Mental Health and Spirituality among Undergraduates in Yucatán: An Exploratory Data Analysis Approach

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Abstract

This study examines the complex relationship between religiosity, spirituality, and mental health, recognizing their crucial but frequently disregarded impact on psychological well-being. Despite a growing body of evidence highlighting this connection, there is still a gap in understanding how different aspects of personal beliefs—religiosity and spirituality—affect levels of depression and anxiety. Our research, carried out among undergraduate students, employed a cross-sectional design to investigate these links, uncovering, in a general manner, an inverse relationship where increased levels of religiosity and spirituality are associated with reduced symptoms of depression and anxiety. Our results suggest distinct possible protective effects of religiosity and spirituality, each offering unique forms of support. This study suggest the possibility to integrate personal belief systems into mental health research and intervention strategies, calling for a comprehensive approach that acknowledges the diverse elements of human well-being.

Keywords

data science, exploratory data analysis, mental health, religion, spirituality

1. Introduction

The transition from adolescence to adulthood usually implies numerous challenges, notably for university students who confront both the academic demands of higher education and significant developmental transitions. This period is marked by heightened susceptibility to mental health issues, particularly depression and anxiety, which are prevalent within this demographic and recognized as significant barriers to personal well-being and academic success [1, 2, 3]. The unique pressures of the academic environment compound these challenges, emphasizing the necessity for a detailed examination of their prevalence, impact, and causative factors among students [4, 5]. Accordingly, the mental well-being of university students emerges as a pivotal area of concern, warranting comprehensive research to understand the extent, consequences, and determinants of these mental health issues within this specific population.

The intersection of mental health with spiritual and religious beliefs in university students presents a significant gap in current research. While the influence of these beliefs on well-being has been acknowledged, there remains a substantial need for in-depth studies to unravel how these dimensions interact with mental health, particularly among students transitioning into university life [6]. This gap becomes even more pronounced in regions like Yucatán, Mexico, where the cultural context, deeply embedded with Mayan heritage, likely plays a pivotal role in shaping these beliefs and, by extension, mental health outcomes. The urgency for such research in Yucatán is further highlighted by its alarming

suicide rates, the highest per violent death across Mexican states, signaling a critical public health issue that demands a closer examination of its unique socio-cultural and spiritual landscape [7, 8]. Despite the global acknowledgment of mental health challenges faced by university students, the specific needs and experiences of those in culturally distinct settings like Yucatán remain underexplored, with most studies concentrating on Western contexts [9, 10, 11]. Addressing these research gaps is crucial for developing targeted interventions that are culturally and contextually sensitive, ultimately contributing to the broader field of mental health research with insights from a unique cultural setting [12].

The aim of this study is to explore the relationships between depression, anxiety, and spiritual/religious beliefs within a select group of undergraduate students in Yucatán, Mexico. Recognizing the limitations imposed by our sample size, our study is positioned as a preliminary inquiry into these dynamics, offering insights that can inform future, more expansive research [13, 14]. Accordingly, our research questions are framed as follows: (1) In what ways do spiritual and religious beliefs intersect with the levels of depression and anxiety observed in our participants? (2) Can we identify patterns within our data that suggest a relationship between students' mental health and their spiritual or religious orientations? Addressing these questions, our study contributes to the growing body of research in this area, laying groundwork for future studies that might expand on our findings and offering preliminary data that could guide the development of culturally sensitive mental health interventions for students and young adults in this region [15, 16].

This article is structured as follows. Section 2 delves into the existing body of literature, highlighting previous findings and identifying gaps that our study aims to address. Section 3 provides a detailed account of our research design, sample selection, data collection instruments, and analytical techniques, ensuring transparency and reproducibility of our methods [17]. In Section 4 we present our findings, including statistical analyses, patterns observed, and initial interpretations of the data. Section 5 offers an in-depth analysis of our results in the context of existing research, exploring the implications of our findings for mental health interventions and future research [18]. Finally, Section 6 summarizes the key insights from our study and proposes directions for subsequent research endeavors.

2. Background

The mental well-being of university students has emerged as a significant public health concern, supported by an increasing body of literature documenting the prevalence of mental health issues within this demographic. A comprehensive study spanning 26 campuses across the United States found notable rates of depression (17.3%), generalized anxiety (7.0%), and suicidal ideation (6.3%) among college students, highlighting the widespread nature of these challenges [19]. Similarly, an examination of depression, anxiety, and suicidality among students at a large public university revealed that approximately 15.6% of undergraduates and 13.0% of graduate students were grappling with at least one form of mental health disorder, further accentuating the pressing need for addressing student mental health [20]. These mental health issues not only have a profound impact on students' academic performance but also affect their social integration and quality of life. The persisting and escalating prevalence of mental health problems among university students necessitates a deeper exploration into the contributing factors and potential mitigating strategies [21].

