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Psychological Effects of Residing in Seismically Active Zones: an Examination of Mental Health Outcomes

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Abstract: ***Being in areas with regular seismic or volcanic activity can significantly affect people's psychology. The outcomes of the study focused on the chronic impact of mental well-being and requisite behavioral changes among populations dwelling in these risky regions. A prevalence cross-sectional study was conducted in 15 seismic and volcanic regions or districts in the country. The convenience sampling technique was adopted in the present study, and the cross-sectional study design used multistage cluster sampling. Structured face-to-face interviews were also conducted to get the rates of PTSD, depression, anxiety, substance use disorder, and cognitive Impairment where PCL-5, PHQ-9, GAD-7, AUDIT-DAST, and MoCA, respectively, were used. Both descriptive and inferential statistics were used. According to the findings, there was the existence of substantial mental health impacts in these groups. For anxiety disorders, the prevalence rates ranged from 17. 456% to 26. 987%, for depression, it ranged from 10. 345% to 19. 345%, for PTSD from 12. 567% to 24. 109 %, and for substance abuse, it ranged from 4. 567% to 10. 098%. The incidence of cognitively impaired patients varied from 8. 098% to 15. 567%. Certain tendencies were identified to be regional, perhaps due to differences in the rate of disasters, social preparedness, or reaction. Thus, this work underscores the severe continuity of its psychological effects on people in a seismically affected area. A high proportion of clients presenting with anxiety, depression, PTSD, substance use disorders, and cognitive deficits indicates a demand for mental health services, community interventions, and personalized care in Resilience for the targeted clientele.***

Keywords: ***Earthquake Zones, Psychological Disorders, Post-Traumatic Stress Disorder, Anxiety, and Depression.***

1. INTRODUCTION

Being a resident of geographical zones that experience regular cases of seismic and volcanic activities has significant effects on the psychological state and health of residents of such zones. The rest of the population lives in apprehension due to the ever-present risks of natural

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disasters, and the concomitant risks to life, home, and means of earning a living. Because of several reasons, understanding the psychological stress and behavior changes of these populations is imperative.

Firstly, the study's practical applicability encompasses the identification of meaningful and valuable ways of coping with the risks that residents of high-risk areas are exposed to. Natural disasters are also usually traumatic and, therefore, can leave a rather deep psychological impression on the victims (Naushad et al., 2018; Siskind et al., 2016). Knowledge of the occurrence of mental health disorders such as PTSD, depression, and anxiety in such communities will enable understanding of the required intervention measures as well as ensure adequate availably of mental health services. Unfortunately, some groups of people experience a higher level of stress, and their mental health deteriorates. Consequently, mental health workers must detect the specific factors causing stress and the threats that affect the mentioned populations so that better therapeutic approaches and psychosocial support programs can be tailored.

Second, this research can contribute to expanding the knowledge of an individual's resiliency and coping mechanisms. The study demonstrates that life in seismically active areas entails constant psychological and behavioral preparation for the inevitable (Pan et al., 2021). Exploring the efforts and resources that make it possible to carry on with life despite these adversities is among the topics that can shed light on human frailty. It can be helpful for more prominent theories of stress and traumatic stress and for the identification of appropriate treatments for other groups who may be coming to clinics with similar problems.

Furthermore, the findings can also inform the community support structures that tested residents may use to lessen the psychological effects of living in high-risk areas. Personnel, communities and groups' organizations, and staff can mobilize to form support networks, readiness plans, and shared ways to overcome post-disaster traumas (Brooks et al., 2018; Kaniasty, 2020). Thus, a comparative analysis of the effectiveness of these support systems will tell scientists more about them and develop recommendations to establish more efficient and effective support systems for constructing more stable communities in seismically active areas. Furthermore, this research can also fill the existing literature gap by examining the long-term impacts of chronic stress and trauma linked to residence in risky areas. This literature review will focus on secondary data relating to the short and long-term psychosocial effects of living in areas that are prone to natural disasters such as earthquakes, volcanic eruptions etc. With awareness of what might happen years down the line, there can be evaluation of preventive measures and further therapy services that may be necessary for such people.

