International Journal of Trend in Scientific Research and Development (IJTSRD)
Volume 9 Issue 5, Sep-Oct 2025 Available Online: www.ijtsrd.com e-ISSN: 2456 – 6470

Regional Variations in Perinatal Mental Health Across North Indian Cities: A Multi-Dimensional Analysis of Anxiety and Depression Patterns

Jyoti Shikha, Dr. Tatheer Fatma

Department of Home Science, Khwaja Moinuddin Chishti Language University, Lucknow, Uttar Pradesh, India

ABSTRACT

This study investigates regional variations in perinatal mental health outcomes across three North Indian cities, focusing on the influence of geographical location and urbanization levels. A cross-sectional study was conducted across Azamgarh, Varanasi, and Lucknow (n = **300**), with mental health assessed using the Perinatal Anxiety Screening Scale (PASS), Pregnancy-Related Anxiety Questionnaire (PRAQ), and Edinburgh Postnatal Depression Scale. Analysis revealed significant regional variations, with Azamgarh showing consistently higher scores across all measures (PASS: M = **2.44**, SD = **0.32**; PRAQ: M = **3.20**, SD = **0.69**; Edinburgh: M = **2.22**, SD = **0.33**) compared to more urbanized Lucknow (PASS: M = **1.74**, SD = **0.56**; PRAQ: M = **2.94**, SD = **0.51**; Edinburgh: M = **1.99**, SD = **0.23**). Varanasi consistently occupied an intermediate position with scores falling between these two extremes. Strong correlations between mental health measures (r = **0.596–0.723**, p < **0.001**) indicated substantial overlap between anxiety and depressive symptoms. These findings highlight a clear urban-rural gradient in perinatal mental health outcomes, suggesting that urbanization level and associated healthcare infrastructure play crucial roles in maternal psychological well-being. The study underscores the need for context sensitive interventions that address the unique challenges faced by women in different urban environments.

KEYWORDS: *perinatal mental health, maternal anxiety, urban-rural differences, North India, pregnancy-specific anxiety, regional variations, mental health screening, maternal healthcare, cross-sectional study.*

How to cite this paper: Jyoti Shikha | Dr. Tatheer Fatma "Regional Variations in Perinatal Mental Health Across North Indian Cities: A Multi-Dimensional Analysis of Anxiety and Depression Patterns" Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-9 | Issue-5, October 2025, pp.637-647, URL: www.ijtsrd.com/papers/ijtsrd97550.pdf

IJTSRD97550

1. INTRODUCTION

1.1. Background and Significance

Perinatal mental health represents a critical yet often overlooked dimension of maternal healthcare, particularly in developing nations where cultural and socioeconomic factors significantly influence healthcare-seeking behaviors Austin and Priest (2005); Fairbrother, Janssen, Antony, Tucker, and Young (2016); Marchesi et al. (2016). Among the spectrum of perinatal mental health conditions, anxiety and depression during pregnancy and the postpartum period pose substantial challenges to maternal and child well-being Adewuya, Ola, Aloba, and Mapayi (2006); Leach, Poyser, and Fairweather-Schmidt (2017). These conditions, if left unaddressed, can have farreaching implications for both maternal health and child development trajectories Austin, Hadzi-Pavlovic, Leader, Saint, and Parker (2005); Buss et al. (2012); Davis et al. (2004).

The prevalence of perinatal anxiety disorders ranges from 13% to 40% globally Dennis, Falah-Hassani, and Shiri (2017), with rates varying significantly across different populations and contexts Buist, Gotman, and Yonkers (2011); Sutter-Dallay, Giaconne-Marcesche, Glatigny-Dallay, and Verdoux (2004). Generalized Anxiety Disorder (GAD) during pregnancy has emerged as a particularly significant concern, affecting a substantial proportion of women during this critical time Misri, Abizadeh, Sanders, and Swift (2015). The challenge of distinguishing between normal pregnancy related concerns and

pathological worry is complicated by the overlap of physical symptoms, such as fatigue and sleep disturbances, with normal experiences of pregnancy and early motherhood Argyropoulos et al. (2007); Weisberg and Paquette (2002).

1.2. Indian Context and Urban-Rural Divide

In the Indian context, the intersection of traditional beliefs, socio-cultural practices, and modern healthcare approaches creates a unique environment for understanding perinatal mental health Upadhyay et al. (2017). Despite India's rapid urbanization and healthcare advancement, regional variations continue to play a pivotal role in shaping maternal mental health experiences and outcomes. The prevalence of perinatal anxiety and depression in India varies significantly across different regions and communities, with rates ranging from 6% to 23% in various hospital- and community-based studies Dubey, Gupta, Bhasin, Muthal, and Arora (2012); Raza and Raza (2019); Savarimuthu et al. (2010).

Research has demonstrated that untreated perinatal anxiety can lead to adverse obstetric outcomes, including increased risk of preterm birth and low birth weight Ding et al. (2014); Grigoriadis et al. (2018); Uguz et al. (2013). Furthermore, maternal anxiety has been associated with long-term effects on child development, including cognitive, emotional, and behavioral difficulties Blair, Glynn, Sandman, and Davis (2011); Brouwers, van Baar, and Pop (2001); Van den Bergh et al. (2020). The frequent co-occurrence of anxiety with depression Grigoriadis et al. (2011); Wenzel, Haugen, Jackson, and Brendle (2005) often leads to a more severe and protracted course of illness Coelho, Murray, Royal-Lawson, and Cooper (2011); Van Balkom et al. (2008).