The relation between spiritual/religious beliefs and mental health has garnered significant attention in recent years [22], with numerous studies aiming to expose the complex nature of this relationship, including among university students. Research has highlighted that spiritual and religious engagement can serve as a coping mechanism, offering solace and resilience in the face of psychological distress [23]. For instance, a study found that university students who placed a high importance on spiritual and religious beliefs were more likely to rely on these values for problem-solving and coping with health and psychological challenges, suggesting a protective effect against mental health issues [24]. Similarly, another investigation revealed a positive correlation between religious beliefs and mental health status among students, indicating that stronger religious convictions might be associated with better mental well-being [25]. Moreover, the positive association between spiritual well-being and mental health in

students further substantiates the potential of spiritual and religious beliefs to enhance psychological resilience and reduce the prevalence of mental health disorders such as depression and anxiety [26]. However, it is important to note that the impact of spirituality and religion on mental health can vary widely among individuals, influenced by factors such as personal beliefs, the extent of religious practice, and the nature of the religious community [7, 27].

Cultural and regional factors play a pivotal role in shaping the mental health landscape of university students, influencing their perceptions, experiences, and coping strategies in the face of psychological challenges [28]. The diversity in cultural backgrounds among students contributes to a wide spectrum of attitudes towards mental health, stigma, and help-seeking behaviors. For instance, studies have shown that cultural stressors and values can significantly impact the mental health of college students, suggesting the need for culturally responsive mental health interventions [29]. Similarly, the socio-cultural environment, including family and academic pressures, can exacerbate mental health issues among university students, emphasizing the importance of considering these factors in mental health support programs [30]. The unique socio-cultural dynamics of regions like Yucatán, with its rich cultural heritage and diverse student population, necessitate a profound understanding of how cultural identity, values, and regional characteristics influence student mental health.

Despite the growing body of research on mental health among university students, significant gaps remain, particularly in understanding the cultural subtleties and regional specificities that influence mental health outcomes. This is especially true for regions like Yucatán, Mexico, where unique cultural, social, and historical contexts may impact the prevalence and manifestation of mental health issues among students. While studies have begun to explore the mental health challenges faced by students in various global contexts, there is a notable scarcity of research focusing on indigenous populations [9, 31]. Additionally, the complexity of mental health, compounded by cultural identity and spiritual beliefs, requires a deeper investigation within specific regional settings to suit interventions effectively [6]. The need for such region-specific studies is highlighted by research suggesting that insights gained in one region cannot be universally applied without considering local contexts [32]. Our study aims to support the filling of these gaps by exploring the interconnections between mental health, spirituality, and religious beliefs among university students in Yucatán.

3. Methodology

Our research was conceived as a cross-sectional study aimed at unraveling the interrelations between depression, anxiety, and spiritual/religious beliefs among undergraduate students. The study was set in the academic environment of Yucatán, Mexico. Conducted over a three-month period from September to November 2021, this investigation sought to capture a snapshot of mental health and spiritual/religious dynamics of Yucatán. The participants were 160 engineering students from Mérida, Yucatán. Inclusion criteria were defined to select currently enrolled undergraduate students, while excluding non-student or postgraduate participants to maintain focus on the undergraduate experience. Prior to participation, individuals were fully briefed on the study's objectives, the voluntary nature of their involvement, and the confidential handling of their responses, ensuring informed consent. Ethical oversight was provided by the corresponding ethics committee, which reviewed and approved the study protocol. Data collection and analysis were conducted with strict adherence to ethical guidelines, including the anonymization of participant data to protect privacy and confidentiality.

Data collection hinged on the deployment of two validated instruments: the Patient Health Questionnaire-9 (PHQ-9) [33] and the Generalized Anxiety Disorder Scale (GAD-7) [34], renowned for their efficacy in gauging depression and anxiety levels respectively. The PHQ-9, with its nine-item framework, offers insights into depression severity by scoring responses on a 4-point Likert scale. The PHQ-9 scores range from 0 to 27, with higher scores indicating more severe levels of depression, classified into five categories from none to severe depression [35, 36]. The GAD-7, on the other hand, is a seven-item construct which measures anxiety on a scale from 0 to 21, with four levels from minimal to severe anxiety [35, 37]. To capture the spiritual and religious dimensions of participants' lives,

participants were offered five self-identification options: Religious, Spiritual Non-religious, Agnostic, Atheist, and Other. The data collection process unfolded online, leveraging a secure web platform [38, 39] that facilitated anonymous participation. Comprehensive instructions accompanied each survey, guiding participants through the process and ensuring clarity and ease of response, thereby optimizing the integrity and reliability of the data collected.

Data analysis focused on Exploratory Data Analysis (EDA) to identify patterns and correlations [40, 41]. Initial steps included assessing sociodemographic characteristics and the distribution of spirituality/religious factors among participants [42]. Subsequent analyses involved descriptive statistics and univariate analysis through boxplot visualizations to explore the behavior of PHQ-9 and GAD-7 scores in relation to spiritual/religious self-identification, paying attention to outliers that might signify data entry errors or provide significant insights. Furthermore, we employed a quartile approach to achieve a balanced data distribution and facilitate the examination of the relationships between depression and anxiety levels with spiritual and religious classifications [43, 42].

