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Machine Learning Analysis of Lifestyle Clusters and Their Association With Mental Health Outcomes in Single Mothers

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ABSTRACT

The objective of this study was to identify distinct lifestyle clusters among single mothers in Tehran using machine learning techniques and to examine the association of these clusters with depression, anxiety, and psychological distress. This cross-sectional analytical study was conducted among single mothers residing in Tehran. Data were collected using standardized self-report instruments assessing lifestyle behaviors, including physical activity, diet quality, sleep patterns, screen time, perceived stress, and social support, as well as mental health outcomes. Unsupervised machine learning algorithms were applied to identify latent lifestyle clusters based on standardized lifestyle indicators. Subsequently, supervised machine learning models were used to evaluate the predictive relationship between lifestyle cluster membership and adverse mental health outcomes. Model performance was assessed using cross-validation procedures and standard performance metrics, and feature importance analyses were conducted to enhance interpretability. Unsupervised clustering identified three distinct lifestyle profiles, including a health-oriented cluster, a moderately adaptive cluster, and a high-risk lifestyle cluster. Inferential analyses revealed statistically significant differences in depression, anxiety, and psychological distress across clusters, with the high-risk lifestyle cluster exhibiting the highest levels of all adverse mental health outcomes and the health-oriented cluster showing the lowest levels ($p < 0.001$). Supervised machine learning models demonstrated good to excellent predictive performance in classifying elevated mental health symptoms, with ensemble-based models achieving the highest accuracy and area under the curve values. Feature importance analyses indicated that perceived stress, sleep quality, and social support were the strongest predictors of adverse mental health outcomes. The findings demonstrate that single mothers' mental health outcomes are strongly associated with distinct lifestyle patterns and that machine learning approaches offer valuable tools for identifying high-risk profiles and key behavioral targets for intervention.

Keywords: Single mothers; Lifestyle clusters; Mental health; Depression; Anxiety; Machine learning

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Introduction

Single motherhood has emerged as a salient and expanding family structure across diverse sociocultural and economic contexts, driven by rising divorce rates, widowhood, migration, and changing social norms surrounding marriage and family life. This demographic shift has positioned single mothers as a population

of growing academic and policy interest, particularly due to their disproportionate exposure to economic hardship, social vulnerability, and mental health risks. Empirical evidence consistently indicates that single mothers experience higher levels of psychological distress, depression, and anxiety compared with partnered mothers, a pattern that reflects the cumulative burden of financial strain, sole caregiving responsibility, and reduced access to social and institutional support systems (1, 2). These challenges are not merely individual in nature but are embedded within broader structural, cultural, and welfare regimes that shape the lived realities of single motherhood (3, 4).

From a socioeconomic perspective, single mothers are more likely to encounter unstable employment trajectories, lower income, and persistent poverty, particularly in contexts characterized by limited social protection and gendered labor markets (5, 6). Employment insecurity and inadequate childcare options often compel single mothers to adopt coping strategies that may adversely affect health-related behaviors, including irregular sleep patterns, poor dietary habits, and reduced engagement in physical activity (7, 8). Over time, these lifestyle disruptions can compound psychological vulnerability, reinforcing cycles of stress and mental health deterioration. Research has further demonstrated that the stressors associated with single motherhood not only affect mothers themselves but also have intergenerational consequences, influencing parenting stress, family dynamics, and child psychosocial adjustment (9, 10).

Mental health outcomes among single mothers have been widely documented across global settings, with depression and anxiety emerging as the most prevalent conditions. Studies conducted in low- and middle-income urban contexts, such as Dhaka, have reported alarmingly high rates of depressive and anxiety disorders among single mothers, underscoring the role of socioeconomic adversity and limited access to mental health services (1). Similar patterns have been observed in other regions, where qualitative and quantitative research highlights how role overload, social stigma, and gender-based oppression exacerbate emotional strain and undermine psychological well-being (11, 12). In East Asian contexts, longitudinal analyses suggest that negative life changes following the transition to single motherhood elevate parenting stress, with depressive symptoms acting as a key mediating mechanism, particularly among low-income mothers (13).

