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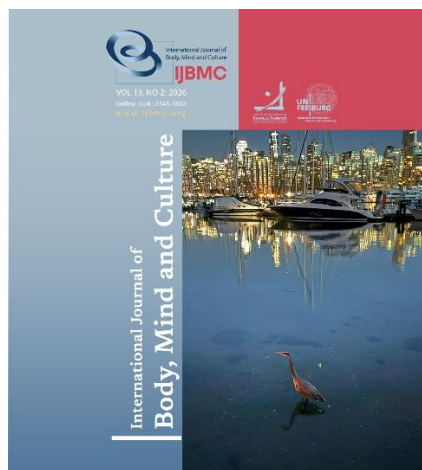
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Spatial Analysis of Mental Health Issues Among Female-Headed Households in Zanjan City

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ABSTRACT

Objective: The increasing trend of female-headed households in the present era has led to specific consequences for this group of women. Due to their unique circumstances, female-headed households cannot often participate effectively in society. This study examines the higher prevalence of poverty and mental health issues among female-headed households compared to male-headed households over the past decade. It aims to identify the dimensions of the social experience of female-headed households with mental health problems in Zanjan city.

Methods and Materials: The research approach is descriptive-analytical, combining library-based research, field studies, the Delphi method for validation of indicators, spatial analysis using GIS, and regression modeling. Furthermore, the final research indicators were determined through the Delphi method, and various aspects of social deprivation were extracted and validated. The data were then analyzed using spatial analysis and Geographic Information Systems (GIS).

Findings: The results indicate meaningful clustering patterns of mental health issues among female-headed households, with distinct variations across different neighborhoods. Meanwhile, the support policies of institutions such as the Committee for Relief and Welfare are random and inconsistent.

Conclusion: The findings emphasize the crucial role of socio-economic and physical factors in shaping the residential patterns of female-headed households with mental health issues and provide insights for targeted policy interventions.

Keywords: Spatial Analysis, Mental Disorder, Female-Headed Households, Zanjan City.

Introduction

The region's geography provides the backdrop for the movement of people, events, and outcomes. It shapes lived experiences and encompasses the various forms of life that reflect the diverse states of human existence. This geography influences all aspects of individuals' lives and determines their destiny, life model, quality of life, and social status. One dimension affected by geographical determinism is the incidence of illness, poverty, deprivation, and social exclusion across different segments of society. Among these, mental illness, influenced by the prevailing societal structure, environmental determinism, and a combination of other social, economic, and geographical factors, profoundly impacts an individual's life. As mentioned earlier, the interplay among spatial structure, environmental determinism, and the conditions and characteristics of individual life is crucial to mental health. Female-headed households are particularly susceptible to these influences, which often result in psychological and emotional stress, ultimately leading to irreparable mental health damage. This is especially true when these communities face a combination of economic, political, social, and cultural crises. Female-headed households are among the population groups most directly affected by economic, social, political, and other changes (Babaeinasir et al., 2024). In developing and underdeveloped countries, these women are particularly vulnerable and fragile within social and economic structures (Shalchi & Gholizadeh, 2018). Due to these factors, women experience feelings of loneliness (Kim et al., 2018), depression, anxiety disorders (Stack & Meredith, 2018), and a decline in mental health (Beyzaei & Zangeneh Motlagh, 2023) at both social and individual levels. Most studies on female-headed households have focused on cases in which women become household heads due to war or crises in socially and economically vulnerable countries (Kwon & Kim, 2020). Today, 60% of women worldwide are the primary breadwinners, and women head 37.5% of households. Consequently, the relative lack of welfare and the significant gap between their status and social welfare indicators, such as education, skills, and other issues, has created a vicious cycle of deprivation that gradually threatens their lives and mental health (Behroz et al., 2023). In Iran, with the introduction of new industries and the formation of

working-class and marginalized communities, disadvantaged groups have emerged. The issue of social isolation, alongside the focus on poverty and poverty alleviation, has drawn the attention of social, economic, and even political thinkers. According to official national statistics, the share of female-headed households in recent years has grown due to several factors, including the rise in single-person households, the increasing divorce rate, the lack of remarriage among widowed or divorced women, higher crime rates, the increase in the prison population, addiction, and the migration of household heads (Babaeinasir et al., 2024). Social experts argue that this phenomenon has led to significant psychological harm. In other words, female-headed households experience increased levels of depression, stress, and anxiety in their lives (Ghandehari et al., 2023). Zanjan City is no exception, as women in this region also face gender-based labeling, social exclusion, and the harmful consequences of these issues. They are constantly grappling with the prevailing conditions. Demographic trends in Zanjan indicate that the city's population rose between 2016 and 2021, which in turn has exacerbated some social problems. A comparison of population density across the various districts of Zanjan reveals that, except for District 1, the other districts have experienced increases in both population and density. Furthermore, the workforce has been the central driver of economic activities in Zanjan, with the service sector employing the largest share of the working population. At the same time, some are also employed in agriculture. According to the latest available data, 60% of the workforce is male, and 40% is female (Hosseini et al., 2023). More than half of employed women are in female-headed households, engaged in economic and social activities while managing the unique challenges and fluctuations of their personal and professional lives. As a result, they also risk their mental health. Thus, the mental health issues faced by female-headed households are of great significance due to their unique social position. This study aims to identify the spatial-social disparities among female-headed households with mental health issues and to analyze this phenomenon in Zanjan City spatially. The research question is thus posed: What is the spatial distribution of female-headed households with mental health issues in Zanjan City?