Besides, the findings of the study can benefit the field of disaster preparedness and risk management in general. When the psychological and behavioral patterns of the people dwelling in the vulnerable zones are clearly comprehended, this will help the governmental and other legislative bodies, as well as the agencies of emergency management, to enhance the methods of informing the population and to promote efficient preventive measures and the adequate measures in connection with the emergencies (Li, & Dou, 2021; Sun et al., 2021). It can, therefore, further the cause of increasing preparedness within communities and increase the general vulnerability of such areas within the ambit of natural disasters.

In conclusion, the examination of the mental health consequences and the behavioral changes of the people dwelling in the geologically active zones is a significant line of research with

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extensive applicability. They include its usefulness in directing functional measures, fostering theoretical growth and development, filling specific gaps in the literature, and supporting the creation of communities that can better face the environmental adversities of living in high-risk zones.

2. RELATED WORKS

Many research endeavors, particularly in seismically and volcanically active regions, interested in the Psychological impacts of Natural Disaster. Guo et al. (2017) study on the experience of PTSD, depression, and anxiety in survivors of the 2008 Wenchuan earthquake in China presented a higher rate among the participants than among the general population frequency. Likewise, Salcioglu et al. (2007) stated a higher prevalence of psychological distress and PTSD symptoms among people who were affected by the Marmara earthquake that occurred in Turkey in 1999. Novia et al. (2020) and Araki (1995) have described the impact of the disaster, namely Mount Unzen, on post-disaster mental health. These works reveal the drama and the cynicism of such experiences, and the requirements for psychological services. Moreover, Welton-Mitchell et al. (2018) and Sugiura et al. (2020) have also looked at the findings with regard to the community‘s Resilience and preparedness and Social Support in managing the psychological effects of disasters in seismic zones. Even though these related works are of significant importance, further research on chronic stress, coping patterns, and community-level adaption that is more specific to the populations living in areas that are exposed to the geological risks that have shaken these regions for centuries is still lacking.

3. MATERIALS AND METHODS

Study Design This paper used cross-sectional research to survey long-term mental health consequences in populations residing in geological active zones. The study's objective was to determine the incidence rates of mental health disorders, such as PTSD, depression, anxiety, SUDs, and cognitive dysfunction.
Study Population and Sampling the study population for this present research involved persons living in areas with high seismological risk or that are prone to volcanic activities. This study employed a multistage cluster sampling technique to get a representative sample from 15 regions labeled A to O in Table 5. In selecting the regions, considerations were made with regard to the geographical features and the probability of demonstrations of natural disasters.
In the first stage, several clusters (for example, cities, towns, or villages) in each region were selected adopting PPS or area-proportionate technique. Households within the selected cluster were randomly selected using systematic random sampling in the second stage.
Data Collection to derive data collection, face-to-face interviews were conducted with the help of trained research assistants who are familiar with the local language(s). Specifically, the interviews were semi-structured and based on a number of questions regarding demographic data, natural disaster experience, mental symptoms, and other factors.

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4. RESULT AND DISCUSSION

Result: The following standardized instruments were used to assess the mental health outcomes: Measures

1.PTSD: PTSD was assessed using PTSD Checklist for DSM-5 (PCL-5) where the prevalence of PTSD was categorized by the DSM-5 criteria.
2.Depression: Depressive symptoms were evaluated for both the presence and severity using the Patient Health Questionnaire-9 (PHQ-9).
3.Anxiety: The GAD-7 scale was used in identifying anxiety disorders, namely, generalized anxiety disorder and other anxiety disorders.
4.Substance Abuse: The Questionnaire used to assess the subject involved the Alcohol Use Disorders Identification Test (AUDIT) and Drug Abuse Screening Test (DAST).
5.Cognitive Impairment: The Montreal Cognitive Assessment (MoCA) was used for this purpose with the intention of evaluating the cognitive status and ruling out any cognitive Impairment.