Building on the foundational insights garnered from the EDA and the qualitative assessment of Sankey diagrams, our subsequent quantitative analysis delved into the distribution percentages of depression and anxiety levels, and the varying degrees of religiosity and spirituality. To quantitatively represent the relationships observed qualitatively in the Sankey diagrams, we calculated differential percentages that represent the distribution shifts across the quartiles of depression and anxiety for each spiritual and religious classification. This method allowed us to quantitatively confirm and expand upon the patterns and correlations initially identified through qualitative means, providing a robust statistical foundation to our exploratory findings. The calculated differentials served as a critical tool in translating the qualitative observations from the Sankey diagrams into quantifiable metrics, enabling a deeper understanding of how religious and spiritual identities correlate with mental health indicators among the study participants.

4. Results

The demographic makeup of our sample was predominantly male, constituting approximately 77.5%, with female participants making up the remaining 22.5%. The vast majority were single (96.9%), with a singular participant reporting being married. The age range of participants spanned from eighteen to twenty-five years, reflecting a typical undergraduate age distribution. Employment status varied, with 15% of the students working part-time while pursuing their studies. The spiritual and religious self-identifications revealed a predominance of religious affiliation (44.4%), followed by varied representations of other spiritual beliefs.

The analysis of mental health among the participating students revealed insightful trends in the prevalence of depression and anxiety as measured by the PHQ-9 and GAD-7 scales, respectively. The PHQ-9 results indicated a broad range of depression levels within the student population, with a mean score of 4.3, suggesting a predominance of minimal to mild depression among the majority. Notably, the distribution across depression severity levels highlighted that a significant portion of the sample fell within the 'none' to 'mild' categories, yet there were instances of moderately severe to severe depression. Similarly, the GAD-7 scores, with a mean of 3.9, mirrored this pattern for anxiety, primarily clustering around the minimal to mild anxiety levels. These observations on the distribution of mental health symptoms are visually depicted in the histograms presented in Figure 1.

With respect to the spiritual and religious convictions of the participants, a substantial number identified as "Religious", accounting for 44.4% of the participants, which aligns with the historically deep-rooted religious traditions in the region. "Spiritual Non-religious" and "Agnostic" categories were closely represented, with 15% and 13.8% respectively, suggesting a significant portion of the student body leans towards spiritual exploration outside conventional religious frameworks. "Atheists", though the smallest group, constituted 11.3% of the sample. The "Other" category, potentially encompassing a variety of less traditional or more personal spiritual beliefs, was selected by 15.6% of the students. A breakdown of these spiritual and religious orientations among the participants is shown in descending

(a) PHQ-9 scores

(b) GAD-7 scores
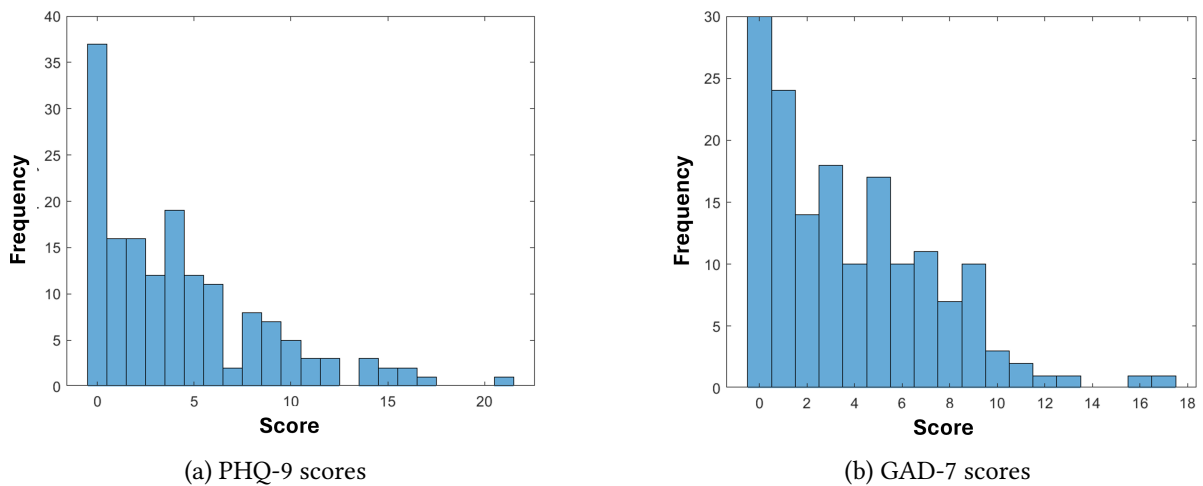
Figure 1: Histograms illustrating the distribution of PHQ-9 (left) and GAD-7 (right) scores among the study participants. The PHQ-9 histogram captures the frequency of depression levels, while the GAD-7 histogram represents the distribution of anxiety levels.

order in Table 1.

