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RESEARCH ARTICLE

THE INTERPLAY OF ANXIETY, STRESS, AND DEPRESSIVE SYMPTOMS AMONG SEXUAL ORIENTATIONS IN ASIAN POPULATIONS

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ABSTRACT

BACKGROUND:

Healthcare management in modern society plays a crucial role in addressing both physical and mental health conditions, with depression being a prominent concern. Stress and anxiety were intercorrelated with depression, which is commonly reported among individuals of both genders. However, few studies have presented results on this interlink based on sexual orientation.

METHODS:

This study involved examining the association between stress, anxiety, and depressive symptoms, and the ability of anxiety and stress to predict depressive symptoms in a sample of 21,972 volunteer participants from Asian countries (Open-Source & Open-Source Psychometrics Project), who self-reported their mental health experiences in questionnaires on an online platform using the DASS-42 self-report questionnaire. Simple and multiple regression analyses were used to examine the interaction between the three emotional states across five sexual orientations.

RESULTS:

Across all five sexual orientations (heterosexual, bisexual, homosexual, asexual, and 'others'), anxiety has been found to be a significant predictor of stress (R2=0.68-0.73) and depressive symptoms (R2=0.64-0.72). Additionally, stress has been shown to be a significant predictor (R2=0.79-0.84) of depressive symptoms. Furthermore, the combination of stress and anxiety was a statistically significant predictor of depressive symptoms in individuals with all five sexual orientations. (Depressive symptoms = 1.26+0.76 stress+0.22 anxiety, R2= 0.66, $p < .001$). In other words, people with higher levels of anxiety and stress are more likely to develop depressive symptoms.

CONCLUSIONS:

This study confirms that anxiety and stress predict depression not only in a general population but also across sexual minority groups, suggesting that mental healthcare management should combine universal approaches addressing common risk factors and targeted interventions to respond to the unique determinants of mental health in sexual minority populations, especially stigma, discrimination, and social exclusion which differ from those in the general population.

KEYWORDS

depressive symptoms; anxiety; stress; sexual orientations; DASS-42

INTRODUCTION

Healthcare management plays a pivotal role in modern society, encompassing comprehensive care for physical health conditions and the intricate realm of mental and psychological consequences. Among the myriad of mental health challenges affecting individuals worldwide, depression stands out as an unparalleled concern. Many root causes of depression have been reported, particularly psychological distress, namely stress and anxiety.

Stress is an originator and contributor of depression resulting from several determinants, particularly the enduring impact of persistent environmental stressors and the lasting repercussions of traumatic childhood experiences and so forth [1]. Additionally, stress and anxiety are interconnected and result in negative mental health outcomes through behavioral and neural mechanisms [2]. For example, the activity of norepinephrine, on its way from the locus coeruleus, passes to the basolateral amygdala, which is accountable for anxiety that is induced by acute stress [2].

A previous study has indicated a direct and indirect interplay between stress, anxiety, and depressive symptoms [3]. The results showed that stress is a significant psychological pain that is linked to anxiety levels and strongly correlated with depressive symptoms levels with a standardized (β) of 0.43. [3]. A study conducted on a sample of participants from Australia and Norway found that anxiety plays a mediating role between depressive symptoms and stressful events [4]. There is a report indicating that up to 25% of patients visiting general practitioners are diagnosed with both depression and anxiety disorders. Significantly, nearly 85% of patients diagnosed with depression also suffer from anxiety, and 90% of those with an anxiety disorder also meet the criteria for depression [5]. Similar studies have found that approximately 58% of individuals diagnosed with depression in the United States also have comorbid anxiety disorders. Moreover, research conducted by the World Health Organization (WHO) demonstrated the predominant comorbid psychological problems between depression and anxiety among patients seeking primary care [6]. The interlink between anxiety and depression is demonstrated that some characteristics of both psychological distresses are on the same continuum [7].