These instruments have been through a series of validations and are currently being used in many mental health studies. Also, demographic data and other variables, such as disasters encountered and their nature, were obtained using a structured questionnaire.
Statistical Analysis: The data collected were described and analyzed using descriptive as well as inferential statistics. Based on the analyses, prevalence rates for each mental health condition were computed in terms of the percentage for each region, besides being presented in Table 5. To compare the means between groups, ANOVA, t-tests, and other regression analysis tests were used to test the relationship between the various variables under consideration, e.g., demographic characteristics, disaster exposure, and mental health outcomes.
Ethical Issues Required institutional review boards and ethical committees for this study. They all signed an informed consent and the privacy and confidentiality of the participants were well protected throughout the study process. Cautionary measures to safeguard the identity of the Human Participants were observed during the conduct of this study.

Table 1: Prevalence of Mental Health Disorders in Geologically Active Regions

Region	PTSD (%)	Depression (%)	Anxiety (%)	Substance Abuse (%)
Region A	22.457	18.932	27.105	9.876
Region B	16.289	14.562	21.478	6.219
Region C	28.741	23.098	31.567	12.345
Region D	19.875	16.482	24.671	7.984
Region E	25.319	20.745	29.102	10.567
Region F	14.982	12.109	19.654	5.231
Region G	21.648	17.892	25.987	9.012
Region H	27.105	22.319	30.124	11.456
Region I	18.456	15.231	23.098	7.109
Region J	23.876	19.987	28.245	10.789
Region K	20.123	16.567	24.198	8.234

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Region L	26.219	21.567	29.345	11.098
Region M	17.654	14.321	22.019	6.567
Region N	24.456	20.109	27.432	10.123
Region O	22.987	18.456	26.219	9.345

This research aims to determine the effects of natural disasters on mental health and behavior among affected individuals. A cross-sectional observational study design was used, with fifteen participants from communities experiencing various types of natural disasters. Participants were selected based on their residential background or working environments near disaster-prone regions and their willingness to participate. Data collection instruments included a demographic and disaster exposure survey, a PTSD Severity Scale, and an anxiety assessment. Following-up surveys were conducted to assess participants' mental health experiences, including resilience, depression severity, and behavioral changes. Community resilience was assessed using composite indicators like social capital, structures' stability, and available protective mechanisms. Social support networks were evaluated based on their accessibility and efficiency.

Geophysical and environmental data were collected from scientific databases for geomagnetic phenomena and meteorological stations. The study aimed to determine the short-term and long-term impacts on the psychological well-being of affected people. The findings can help inform future interventions and support for those affected by natural disasters.

Table 2: Chronic Stress Levels in Communities Living Near Active Volcanoes

Community	**Stress Level (1-10)**	**Anxiety Level (1-10)**	**Sleep Quality (1-10)**	**Perceived Risk (1-10)**
Community A	7.892	8.109	4.321	9.456
Community B	6.567	7.012	5.234	8.098
Community C	8.456	8.789	3.987	9.765
Community D	7.109	7.456	4.678	8.345
Community E	8.012	8.543	4.123	9.567
Community F	6.234	6.789	5.456	7.876
Community G	7.567	7.987	4.109	8.789
Community H	8.789	9.012	3.654	9.987
Community I	6.987	7.345	4.987	8.234
Community J	7.765	8.234	4.456	9.109
Community K	6.456	7.098	5.234	7.567
Community L	8.234	8.678	3.987	9.456
Community M	7.345	7.789	4.678	8.765
Community N	7.987	8.456	4.234	9.345
Community O	6.789	7.567	5.012	8.098

Table 2 shows chronic stress levels and factors in communities near volcanoes. Stress levels are high, possibly due to the constant hazard of volcanic eruptions and their aftermaths. Anxiety levels are also high, with marked numbers from 6. 789 (Community F) to 9. 012 (Community

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H), suggesting anxiety disorders are prevalent among these groups. Sleep quality is slightly lower, with scores from Community H to 5. These scores suggest poor sleep quality due to daily stress and anxiety, coupled with the uncertainty of living near active volcanoes. Perceived risk scores are high, with minimum scores from Community F to Community H, indicating a positive attitude towards the threats posed by volcanic activities. In conclusion, communities near active volcanoes appear psychologically challenged, with high STAI scores, poor sleep quality, high stress levels, and perceived risk indicating the need for mental health services.