Table 1
Distribution of the spiritual and religious beliefs of the 160 undergraduate students who participated in this study.

Spiritual/Religious Factor	Participants	Percentage (%)
Religious	71	44.4%
Other	25	15.6%
Spiritual Non-religious	24	15.0%
Agnostic	22	13.8%
Atheist	18	11.3%
Total	160	100%

The EDA aimed to uncover relationships between mental health indicators and the spiritual/religious beliefs of the participants. Notably, the PHQ-9 and GAD-7 scores, representing depression and anxiety levels respectively, were subjected to correlation analysis with the categorized spiritual and religious beliefs. Preliminary findings indicated that certain spiritual/religious orientations appeared to correlate with specific mental health outcomes. For instance, individuals identifying as "Spiritual Non-religious" exhibited a slight but discernible trend towards higher anxiety levels as compared to their "Religious" counterparts. This suggests that the nature of one's spiritual beliefs might indeed play a role in their mental well-being. Conversely, those with "Agnostic" beliefs did not initially show a significant difference in depression scores when compared to the "Religious" group, indicating that the absence of conventional religious beliefs does not necessarily correlate with higher depression levels. These behaviors are represented in the boxplots for PHQ-9 and GAD-7 scores in Figure 2. The correlation plot (Figure 3) further illustrates these associations, highlighting a slight trend of linear correlation between the values of PHQ-9 and GAD-7, consistent with reported comorbidity of depression and anxiety [44], across different spiritual and religious classifications.

In our EDA, particular attention was given to outliers and data dispersion, especially as represented in the boxplot graphics for PHQ-9 and GAD-7 scores (Figure 2). These outliers, while few, were not merely statistical anomalies but potentially indicative of individuals with exceptionally high levels of depression or anxiety, significantly deviating from the median scores. For example, the PHQ-9
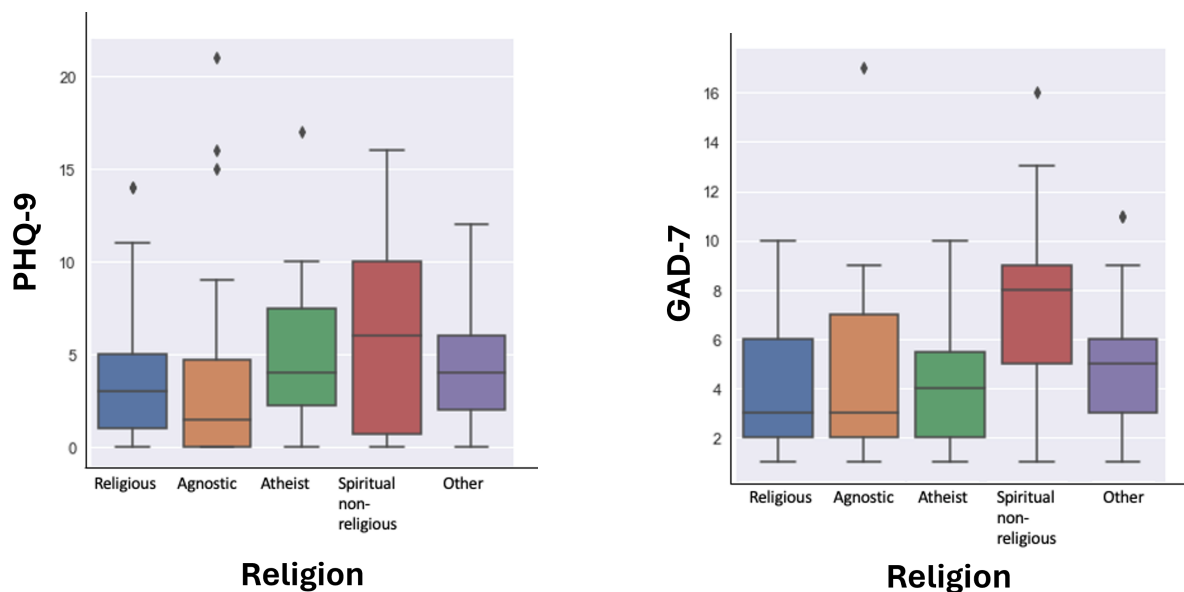
Figure 2: Data behavior by spirituality/religion factors on PHQ-9 and GAD-7. Outliers represent students with notably high levels of depression and anxiety.
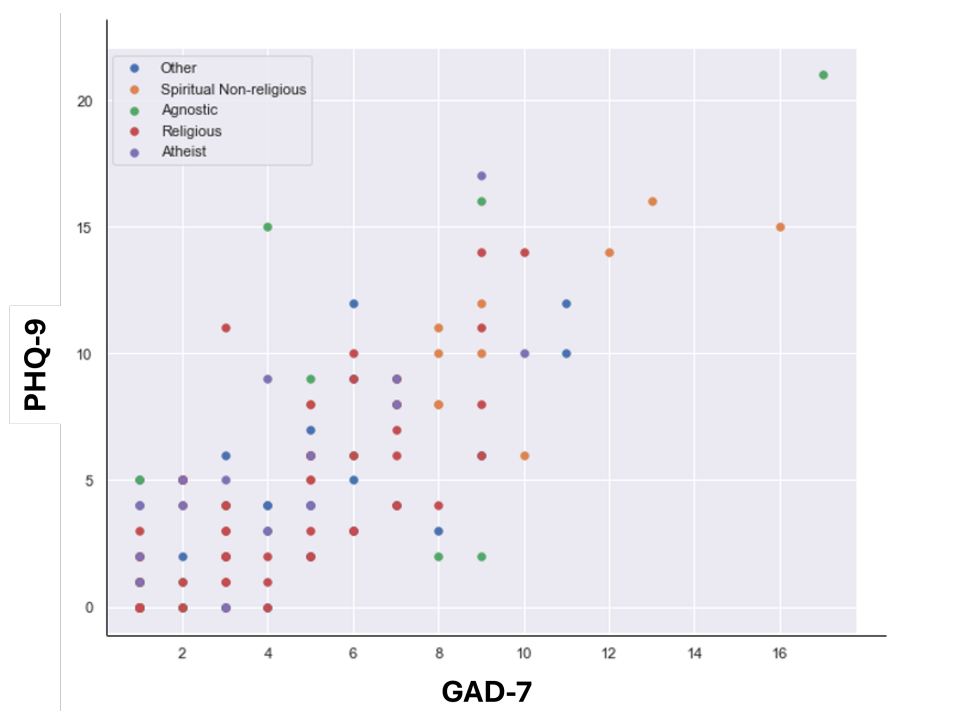
Figure 3: Relationship between PHQ-9 and GAD-7 questionnaire according to religion choose by students. A wide dispersion of the data can be observed with a slight trend of linear correlation between the values of PHQ-9 and GAD-7.