GENDER EFFECTS

Gender is one of the health determinants that make males and females experience health problems differently [8]. For example, according to the research, male hospitalized patients in Thailand had a lower rate of mood (affective) disorders than females [9], [10]. Another study reported that the prevalence of anxiety and depressive disorders is greater in women than in men, with a ratio of 2:1 observed in individuals aged 15 – 49 years [11]. However, the results of a study demonstrate that there is no significant differentiation between males and females regarding the co-occurrence of anxiety and depressive disorders. This implies that both genders have an equal opportunity to experience anxiety, which may be interconnected with depression [12]. In minority groups, a study of the correlation between stressful life events and depressive symptoms in a 62-person sample of minority groups, including lesbians, gays, and bisexuals people, revealed that stress was markedly connected to depression [13]. Other studies found the same evidence that the self-identifying 876 LGBT individuals had an amount of stress related to coming out that was associated with depression [14]. The relationship between depressive symptoms, anxiety, and stress is a complex one, and recent studies have revealed that there are correlations between these three factors among different sexual orientations. Research has found that anxiety is a significant predictor of stress and depressive symptoms in individuals of all sexual orientations, and that stress also has a significant impact on the development of depressive symptoms. Furthermore, it has been demonstrated that the presence of both stress and anxiety together increases the likelihood of experiencing depressive symptoms. The prevalence of depression, especially major depressive disorders, in Asian populations has been reported; for example, it makes up 7.8 million DALYs in Southeast Asian people [15]. The global prevalence of depression is estimated at nearly 322 million individuals. Approximately 50% of these individuals reside in Southeast Asia and the Western Pacific regions. The prevalence of anxiety disorders and depressive disorders in many countries in Asia was ranked between 3.0 and 4.5% and between 2.9 and 4.4%, respectively [16]. This means that many Asian people are suffering from depression.

As we know from the research evidence, stress, anxiety, and depression are interrelated. Notably, very few studies have presented results of the interlink between three psychological distresses (stress, anxiety, and depressive symptoms) based on sexual orientation. Therefore, this current study aims to examine the relationship between stress, anxiety, and depressive

symptoms among voluntary participants from Asian countries, who are divided into five different sexual orientations by their self-reports. The results of this study will contribute to the understanding of the relationship between stress, anxiety, and depressive symptoms among individuals from Asian countries and demonstrate this relationship in different sexual orientations. This current study highlights the evidence that presents the interconnection between three psychological distress factors: depressive symptoms, anxiety, and stress, divided by five sexual orientations. This evidence can also support informing the healthcare sector and policymakers to take into account that healthcare management for stress and anxiety is crucial in reducing the risk of developing depression.

METHODS

SOURCE OF DATA

This study used secondary data from the Open-Source Psychometrics Project The data is available and obtained from https://openpsychometrics.org/_rawdata/, which is an online personality test that collects the answers to personality and psychological assessments from voluntary participants around the world who are willing to answer online questionnaires. The DASS_42 has demonstrated strong psychometric properties across diverse populations, including high internal consistency, good convergent and discriminant validity, and robust factorial structure [17]. Moreover, many studies have reported the use of DASS-42 [18], [19], [20]

The collected data did not include personally identifiable information. The data was collected between 2017 and 2019. The study period from 2017 to 2019 was selected because it corresponds with a time frame during which data was collected and available from the Open-Source Psychometrics Project.

Inclusion criteria

The questionnaire was administered in English, and only participants in this study, despite coming from various countries, were included if they had a sufficient understanding of English to complete the questionnaire. The participants were adults aged between 18 and 60 years, from Asian countries,
including Afghanistan, Bahrain, Bangladesh, Brunei Darussalam, Cambodia, China, Hong Kong, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Korea, Kuwait, Laos, Lebanon, Macao, Malaysia, Maldives, Mongolia, Nepal, Oman, Pakistan, Philippines, Qatar, Saudi Arabia, Singapore, Sri Lanka, Taiwan, Tajikistan, Thailand, United Arab Emirates, Uzbekistan, and Vietnam. Participants were required to self-identify their gender (male, female, or other) and sexual orientation (heterosexual, bisexual, homosexual, asexual, or other) through an online self-report questionnaire on the Open-Source Psychometrics Project surveys.

