ORIGINAL RESEARCH ARTICLE

Urban planning, informal settlements, and maternal health outcomes: Investigating the role of built environment in antenatal and postnatal care utilization in China

DOI: 10.29063/ajrh2025/v29i12s.5

Tiantian Mu[1], Guangyu Zhu[2], Yang Xu[3] and Osman Alipour[4]*

School of Housing, Building and Planning, Universiti Sains Malaysia[1]; School of Design and Art Communications University of Zhejiang, Communication University of Zhejiang, No.998 Xuanqiao Road, Qiantang District, Hangzhou, Zhejiang, China[2]; Arts College of WuYi University, WuYi University, No. 358, Baihua Road, Fujian Province, Wuyishan City, 354300, China[3]; Young Researchers and Elite Club, Sardasht Branch, Islamic Azad University, City, Iran[4]

***For Correspondence:** Email: *yu660007@126.com*

Abstract

China's rapid urbanization has spawned extensive informal settlements, where millions of migrant families live in overcrowded, underserved areas. These environments, characterized by inadequate housing, poor sanitation, unsafe conditions, and limited healthcare access, significantly impede the utilization of maternal healthcare, specifically Antenatal (ANC) and Postnatal Care (PNC). This study examines how built environment characteristics influence ANC and PNC use among women in these settlements across four major Chinese cities. A cross-sectional study collected data from 800 women who had given birth in the previous two years. Built environment elements were measured via subjective assessments and objective indicators, including GPS-based distance to the nearest health facility. Associations were analyzed using multivariate logistic and negative binomial regression models. Findings identify distance to health facilities, housing quality, neighborhood safety, walkability, sanitation, and transport access as critical determinants. Women in disadvantaged settings were less likely to receive adequate ANC or timely PNC. Socio-economic factors -hukou status, education, income, and health insurance- further shaped utilization patterns. The results underscore the necessity of integrating maternal health strategies into urban planning. Improving transport connectivity, upgrading informal settlements, and reducing institutional barriers for migrants are vital to enhancing maternal health and fostering equity in China's rapidly urbanizing landscape. *(Afr J Reprod Health 2025; 29 [12s]: 37-45).*

Keywords: Urban Planning, Informal Settlements, Built Environment, Maternal Health

Résumé

L'urbanisation rapide de la Chine a engendré de vastes quartiers informels où des millions de familles migrantes vivent dans des zones surpeuplées et mal desservies. Ces environnements, caractérisés par un logement inadéquat, un assainissement médiocre, l'insécurité et un accès limité aux soins, entravent considérablement l'utilisation des soins de santé maternelle, notamment les soins prénatals (ANC) et postnatals (PNC). Cette étude examine comment les caractéristiques du cadre bâti influencent l'utilisation de l'ANC et du PNC parmi les femmes de ces quartiers dans quatre grandes villes chinoises. Une étude transversale a recueilli des données auprès de 800 femmes ayant accouché au cours des deux années précédentes. Les éléments du cadre bâti ont été mesurés par des évaluations subjectives et des indicateurs objectifs, incluant la distance GPS jusqu'au centre de santé le plus proche. Les associations ont été analysées à l'aide de modèles de régression logistique multivariée et binomiale négative. Les résultats identifient la distance aux établissements de santé, la qualité du logement, la sécurité du quartier, la marchabilité, l'assainissement et l'accès aux transports comme des déterminants critiques. Les femmes des environnements défavorisés étaient moins susceptibles de bénéficier de soins prénatals adéquats ou de soins postnatals en temps utile. Les facteurs socio-économiques -statut hukou, éducation, revenu et assurance maladie- ont également influencé les schémas d'utilisation. Ces résultats soulignent la nécessité d'intégrer les stratégies de santé maternelle dans la planification urbaine. Améliorer la connectivité des transports, moderniser les quartiers informels et réduire les obstacles institutionnels pour les migrants sont essentiels pour améliorer la santé maternelle et promouvoir l'équité dans le paysage urbain chinois en expansion rapide. *(Afr J Reprod Health 2025; 29 [12s]: 37-45).*