Female-headed households are considered a vulnerable and sensitive group globally, directly affected

by various critical factors. They belong to disadvantaged groups and are subject to social exclusion and attacks resulting from structural constraints and the scope of their functional roles. These factors exacerbate their exclusion and sense of deprivation, ultimately affecting their overall health. These women are frequently exposed to psychosocial stress due to their multiple and simultaneous roles in society (Shadabi et al., 2020). Women who are economically and socially more vulnerable, due to their role as breadwinners and their responsibilities in family care, are at a higher risk to their health (Kwon & Kim, 2020). Additionally, due to traditional societal norms, limited access to social networks, personal beliefs, and a general lack of social empowerment, they face numerous problems and harms (Teymori et al.). In some cases, mental health is not merely limited to the absence of psychological disorders; it encompasses a state of well-being where an individual can actualize their abilities and talents while coping with the pressures of everyday life. Female heads of households are particularly affected by this issue (Kwon & Kim, 2020). According to Lazarus, psychological stress is defined as a state of mental strain resulting from a set of physical pressures or a series of psychological and social events. According to Lazarus's theory, psychological stress is the relationship between a person and their environment, which the person appraises as a demand that exceeds their capacity and threatens their well-being (Nourian Aghdam et al., 2017). Therefore, it can be argued that much of the psychological and emotional stress experienced by female-headed households may result from environmental factors. Given the circumstances mentioned, the multi-responsibility characteristic of female-headed households places them at greater risk of conflict and in a cycle of environmental and social challenges than typical individuals. This, in turn, imposes unavoidable pressures and confronts them with major mental health challenges. Stress is an unpleasant physiological or psychological state that arises in response to stress-inducing stimuli in the environment, and psychological pressure results from unexpected or challenging events.

Women, particularly those who are heads of households, are constantly engaged with various social issues and their associated psychological consequences in the urban environment. Several studies have explored these impacts. Ghandehari et al. (2023), in their research

titled "The Impact of Rollo May's Existential Psychotherapy on Death Anxiety, Loneliness, and Life Meaning in Female-Headed Households," indicate that Rollo May's existential psychotherapy affects death anxiety and loneliness and suggest that responsible institutions should facilitate treatment conditions. (Hayati et al., 2021), in their study titled "The Impact of Self-Efficacy Beliefs and Happiness on Physical and Mental Health Dimensions of Female-Headed Households Covered by the Welfare Organization of Abadan County," state that effective interventions can enhance self-efficacy beliefs and happiness, leading to improved physical and mental health for these women. (Beyzaei & Zangeneh Motlagh, 2023), in their study titled "Investigating Psychological and Personality Damages of Female-Headed Households Supported by the Relief Committee in Zarandieh County," report that psychological damages such as depression, social dysfunction, anxiety, and sleep disorders are prevalent among women covered by the relief committee. Shadabi et al. (2021), in their research work titled "The Relationship Between Support Roles, Mental Health, and Life Satisfaction in Female-Headed Households in Karaj: A Structural Equation Modeling Approach," find that support roles have a negative relationship with mental health. In other words, a reduction in support roles is associated with an increase in mental health problems. Kwon & Kim (2020), in their study titled "Psychological Well-Being of Female-Headed Households Based on Age Classification: A Cross-Sectional Study in South Korea," show that for individuals over 50 years old, lower educational levels, living alone, low-income, musculoskeletal pain, fatigue, and depression/anxiety have a negative correlation with psychological well-being. Therefore, a multidimensional, supportive strategy should be incorporated into the concept of social deprivation, and a preventive approach is necessary to establish a supportive system. Behroz et al. (2023), in their research on the "Relationship Between Social Support and Psychological Capital with Empowerment of Female-Headed Households," demonstrate that enhancing empowerment, social support, and psychological capital enables these women to cope with the stress arising from everyday problems.

Therefore, analyzing the interaction between space and society is crucial for understanding social injustices and harms, and for developing policies to mitigate or

address them. Zanjan city, given its geographical location and cultural, social, and prevailing conditions, is not exempt from this trend. Women in this region are also not safe from gender-based labels, social exclusion, and their harmful effects, and they continuously struggle with the prevailing conditions. Thus, the present study aims to analyze the spatial distribution of ill female-headed households in Zanjan city to better understand this phenomenon. The research question is: What is the spatial distribution of ill female-headed households in Zanjan city?

Methods and Materials

Study Design

This study examines the spatial distribution of female-headed households in Zanjan city, focusing on mental health issues, using an applied approach. Multiple methods have been employed throughout the research to achieve various objectives. This research is applied in purpose and descriptive-analytical in method, consisting of several stages. In the first step, indicators of deprivation experience in Zanjan city were developed based on the global and Iranian scientific literature. The weighting of indicators was conducted using the Delphi method, with expert opinions as the primary input. In the next stage, neighborhoods in Zanjan were classified using validated indicators derived from expert-driven methods, with data from the 2016 statistical blocks and the database of female-headed households from the Imam Khomeini Relief Committee. To provide a theoretical explanation of the topic and to understand the literature and theoretical foundations, information was collected through documentary methods. For field studies, data were gathered by visiting the site, comparing and isolating the data with reality, and