Beyond structural stressors, psychosocial resources such as social support, resilience, and emotion regulation have been identified as critical protective factors for single mothers' mental health. Perceived social support from family, community, and formal services has been shown to buffer the adverse psychological effects of caregiving burden and economic hardship (14). Similarly, adaptive emotion regulation strategies and resilience capacities are associated with lower levels of distress and improved psychological adjustment among single mothers managing multiple social roles (15). In the Iranian context, participatory and empowerment-oriented interventions have demonstrated promise in enhancing coping skills and life management capacities among single mothers, highlighting the importance of culturally sensitive approaches to mental health promotion (16). However, access to such resources remains uneven, often shaped by welfare policies, social attitudes, and institutional discourses that can either legitimize or marginalize single mothers' needs (3, 4).

While the literature has extensively examined individual risk and protective factors, there is growing recognition that health behaviors and psychosocial variables do not operate in isolation. Instead, they form interconnected lifestyle patterns that jointly influence mental health outcomes. Lifestyle encompasses a

multidimensional constellation of behaviors and conditions, including physical activity, diet, sleep, substance use, screen time, stress exposure, and social connectedness. Among single mothers, lifestyle behaviors are often shaped by time scarcity, economic constraints, and caregiving demands, leading to heterogeneous patterns of adaptation and risk (7, 8). Traditional variable-centered analytical approaches, while informative, may fail to capture the complexity and co-occurrence of these behaviors within individuals.

Recent methodological advances have introduced machine learning as a powerful tool for uncovering latent patterns within complex, high-dimensional data. Unsupervised learning techniques, such as clustering algorithms, enable researchers to identify naturally occurring lifestyle profiles without imposing a priori assumptions about variable relationships. These approaches have been increasingly applied in public health and mental health research to classify behavioral patterns and examine their associations with health outcomes. Compared with conventional statistical models, machine learning methods offer enhanced capacity to model nonlinear relationships, interactions, and heterogeneity within populations. Despite their growing use, applications of machine learning to the study of single mothers' lifestyles and mental health remain scarce, particularly in non-Western and middle-income contexts.

In parallel, explainable machine learning frameworks have addressed longstanding concerns regarding the interpretability of algorithmic models in health research. By integrating feature importance metrics and post hoc explanation techniques, researchers can elucidate how specific lifestyle components contribute to mental health risk, thereby enhancing the translational value of findings for policy and intervention design. This is particularly relevant for vulnerable populations such as single mothers, where evidence-informed, targeted strategies are needed to optimize limited resources and maximize preventive impact. International organizations have emphasized the importance of data-driven approaches to inform social protection policies for single mothers, advocating for integrated frameworks that consider health, employment, and social support simultaneously (17).

Within the Iranian context, single mothers represent a socially and economically vulnerable group whose mental health needs are shaped by unique cultural, legal, and welfare structures. Barriers related to remarriage, social stigma, and limited institutional support can further constrain lifestyle choices and coping strategies (18). Although prior Iranian studies have explored empowerment, social participation, and psychosocial adjustment among single mothers, there remains a lack of empirical research adopting advanced analytical techniques to systematically examine lifestyle patterns and their mental health correlates. Addressing this gap is essential for developing nuanced, contextually grounded insights that move beyond deficit-oriented narratives and recognize the heterogeneity of single mothers' lived experiences.

Taken together, the existing literature underscores the multifaceted vulnerabilities of single mothers while also pointing to the potential of integrative, data-driven approaches to better understand and address their mental health outcomes. However, few studies have combined lifestyle-focused frameworks with machine learning methodologies to identify distinct behavioral profiles and examine their differential associations with mental health indicators. Moreover, evidence from Middle Eastern urban settings, including Tehran, remains particularly limited, despite the relevance of socioeconomic pressures, rapid urbanization, and evolving family structures in shaping maternal well-being.

Accordingly, the aim of the present study was to apply machine learning techniques to identify lifestyle clusters among single mothers in Tehran and to examine the association of these clusters with mental health outcomes, including depression, anxiety, and psychological distress.

Methods and Materials

Study Design and Participants

The present study employed a cross-sectional, analytical design with a machine learning–oriented modeling framework to identify lifestyle clusters and examine their associations with mental health outcomes among single mothers residing in Tehran, Iran. The target population consisted of single mothers defined as women who were divorced, widowed, or separated and who had at least one dependent child living with them. Participants were recruited from multiple urban districts of Tehran through a combination of community health centers, municipal social support offices, non-governmental organizations providing services to women-headed households, and online announcements disseminated through local support networks. Inclusion criteria comprised being between 20 and 55 years of age, having lived in Tehran for at least one year, and possessing sufficient literacy to complete self-report questionnaires. Exclusion criteria included the presence of severe cognitive impairment, diagnosed psychotic disorders, or current substance dependence that could interfere with reliable self-reporting. Sampling was conducted using a multistage convenience approach with efforts to ensure heterogeneity in socioeconomic status, employment conditions, and residential areas. Prior to participation, all eligible individuals received a full explanation of the study objectives and procedures, and written informed consent was obtained.