Exclusion criteria

This included individuals who were under 18 or over 60 years old, those not from the specified Asian countries, and those who did not complete the online self-report questionnaire or provided incomplete responses of gender, sexual orientation, and country on Open-Source Psychometrics Project surveys.

PROCEDURES

This study uses secondary data that is from the open-source dataset provided in the Open-Source Psychometrics Project via public website. Therefore, the protocols and outcome variables followed the original surveys.

The study employed a 42-item self-report scale of the Depression, Anxiety, and Stress Scales (DASS-42) [21] self-report questionnaire [22], which consisted of 14 items for each variable, and a 4-point Likert-type rating scale (1 = not at all applicable to me, 2 = applicable to me to some degree or some of the time, 3 = applicable to me to a considerable degree or a good part of the time, 4 = applicable to me very much or most of the time) to measure the level of stress, anxiety, and depressive symptoms.

The reliability test of the DASS-42 scales covers three dimensions, including depressive symptoms (0.96), anxiety (0.91), and stress (0.93). The strength of the association of all three dimensions was excellent.

DATA ANALYSIS

The research design utilized simple regression analysis to test the correlations between stress and anxiety, stress and depressive symptoms, and anxiety and depressive symptoms. Additionally, multiple regression was used to test the ability of stress and anxiety to predict depressive symptoms. A summary of the model (the correlation (R^2) and corresponding values), the ANOVA test, the coefficients, the simple regression equation, and the multiple regression equation were analyzed and presented.

ETHICS APPROVAL

This study used publicly available data for research purposes in the form of aggregate datasets (CSV) from the website of the Open-Source Psychometrics Project, which contains anonymous individual information; therefore, ethical approval from a human research ethics committee or institutional review board approval was not applicable.

RESULTS

THE CORRELATION BETWEEN STRESS AND ANXIETY

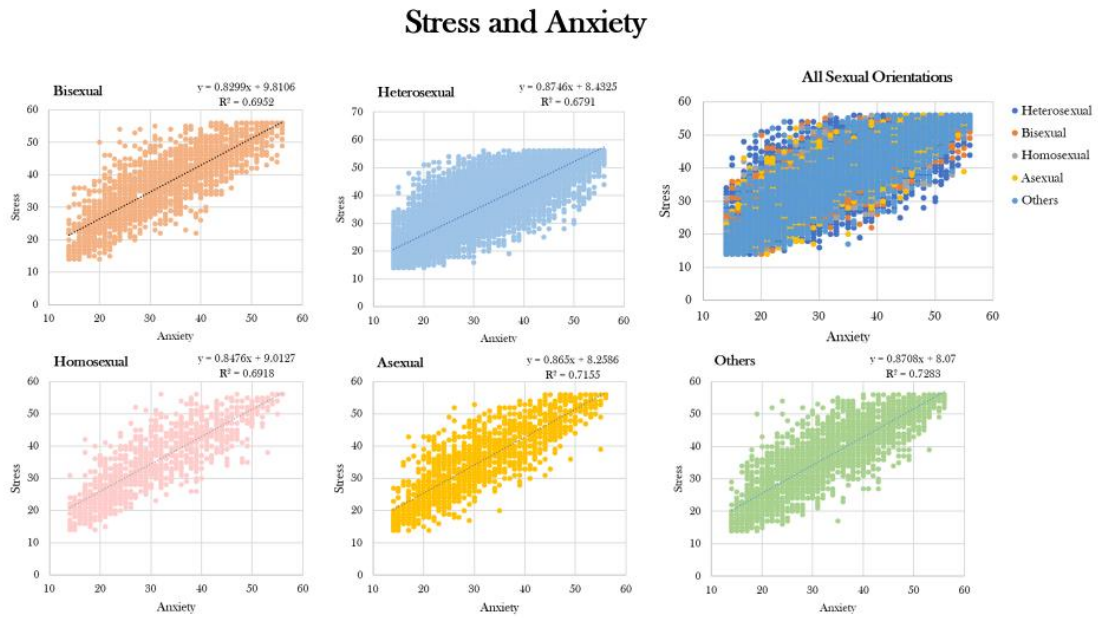
A summary of the model, including the correlation (R^2) and related values, the ANOVA test, the coefficients, and the simple regression equation, is presented in Table 1. Figure 1 illustrates the correlation between the rate of stress and anxiety scores among 21,972 participants, segmented by five sexual orientations, using a dynamic XY scatter plot. Linear regression trendlines, shown in blue, indicate that anxiety and stress are significantly positively correlated (p-value < 0.001) in all five sexual orientations. The results of the analysis show that anxiety is a strong predictor of stress for all five sexual orientations, with a correlation coefficient (R^2) ranging from 0.68 to 0.73.