conducting interviews with officials and experts. These included social science experts, welfare specialists, urban planners, women's studies specialists, and economists with at least two years of relevant work and research experience on women. An online Delphi survey questionnaire was designed across four dimensions and distributed to 25 specialists. These dimensions included general framework, physical structure, demographic, social, and economic aspects. A total of 15 main indicators were selected from the relevant scientific literature. The questionnaire items in the first round were designed to allow experts to assess the importance of each indicator on a scale from 1 to 100. The Delphi survey continued until consensus was reached. To this end, the weights assigned were categorized into five levels: very unrelated, somewhat related, related, somewhat related, and highly related. In the second round, indicators with scores below 50 were reviewed, and consensus was reached on their relevance. After identifying the indicators and preparing information layers in the GIS, the output layers were generated. The weights derived from the Delphi method were then analyzed using hot-spot techniques and Moran's I. In the next step, the illness model for female-headed households in Zanjan city was fitted using Geographic Weighted Regression, and the city's zoning by social deprivation experience was determined at the neighborhood level. Since the unit of analysis for this research is the neighborhood, all neighborhoods in Zanjan city were studied and analyzed. Cochran's formula was used to calculate the statistical sample size and the statistical size of each category, in proportion to the population of each area. Table 1 presents the indicators studied and assessed in the research, which are the outputs of the Delphi method.

Table 1

Study indicators and Research evaluation

Dimensions	Indicator	Delphi Weight (%)
Demographic	Widowed women due to the death of a partner	7
	Divorced women	9
	Women who have never married	2
	Married women who have not given birth to a living child	5
Physical	The ratio of apartment units to the statistical block	4
Social	Women's literacy rate	11
Economic	Ratio of apartment units to statistical block	3
	Ratio of tenants to the population of the statistical block	12
	Women's unemployment rate	8

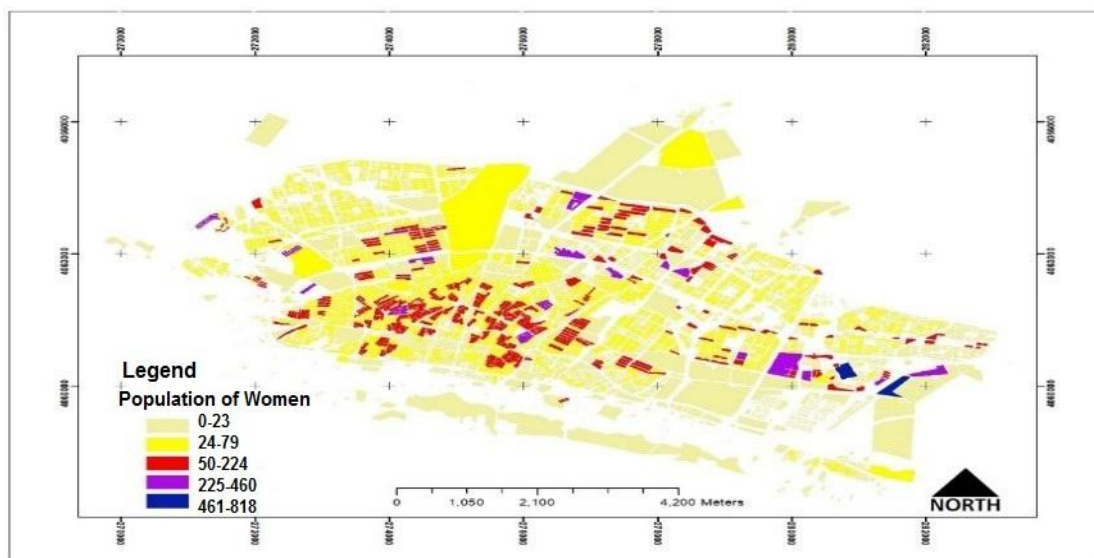
Study Area

In the present era, with the emergence of human factors in development theories, one of the critical indicators of a country's development is women's status and the level of their empowerment (Heidari, 2018). Therefore, the core values of sustainable development focus on improving the quality of life and empowering individuals, with social justice being one of the most

crucial requirements. The first step in this process is understanding the current situation of the female population in terms of location and spatial structure. Figure 1 schematically illustrates the female population by neighborhood. As shown on this map, the central, eastern, and northeastern parts of the city have the highest density of women.