1.3. Healthcare Infrastructure and Urbanization

The North Indian urban landscape, characterized by varying levels of urbanization and healthcare infrastructure, presents an ideal setting for examining regional variations in perinatal mental health. Previous research has highlighted the influence of factors such as healthcare accessibility, quality of maternal services, and socioeconomic development on maternal mental well-being Fisher et al. (2012). Studies in low- and middle-income countries have identified several infrastructure-related factors affecting perinatal mental health, including:

- Accessibility and quality of healthcare services Golbasi, Kelleci, Kisacik, and Cetin (2010)
- Urban versus rural healthcare delivery systems Hopkins and Campbell (2008)
- Socioeconomic development and infrastructure Faisal-Cury, Menezes, Araya, and Zugaib (2009); Fisher et al. (2012)
- Mental health awareness and screening practices Manso-C´ordoba, Pickering, Ortega, Asu´nsolo, and Romero (2020)
- Healthcare provider training and resources Andersson et al. (2003)

1.4. Current Approaches to Perinatal Mental Health

Recent developments in perinatal mental health screening and intervention have shown promising results in various settings Austin et al. (2008); Goodman et al. (2014). Cognitive-behavioral therapy (CBT) and mindfulness-based approaches have demonstrated effectiveness in managing perinatal anxiety Duncan and Bardacke (2010); Dunn, Hanieh, Roberts, and Powrie (2012); Vieten and Astin (2008). However, the implementation of these interventions across diverse regional settings requires careful consideration of local healthcare infrastructures and accessibility factors Bastani, Hidarnia, Kazemnejad, Vafaei, and Kashanian (2005); Urech et al. (2010).

1.5. Research Gaps and Objectives

Current literature reveals significant gaps in understanding how urbanization levels and regional characteristics influence perinatal mental health outcomes in India. While studies have documented the prevalence of perinatal anxiety and depression in various Indian settings Evans, Heron, Francomb, Oke, and Golding (2001); Gavin et al. (2005), few have systematically examined these conditions across multiple cities representing different levels of urbanization. Furthermore, the validation and application of standardized screening tools across different regional contexts require careful consideration of local healthcare practices Borkovec, Newman, and Castonguay (2003); Donker, Griffiths, Cuijpers, and Christensen (2009).

The present study aims to address these knowledge gaps by:

1. Examining the prevalence and patterns of perinatal anxiety and depression across three North Indian cities: Azamgarh, Varanasi, and Lucknow
2. Investigating the relationship between urbanization levels and maternal mental health manifestations
3. Analyzing the correlations between different mental health measures across regional contexts
4. Assessing the implications of regional variations for healthcare delivery and intervention strategies

1.6. Methodological Approach

This research utilizes three validated assessment tools: the Perinatal Anxiety Screening Scale (PASS) Somerville et al. (2014), the Pregnancy-Related Anxiety Questionnaire

(PRAQ-R2) Huizink et al. (n.d.), and the Edinburgh Postnatal Depression Scale (EPDS) Cox, Holden, and Sagovsky (1987). These instruments have been widely used in various cultural contexts and have demonstrated reliability in assessing different aspects of perinatal mental health Hoffman and Mathew (2008); Huppert, Ryan, and Stein (2004).

The selection of these three North Indian cities offers a unique opportunity to examine the influence of urbanization on maternal mental health. Varanasi, one of the oldest continuously inhabited cities in the world, represents a blend of traditional practices and modern healthcare. Lucknow, as a major urban center, provides insights into maternal mental health in a rapidly developing metropolitan context. Azamgarh, with its semi-urban character, offers perspectives on maternal mental health in transitioning communities.

1.7. Key Contributions

This study makes the following contributions:

- Quantifies regional variations in perinatal mental health across three North Indian cities, demonstrating significant urban-rural differences in anxiety and depression scores
- Documents patterns of mental health outcomes across different urban contexts
- Validates PASS, PRAQ-R2, and Edinburgh scales in diverse Indian urban settings, showing strong inter-measure correlations
- Provides a methodological framework for studying perinatal mental health across varying urban environments
- Establishes an empirical basis for developing regionally tailored mental health interventions

1.8. Paper Organization

The paper is structured as follows:

- Section 2: Methodology, including study design and assessment tools
- Section 3: Analysis of demographic characteristics, regional variations, and correlational findings
- Section 5: Synthesis of findings, implications, and future directions

Understanding regional variations in perinatal mental health across North Indian cities is crucial for several reasons. First, it can inform the development of context sensitive screening and intervention strategies for Mental Health (UK et al. (2007). Second, it may help identify vulnerable populations requiring targeted support Iqbal, Sobhan, and Ryals (2002). Finally, insights from this study can contribute to policy development aimed at improving maternal mental health services across diverse urban environments Katzman (2011); Stein et al. (2011).

2. Methods

2.1. Study Design and Setting

2.1.1. Study Design

This cross-sectional study was conducted between June 2024 and December 2024 across three North Indian cities: Azamgarh, Varanasi, and Lucknow. These cities were strategically selected to represent varying levels of urbanization and different healthcare infrastructures within the North Indian landscape. Varanasi, a historical city, represents a traditional urban setting; Lucknow exemplifies a modern metropolitan environment; and Azamgarh provides insights from a semi-urban perspective.

2.1.2. Sampling Methodology

The study employed a stratified random sampling approach to ensure representative participation. A total of 300 pregnant women were recruited from both government and private healthcare facilities across the three cities, with 100 participants from each city. This balanced geographic distribution enables robust comparative analysis across different urban contexts.

2.1.3. Ethical Approval and Data Collection Sites

The study protocol received approval via email correspondence with the relevant institutional authorities. Data were collected from Community Health Centres (CHCs) and Primary Health Centres (PHCs) across the three study districts—Azamgarh, Varanasi, and Lucknow—providing a comprehensive grassroots-level perspective on maternal mental health services. This approach enabled direct observation of healthcare delivery systems at the primary care level.