boxplot revealed five outlier data points, suggesting a small subset of students experiencing severe depression. Similarly, the GAD-7 analysis identified three outliers, pointing towards notable cases of elevated anxiety levels. Such dispersion in the data highlights the presence of significant mental health challenges within segments of the student population.

We introduced a quartile-based categorization system to our EDA to refine our understanding of the data distribution for anxiety and depression levels. This approach was instrumental in balancing the

dataset, which enhanced the reliability of our subsequent analyses. Specifically, we divided the range of scores into four quartiles: the first quartile (Q_1) included scores from zero to one, indicating minimal symptoms; the second quartile (Q_2) contained scores from two to three, suggesting mild symptoms; the third quartile (Q_3) ranged from four to six, corresponding to moderate symptoms; and the fourth quartile (Q_4) encompassed scores of seven and above, indicative of more severe symptomatology.

We categorized the students' spiritual and religious beliefs into three distinct levels, respectively, to examine possible correlations with their mental health. The first level consisted of students who considered themselves "Atheists", indicating they do not hold religious or spiritual beliefs (R_1 and S_1 for religious and spiritual beliefs, respectively). The second level, for R_2 we considered participants who identified themselves as either "Agnostic", "Other", or "Spiritual Non-religious". For S_s we considered individuals who identified themselves as either "Agnostic" or "Other". Finally, the third level consisted, for R_3 students who identified as "Religious", and for S_3 students who identified as either "Religious" or "Spiritual Non-religious". This approach helped us investigate the relationship between varying degrees of spirituality and religiousness with the students' levels of depression and anxiety.

The Sankey diagrams in Figure 4 provide a visual representation of these relationships, revealing how mental health status flows and intersects with personal beliefs. For GAD-7, the most substantial frequency observed was between the lowest quartile of anxiety (Q_1) and the highest level of spirituality (S_3), as well as with the highest religious factor (R_3), suggesting a prominent connection between lower anxiety and stronger spiritual or religious self-identification. Similarly, for PHQ-9, the greatest frequency was seen bridging the lowest depression quartile (Q_1) with the highest spirituality and religiosity levels (S_3 and R_3), implying a correlation where individuals with minimal depression symptoms often align with more definitive spiritual or religious stances.

Building upon the visually intuitive insights provided by the Sankey diagrams in Figure 4, we further quantified the interrelationships between mental health and personal beliefs. To this end, we introduced a statistical measure that illustrates the shift in depression prevalence across different levels of religiosity. As we transition from the narrative conveyed by the diagrams to a more analytical interpretation, we employ a mathematical approach to capture the essence of our data into a coherent statistical narrative. In this regard, we have formalized the representation of religious groups with R_i, spiritual groups with S_i and quartiles of depression/anxiety with Q_j, which allowed for a precise computation of the proportion of individuals within each intersection of these categories.

