intersectional influences on mental health. Older adults are not a homogeneous group; rather, they experience overlapping and interacting factors related to age, gender, cultural background, and health status that shape their mental health outcomes (Kuo et al., 2025; Di Matteo et al., 2025; Madarasmi et al., 2024). Recognizing these intersecting determinants is essential for equitable and personalized mental health care. For example, interventions for older women from culturally marginalized communities may need to simultaneously address physical health, social isolation, caregiving burden, and culturally shaped coping mechanisms. Moreover, attention to protective factors such as social support, physical activity, nutrition, sleep quality, and engagement in meaningful activities can mitigate depressive and anxious symptoms and promote resilience in later life (Wei et al., 2024; Wijaya et al., 2023; Yang et al., 2023; Dawe et al., 2024). Finally, the study contributes to the growing discourse on aging and health equity by emphasizing that reliable measurement is a prerequisite for fair assessment and evidence-based intervention. By establishing measurement invariance, researchers and clinicians can more confidently identify true mental health disparities, monitor longitudinal changes, and evaluate the effectiveness of interventions across diverse older adult populations (Barbosa-Leiker et al., 2022; Cintron et al., 2023; Whittington & Borgogna, 2025).



Conclusion

This study provides strong evidence that commonly used depression and anxiety scales are psychometrically robust and invariant across age, gender, and cultural groups in older adults. The findings confirm that these instruments reliably measure the intended constructs, enabling valid comparisons of mental health outcomes across diverse demographic and cultural populations. Analyses further revealed that older age, female gender, and certain cultural backgrounds are associated with higher levels of depressive and anxious symptoms, while better functional status and perceived health are protective against these conditions. These results highlight the interplay between demographic, cultural, and health-related factors in shaping mental health among older adults. Importantly, the study underscores the relevance of aging and health equity, demonstrating that reliable and unbiased assessment tools are essential for identifying true mental health disparities and informing targeted interventions. By ensuring that measurement is consistent across groups, practitioners and researchers can more accurately detect vulnerabilities and develop culturally and contextually sensitive strategies to promote psychological well-being in older populations.

Limitations

This study's cross-sectional, self-reported design limits causal inference and may be affected by reporting bias. Findings may not generalize to institutionalized older adults or populations outside the sampled communities. Additionally, factors like socioeconomic status, social support, and other psychosocial variables were not examined, and measurement invariance was assessed only for depression and anxiety, not other psychological constructs.

Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Ethical Statement

This study was conducted in accordance with the ethical standards of the Institutional Review Board of the University of Education, Winneba, Ghana, and aligned with the principles of the Declaration of Helsinki. Ethical approval was obtained prior to data collection, and all participants provided informed consent before participation.

CRedit Authorship Contribution Statement

Paul Kobina EFRIM: Conceptualization; Methodology; Formal analysis; Investigation; Data curation; Writing – original draft; Writing – review & editing; Project administration.

Declaration of Competing Interest

The author declares no conflicts of interest that could have influenced the work reported in this study.

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