Figure 1

Population of women by neighborhoods in Zanjan city



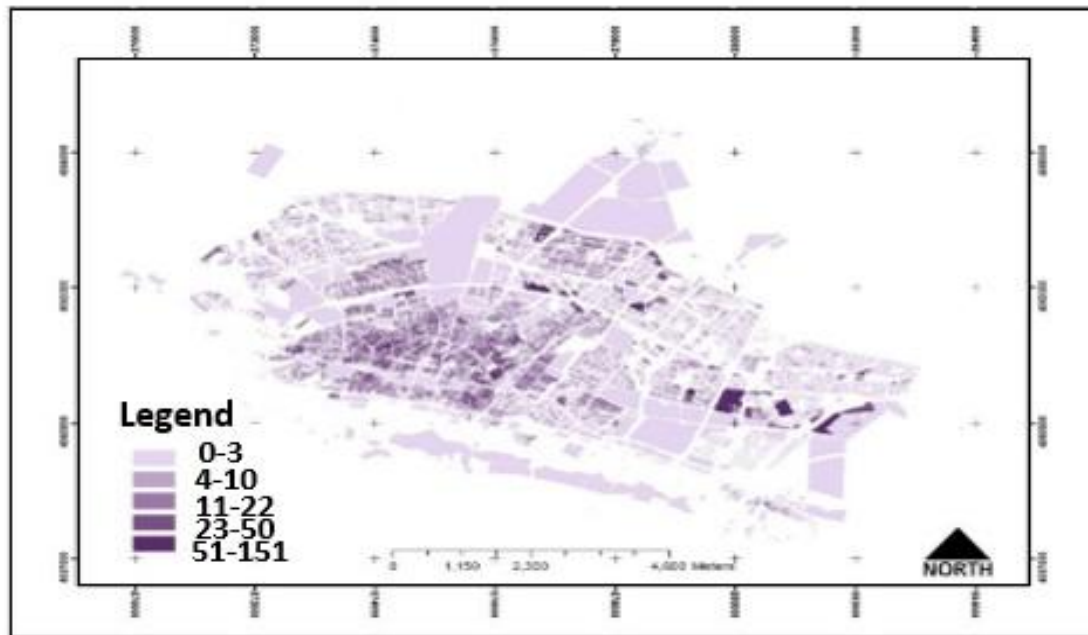
Findings and Results

There is a discrepancy regarding the relationship between female-headed households and mental illness. Based on some experiences, not only is there no negative relationship between female-headed households and illness, but these households can sometimes be worse off than those led by men (Babaeinasir et al., 2024). However, female-headed households generally have lower average incomes, fewer assets, and less access to resources such as land, financial capital, and technology. Gender, caregiving, and family burdens collectively constitute the triple burden on female-headed households (Crawford et

al., 2023). These factors are significant contributors to creating tension and psychological stress in individuals. Figure 2 shows the population density of female-headed households suffering from mental illness, by neighborhood in Zanjan city. This population includes widows and divorced women. According to the detailed results, there are 16,556 female-headed households registered in Zanjan, accounting for 7.8% of the city's female population. Of this number, 9,732 are affected by neurological, psychological, and mental disorders, with a spatial distribution that shows greater concentration in the city's central and western parts.

Figure 2

Population density of ill female-headed households by neighborhoods

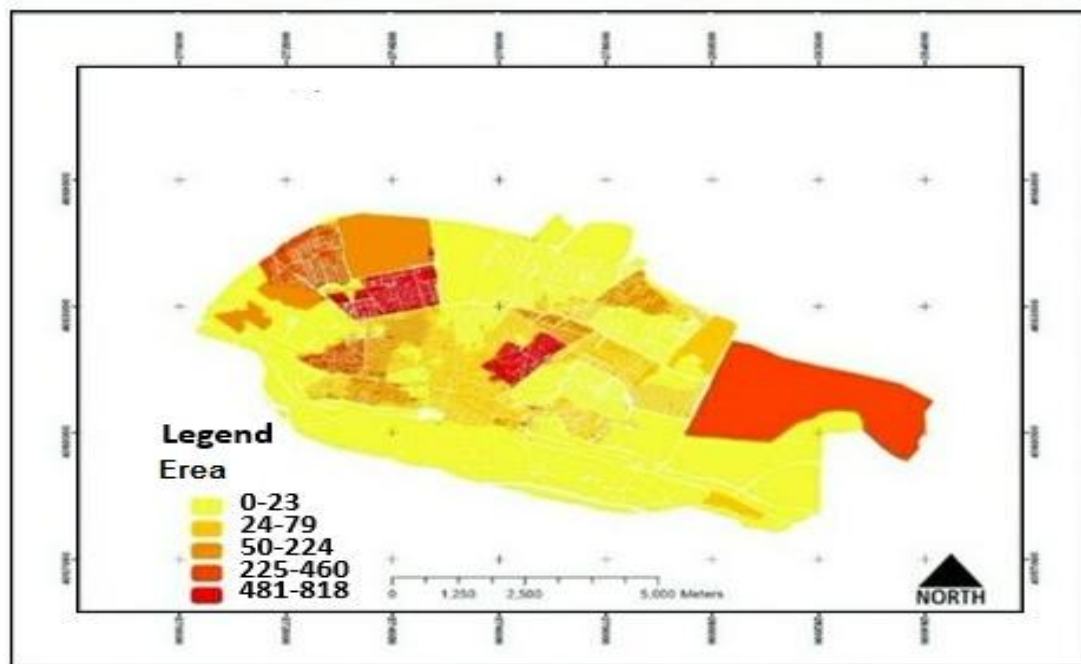


The Imam Khomeini Relief Committee and the Welfare Organization are the country's most significant support organizations, established to help impoverished families and poor, ill women reduce their deprivation. They cover thousands of such individuals or families. However, despite the efforts of these two organizations, a question arises regarding how successful they have been in reducing poverty, or what is often referred to as poverty alleviation, and what challenges they face. Another issue concerning poverty alleviation organizations is that various institutions and organizations, such as the Mostazafan Foundation, the 15 Khordad Foundation, the Imam Khomeini Relief Committee, the Welfare Organization, and other government, private, and charitable organizations, consider combating deprivation their responsibility. However, it is unclear which entity is primarily responsible for supporting poor people. Even the Ministry of Welfare and Social Security cannot claim to have comprehensive resources for combating poverty

and illness. The welfare organization and the Imam Khomeini Relief Committee consistently cite financial resource shortages. In reality, organizations that cover the people experiencing poverty are continually facing financial and economic problems. In contrast, other organizations with significant financial resources are not responsible for addressing the financial issues of people with low incomes. Figure 3 shows the spatial distribution of female-headed households with health issues covered by the Imam Khomeini Relief Committee, by neighborhood. According to this map, the neighborhoods of Islamabad and Bisim have the highest density of female-headed households. Following these neighborhoods, Koy-e Farhang, Darmanghah, Pounak, and Golshahr rank next. Approximately 5,095 female-headed households are under the coverage of the Imam Khomeini Relief Committee, equivalent to 2.4% of the total female population of Zanjan city and 30.8% of the female-headed households in Zanjan city.