For example, in the highly-religious group R_3, the proportion of individuals in the lowest quartile of depression Q_1 was calculated, and similarly, this proportion was computed for the non-religious group R_1. By comparing these proportions, we obtained a differential $D_{R_3,R_1}(Q_1)$, which numerically encapsulates the increase in lower severity depression scores as one moves from atheistic to religious self-identification.
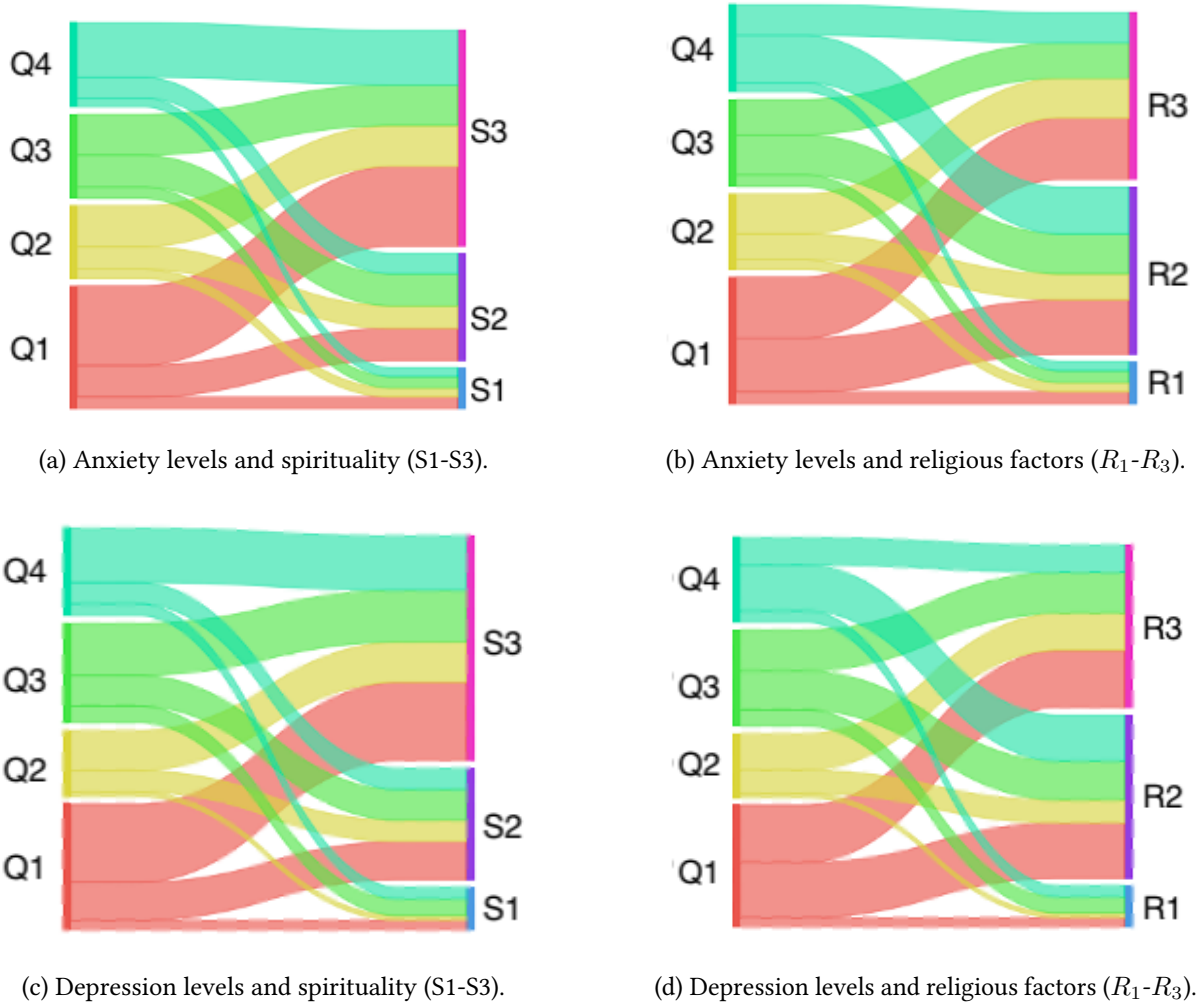
Let R_i denote the ith religious classification group, where i can take values from the set $\{1, 2, 3\}$. Similarly, let Q_j represent the jth depression quartile, where j is from the set $\{1, 2, 3, 4\}$, indicating increasing severity of depression from minimal to severe. For a given religious group R_i, the proportion of participants in a depression quartile Q_j is denoted by $P(R_iQ_j)$ and is calculated as the number of participants in both R_i and Q_j, denoted by $n(R_iQ_j)$, divided by the total number of participants in R_i, denoted by $N(R_i)$:

$$P(R_iQ_j) = \frac{n(R_iQ_j)}{N(R_i)}$$

.