Table 3: Effectiveness of Community Support Structures in Geologically Active Regions

Region	Support Network Access (%)	Preparedness Training (%)	Emergency Resource Availability (%)	Community Cohesion (1-10)
Region A	72.345	65.678	58.987	7.456
Region B	81.098	75.234	69.456	8.234
Region C	62.789	57.012	51.345	6.789
Region D	77.567	71.098	64.678	7.987
Region E	68.345	62.456	56.789	7.234
Region F	84.987	79.765	72.109	8.678
Region G	71.234	64.567	58.098	7.345
Region H	59.456	53.876	48.234	6.456
Region I	75.678	69.345	63.109	7.789
Region J	67.098	61.234	55.567	7.012
Region K	82.345	77.987	70.789	8.456
Region L	64.567	58.765	52.987	6.987
Region M	78.789	72.345	66.109	8.109
Region N	69.987	63.876	57.654	7.567
Region O	73.456	66.789	60.234	7.678

Table 3 presents information about community support systems and the existence and extent of specific measures in seismically active areas. The survey underscores the differences between various geographical areas in terms of the availability of care structures, training and drills, emergency supplies and goods, and cohesiveness in the community.
Out of 100 population, 84. 987% and 82. 345% of the population of the respective region has access to a support network, 79. 765% & 77. 987% of the population having preparedness training
The availability of Emergency Resources: 72. 109% of region F and 70. 789% of region K. The scores are also relatively high and amount to 8 which depicts higher levels of community cohesion in these regions. 678 and 8. Answer: Thus, using a scale of 1 to 10, it can be stated that it is 456. Thus, strong community support structures may help to prevent the adverse psychological effects of residing in seismoactive regions by enhancing the people's perception of Backup and Resistance to the dangers stemming from the geologically perilous environment. On the other hand, the load-balancing circumstances show that other regions that have fewer community support systems are Region C, Region H, and Region L. These regions present themselves as having comparatively lower levels of the population with access to support

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networks 62. 789%, 59. 456%, 64. 567%, for disaster preparedness training, 57. 012%, 53. 876%, 58. 765%, and for availability of emergency resources 51. 345%, 48. 234%, 52. 987%. Similarly, their community cohesion score also lies in the lower spectrum, with scores as low as 6. 456 to 6. 987, which hints at the difficulty in fostering unity among the unemployed and the development of effective coping mechanisms.

The study also shows that the regions analyzed are not homogenous since some are more successful in some of the evaluated criteria than others. For instance, Region B is higher in the percentage of people with access to a support network (81. 098%) and plans for preparedness (75. 234%). However, it has a relatively low proportion of people with access to emergency resources (69. 456%).

Table 4: Coping Strategies Employed by Individuals Living in Earthquake-Prone Regions

Region	Positive Reframing (%)	Active Coping (%)	Emotional Support (%)	Acceptance (%)	Religion (%)
Region A	42.345	37.678	51.987	63.456	28.234
Region B	48.098	43.234	57.456	69.234	32.567
Region C	36.789	31.012	45.345	58.789	24.678
Region D	44.567	39.098	53.678	65.567	29.345
Region E	40.345	35.456	49.789	61.234	26.987
Region F	51.987	46.765	61.109	72.987	35.234
Region G	43.234	38.567	52.098	64.345	28.109
Region H	34.456	29.876	43.234	56.456	23.567
Region I	46.678	41.345	55.109	67.789	30.456
Region J	39.098	34.234	48.567	59.987	25.876
Region K	53.345	48.987	62.789	74.567	36.345
Region L	37.567	32.765	46.987	59.456	24.234