TABLE 1. THE CORRELATION BETWEEN STRESS AND ANXIETY AND A SIMPLE REGRESSION EQUATION WITH A MODEL SUMMARY AND AN ANOVA TEST BY SEXUAL ORIENTATIONS (N = 21,972)

Sexual orientations	Model summary					ANOVA test	Coefficients	
	N	R	R-Square	Adjusted R-square	Standard Error	F (p-value)	Regression equation	t (p-value)
All	21,972	0.83	0.69	0.69	5.81	49,143.28 ***	Y = 8.57+0.87x	221.68 ***
Heterosexual	14,937	0.82	0.68	0.68	5.89	31,611.92 ***	Y = 8.43+0.87x	177.80 ***
Bisexual	2,031	0.83	0.70	0.70	5.71	4,627.34 ***	Y = 9.81+0.83x	68.02 ***
Homosexual	1,048	0.83	0.69	0.69	5.63	2,348.21 ***	Y = 9.01+0.85x	48.46 ***
Asexual	1,357	0.85	0.72	0.72	5.69	3,407.84 ***	Y = 8.26+0.87x	58.38 ***
Others	2,599	0.85	0.73	0.73	5.54	6,960.29 ***	Y = 8.07+0.87x	83.43 ***

Note: Y = stress, x = anxiety, *** p-value < 0.001

FIGURE 1 THE CORRELATION BETWEEN STRESS AND ANXIETY OF 21,972 PARTICIPANTS, SEGMENTED BY ALL PARTICIPANTS AND FIVE SEXUAL ORIENTATIONS.