Figure 3

Spatial distribution of ill female-headed households covered by the Imam Khomeini Relief Committee by neighborhoods



Hot spots were analyzed to determine the spatial distribution of ill female-headed households, distinguishing between those covered by the Imam Khomeini Relief Committee and those not covered. Moran's I statistic findings indicate a significant spatial correlation in the distribution of female-headed households with health issues in Zanzan city. Figure 4 shows the Z-statistic. As illustrated in the figure, Moran's I statistic calculated using Euclidean distance has a positive and significant value. A Moran's I value of 0.13 indicates that the spatial distribution of ill women is clustered. Since this value exceeds 1, the clustering intensity is very high and robust. This means that female-headed households facing health issues choose specific areas of the city to live in for economic, social, and other

reasons. Interviews and field surveys revealed that factors such as housing prices and rent, convenient and affordable urban transportation, cultural and social homogeneity, and physical conditions can influence the choice of specific residential areas for female-headed households. Figure 5 also shows that within the study area, the spatial distribution of this group of women is clustered into hot and cold spots with high or low values. Positive Z-statistics on the map, shown in red, indicate high values and hot-spot clusters. As the numerical score and color range decrease from red to yellow, significance diminishes, and the spots become cooler. Areas with a 99% concentration of hot spots are identified as needing special attention.

Figure 4

Final report of Moran's I statistics and spatial distribution of ill female-headed households

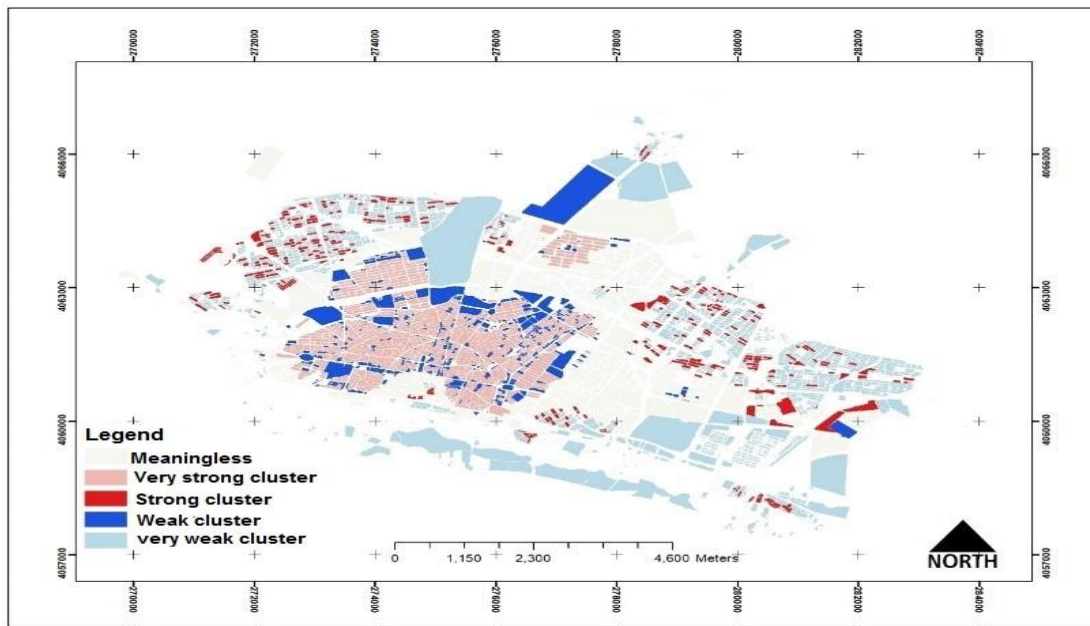


Figure 5

Spatial distribution of ill female-headed households in Zanjan city

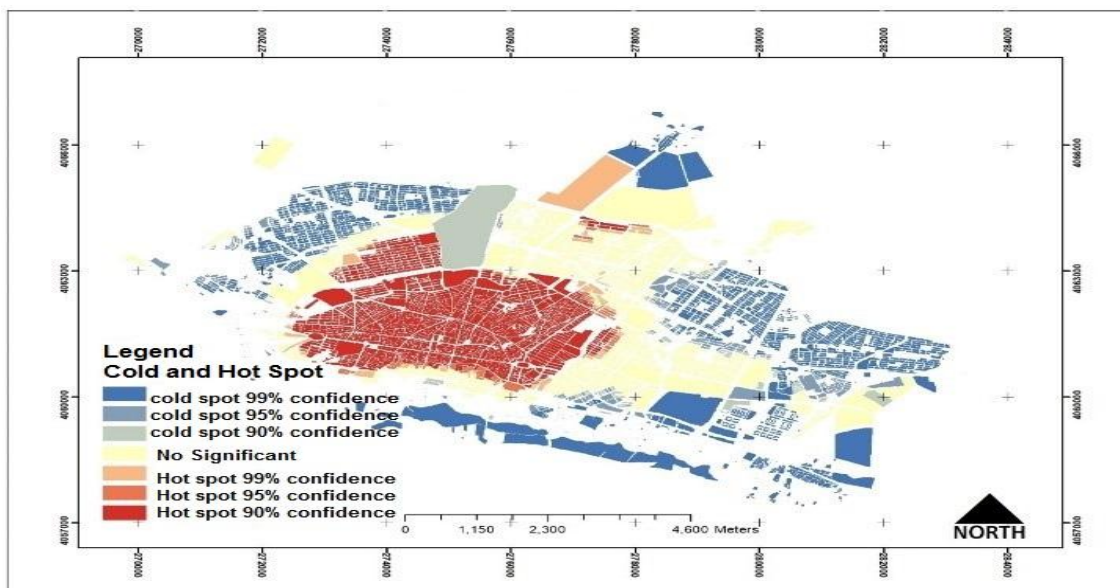


Figure 6 shows that more than 48% of Zanjan city's area falls within a solid cluster at 99% confidence. This cluster mainly corresponds to the central part of the city, the dilapidated areas of Zanjan, and the Islamabad neighborhood. According to this map, as the distance

from the city center increases, cold clusters with higher significance become more evident. Cold clusters with a 99% confidence are observed in the neighborhoods of Koy-e Farhang, Shahrak-e Gharb, Golshahr, Karmandan, and Oloum-e Paye.