Participants were assured of data confidentiality and their right to withdraw from the study at any time without affecting their healthcare services. Special considerations were made for participants identified with severe anxiety or depression, including immediate referral to available mental health professionals. The community-based sampling approach strengthened the ecological validity of the findings by capturing experiences across diverse healthcare settings.

2.2. Assessment Tools

2.2.1. Perinatal Anxiety Screening Scale (PASS)

The PASS is a 31-item self-report instrument designed specifically for perinatal anxiety screening Somerville et al. (2014). The scale assesses four distinct anxiety domains:

- Acute anxiety and adjustment
- General worry and specific fears
- Perfectionism, control and trauma
- Social anxiety

Each item is scored on a 4-point Likert scale (0-3), with higher scores indicating greater anxiety severity.

2.2.2. Pregnancy-Related Anxiety Questionnaire (PRAQ-R2)

The PRAQ-R2 consists of 11 items specifically focused on pregnancy-related anxieties Huizink et al. (n.d.). The questionnaire evaluates three primary domains:

- Fear of giving birth
- Worries about bearing a physically or mentally handicapped child
- Concerns about one's own appearance

Responses are recorded on a 5-point scale, providing a nuanced assessment of pregnancy-specific concerns.

2.2.3. Edinburgh Postnatal Depression Scale (EPDS)

The EPDS is a 10-item screening tool widely used for identifying perinatal depression Cox et al. (1987). The scale has been extensively validated across various cultural contexts and has demonstrated high sensitivity and specificity in identifying depressive symptoms. Each item is scored on a 0-3 scale, with a maximum total score of 30.

All three assessment tools were translated into Hindi and Urdu following the WHO guidelines for instrument translation and adaptation.

2.3. Data Collection and Analysis

2.3.1. Survey Administration

Data collection was conducted by trained research assistants who were fluent in both Hindi and Urdu. The surveys were administered in private settings within healthcare facilities, ensuring participant comfort and confidentiality. Each participant was given sufficient time to complete the questionnaires, with assistance provided when requested. The research assistants were trained to:

- Explain the study objectives and procedures
- Obtain informed consent
- Assist with questionnaire completion when necessary
- Identify signs of distress requiring immediate attention

2.3.2. Statistical Methods

The statistical analysis included:

- Descriptive statistics for demographic characteristics
- Independent t-tests and ANOVA for comparing mental health scores across cities
- Pearson correlation coefficients to examine relationships between different mental health measures
- Multiple regression analysis to examine the relationship between urbanization levels and mental health outcomes
- Factor analysis to assess construct validity of the translated instruments across different urban contexts

All statistical analyses were performed using SPSS version 26.0, with a significance level set at p ¡ 0.05.

3. Results

3.1. Demographic Characteristics of the Study Population

Our study encompassed a total of 300 participants distributed across three major North Indian cities. The demographic distribution demonstrated remarkable balance across key variables. Geographically, each city—Azamgarh, Varanasi, and Lucknow—accounted for exactly one-third of the sample (n = 100, 33.3% each). This balanced geographic distribution strengthens the reliability of subsequent comparative analyses examining regional variations in mental health outcomes. Figure 1 illustrates this geographic distribution along with other demographic characteristics.

3.2. Regional Variations in Mental Health Measures

Analysis of mental health scores revealed significant geographic variations across the three cities, demonstrating a clear urban-rural gradient in perinatal mental health outcomes. Azamgarh, the least urbanized of the three cities, consistently demonstrated the highest mean scores across all three assessment scales: PASS (M = 2.44, SD = 0.32, 95% CI [2.38–2.50]), PRAQ (M = 3.20, SD = 0.69, 95% CI [3.06–3.33]), and Edinburgh (M = 2.22, SD = 0.33, 95% CI [2.16–2.29]).

In contrast, Lucknow, the most urbanized city in our study, exhibited the lowest mean scores across all measures: PASS (M = 1.74, SD = 0.56, 95% CI [1.63–1.85]), PRAQ (M = 2.94, SD = 0.51, 95% CI [2.84–3.04]), and Edinburgh (M = 1.99, SD = 0.23, 95% CI [1.95–2.04]).

Varanasi, with its intermediate level of urbanization, consistently occupied an intermediate position with scores falling between these two extremes: PASS (M = 2.17, SD = 0.47, 95% CI [2.08–2.26]), PRAQ (M = 3.11, SD = 0.61, 95% CI [2.99–3.23]), and Edinburgh (M = 2.06, SD = 0.25, 95% CI [2.01–2.11]).

These regional patterns, illustrated in Figure 2, demonstrate a consistent relationship between urbanization level and mental health outcomes. The magnitude of regional differences was most pronounced for PASS scores, with a mean difference of

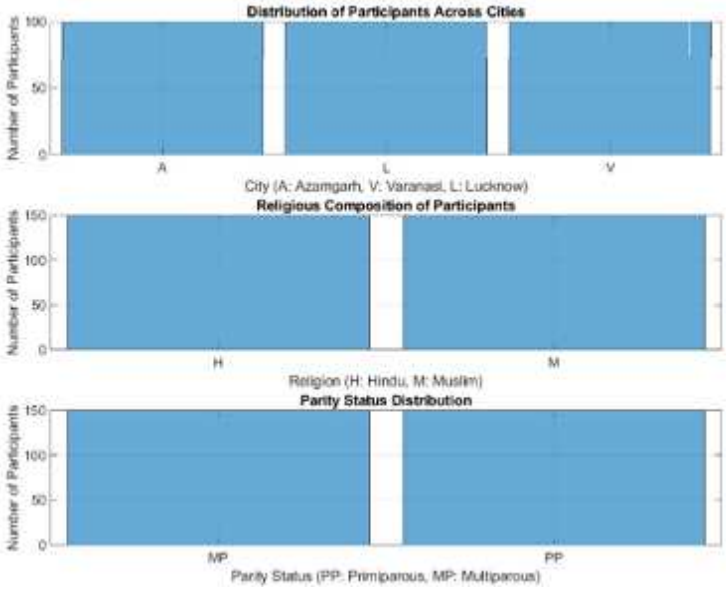

Fig. 1 Distribution of participant characteristics across key demographic variables. (A) Geographic distribution showing equal representation across three North Indian cities: Azamgarh (33.3%), Varanasi (33.3%), and Lucknow (33.3%). (B) Religious composition showing equal representation between Hindu (50%) and Muslim (50%) participants. (C) Parity status distribution demonstrating equal representation between primiparous (50%) and multiparous (50%) mothers.