Applying this to our specific case, for the most religious group R_3, the proportion of participants in the lowest quartile of depression Q_1 is given by:

$$P(R_3Q_1) = \frac{n(R_3Q_1)}{N(R_3)} = \frac{25}{25 + 16 + 18 + 12} = 35.21\%$$

.

Similarly, for the least religious group R_1, we calculate:

(a) Anxiety levels and spirituality (S1-S3).

(b) Anxiety levels and religious factors (R_1-R_3).

(c) Depression levels and spirituality (S1-S3).

(d) Depression levels and religious factors (R_1-R_3).

Figure 4: Set of Sankey diagrams illustrating the relationships between mental health levels as measured by GAD-7 and PHQ-9 questionnaires with spiritual and religious factors. Subfigures (a) and (b) represent anxiety correlations with spirituality and religiosity, respectively, while subfigures (c) and (d) show depression correlations with the same factors.

$$P(R_1 Q_1) = \frac{n(R_1 Q_1)}{N(R_1)} = \frac{4}{4 + 2 + 7 + 5} = 22.22\%$$

.

The differential measure $D_{R_3, R_1}(Q_1)$ between R_3 and R_1 for the lowest quartile Q_1 is then:

$$D_{R_3, R_1}(Q_1) = P(R_3 Q_1) - P(R_1 Q_1) = 35.21 - 22.22 = 12.99\%$$

.

This differential, $D_{R_3, R_1}(Q_1)$, signifies the increase in the relative frequency of participants in the lowest depression quartile Q_1 as we move from the least religious group R_1 to the most religious group R_3. Such a comparison shows the positive association between higher levels of religious identification and the prevalence of lower severity depression scores within our sample population, in other words, an inverse relation between religiousness and depression.

To offer a comprehensive perspective on the complex relationships identified in our analysis, Table 2 presents the range of calculated differentials and their interpretations. This table combines the insights into both depression and anxiety, revealing the nature of their relationships with varying levels of spirituality and religiousness. A further analysis is discussed in the following section.

Table 2

Differential analysis of depression and anxiety quartiles across spirituality and religiousness levels. An "inverse relationship" indicates that an increase in one variable (e.g., religiosity) is associated with a decrease in the other variable (e.g., depression levels).

	Depression		Anxiety	
Differential	**Value**	**Relationship**	**Value**	**Relationship**
$D_{R_3,R_1}(Q_1)$	12.99	Inverse	8.84	Inverse
$D_{S_3,S_1}(Q_1)$	12.52	Inverse	9.06	Inverse
$D_{R_3,R_1}(Q_4)$	-10.88	Inverse	-3.91	Inverse
$D_{S_3,S_1}(Q_4)$	-3.57	Inverse	3.04	Direct
$D_{Q_4,Q_1}(S_1)$	5.96	Inverse	1.55	Neutral
$D_{Q_4,Q_1}(R_1)$	5.96	Inverse	1.55	Neutral
$D_{Q_4,Q_1}(S_3)$	-0.1	Neutral	0.06	Neutral
$D_{Q_4,Q_1}(R_3)$	-14.73	Inverse	-13.01	Inverse

5. Discussion

In our investigation, we delved into the complex relationships between personal beliefs, specifically religiosity and spirituality, and mental health outcomes among undergraduate students. A key discovery of our study is the inverse relationship between levels of depression and anxiety and the degree of religious and spiritual identification. This finding indicates that students who identify more strongly with religious or spiritual beliefs tend to exhibit lower levels of depression and anxiety. This pattern was consistently observed across various degrees of religiosity and spirituality, highlighting a significant association between personal belief systems and mental well-being in this demographic.

Table 2 enhances our comprehension of the dynamics between mental health and personal belief systems by quantitatively showing the differentials and their implications on depression and anxiety. An overarching inverse relationship is observed in most instances, signifying that heightened religiosity or spirituality commonly correlates with diminished levels of depression and anxiety. This trend is consistently evident in comparisons between high religiosity (R_3) and low religiosity (R_1), as well as between high spirituality (S_3) and low spirituality (S_1), particularly within the first quartile (Q_1), which denotes minimal symptomatology. An intriguing departure is noted in the analysis of the fourth quartile (Q_4), where a direct relationship is observed between elevated spirituality (S_3) and anxiety levels, suggesting that, in certain contexts, greater spirituality may be associated with increased anxiety. This counterintuitive finding warrants further exploration to ascertain the specific facets of spirituality contributing to this pattern. We also considered the notion of a "neutral" relationship for differentials under 2%, such as $D_{Q_4,Q_1}(S_1)$, $D_{Q_4,Q_1}(R_1)$, and $D_{Q_4,Q_1}(S_3)$ in the anxiety context, implying a lack of significant correlation between these variables. This refinement offers a deeper understanding of scenarios where the link between mental health and personal beliefs may not be as marked.