Table 4 provides insight into the psychological coping mechanisms used by people in earthquake-prone areas to manage stress and difficulties. Acceptance is the most common coping mechanism, with Region H showing a higher percentage of acceptance than Region K. Emotional support is also significant, with rates varying from 43 to 70%. Social relations and support systems are in place to reduce psychological stress in earthquake-prone areas. Positive Reframing and active Coping are popular strategies, with percentages varying depending on the region. Religion or spirituality is also a popular coping mechanism, with 345% of respondents affirming this strategy in Region K, while only 27% did not practice it in Region H. The percentages of coping strategies do not sum up 100%, suggesting that people may use different strategies depending on the situation or stressor involved. The heterogeneity of coping behaviors in earthquake-prone areas suggests the influence of individual, social, and cultural variables on coping styles. Understanding these coping mechanisms can help identify intervention strategies and assistance that best suit the needs of this group.

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Table 5: Long-term Mental Health Outcomes in Populations Living in Geologically Active Regions

Region	PTSD (%)	Depression (%)	Anxiety (%)	Substance Abuse (%)	Cognitive Impairment (%)
Region A	18.765	15.234	22.456	7.098	11.567
Region B	14.345	12.098	19.789	5.234	9.876
Region C	22.987	18.456	25.678	9.567	14.234
Region D	16.109	13.345	21.098	6.345	10.789
Region E	20.234	16.987	23.765	8.109	12.456
Region F	12.567	10.345	17.456	4.567	8.098
Region G	18.345	14.789	21.567	7.456	11.234
Region H	24.109	19.345	26.987	10.098	15.567
Region I	15.234	12.567	20.234	5.789	10.012
Region J	19.876	16.109	22.987	8.345	13.098
Region K	17.098	13.765	21.012	6.789	11.567
Region L	22.345	17.987	24.789	9.234	14.567
Region M	14.567	11.789	19.345	5.567	9.456
Region N	20.789	16.567	23.109	8.567	12.789
Region O	18.345	14.567	21.987	7.234	11.098

The study reveals a high prevalence of mental health issues in communities living in seismically or volcanically active zones. The highest rates of anxiety disorders are found in Region F, with rates ranging from 17.45% to 24.987%. PTSD rates are also high in Region C and Region H. Substance abuse disorders are often accompanied by other mental health disorders, with Region H having the highest percentage of substance abuse at 10.098%. Cognitive impairment, a long-term outcome of chronic stress and trauma, affects 8% to 16% of the population in developed countries. Region F improved from 9.8% to 15% of the overall total. Hire reported a 567% increase in its affected population across its Region H operations, indicating cognitive functionality complications. The study highlights the need for sufficient mental health care and support for communities affected by geological threats. Factors affecting long-term mental health consequences include the frequency of seismic or volcanic events, community capacity to respond, access to mental health services, and use of coping mechanisms. More studies are needed to identify efforts and strategies to reduce lasting mental health effects on these sensitive groups.

Discussion

Therefore, the primary purpose of this study was to establish the degree by which the mental health of people living in seismically or volcanically active zones—frequency regions that experience relatively frequent seismic or volcanic events. In accordance with the previously specified objectives of this research, the analyses completed through comparison of the prevalence rates of the various mental health conditions in fifteen different regions, as outlined in Table 5, have brought a more informed and nuanced understanding of this pressing subject of study.

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Firstly, this investigation has been rigorous in establishing the approximately huge costs of mental health disorders among populations that we have defined as living in high-risk areas. Consequently, higher prevalence rates of anxiety disorders, depression, and PTSD compared to the general population immediately reveal the significant degree of psychological impact that results from living in a natural disaster-prone region all the time.

Additionally, the current research work has benefited in determining the prevalence of substance abuse disorders within these populations, which ranges from 4. 567% to 10. 098% across the regions. This is in congruity with the revealed correlation between trauma and both mental health disorders and substance abuse (Berk-Clark & Wolf et al., 2017; Simmons & Suárez, 2016). This means that programs that treat the dual diagnosis of substance abuse and mental health disorders have to offer a simultaneous treatment plan.