0.70 between Azamgarh and Lucknow, suggesting that general perinatal anxiety may be particularly sensitive to regional and environmental factors.

3.3. Correlational Analysis of Mental Health Measures

Examination of the relationships between the three mental health assessment scales revealed significant positive correlations across all measures, with consistent patterns across the three cities. The strongest correlation emerged between PASS and PRAQ scores ($r = 0.723$, $p < 0.001$), suggesting considerable overlap between general perinatal anxiety and pregnancy-specific anxiety. PRAQ and Edinburgh scores showed a moderately strong correlation ($r = 0.664$, $p < 0.001$), while PASS and Edinburgh scores demonstrated a moderate correlation ($r = 0.596$, $p < 0.001$). These correlations indicate substantial interconnectedness between different aspects of perinatal mental health while suggesting that each measure captures distinct components of the overall psychological experience.

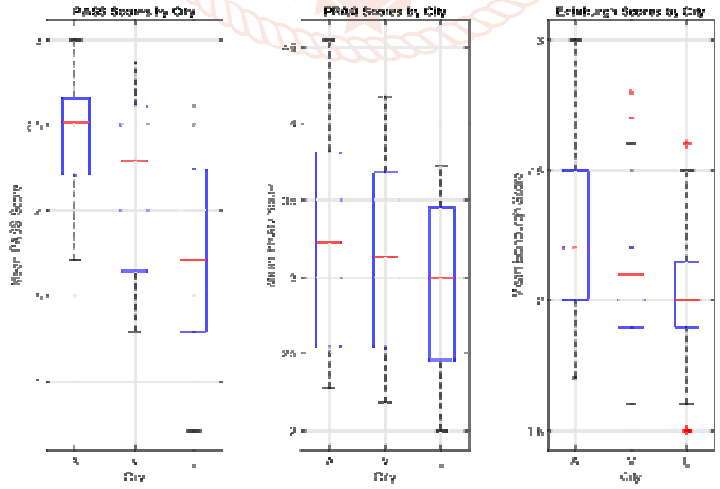

Fig. 2 Regional variations in mental health assessment scores across the three study cities. Box plots illustrate the distribution of (A) Perinatal Anxiety Screening Scale (PASS) scores, (B) Pregnancy Related Anxiety Questionnaire (PRAQ) scores, and (C) Edinburgh Postnatal Depression Scale scores. The central line in each box represents the median, while the boxes denote the interquartile range (IQR). Whiskers extend to the most extreme data points not considered outliers (within 1.5 times the IQR), with individual points representing outliers. Note the consistent pattern of highest scores in Azamgarh and lowest scores in Lucknow across all three measures, suggesting systematic regional differences in perinatal mental health outcomes.

When analyzed by city, the correlational patterns showed subtle variations. The correlation between PASS and PRAQ was strongest in Azamgarh ($r = 0.746$, $p < 0.001$), slightly weaker in Varanasi ($r = 0.718$, $p < 0.001$), and weakest in Lucknow ($r = 0.685$, $p < 0.001$), suggesting that the relationship between general and pregnancy-specific anxiety might be modulated by urban context. Similar patterns were observed for the correlations between PASS and Edinburgh scores and between PRAQ and Edinburgh scores.

These interrelationships are visualized in Figure 3, which illustrates the overall correlation patterns across the entire sample.

3.4. City-Specific Patterns and Healthcare Infrastructure

Detailed analysis of city-specific patterns revealed distinct characteristics in the manifestation of perinatal mental health concerns across different urban contexts. These patterns appeared to align with the varying healthcare infrastructure and urbanization levels of the three cities.

In Azamgarh, characterized by its semi-urban environment and more limited healthcare resources, we observed the highest levels of anxiety and depression across all

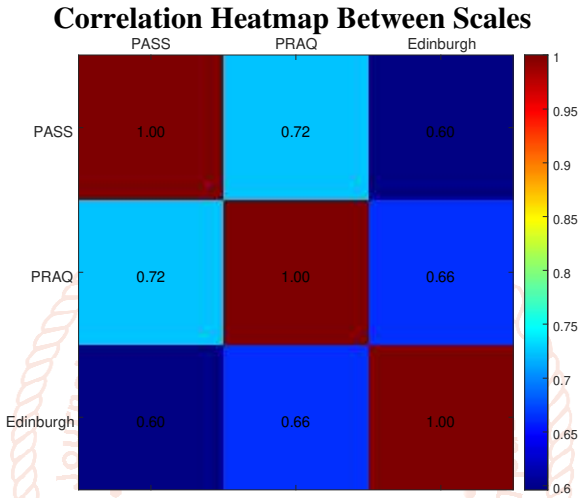

Fig. 3 Correlation heatmap illustrating the interrelationships between PASS, PRAQ, and Edinburgh scale scores. The color intensity corresponds to correlation strength, with darker shades indicating stronger relationships. Numerical values in each cell represent Pearson correlation coefficients (r). The strongest correlation appears between PASS and PRAQ ($r = 0.723$, $p < 0.001$), suggesting substantial overlap between general and pregnancy-specific anxiety. The moderate correlation between PASS and Edinburgh scores ($r = 0.596$, $p < 0.001$) indicates that while anxiety and depressive symptoms often co-occur, they remain distinct aspects of perinatal mental health. The moderately strong correlation between PRAQ and Edinburgh scores ($r = 0.664$, $p < 0.001$) suggests that pregnancy specific anxieties may have a particular relationship with depressive symptomatology.

measures. The consistency of elevated scores across different mental health dimensions suggests a systemic impact of healthcare infrastructure limitations on overall perinatal mental well-being. Notably, the distribution of scores in Azamgarh also showed greater variability (as indicated by higher standard deviations), potentially reflecting less standardized healthcare experiences.