THE CORRELATION BETWEEN STRESS AND DEPRESSIVE SYMPTOMS

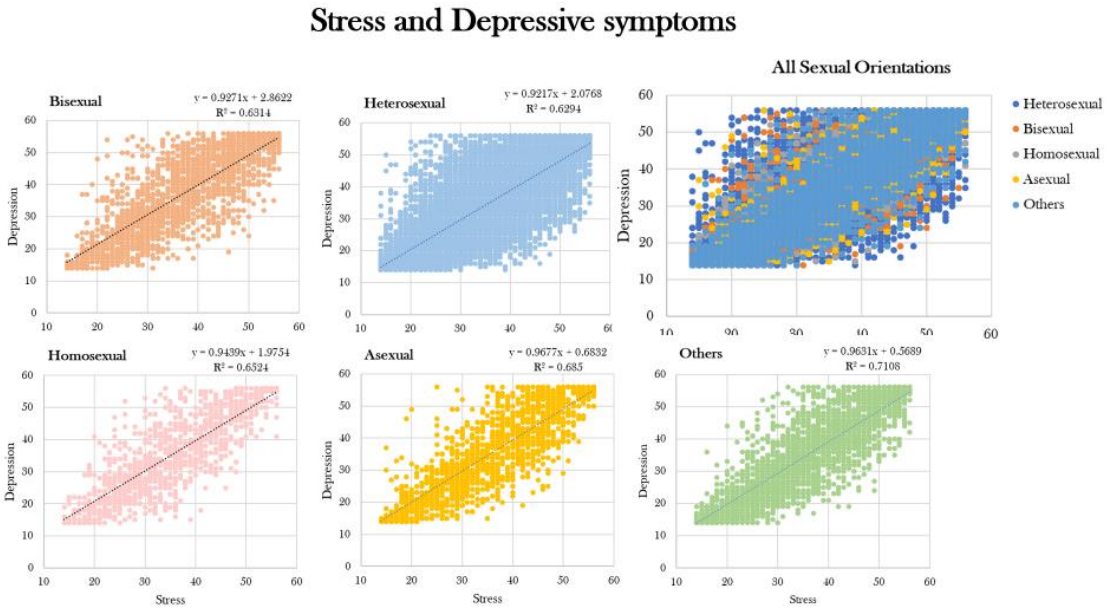
The report of simple regression analysis, including a summary of the model (the correlation (R^2) and related values), the ANOVA test, the coefficients, and the simple regression equation (Table 2). The dynamic XY scatter plot (Figure 2) illustrates the correlation between the rate of occurrence of stress and depressive symptoms scores of 21,972 participants, segmented by five sexual orientations. The blue line shows a linear regression trendline. As can be seen, there was a significant positive correlation (*p*-value < 0.001) between stress and depressive symptoms in all five sexual orientations. Stress in the equation can predict depressive symptoms in all five sexual orientations with a correlation (R^2) between 0.63 and 0.71.

TABLE 2. THE CORRELATION BETWEEN STRESS AND DEPRESSIVE SYMPTOMS AND A SIMPLE REGRESSION EQUATION WITH A MODEL SUMMARY AND AN ANOVA TEST BY SEXUAL ORIENTATIONS (N= 21,972).

Sexual orientations	Model summary					ANOVA test	Coefficients	
	N	R	R-Square	Adjusted R-square	Standard Error	F (*p*-value)	Regression equation	t (*p*-value)
All	21,972	0.80	0.65	0.65	7.22	40,037.21 ***	Y = 1.82+0.93x	200.09 ***
Heterosexual	14,937	0.79	0.63	0.63	7.35	25,363.53 ***	Y = 2.08+0.92x	159.26 ***
Bisexual	2,031	0.79	0.63	0.63	7.33	3,476.08 ***	Y = 2.86+0.93x	58.96 ***
Homosexual	1,048	0.81	0.65	0.65	6.99	1,963.18 ***	Y = 1.98+0.94x	44.31 ***
Asexual	1,357	0.83	0.68	0.68	7.01	2,945.95 ***	Y = 0.68+0.97x	54.28 ***
Others	2,599	0.84	0.71	0.71	6.53	6,383.28 ***	Y = 0.57+0.96x	79.90 ***

Note: Y = depression, x = stress, *** *p*-value < 0.001

FIGURE 2 THE CORRELATION BETWEEN STRESS AND DEPRESSIVE SYMPTOMS OF 21,972 PARTICIPANTS, SEGMENTED BY ALL PARTICIPANTS AND FIVE SEXUAL ORIENTATIONS.



THE CORRELATION BETWEEN ANXIETY AND DEPRESSIVE SYMPTOMS

A simple regression analysis was conducted, and the results are presented in Table 3, including a summary of the model (correlation coefficient (R^2) and related values), the ANOVA test, the coefficients, and the simple regression equation. The relationship between anxiety and depressive symptom scores for 21,972 participants, divided by five sexual orientations, is shown in Figure 3 using a dynamic XY scatter plot with a linear regression trendline in blue. The analysis revealed a significant positive correlation (p-value < 0.001) between anxiety and depressive symptoms for all sexual orientations. Anxiety was a strong forecaster of depressive symptoms for all five groups, with a correlation coefficient (R^2) ranging from 0.50 to 0.60. This suggests that individuals with higher levels of anxiety were more likely to experience depressive symptoms across all five sexual orientations.