Figure 6

Intensity and weakness of cold and hot spots of ill female-headed households in Zanjan city

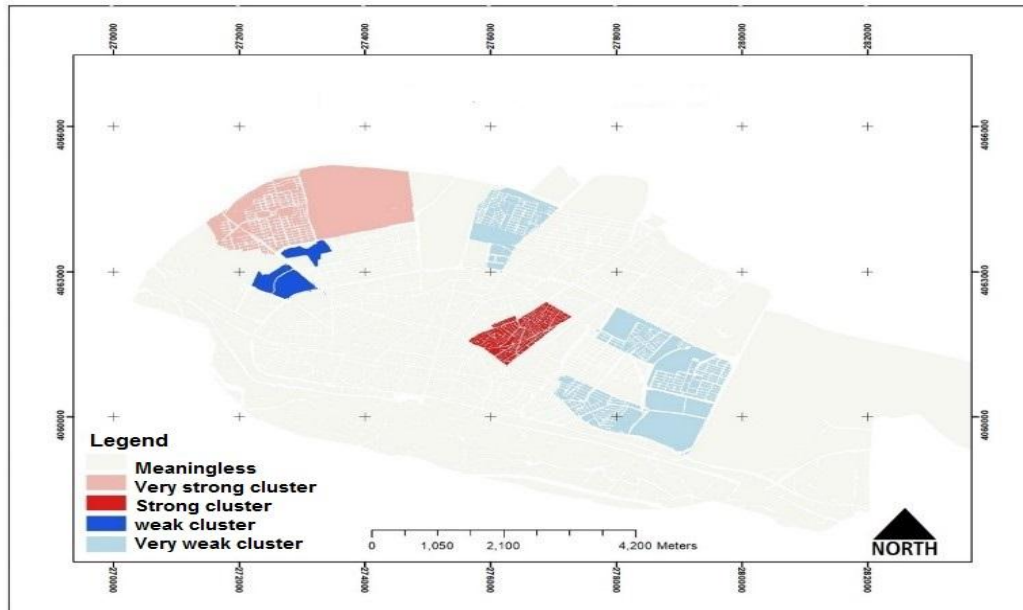
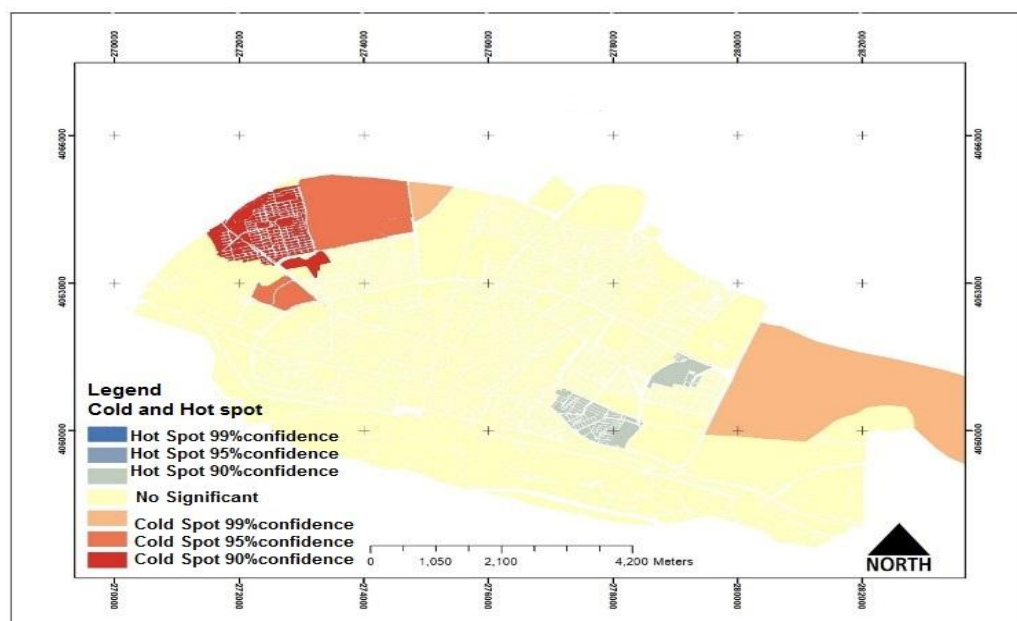


Figure 7 shows the clustering of the spatial distribution of ill female-headed households covered by the Imam Khomeini Relief Committee by neighborhood. In Zanjan city, over 83% of neighborhoods show no significant relationship between the spatial distribution of female-headed households covered by the relief committee and neighborhoods. Less than 2% of the city area shows a strong, significant relationship between the

spatial distribution of female-headed households covered by the relief committee and the neighborhoods. The neighborhoods of Koy-e Farhang and Shahrak-e Gharb exhibit robust clustering, while the neighborhoods of Bisim and Terans do not. Conversely, less than 5% of the city area shows very weak clustering, corresponding to the neighborhoods of Oloum-e Paye, Manzariyeh, Baharestan, and Shahriar.