Lucknow, as the capital city of Uttar Pradesh with the most developed healthcare infrastructure, consistently demonstrated the lowest anxiety and depression scores. This pattern suggests that better access to healthcare resources, greater availability of specialized maternal care, and higher awareness of mental health issues may collectively contribute to improved perinatal mental health outcomes. The narrower distribution of scores in Lucknow (particularly for Edinburgh scale scores, $SD = 0.23$) indicates more consistent and standardized maternal mental healthcare experiences.

Varanasi occupied an intermediate position across all mental health measures, aligning with its intermediate status in terms of urbanization and healthcare infrastructure. The city's blend of traditional and modern healthcare approaches appears to result in mental health outcomes that fall between those of the more traditional Azamgarh and the more modernized Lucknow.

A particularly notable finding emerged in the analysis of correlations between different mental health measures across cities. The strength of correlations between anxiety and depression measures decreased with increasing urbanization, with the strongest correlations observed in Azamgarh and the weakest in Lucknow. This pattern suggests that in more urbanized environments with better healthcare infrastructure, there may be greater differentiation between different aspects of mental health, potentially reflecting more specialized and nuanced mental healthcare approaches.

These findings collectively paint a complex picture of perinatal mental health across different urban contexts in North India, where outcomes appear to be significantly influenced by the level of urbanization and associated healthcare infrastructure. The systematic variations observed across cities suggest that urbanization and its accompanying improvements in healthcare access and quality may play a crucial role in determining maternal mental health outcomes.

4. Discussion

4.1. Urban-Rural Gradient in Perinatal Mental Health

Our findings demonstrate a clear urban-rural gradient in perinatal mental health outcomes across the three North Indian cities, with consistently higher anxiety and depression scores in the less urbanized Azamgarh compared to the metropolitan city of Lucknow. This pattern suggests that urbanization level and associated healthcare infrastructure play significant roles in shaping maternal mental health experiences.

Several factors may contribute to this observed gradient. First, accessibility and quality of healthcare services typically improve with increasing urbanization Golbasi et al. (2010). Lucknow, as the capital city of Uttar Pradesh, offers more specialized maternal healthcare facilities, potentially including better mental health screening and support services. In contrast, Azamgarh's more limited healthcare infrastructure may result in less attention to maternal mental health issues, potentially explaining the higher anxiety and depression scores observed.

Second, awareness and understanding of perinatal mental health concerns may vary across different urban contexts Manso-C´ordoba et al. (2020). More urbanized environments often foster greater mental health literacy among both healthcare providers and the general population, potentially leading to earlier identification and management of perinatal mental health issues. The lower scores observed in Lucknow may reflect this increased awareness and proactive management.

Third, socioeconomic factors associated with urbanization may influence maternal mental health outcomes Faisal-Cury et al. (2009); Fisher et al. (2012). Urban centers like Lucknow typically offer better educational and employment opportunities, potentially providing women with greater resources and agency to address their mental health needs.

4.2. Implications for Healthcare Delivery

The observed regional variations in perinatal mental health outcomes have important implications for healthcare delivery across different urban contexts. The consistently higher scores in Azamgarh suggest an urgent need for enhanced mental health resources in similar semi-urban settings. This might include:

- Strengthening mental health screening programs in primary healthcare settings
- Training healthcare providers in identifying and addressing perinatal mental health concerns
- Developing community-based support systems for pregnant and postpartum women • Implementing telehealth initiatives to bridge gaps in specialized mental healthcare access

The intermediate scores observed in Varanasi suggest that cities in transition between traditional and modern healthcare approaches may benefit from targeted interventions that address both infrastructure limitations and cultural factors influencing mental health. These might include culturally sensitive screening tools and interventions that can be integrated into existing healthcare frameworks.

The relatively lower scores in Lucknow, while encouraging, should not lead to complacency. Even in this more urbanized context, perinatal anxiety and depression remain significant concerns requiring continued attention. The more standardized healthcare environment in Lucknow may provide a model for developing systematic approaches to perinatal mental health screening and support that could be adapted for less urbanized settings.

4.3. Correlational Patterns and Integrated Approaches

The strong correlations identified between different mental health measures across all three cities highlight the interconnected nature of various aspects of perinatal mental health. The particularly strong correlation between PASS and PRAQ scores ($r = 0.723$, $p < 0.001$) suggests substantial overlap between general perinatal anxiety and pregnancy-specific concerns.

These correlational patterns support an integrated approach to perinatal mental health screening and intervention that considers multiple aspects of

psychological wellbeing simultaneously. Such an approach might be particularly valuable in settings with limited healthcare resources, where comprehensive screening tools could help identify women requiring further support.

The subtle variations in correlational patterns across cities, with stronger correlations in Azamgarh compared to Lucknow, suggest that the relationship between different aspects of mental health may be influenced by urban context. In more urbanized settings with more specialized healthcare, there may be greater differentiation between different aspects of mental health, potentially reflecting more nuanced approaches to mental healthcare.