Measures

Data were collected using a structured battery of standardized self-report instruments designed to comprehensively capture lifestyle behaviors and mental health outcomes. Lifestyle variables included multiple domains such as physical activity, dietary patterns, sleep quality and duration, smoking and substance use behaviors, digital media use, perceived work–life balance, and engagement in stress-management or self-care practices. Physical activity was assessed through a validated questionnaire measuring frequency, duration, and intensity of weekly activities, while dietary behaviors were evaluated using a food frequency–based instrument focusing on consumption of fruits, vegetables, processed foods, and sugary beverages. Sleep patterns were assessed using a standardized sleep quality scale capturing both quantitative and qualitative aspects of sleep. Psychosocial lifestyle components, including perceived social support and daily stress exposure, were measured using established scales with demonstrated reliability in Iranian populations. Mental health outcomes constituted the dependent variables of the study and included symptoms of depression, anxiety, and psychological distress, assessed through widely used screening instruments with validated Persian versions. Additional demographic and contextual variables, such as age, number of children, employment status, educational level, household income, and duration of single motherhood, were also collected to support descriptive analyses and model adjustment. All instruments demonstrated acceptable internal consistency in the present sample, and data collection was conducted either in supervised group settings or through secure online forms to maximize accessibility while preserving data integrity.

Data Analysis

Data analysis followed a multistep procedure integrating conventional statistical preprocessing with unsupervised and supervised machine learning techniques. Initially, raw data were screened for completeness, outliers, and logical inconsistencies. Missing values were handled using appropriate imputation methods based on the proportion and pattern of missingness. Continuous variables were standardized to ensure comparability across different measurement scales, and categorical variables were encoded using suitable transformation techniques. To identify latent lifestyle profiles, unsupervised clustering algorithms were applied to the lifestyle-related variables. Several clustering methods, including k-means and hierarchical clustering, were evaluated, and the optimal number of clusters was determined using internal validation indices such as the silhouette coefficient and the elbow method. Once stable lifestyle clusters were identified, cluster membership was used as the primary independent variable in subsequent analyses. Supervised machine learning models, including regularized logistic regression and tree-based algorithms, were then employed to examine the association between lifestyle clusters and mental health outcomes. Model performance was assessed using cross-validation procedures and standard metrics such as accuracy, precision, recall, and area under the receiver operating characteristic curve. To enhance interpretability, feature importance measures and post hoc explainability techniques were applied to clarify the contribution of specific lifestyle factors to mental health outcomes. All analyses were conducted using Python-based machine learning libraries and statistical software, with significance levels set a priori.

Findings and Results

The findings are presented in a structured sequence to first describe the characteristics of the study sample and then report the results of machine learning–based lifestyle clustering and its associations with mental health outcomes among single mothers in Tehran. Table 1 presents the demographic and baseline characteristics of the participants, providing contextual grounding for the subsequent analytical results.

Table 1. Demographic and baseline characteristics of the study participants (N = 412)

Variable	Category	n	%
Age (years)	20–29	74	18.0
	30–39	168	40.8
	40–49	128	31.1
	≥50	42	10.2
Marital status	Divorced	231	56.1
	Widowed	149	36.2
	Separated	32	7.7
Education level	Primary/Secondary	96	23.3
	Diploma	164	39.8
	University degree	152	36.9
Employment status	Unemployed	177	43.0
	Part-time	121	29.4
	Full-time	114	27.6
Monthly household income	Below city median	248	60.2
	At/above city median	164	39.8
Number of children	One	189	45.9
	Two	151	36.7
	Three or more	72	17.5

As shown in Table 1, the mean age of participants was 37.9 years (SD = 8.6), with the majority falling within the 30–39 and 40–49 age ranges. More than half of the sample consisted of divorced mothers, and approximately one-third were widowed. Educational attainment was relatively heterogeneous, with nearly equal representation of diploma holders and university graduates. A substantial proportion of participants reported unemployment or unstable employment conditions, and nearly two-thirds lived in households with income below the median level for Tehran. These characteristics reflect the socioeconomic vulnerability that often accompanies single motherhood in urban Iranian contexts and underscore the relevance of examining lifestyle patterns and mental health within this population.