TABLE 3. THE CORRELATION BETWEEN ANXIETY AND DEPRESSIVE SYMPTOMS AND A SIMPLE REGRESSION EQUATION WITH A MODEL SUMMARY AND AN ANOVA TEST BY SEXUAL ORIENTATIONS (N= 21,972).

Sexual orientations	Model summary					ANOVA test	Coefficients	
	N	R	R-Square	Adjusted R-square	Standard Error	F (*p*-value)	Regression equation	t (*p*-value)
All	21,972	0.72	0.52	0.52	8.38	24,167.59 ***	Y = 7.77+0.88x	155.46 ***
Heterosexual	14,937	0.71	0.50	0.50	8.51	15,106.81 ***	Y = 7.83+0.87x	122.91 ***
Bisexual	2,031	0.72	0.52	0.52	8.40	2,163.32 ***	Y = 9.83+0.83x	46.51 ***
Homosexual	1,048	0.73	0.53	0.53	8.12	1,183.79 ***	Y = 8.42+0.87x	34.41 ***
Asexual	1,357	0.76	0.58	0.58	8.12	1,849.89 ***	Y = 6.44+0.91x	43.01 ***
Others	2,599	0.77	0.60	0.60	7.72	3,827.79 ***	Y = 6.41+0.90x	61.87 ***

Note: Y = depression, x = anxiety, *** *p*-value < 0.001

FIGURE 3 THE CORRELATION BETWEEN ANXIETY AND DEPRESSIVE SYMPTOMS OF 21,972 PARTICIPANTS, SEGMENTED BY ALL PARTICIPANTS AND FIVE SEXUAL ORIENTATIONS.