4.4. Methodological Contributions and Limitations

This study makes important methodological contributions to the field of perinatal mental health research in diverse urban contexts. The validation of PASS, PRAQ-R2, and Edinburgh scales across three different North Indian cities provides valuable tools for future research and clinical practice in similar settings. The strong correlations between these measures support their validity in assessing different aspects of perinatal mental health in the Indian context.

However, several limitations should be acknowledged. First, the cross-sectional design prevents the establishment of causal relationships between urbanization levels and mental health outcomes. Longitudinal studies tracking mental health trajectories throughout the perinatal period could provide more definitive insights into how urban environments shape maternal mental health over time.

Second, while our study captured variations across three cities representing different levels of urbanization, it does not provide a comprehensive picture of all urban contexts in North India. Additional research encompassing a wider range of urban environments would further enhance our understanding of regional variations in perinatal mental health.

Finally, our study focused primarily on formal healthcare settings. Future research could benefit from including women who do not regularly access formal healthcare services, potentially providing insights into more marginalized populations.

5. Conclusion

This comprehensive investigation of perinatal mental health across three North Indian cities reveals consistent patterns of regional variation in anxiety and depression scores that align with urbanization levels and associated healthcare infrastructure. The clear urban-rural gradient, with higher scores in Azamgarh and lower scores in Lucknow, underscores the significant role of urbanization in shaping maternal mental health outcomes.

The systematic variation in mental health scores across cities, with Azamgarh consistently showing higher levels (PASS: M = 2.44, PRAQ: M = 3.20, Edinburgh: M = 2.22) compared to Lucknow (PASS: M = 1.74, PRAQ: M = 2.94, Edinburgh: M = 1.99), highlights the importance of contextual factors in determining perinatal mental health experiences. These regional differences, characterized by a clear gradient from more traditional to more urbanized settings, suggest that the process of urbanization and its associated improvements in healthcare access and quality may significantly influence both the manifestation and management of perinatal mental health concerns.

The strong correlations identified between different mental health measures (r ranging from 0.596 to 0.723) indicate substantial overlap between various aspects of perinatal mental health, suggesting that anxiety and depression often co-occur during the perinatal period. This finding supports an integrated approach to mental health screening and intervention that considers multiple aspects of psychological well-being simultaneously.

These findings have several important implications for clinical practice and public health policy:

- The substantial regional variations suggest that mental health services need to be tailored to local contexts, with particular attention to the unique challenges faced in less urbanized areas. The higher anxiety and depression scores in Azamgarh indicate a potential need for enhanced mental health resources in similar semi-urban settings.
- Healthcare providers should consider implementing specialized support programs in less urbanized areas, potentially including enhanced antenatal education, peer support groups, and more frequent mental health screening.
- The integrated relationships between different aspects of mental health support a comprehensive approach to perinatal mental healthcare that addresses multiple dimensions of psychological well-being simultaneously.

Looking forward, these findings point to several promising directions for future research and intervention development. Longitudinal studies tracking mental health trajectories throughout the perinatal period could provide valuable insights into

how regional factors influence mental health over time. Additionally, intervention studies testing context-adapted support programs could help determine the most effective approaches for different urban environments.

In conclusion, this study provides a nuanced understanding of how perinatal mental health in North India is shaped by regional and environmental factors associated with different levels of urbanization. The findings emphasize the importance of developing flexible, context-sensitive approaches to maternal mental healthcare that can effectively address the diverse needs of women across the urban-rural continuum.

References

[1] Adewuya, A., Ola, B., Aloba, O., Mapayi, B. (2006). Anxiety disorders among nigerian women in late pregnancy: a controlled study. *Archives of women's mental health*, *9*, 325–328,

[2] Andersson, L., Sundstr¨om-Poromaa, I., Bixo, M., Wulff, M., Bondestam, K., ˚Astr¨om, M. (2003). Point prevalence of psychiatric disorders during the second trimester of pregnancy: a population-based study. *American journal of obstetrics and gynecology*, *189*(1), 148–154,

[3] Argyropoulos, S.V., Ploubidis, G.B., Wright, T.S., Palm, M.E., Hood, S.D., Nash, J.R., ... others (2007). Development and validation of the generalized anxiety disorder inventory (gadi). *Journal of Psychopharmacology*, *21*(2), 145–152,

[4] Austin, M.-P., Frilingos, M., Lumley, J., Hadzi-Pavlovic, D., Roncolato, W., Acland, S., ... Parker, G. (2008). Brief antenatal cognitive behaviour therapy group intervention for the prevention of postnatal depression and anxiety: a randomised controlled trial. *Journal of affective disorders*, *105*(1-3), 35–44,

[5] Austin, M.-P., Hadzi-Pavlovic, D., Leader, L., Saint, K., Parker, G. (2005). Maternal trait anxiety, depression and life event stress in pregnancy: relationships with infant temperament. *Early human development*, *81*(2), 183–190,

[6] Austin, M.-P., & Priest, S. (2005). Clinical issues in perinatal mental health: new developments in the detection and treatment of perinatal mood and anxiety disorders. *Acta Psychiatrica Scandinavica*, *112*(2), 97–104,

[7] Bastani, F., Hidarnia, A., Kazemnejad, A., Vafaei, M., Kashanian, M. (2005). A randomized controlled trial of the effects of applied relaxation training on reducing anxiety and perceived stress in pregnant women. *Journal of midwifery & women's health*, *50*(4), e36–e40,

[8] Blair, M.M., Glynn, L.M., Sandman, C.A., Davis, E.P. (2011). Prenatal maternal anxiety and early childhood temperament. *Stress*, *14*(6), 644–651,

[9] Borkovec, T.D., Newman, M.G., Castonguay, L.G. (2003). Cognitive-behavioral therapy for generalized anxiety disorder with integrations from interpersonal and experiential therapies. *CNS spectrums*, *8*(5), 382–389,