The second stage of analysis focused on identifying latent lifestyle profiles using unsupervised machine learning techniques.

Table 2. Lifestyle cluster characteristics based on standardized lifestyle indicators

Lifestyle indicators (z-scores)	Cluster A: Health-oriented (n = 118)	Cluster B: Moderately adaptive (n = 167)	Cluster C: High-risk lifestyle (n = 127)
Physical activity	0.84	0.12	-0.71
Diet quality	0.76	0.05	-0.68
Sleep quality	0.69	0.08	-0.74
Screen time	-0.62	0.14	0.81
Smoking/substance use	-0.58	0.09	0.77
Perceived stress	-0.73	0.18	0.85
Social support	0.81	0.22	-0.79

Table 2 demonstrates that the clustering algorithm identified three distinct lifestyle profiles. Cluster A, labeled the health-oriented lifestyle, was characterized by higher physical activity, healthier dietary patterns, better sleep quality, lower screen time, minimal engagement in smoking or substance use, and higher perceived social support. Cluster B, the moderately adaptive lifestyle, exhibited near-average scores across most indicators, reflecting a balanced but not optimal lifestyle pattern. Cluster C, labeled the high-risk lifestyle, showed consistently unfavorable scores, including low physical activity, poor diet and sleep, excessive screen time, higher engagement in smoking-related behaviors, elevated perceived stress, and low social support. Internal validation indices indicated adequate cluster separation and stability, supporting the robustness of the identified profiles.

Following cluster identification, differences in mental health outcomes across lifestyle clusters were examined.

Table 3. Mean mental health scores across lifestyle clusters

Mental health outcome	Cluster A	Cluster B	Cluster C	F	p
Depression symptoms	7.4 ± 4.1	11.6 ± 5.2	17.9 ± 6.3	96.32	<0.001
Anxiety symptoms	8.1 ± 4.5	12.9 ± 5.7	19.4 ± 6.8	104.77	<0.001
Psychological distress	9.6 ± 4.8	14.2 ± 5.9	21.1 ± 7.2	112.05	<0.001

As reported in Table 3, statistically significant differences were observed among the three lifestyle clusters for all assessed mental health outcomes. Participants in the health-oriented cluster reported the lowest levels of depressive symptoms, anxiety, and psychological distress, whereas those in the high-risk lifestyle cluster exhibited markedly elevated scores across all outcomes. The moderately adaptive cluster consistently fell between the two extremes. These findings indicate a strong gradient relationship between lifestyle patterns and mental health status among single mothers.

To further evaluate the predictive utility of lifestyle cluster membership, supervised machine learning models were applied to classify clinically significant mental health symptoms.

Table 4. Performance of machine learning models in predicting elevated mental health symptoms

Model	Accuracy	Precision	Recall	AUC
Logistic regression	0.78	0.76	0.74	0.82
Random forest	0.84	0.83	0.81	0.89
Gradient boosting	0.86	0.85	0.83	0.91

Table 4 indicates that all evaluated models demonstrated acceptable to high predictive performance, with ensemble-based approaches outperforming traditional logistic regression. The gradient boosting model achieved the highest accuracy and area under the curve, suggesting superior discrimination between participants with and without elevated mental health symptoms based on lifestyle cluster membership and associated features. These results highlight the added value of machine learning techniques in modeling complex, multidimensional lifestyle–mental health relationships.

Finally, feature importance and explainability analyses were conducted to clarify which lifestyle factors most strongly contributed to mental health predictions.

Table 5. Top lifestyle predictors of adverse mental health outcomes based on feature importance analysis

Rank	Predictor	Relative importance
1	Perceived stress	0.31
2	Sleep quality	0.24
3	Social support	0.18
4	Physical activity	0.15
5	Screen time	0.12

As shown in Table 5, perceived stress emerged as the most influential predictor of adverse mental health outcomes, followed by sleep quality and social support. Behavioral factors such as physical activity and screen time also contributed meaningfully, though to a lesser extent. This hierarchy of predictors underscores the interplay between psychosocial stressors and daily lifestyle behaviors in shaping mental health vulnerability among single mothers.