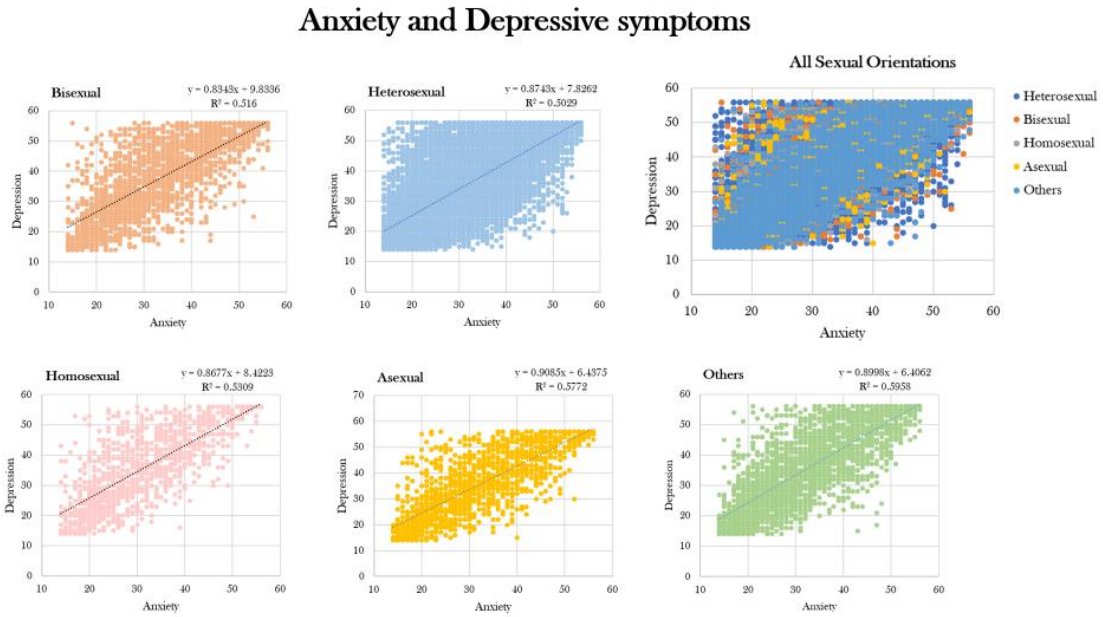


Table 4 presents the results of a multiple regression analysis examining the relationship between stress, anxiety, and depressive symptoms in the five sexual orientations. The summary of the model (the correlation (R^2) and related values), the ANOVA test, coefficients, and multiple regression equation, are provided. The results indicated a significant correlation (*p*-value < 0.001) between stress, anxiety, and depressive symptoms across all five sexual orientations. The equation suggests that stress and anxiety can predict depressive symptoms with a moderate correlation (R^2 = 0.64 - 0.72) for all five sexual orientations. As a matter of fact, those of all sexual orientations with higher levels of stress and anxiety were more likely to encounter depressive symptoms.

TABLE 4. THE CORRELATION AMONG STRESS, ANXIETY, AND DEPRESSIVE SYMPTOMS AND A MULTIPLE REGRESSION EQUATION WITH A MODEL SUMMARY AND AN ANOVA TEST BY SEXUAL ORIENTATIONS (N= 21,972).

Sexual orientations	Model summary					ANOVA test	Coefficients		
	N	R	R-Square	Adjusted R-square	Standard Error	F (*p*-value)	Regression equation	x_1 t (*p*-value)	x_2 t (*p*-value)
All	21,972	0.81	0.66	0.66	7.12	20,924.18 ***	$Y= 1.26+0.76x_1+0.22x_2$	91.76 ***	25.34 ***
Heterosexual	14,937	0.80	0.64	0.64	7.26	13,213.39 ***	$Y= 1.45+0.76x_1+0.21x_2$	75.02 ***	19.87 ***
Bisexual	2,031	0.80	0.64	0.64	7.23	1,815.62 ***	$Y= 2.49+0.75x_1+0.21x_2$	26.66 ***	7.60 ***
Homosexual	1,048	0.81	0.66	0.66	6.88	1,027.33 ***	$Y= 1.53+0.76x_1+0.22x_2$	20.23 ***	5.70 ***
Asexual	1,357	0.84	0.70	0.70	6.87	1,560.81 ***	$Y= 1.16+0.76x_1+0.25x_2$	23.20 ***	7.49 ***
Others	2,599	0.85	0.72	0.72	6.41	3,352.81 ***	$Y= 1.15+0.78x_1+0.22x_2$	34.12 ***	9.69 ***

Note: Y = depression, x_1 = stress, x_2 = anxiety, *** *p*-value < 0.001

DISCUSSION

The results of the simple regression analysis for all five sexual orientations were consistent, revealing that anxiety serves as a strong predictor of stress, stress predicts depressive symptoms, and anxiety also predicts depressive symptoms. This suggests that individuals: 1) reporting higher levels of anxiety tend to report higher levels of stress; 2) those with higher levels

of stress are more likely to experience depressive symptoms; and 3) those with higher levels of anxiety are more likely to experience depressive symptoms. In addition, the mix of stress and anxiety had a significant statistical correlation with the development of depressive symptoms in people of any of the five sexual orientations.

This current study investigates the connection between three psychological distresses in within a sample of people who identify with specific sexual orientation. However, in scientific research exploring people living with health conditions, such as heart failure patients [23], [24], maternal conditions like postpartum weight retention [25], people living with cancer [26], and substance abusers [27], [28], and people living with positive detectable HIV [29], there is the same evidence of a comorbid relationship between stress, anxiety, and depression. All five sexual orientations show the same positive predictive value for anxiety and stress on depression. However, when deeply investigate, some studies report that sexual minority populations report a higher risk of these three than heterosexual individuals. For example, lesbians [30], bisexual women, and gay men [31].