Figure 7

Clustering of the spatial distribution of ill female-headed households covered by the Imam Khomeini Relief Committee



Map 8 illustrates that within the study area, the spatial distribution of female-headed households with high or low values is clustered into hot and cold spots. Positive Z-statistics on the map, shown in red, indicate high values and form hot-spot clusters. As the numerical score and color range decrease from red to yellow, the significance diminishes, and the spots become cooler. Neighborhoods with a 99% concentration of hot spots are identified as neighborhoods requiring special

attention. This neighborhood corresponds to Koy-e Farhang. The findings of this analysis indicate that female-headed households covered by the Imam Khomeini relief committee predominantly reside in the Koy-e Farhang neighborhood. In contrast, the neighborhoods of Koy-e Shahriar and Fateh show the lowest level of support, as evidenced by cold spots at the 95% confidence level.

Figure 8

Hot and cold spots of ill female-headed households covered by the Imam Khomeini relief committee in Zanjan city

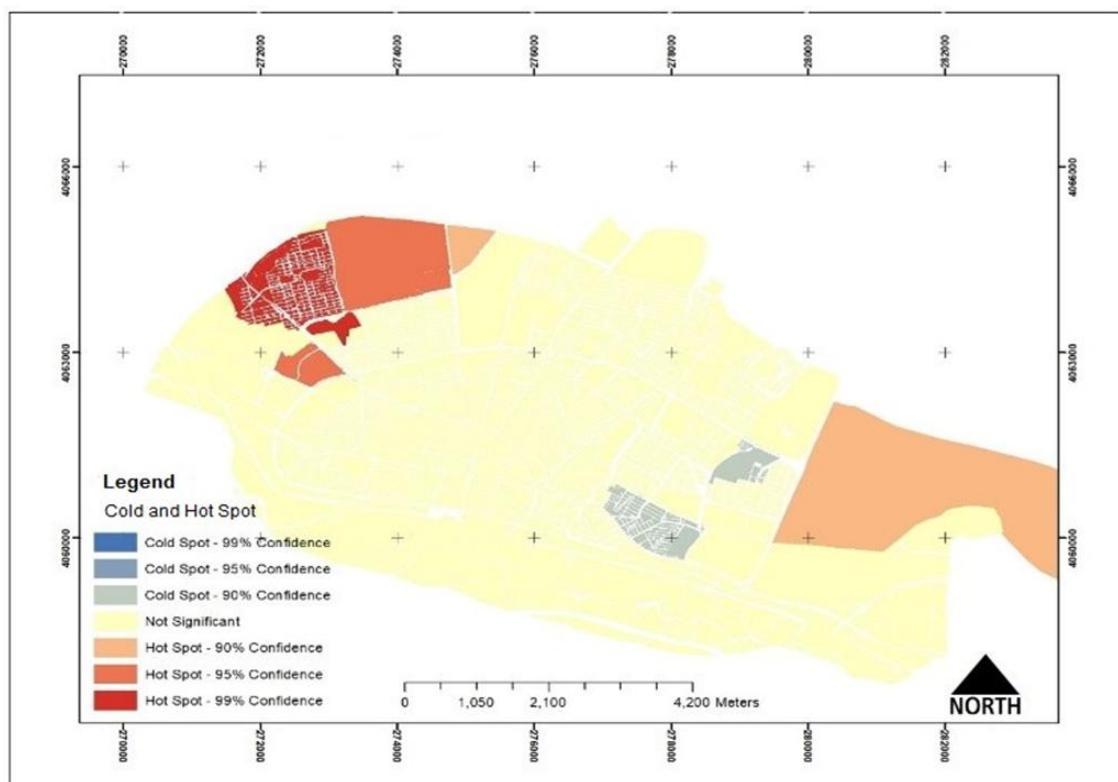
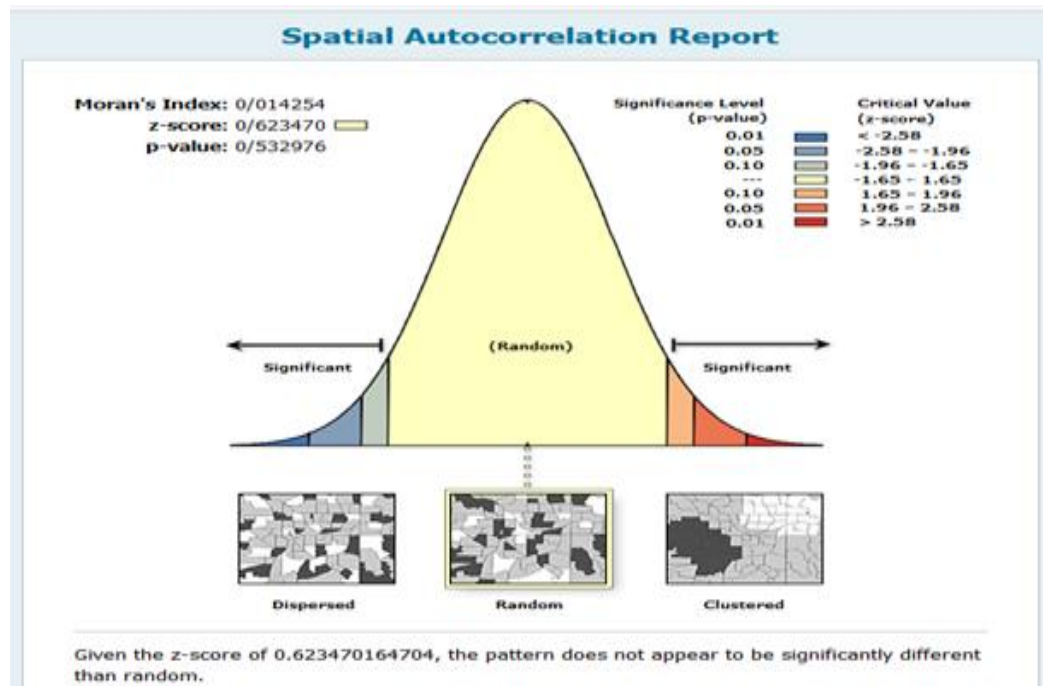