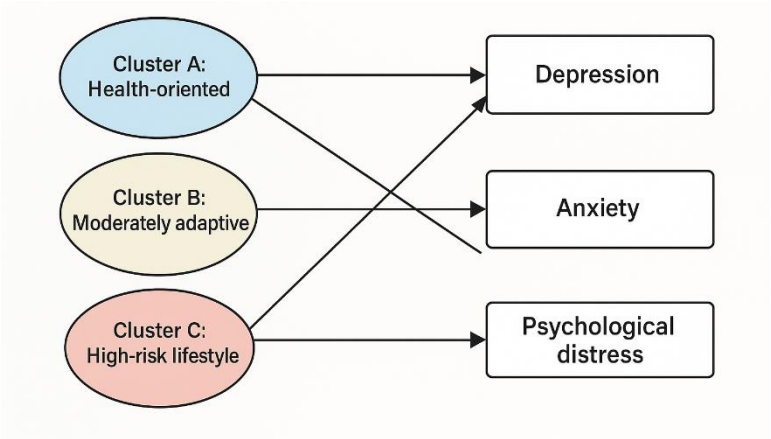

Figure 1. Conceptual visualization of lifestyle clusters and their associations with mental health outcomes

Discussion and Conclusion

The present study applied a machine learning–based analytical framework to identify lifestyle clusters among single mothers in Tehran and to examine how these clusters are associated with mental health outcomes. The findings demonstrated the existence of three distinct lifestyle profiles—health-oriented, moderately adaptive, and high-risk—each exhibiting markedly different patterns of depression, anxiety, and psychological distress. This clustering-based perspective advances the existing literature by moving beyond isolated risk factors and highlighting the cumulative and interactive nature of lifestyle behaviors in shaping mental health among single mothers.

The identification of a health-oriented lifestyle cluster characterized by higher physical activity, better sleep quality, healthier dietary patterns, lower perceived stress, and stronger social support aligns closely with prior evidence emphasizing the protective role of psychosocial and behavioral resources in single mothers' well-being. Previous studies have shown that perceived social support functions as a critical buffer against stress and psychological distress in single mothers, particularly those facing complex caregiving demands or children's special needs (14). Similarly, emotion regulation and resilience have been identified as central mechanisms through which single mothers adapt to multiple role demands and mitigate mental health risks (15). The lower levels of depression and anxiety observed in the health-oriented cluster suggest that the co-occurrence of adaptive behaviors and psychosocial resources creates a synergistic protective effect that cannot be fully captured through variable-centered approaches.

In contrast, the high-risk lifestyle cluster exhibited consistently unfavorable behavioral and psychosocial patterns alongside significantly elevated mental health symptoms. This profile was marked by poor sleep quality, unhealthy dietary behaviors, low physical activity, excessive screen time, high perceived stress, and limited social support. These findings resonate strongly with prior research documenting high rates of depression and anxiety among single mothers living under conditions of socioeconomic strain and chronic stress (1, 2). Qualitative evidence further suggests that persistent psychological pressure, especially during the postpartum and early parenting phases, can erode coping capacities and intensify emotional vulnerability (11). The present results extend this literature by demonstrating that such vulnerabilities tend to cluster into broader lifestyle configurations rather than occurring as isolated problems.

The moderately adaptive cluster, which displayed near-average levels across most lifestyle indicators and intermediate mental health outcomes, highlights the heterogeneity within the population of single mothers. This group appears to represent a substantial segment of mothers who manage to maintain functional routines despite structural and personal constraints but remain vulnerable to psychological distress under cumulative stress exposure. This finding is consistent with research indicating that many single mothers adopt pragmatic coping strategies that allow them to balance work, caregiving, and household responsibilities, albeit often at the cost of chronic fatigue and moderate stress (7, 8). The existence of this intermediate cluster underscores the importance of preventive interventions aimed at strengthening protective factors before mothers transition into higher-risk profiles.

The strong gradient observed between lifestyle clusters and mental health outcomes supports theoretical models that conceptualize mental health as the product of interacting behavioral, social, and structural determinants. The markedly higher levels of depression, anxiety, and psychological distress in the high-risk cluster are consistent with findings linking cumulative disadvantage, employment insecurity, and poverty to

adverse mental health trajectories among single mothers (5, 6). Furthermore, prior research has shown that parenting stress and maternal psychopathology are closely intertwined, with implications for both maternal functioning and child adjustment (9, 10). The present findings suggest that lifestyle clusters may serve as an integrative lens through which these interconnected risks can be understood and addressed.