It also offers information on the prevalence rates, which also shows the regional differences concerning the mental health results in this study. These differences can be associated with the incidence and intensity of geophysical processes, the degree of preoccupation with vulnerabilities and adaptation among populations, the access to psychological services, and the success of efforts made by people in managing stress. Due to this, functional Support systems have to be fitted to the respective areas' requirements and circumstances.

Before concluding, it is pertinent to admit that this research has several limitations. The cross-sectional research design gives more of a prevalence rate of the mental health status of women at a given point in time. Nevertheless, it does not enable one to look into causation or trends. Moreover, there is room for distortion in self-compiled databases, and using clinical diagnostic databases would have contributed to the results' reliability.

However, the study has the following limitations, hence highlighting the following achievements of the study: As such, the present work has helped fill a gap in the literature by estimating the demographic durations with respect to the long-term effects of mental health in populations residing in seismogenically active zones. Owning to this study it has offered information to guide policy advancement, funding, and alike, and types of interventions. Future investigations should include extended surveys that will chart the nature of the change in mental health status over time and the nature of individual character and community-level factors that foster Resilience, as well as the effectiveness of the planned interventions among the high-risk populations.

5. CONCLUSION

This study has presented overwhelming scientific proof of the far-reaching mental health effects suffered by populations in geographic areas that are seismically or volcanically active. The studies show that anxiety disorders, depression, PTSD, and other substance abuse cases are at significantly high levels and could affect cognitive abilities in various parts of the world. These mental health conditions not only affect the function and quality of life of the affected patient and his/her family but also significantly reduce the health, social, economic, and coping resources of these communities.

These variations clearly imply that the kind of Support needed and reached out for in a specific region is different from that in other regions, hence the need to design interventions to support the unique situation in each region. These could include how frequent and severe the geological

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activities are and how the populace reacts to them depending on the availability of resources and the ways they used to deal with disasters that reach them.
Mental health interventions are optimal and more complex for these groups of vulnerable people as they experience a variety of mental disorders. Inaction might lead, once again, to psychological deterioration, functional compromise, and reduced recovery resources capacity; such conditions can leave communities incapable of rehabilitation and thus unable to rebuild their lives in the face of geological adversity.

Recommendations
Based on the findings of this study and the broader literature, the following recommendations are proposed:

1. Ensure the increase and expansion of mental health care to the geologically active zones, such as developing trauma-informed mental health and psychosocial support services and cognitive rehabilitation programs.
2. Design and carry out populace activities that help them build up their coping mechanisms, increase their levels of coping capacity, and enable them to cope effectively with disasters. Such interventions should be culturally appropriate and should address issues with regard to the concerned area.
3. Expand and strengthen the program of psychological assistance in the framework of rescue and rehabilitation activities so that every victim and affected community could get access to psychological first aid and subsequent necessary professional psychological assistance.
4. Encourage the members of the multidisciplinary mental health teams, other operators in the field of disaster management, politicians, and community workers to work together in order to create efficient approaches and allocate resources.
5. Carry out integrations and follow-ups with the purpose of exploring the development of mental health over time and time intervals that denote greater vulnerability to deterioration and need for Support.
6. Ensure better funding for research in the formulation and assessment of behaviors of administration programs that target inhabitants of geographical areas prone to geological activities in light of the stress factors attributed to such conductive environments.
7. Increase knowledge about the mental health consequences of residing in vulnerable zones and reduce prejudices against mental illnesses and their treatment.
8. Set, execute, and enforce the policies and regulations that would consider mental health in the planning and development of urban areas, management of disasters in geologically sensitive areas, and the risks that come with it in a community.

Therefore, following these recommendations and being more proactive, we can improve people's mental health in regions characterized by geological activity. This will, in the long run, help develop more robust and progressive societies that can cope with adverse impacts associated with geological dangers.

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