[10] Brouwers, E.P., van Baar, A.L., Pop, V.J. (2001). Maternal anxiety during pregnancy and subsequent infant development. *Infant Behavior and Development*, *24*(1), 95–106,

[11] Buist, A., Gotman, N., Yonkers, K.A. (2011). Generalized anxiety disorder: course and risk factors in pregnancy. *Journal of affective disorders*, *131*(1-3), 277–283,

[12] Buss, C., Davis, E.P., Shahbaba, B., Pruessner, J.C., Head, K., Sandman, C.A. (2012). Maternal cortisol over the course of pregnancy and subsequent child amygdala and hippocampus volumes and affective problems. *Proceedings of the National Academy of Sciences*, *109*(20), E1312–E1319,

[13] Coelho, H.F., Murray, L., Royal-Lawson, M., Cooper, P.J. (2011). Antenatal anxiety disorder as a predictor of postnatal depression: a longitudinal study. *Journal of affective disorders*, *129*(1-3), 348–353,

[14] Cox, J.L., Holden, J.M., Sagovsky, R. (1987). Detection of postnatal depression:

[15] development of the 10-item edinburgh postnatal depression scale. *The British journal of psychiatry*, *150*(6), 782–786,

[16] Davis, E.P., Snidman, N., Wadhwa, P.D., Glynn, L.M., Schetter, C.D., Sandman, C.A. (2004). Prenatal maternal anxiety and depression predict negative behavioral reactivity in infancy. *Infancy*, *6*(3), 319–331,

[17] Dennis, C.-L., Falah-Hassani, K., Shiri, R. (2017). Prevalence of antenatal and postnatal anxiety: systematic review and meta-analysis. *The British Journal of Psychiatry*, *210*(5), 315–323,

[18] Ding, X.-X., Wu, Y.-L., Xu, S.-J., Zhu, R.-P., Jia, X.-M., Zhang, S.-F., ... Tao, F.B. (2014). Maternal anxiety during pregnancy and adverse birth outcomes: a systematic review and meta-analysis of prospective cohort studies. *Journal of affective disorders*, *159*, 103–110,

[19] Donker, T., Griffiths, K.M., Cuijpers, P., Christensen, H. (2009). Psychoeducation for depression, anxiety and psychological distress: a meta-analysis. *BMC medicine*, *7*, 1–9,

[20] Dubey, C., Gupta, N., Bhasin, S., Muthal, R.A., Arora, R. (2012). Prevalence and associated risk factors for postpartum depression in women attending a tertiary hospital, delhi, india. *International Journal of Social Psychiatry*, *58*(6), 577– 580,

[21] Duncan, L.G., & Bardacke, N. (2010). Mindfulness-based childbirth and parenting education: promoting family mindfulness during the perinatal period. *Journal of child and family studies*, *19*, 190–202,

[22] Dunn, C., Hanieh, E., Roberts, R., Powrie, R. (2012). Mindful pregnancy and childbirth: effects of a mindfulness-based intervention on women's psychological distress and well-being in the perinatal period. *Archives of women's mental health*, *15*, 139–143,

[23] Evans, J., Heron, J., Francomb, H., Oke, S., Golding, J. (2001). Cohort study of depressed mood during pregnancy and after childbirth. *Bmj*, *323*(7307), 257– 260,

[24] Fairbrother, N., Janssen, P., Antony, M.M., Tucker, E., Young, A.H. (2016). Perinatal anxiety disorder prevalence and incidence. *Journal of affective disorders*, *200*, 148–155,

[25] Faisal-Cury, A., Menezes, P., Araya, R., Zugaib, M. (2009). Common mental disorders during pregnancy: prevalence and associated factors among low-income women in s˜ao paulo, brazil: depression and anxiety during pregnancy. *Archives of women's mental health*, *12*, 335–343,

[26] Fisher, J., Mello, M.C.d., Patel, V., Rahman, A., Tran, T., Holton, S., Holmes, W. (2012). Prevalence and determinants of common perinatal mental disorders in women in low-and lower-middle-income countries: a systematic review. *Bulletin of the World Health Organization*, *90*, 139–149,

[27] for Mental Health (UK, N.C.C., et al. (2007). Antenatal and postnatal mental health: the nice guideline on clinical management and service guidance..

[28] Gavin, N.I., Gaynes, B.N., Lohr, K.N., Meltzer-Brody, S., Gartlehner, G., Swinson, T. (2005). Perinatal depression: a systematic review of prevalence and incidence. *Obstetrics & Gynecology*, *106*(5 Part 1), 1071–1083,

[29] Golbasi, Z., Kelleci, M., Kisacik, G., Cetin, A. (2010). Prevalence and correlates of depression in pregnancy among turkish women. *Maternal and child health journal*, *14*, 485–491,

[30] Goodman, J.H., Guarino, A., Chenausky, K., Klein, L., Prager, J., Petersen, R., ... Freeman, M. (2014). Calm pregnancy: results of a pilot study of mindfulnessbased cognitive therapy for perinatal anxiety. *Archives of women's mental health*, *17*, 373–387,

[31] Grigoriadis, S., de Camps Meschino, D., Barrons, E., Bradley, L., Eady, A., Fishell, A., ... others (2011). Mood and anxiety disorders in a sample of canadian perinatal women referred for psychiatric care. *Archives of women's mental health*, *14*, 325–333,

[32] Grigoriadis, S., Graves, L., Peer, M., Mamisashvili, L., Tomlinson, G., Vigod, S.N., ... others (2018). Maternal anxiety during pregnancy and the association with adverse perinatal outcomes: systematic review and meta-analysis. *The Journal of clinical psychiatry*, *79*(5), 813,