The supervised machine learning analyses further demonstrated that lifestyle cluster membership and associated behavioral features could predict elevated mental health symptoms with relatively high accuracy, particularly when ensemble-based models were employed. This result is methodologically significant, as it highlights the added value of machine learning approaches in modeling complex, nonlinear relationships between lifestyle behaviors and mental health outcomes. Traditional regression-based models often assume linearity and independence among predictors, assumptions that are frequently violated in real-world behavioral data. By contrast, the superior performance of tree-based and boosting algorithms observed in this study suggests that mental health vulnerability among single mothers is shaped by interactive and threshold-based processes that are better captured through flexible modeling techniques.

The feature importance analysis provides further insight into the mechanisms underlying these associations. Perceived stress emerged as the most influential predictor of adverse mental health outcomes, followed by sleep quality and social support. This hierarchy is consistent with a substantial body of literature identifying chronic stress as a central pathway linking socioeconomic adversity to depression and anxiety in single mothers (2, 13). Sleep disturbances, which are both a consequence and a driver of psychological distress, have also been widely documented among single mothers balancing employment and caregiving demands (8). The prominent role of social support in the predictive models reinforces prior findings that social connectedness and perceived support are among the most robust protective factors for mental health in this population (14, 17).

Importantly, the findings must also be interpreted within the sociocultural and policy context of Iran. Single mothers in Iran often face additional challenges related to social stigma, legal constraints, and limited welfare support, which can shape both lifestyle choices and mental health outcomes. Barriers to remarriage and social reintegration have been identified as significant stressors that may restrict access to emotional and economic resources (18). At the same time, empowerment-oriented and group-based interventions have demonstrated potential to enhance problem-solving skills and psychosocial well-being among Iranian single mothers (16). The identification of distinct lifestyle clusters in the present study suggests that such interventions may need to be tailored to different profiles rather than adopting a one-size-fits-all approach.

From a broader perspective, the results contribute to ongoing debates regarding the social positioning of single mothers and the ways in which welfare discourses and institutional practices shape their lived experiences. Research has shown that policy narratives often oscillate between stigmatization and moralization of single motherhood, influencing access to resources and support (3, 4). The strong association between high-risk lifestyle clusters and poor mental health outcomes observed in this study underscores the importance of structural interventions that address not only individual behaviors but also the social and economic conditions that constrain lifestyle choices. In this regard, international frameworks advocating comprehensive social protection for single mothers provide a relevant reference point for policy development (17).

Overall, the findings support a holistic and person-centered understanding of mental health among single mothers, emphasizing that lifestyle behaviors, psychosocial resources, and structural conditions interact to produce distinct patterns of vulnerability and resilience. By leveraging machine learning techniques, the present study offers a nuanced and empirically grounded contribution to the literature, with implications for both research and practice in mental health, social policy, and family studies.

One limitation of this study is its cross-sectional design, which precludes causal inference regarding the directionality of associations between lifestyle clusters and mental health outcomes. The reliance on self-report measures may also introduce reporting bias, particularly for sensitive behaviors such as substance use or psychological symptoms. In addition, the use of convenience sampling within an urban setting limits the generalizability of findings to rural areas or other cultural contexts. Finally, although machine learning models demonstrated strong performance, the results are contingent on the selected variables and algorithms and may vary with alternative modeling choices.

Future research should employ longitudinal designs to examine transitions between lifestyle clusters over time and to clarify causal pathways linking lifestyle patterns to mental health trajectories among single mothers. Incorporating objective measures of behavior, such as wearable-based activity or sleep data, could further enhance measurement precision. Comparative studies across different cultural and policy contexts would also be valuable in identifying context-specific versus universal lifestyle–mental health relationships. Additionally, integrating qualitative methods could enrich understanding of the subjective meanings and constraints underlying different lifestyle profiles.

From a practical standpoint, the findings highlight the need for targeted, cluster-informed interventions that address the specific needs of single mothers with different lifestyle profiles. Mental health promotion programs should integrate stress management, sleep hygiene, and social support enhancement alongside economic and employment support. Policymakers and service providers may benefit from using data-driven profiling approaches to allocate resources more efficiently and to design flexible support systems that recognize heterogeneity among single mothers. Ultimately, interventions that simultaneously address behavioral, psychosocial, and structural determinants are likely to be most effective in improving mental health outcomes in this vulnerable population.