The overall inverse relationship observed between religiosity/spirituality and depression/anxiety suggests that personal beliefs may serve as a protective factor in mental health, consistent with previous research [24, 45, 46]. This connection could be attributed to several factors inherent in religious and spiritual practices. For instance, these practices often involve community support, regular social interactions, and a framework for understanding life's challenges, all of which can contribute to better mental health outcomes. Furthermore, the sense of purpose and meaning that individuals often derive from their religious or spiritual beliefs could play a critical role in mitigating feelings of despair or anxiety. Such interpretations align with existing psychological theories that emphasize the importance of social support and a coherent worldview in promoting mental resilience [47, 48]. Therefore, our findings contribute to a growing body of evidence suggesting that the benefits of religious and spiritual involvement may extend beyond personal fulfillment to include tangible effects on mental health.

The insights gleaned from our study hold substantial practical implications, particularly for mental health professionals and intervention programs. Recognizing the inverse relationship between religiosity/spirituality and depression/anxiety, therapists and counselors might consider integrating discussions

around personal beliefs and values into their therapeutic approaches. Such incorporation could enhance the relevance and efficacy of mental health interventions by aligning them more closely with the individual's belief system, providing an additional layer of support and resilience. Furthermore, educational and community programs aimed at promoting mental well-being could benefit from acknowledging the role of spiritual and religious practices. By fostering environments that respect and encourage these aspects of personal identity, such initiatives could contribute to more supportive community networks, potentially reducing the prevalence of mental health issues. This approach underscores the importance of a multi-dimensional strategy in mental health care, where psychological, social, and spiritual components are interwoven to support overall well-being.

In our investigation, EDA was a pivotal tool that allowed us to unveil patterns and correlations within our dataset, providing an initial, broad view of the relationships between mental health indicators and spiritual/religious beliefs among undergraduate students in Yucatán. This approach facilitated a more profound understanding of the data, enabling us to identify and visualize trends, outliers, and distribution characteristics that might not be immediately apparent with more traditional statistical methods. Through the application of EDA techniques, such as descriptive statistics, Sankey diagrams and boxplot visualizations, we could explore the intricate behaviors of depression and anxiety scores in relation to the participants' spiritual or religious self-identification. This methodological choice evidences the importance of adopting flexible, data-driven approaches in psychological research.

Our study, while presenting important correlations, is subject to certain limitations that warrant mention. Primarily, the cross-sectional nature of our research design precludes the establishment of causality between the variables studied. Furthermore, our reliance on self-reported measures introduces the potential for response bias, which might affect the accuracy of the data collected. The sample, comprised solely of undergraduate students, limits the generalizability of our findings to broader populations. These limitations open avenues for future research, such as longitudinal studies that could explore the dynamic nature of these relationships over time and delve into causality. Additionally, employing a more diverse sample and integrating objective measures alongside self-reports could enhance the robustness and applicability of the findings. Future studies might also consider the multifaceted nature of religiosity and spirituality, exploring how different aspects of these constructs interact with various mental health outcomes.

6. Conclusions

Our investigation revealed a significant inverse relationship between religiosity/spirituality and depression and anxiety levels among undergraduate students, pinpointing the protective influence of personal belief systems on mental health. This discovery suggests that individuals with a strong sense of religious or spiritual identity may tend to show fewer symptoms of depression and anxiety. Delving deeper, our study began to distinguish between the effects of religiosity and spirituality on mental well-being. Religiosity, with its communal rituals and structured beliefs, may provide individuals with social support and a collective identity, potentially buffering against mental health challenges. Spirituality, characterized by personal reflection and a search for meaning, might offer a unique form of emotional sustenance, enabling individuals to navigate life's stresses with a sense of inner peace. This differentiation between the impacts of religiosity and spirituality highlights the complex role of personal beliefs in mental health and the necessity of considering these varied dimensions in mental health research and practice.

The findings from our study should encourage mental health practitioners to explore more holistic approaches which recognize and integrate the spiritual and religious dimensions of individuals' lives into therapeutic practices. This integration could not only enrich the therapeutic process by aligning with clients' personal belief systems but also leverage these beliefs as resources for resilience, coping, and recovery. The practical implications extend beyond clinical settings, suggesting that educational curricula and community health initiatives could benefit from incorporating elements that foster spiritual well-being, thus contributing to a more comprehensive strategy for mental health promotion.

Future research directions should leverage advanced data science and computational techniques to extend our findings, focusing on evidencing causal relationships between religiosity/spirituality and mental health through sophisticated longitudinal data analysis. The employment of machine learning models and artificial intelligence algorithms could offer new insights into these complex dynamics across varied cultural and demographic landscapes, thereby enhancing the robustness and applicability of the results. Further exploration into the granular aspects of religious and spiritual practices, utilizing computational text analysis and natural language processing, could unearth the specific elements that exert the most substantial influence on mental well-being. Integrating quantitative models with multidisciplinary knowledge from psychology, sociology, and theology, facilitated by big data analytics, could furnish a holistic and nuanced understanding of the intricate nexus between personal beliefs and mental health.

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