Figure 9 illustrates the Moran's statistic for female-headed households with health issues covered by the Imam Khomeini relief committee across Zanjan. The positive Moran's I value of 0.14 and the Z-value of 0.62 indicate a random spatial distribution of ill female-headed households. A p-value of 0.5 indicates that changes in spatial conditions and equations could alter the spatial structure and distribution of ill female-headed households, resulting in either clustering or

dispersion. Figure 9 shows the spatial distribution of female-headed households across Zanjan, while Figure 10 illustrates the intensity and weakness of the clusters. The findings from these maps indicate a 99% confidence level that hot spots may form in the city center if spatial conditions and equations change. Conversely, in the eastern and northeastern parts of the city, there is a 99% confidence level that cold spots may develop.

Figure 9

Moran's I statistic for ill female-headed households covered by the Imam Khomeini relief committee in Zanjan city



Discussion and Conclusion

In response to the main research question regarding the spatial distribution of ill female-headed households in Zanjan city, these households are clustered. Figure 4 shows the final report of Moran's I statistic. According to this statistic, since the value exceeds 1, the clustering intensity is very high. This indicates that female-headed households choose specific city areas to live in for various economic, social, and other reasons. Field interviews and surveys revealed that housing and rental prices, convenient and affordable urban transportation, and cultural and social homogeneity can significantly influence the selection of specific locations for ill female-headed households. Figure 5 also shows that within the study area, the spatial distribution of these households is clustered into hot and cold spots with varying values. The positive Z-statistic on the map, shown in red, indicates that more than 48% of Zanjan city is in a robust cluster at the 99% confidence level. This cluster mainly corresponds to the central part, the dilapidated areas of Zanjan, and the Islamabad neighborhood. Based on this map, as the distance from the city center increases, cold

clusters become more spatially significant. These cold clusters, with a 99% confidence, are observed in neighborhoods such as Koy-e Farhang, Shahrak-e Gharb, Golshahr, Karmandan, and Oloum-e Payeh. The results of the research, the analysis of layers, and the conducted assessments indicate a relationship between poverty, widowhood, social deprivation, and the illnesses affecting these women. As shown in Figure 2, many of these individuals have settled in the southern part of the city center, which is primarily characterized by deteriorated areas and informal settlements, such as the Islamabad neighborhood. This intensity is highlighted through hot spot analysis in Figure 6. The closer to affluent areas, such as Shahrak-e Karmandan, Oloum-e Payeh, and others, the greater the decrease in intensity and the approach to zero density. Therefore, it can be argued that this issue is linked to physical indices. This finding aligns with the study by [Shalchi & Gholizadeh \(2018\)](#), which examined the role of dilapidated structures and informal settlements in the level of social deprivation among women. On the other hand, Moran's I statistic of 0.13 indicates that the spatial distribution of female-headed households is clustered. Since this value

is greater than 1, it indicates a high and robust clustering intensity. In other words, these ill female-headed households select specific city locations to live in due to a combination of economic and social factors. This result is consistent with the findings of (Babaeinasir et al., 2024) and (Ahmadi et al., 2022), which examined the impact of poverty and economic status on the level of exclusion of female-headed households, as well as with the findings of (Pohlan, 2019), which explored the role of unemployment in the level of deprivation. Regression modeling of female-headed households reveals a strong positive correlation at the 95% confidence level in neighborhoods such as Koy-e Farhang, Elahiyeh, Bisim, and Terans. In contrast to the central part of the city, Golshahr Phase 1, Shahrak-e Qods, and Noth Saadi, a strong negative correlation at the 95% confidence level is observed between female-headed households and their spatial distribution in Zanjan.

Conclusion

Examining the results of the research on the neurological and mental illness of female heads of households in Zanjan city shows that factors such as social, economic, cultural base, and physical factors have played an essential role in choosing a place for these people to continue their lives, especially in the coordinates that have low flexibility from an economic point of view and are generally considered as informal or vulnerable and underutilized places. Because investigations conducted in prosperous areas of the city have indicated a negative relationship between the distribution of these people in these urban areas and their social and economic base, it can be concluded that both the social and economic base and people's physical conditions are directly related to their life coordinates. Therefore, based on the conducted studies, a series of constructive recommendations can be provided, which are as follows:

Urban actors' and stakeholders' attention to the central area and the deteriorated fabric of the city as a hotspot cluster for female-headed households with mental health issues in Zanjan.

Urban stakeholders' attention to the Islamabad neighborhood as a hotspot cluster for female-headed households in Zanjan.

Implementation and support for female-headed households with mental health issues in hotspot areas of

the city by the Imam Khomeini Relief Committee to improve mental health.

Adoption of supportive policies for the spatial distribution of female-headed households with mental health issues in the city to prevent the creation of problematic urban areas.

Focus on urban housing policies for low-income groups to reduce the intensity of hotspot clusters in the central area, urban planners say.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. An ethical consideration in this study was that participation was entirely optional.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contribute to this study.

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