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Authors' Contributions

All authors equally contributed to this study.

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.

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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References

1. Nahar JS, Algin S, Sajib MWH, Ahmed S, Arafat SY. Depressive and anxiety disorders among single mothers in Dhaka. International Journal of Social Psychiatry. 2020;66(5):485-8. doi: 10.1177/0020764020920671.
2. Berryhill MB, Durtschi JA. Understanding Single Mothers' Parenting Stress Trajectories. Marriage & Family Review. 2016;53(3):227-45. doi: 10.1080/01494929.2016.1204406.
3. Herbst-Debby A. Welfare Mom as Warrior Mom: Discourse in the 2003 Single Mothers' Protest in Israel. Journal of Social Policy. 2012;42(1):129-45. doi: 10.1017/s0047279412000529.
4. Herbst-Debby A. (De)legitimization of Single Mothers' Welfare Rights: United States, Britain and Israel. Journal of European Social Policy. 2022;32(3):302-16. doi: 10.1177/09589287221076743.
5. Damaske S, Bratter JL, Frech A. Single mother families and employment, race, and poverty in changing economic times. Social Science Research. 2017;62:120–33.
6. Deleire T, Kalil A. Good Things Come in Threes: Single-Parent Multigenerational Family Structure and Adolescent Adjustment. Demography. 2002;39(2):393-413. doi: 10.2307/3088345.
7. Brady M. Gluing, Catching and Connecting: How Informal Childcare Strengthens Single Mothers' Employment Trajectories. Work Employment and Society. 2016;30(5):821-37. doi: 10.1177/0950017016630259.
8. Hashim IHM, Azmawati AA, Endut N, editors. Stress, roles and responsibilities of single mothers in Malaysia. SHS Web of Conferences; 2015: EDP Sciences.
9. Daryanani I, Hamilton JL, Abramson LY, Alloy LB. Single mother parenting and adolescent psychopathology. Journal of Abnormal Child Psychology. 2016;44(7):1411-23. doi: 10.1007/s10802-016-0128-x.
10. Hassan TY, Al-Diwan JK. Externalizing Behavior Problems of Children Raised by Single Mother. Journal of Global Scientific Research. 2022;7(3):2195-200. doi: 10.5281/zenodo.6399484.
11. Benuyenah V, Tran PB. Postpartum Psychological Pressure on Single Mothers: An Interpretative Phenomenological Analysis. Journal of Humanities and Applied Social Sciences. 2020;3(3):199-216. doi: 10.1108/jhass-12-2019-0089.
12. Munsayac C, Zulueta AJ, Garcia IY, Bardelosa JR, Mateo JR, Villarama J. A Mother's Woes: Implications of Gender-Based Oppression on Single Motherhood. Jip. 2024;2(7). doi: 10.69569/jip.2024.0088.
13. Lee R. Influence of the Negative Life Changes Experienced After Becoming Single Mothers on Parenting Stress: Focusing on the Moderated Mediation Effect of Depression by Low-Income Status. Korean Journal of Stress Research. 2024;32(2):85-93. doi: 10.17547/kjsr.2024.32.2.85.
14. Balachandran KP, Bhuvaneswari M. Perceived Social Support Among Parents and Exploration of Challenges Faced by Single Mothers of Children With Neurodevelopmental Disorders—A Mixed Method Study. Annals of Neurosciences. 2025. doi: 10.1177/09727531251327832.
15. Azara F, Widyatno A, Bisri M, Hapsari AD. The Relationship Between Emotion Regulation and Resilience in Single Mothers Possessing Multiple Roles in Malang City. KnE Social Sciences. 2022:222–9-–9.

16. Rasi HA, Moula A, Puddephatt AJ, Timpka T. Empowering Single Mothers in Iran: Applying a Problem-Solving Model in Learning Groups to Develop Participants' Capacity to Improve Their Lives. The British Journal of Social Work. 2012;43(5):833-52. doi: 10.1093/bjsw/bcs009.

17. Unicef. Social Protection for Single Mothers: International Practice. 2020.

18. Eskafi M, Yousefi M. Single mothers' tendency to remarry and the obstacles: A Case on Basic Theory. Journal of Research and Health. 2021;11(2):131-8. doi: 10.32598/JRH.11.2.1368.3.