From the perspective of psychoneuroendocrinology, the interesting evidence demonstrates a correlation between stress and depression, in particular the activities in the brain and hormones related to them. Prolonged or chronic stress is able to result in excessive brain activity and is associated with the intercorrelation between the hypothalamus, pituitary gland, and adrenal glands (HPA) [1]. When the HPA is hyperactive, it leads to the release of high levels of stress hormones, namely "cortisol", which may cause depression [1], [32]. Hypersecretion of cortisol was discovered in approximately half of the depressive patients in a study [32]. Anxiety and depression have a strong bond, as indicated by research evidence. Approximately one in four patients in general medical practice has a comorbidity between anxiety and depression. Around 85% of depressive patients reported experiencing anxiety symptoms. Likewise, approximately 90% of patients with anxiety disorders also exhibit symptoms of depression [5]. Similarly, in a study in the Netherlands, 75% of individuals diagnosed with a depressive disorder currently have an anxiety disorder. Similarly, 81% of individuals currently diagnosed with an anxiety disorder also have a current depressive disorder [33].

From the evidence, it can be concluded that anxiety, stress, and depression present a strong interconnection with the same results in various groups of people, including those with different sexual orientations, the general population, non-clinical groups, and people affected by negative health outcomes. However, the prevalence and severity of these conditions may be higher among certain clinical populations compared to the general population.

IMPLICATIONS AND ACADEMIC SUGGESTIONS

The current study's evidence indicates the significant interplay of anxiety and stress on depressive symptoms. Consistently, a strong correlation between these three psychological distresses is found in all five sexual orientations (heterosexual, bisexual, homosexual, asexual, and others). This is able to confirm that anxiety and stress significantly predict depression within these groups, but it is important to contextualize these findings within broader population research. Previous studies have demonstrated that psychological distress patterns are prevalent across general populations, regardless of sexual orientation. The confirmation of similar patterns within sexual minority populations underscores that while this group share common mental health challenges with the general population, the findings highlight the need for tailored mental health interventions sensitive to the unique experiences and stressors experienced by minority individuals.

Therefore, in terms of mental healthcare management, it is necessary to further investigate potential contributing factors and develop interventions or approaches to promote healthy mental health for individuals of all sexual orientations. Conducting more studies in different countries, cultures, social contexts, and so on, to gain a better understanding of the specific factors that contribute to the development of these mental health issues among different sexual orientations. Moreover, developing targeted interventions for individuals of different sexual orientations that address the unique stressors and experiences that they may face requires understanding the specific mental health needs of individuals of different sexual orientations. There are many healthcare management strategies to reduce stress and anxiety and lower the risk of depression. For example, screening and recognizing the signs of stress and anxiety and seeking help early intervention. Stress management should be promoted in groups of people who are suffering from stress and related symptoms. Additionally, many therapeutic interventions including, mindfulness and meditation, healthy lifestyles,

identifying triggers of psychological distress, and so on, should be promoted through health education and health promotions. Furthermore, developing support groups, group counseling, and community programs for people of different sexual orientations is an intriguing approach to assisting them in coping with stress and anxiety and diminishing their risk of developing depression or depressive disorders.

LIMITATIONS

The online questionnaire for the DASS-42 of this study is the English version and is only available on the online platform. Accordingly, all the data collected came from participants who had English proficiency and could access the website. The participants who were unable to access the website and had difficulty understanding and communicating in their English language skills were excluded from this study.

CONCLUSION

The research has demonstrated that anxiety plays a major role in the development of both stress and depressive symptoms. Additionally, stress has been identified as a crucial contributor to the onset of depressive symptoms. Furthermore, research has established that the co-occurrence of stress and anxiety increases the likelihood of experiencing depressive symptoms across all five sexual orientations. Healthcare management strategies are crucial approaches that should be planned; in particular, minimizing stress and anxiety can help reduce the risk of developing depression. Anxiety and stress are key factors that contribute to depressive symptoms. It should, therefore, be necessary to explore the underlying factors contributing to psychological distress among individuals with different sexual orientations. This could include conducting studies in various countries, cultures, and social contexts to gain a more comprehensive understanding of the unique challenges faced by these individuals.

ABBREVIATIONS

DASS-42 = The Depression, Anxiety, and Stress Scale with 42 items
HPA = The hypothalamus, pituitary gland, and adrenal glands
R^2 = R-square
HIV = Human Immunodeficiency Virus

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