[33] Hoffman, E.J., & Mathew, S.J. (2008). Anxiety disorders: a comprehensive review of pharmacotherapies. *Mount Sinai Journal of Medicine: A Journal of Translational and Personalized Medicine: A Journal of Translational and Personalized Medicine*, *75*(3), 248–262,

[34] Hopkins, J., & Campbell, S. (2008). Development and validation of a scale to assess social support in the postpartum period. *Archives of women's mental health*, *11*, 57–65,

[35] Huizink, A., Delforterie, M., Scheinin, N., Tolvanen, M., Karlsson, L., Karlsson, H. (n.d.). Pregnancy-related anxiety questionnaire–revised; modified version. *Archives of Women's Mental Health*, ,

[36] Huppert, J.D., Ryan, M., Stein, D. (2004). Generalized anxiety disorder. *Clinical manual of anxiety disorders*, 147–171,

[37] Iqbal, M.M., Sobhan, T., Ryals, T. (2002). Effects of commonly used benzodiazepines on

the fetus, the neonate, and the nursing infant. *Psychiatric Services*, *53*(1), 39–49,

[38] Katzman, M.A. (2011). Aripiprazole: a clinical review of its use for the treatment of anxiety disorders and anxiety as a comorbidity in mental illness. *Journal of affective disorders*, *128*, S11–S20,

[39] Leach, L.S., Poyser, C., Fairweather-Schmidt, K. (2017). Maternal perinatal anxiety: A review of prevalence and correlates. *Clinical Psychologist*, *21*(1), 4–19,

[40] Manso-C´ordoba, S., Pickering, S., Ortega, M.A., Asu´nsolo, A., Romero, D. (2020).´ Factors related to seeking help for postpartum depression: a secondary analysis of new york city prams data. *International journal of environmental research and public health*, *17*(24), 9328,

[41] Marchesi, C., Ossola, P., Amerio, A., Daniel, B., Tonna, M., De Panfilis, C. (2016). Clinical management of perinatal anxiety disorders: A systematic review. *Journal of affective disorders*, *190*, 543–550,

[42] Misri, S., Abizadeh, J., Sanders, S., Swift, E. (2015). Perinatal generalized anxiety disorder: assessment and treatment. *Journal of women's health*, *24*(9), 762–770,

[43] Raza, S.K., & Raza, S. (2019). Postpartum psychosis.

[44] Savarimuthu, R.J., Ezhilarasu, P., Charles, H., Antonisamy, B., Kurian, S., Jacob, K. (2010). Post-partum depression in the community: a qualitative study from rural south india. *International Journal of Social Psychiatry*, *56*(1), 94–102,

[45] Somerville, S., Dedman, K., Hagan, R., Oxnam, E., Wettinger, M., Byrne, S., ... Page, A.C. (2014). The perinatal anxiety screening scale: development and preliminary validation. *Archives of women's mental health*, *17*, 443–454,

[46] Stein, D.J., Bandelow, B., Merideth, C., Olausson, B., Szamosi, J., Eriksson, H. (2011). Efficacy and tolerability of extended release quetiapine fumarate (quetiapine xr) monotherapy in patients with generalised anxiety disorder: an analysis of pooled data from three 8-week placebo-controlled studies. *Human Psychopharmacology: Clinical and Experimental*, *26*(8), 614–628,

[47] Sutter-Dallay, A.L., Giaconne-Marcesche, V., Glatigny-Dallay, E., Verdoux, H. (2004). Women with anxiety disorders during pregnancy are at increased risk of intense postnatal depressive symptoms: a prospective survey of the matquid cohort. *European psychiatry*, *19*(8), 459–463,

[48] Uguz, F., Sonmez, E.O., Sahingoz, M., Gokmen, Z., Basaran, M., Gezginc, K., ... others (2013). Maternal generalized anxiety disorder during pregnancy and fetal brain development: a comparative study on cord blood brain-derived neurotrophic factor levels. *Journal of psychosomatic research*, *75*(4), 346–350,

[49] Upadhyay, R.P., Chowdhury, R., Salehi, A., Sarkar, K., Singh, S.K., Sinha, B., ... Kumar, A. (2017). Postpartum depression in india: a systematic review and meta-analysis. *Bulletin of the World Health Organization*, *95*(10), 706,

[50] Urech, C., Fink, N.S., Hoesli, I., Wilhelm, F.H., Bitzer, J., Alder, J. (2010). Effects of relaxation on psychobiological wellbeing during pregnancy: a randomized controlled trial. *Psychoneuroendocrinology*, *35*(9), 1348–1355,

[51] Van Balkom, A.J., Van Boeijen, C.A., Boeke, A.J.P., Van Oppen, P., Kempe, P.T., Van Dyck, R. (2008). Comorbid depression, but not comorbid anxiety disorders, predicts poor outcome in anxiety disorders. *Depression and Anxiety*, *25*(5), 408–415,

[52] Van den Bergh, B.R., van den Heuvel, M.I., Lahti, M., Braeken, M., de Rooij, S.R., Entringer, S., ... others (2020). Prenatal developmental origins of behavior and mental health: The influence of maternal stress in pregnancy. *Neuroscience & Biobehavioral Reviews*, *117*, 26–64,

[53] Vieten, C., & Astin, J. (2008). Effects of a mindfulness-based intervention during pregnancy on prenatal stress and mood: results of a pilot study. *Archives of women's mental health*, *11*, 67–74,

[54] Weisberg, R.B., & Paquette, J.A. (2002). Screening and treatment of anxiety disorders in pregnant and lactating women. *Women's Health Issues*, *12*(1), 32–36,

[55] Wenzel, A., Haugen, E.N., Jackson, L.C., Brendle, J.R. (2005). Anxiety symptoms and disorders at eight weeks postpartum. *Journal of anxiety disorders*, *19*(3), 295–311