Mots-clés: Urbanisme, Quartiers Informels, Cadre Bâti, Santé Maternelle

Introduction

Over the last few decades, China has undergone some of the most rapid and far-reaching urban transformations in modern history. As major cities expanded outwards, large areas of new economic zones and transport corridors appeared, but so too did a wide array of unplanned, densely settled areas falling outside the formal urban planning system. These areas, commonly referred to as urban villages or informal settlements, have become home for millions of rural-to-urban migrants who seek employment opportunities and affordable housing. The living conditions in such settlements are often compromised by crowding, inadequate sanitation, hazardous pathways, weak waste management systems, and poor housing structures. The environmental challenges for people who live there are strong determinants of their everyday lives and health opportunities, particularly during pregnancy and the postpartum period[1,2].

Although China has made significant progress in reducing maternal mortality over the past three decades, wide disparities persist between registered urban residents and migrant populations. Women without local hukou often experience structural barriers to maternal healthcare access, such as antenatal and postnatal care[3,4]. Women without local *hukou*—China's household registration system that restricts migrants' access to public services—often experience structural barriers to maternal healthcare access, such as antenatal and postnatal care. Administrative restrictions, low insurance coverage, long travel distances, and financial constraints commonly lead to either late or no utilization of necessary maternal health services[5]. The situation is even more complicated in informal settlements, where poor infrastructure and spatial disconnections from healthcare facilities give rise to added obstacles that impinge on health-seeking behavior.

ANC and PNC are the cornerstones of health outcomes for both mother and child. Early ANC detects complications, allows nutritional supplementation, and provides guidance for safe pregnancy practices. PNC is equally important to ensure that recovery is monitored, postpartum complications are identified and newborns are given their due care. However, for many women residing in slums, the decision to seek care is often not based on personal beliefs or financial capability but rather on the physical environment that surrounds them. Such issues as unsafe streets, lack of lighting, environmental pollution, overcrowding, or even living far from the clinic may reduce the likelihood of seeking care when needed [6,7].

Although there is growing international research linking built environment characteristics with health behaviours, empirical work investigating these associations in the Chinese context remains limited. Most studies have analysed urban planning concerns in isolation from public health outcomes, failing to capture how the two interact in shaping maternal health service utilization [8]. This study seeks to fill this gap by exploring ways in which the built environment affects ANC and PNC utilisation among women residing in informal settlements across major Chinese cities. Based on a quantitative approach, this paper explores how housing quality, neighbourhood safety, sanitation, distance to facilities and transport availability influence maternal health-seeking behaviours. The findings have implications for more inclusive urban planning and public health policy that integrate environmental design into maternal health interventions.

Literature review

China's urbanization has produced a unique spatial landscape of juxtaposed formal and informal settlements. Urban villages have emerged as a key housing option for migrant workers who cannot access subsidized or regulated urban housing. Descriptive studies of such settlements highlight the prevalence of narrow lanes, high density building clusters, deficient sanitation services, and lax regulatory oversight[1]. These physical features have direct implications for health vulnerability, especially for women with restricted mobility, limited health information, and environmental exposure[2,6].

Health disparities research in China has repeatedly indicated that migrants have poorer health outcomes and lower utilization of public services than registered urban residents[3,9,10]. The hukou system continues to be one of the strongest institutional determinants of health care

accessibility. Migrant women without local hukou commonly face administrative obstacles, higher out-of-pocket expenses, and lower levels of access to maternal health subsidies[8]. These migrants are consequently more likely to delay or forgo necessary ANC and PNC visits, even if services are accessible within the city.

The built environment has increasingly been recognised as a central determinant of health in global research. International studies indicate that such environmental conditions as good-quality housing, safe street conditions, adequate lighting, appropriate drainage, and the availability of pathways at pedestrian height significantly impact the propensity to seek out health care[11]. Poor housing conditions and poor sanitation contribute to increased exposure to a range of pollutants and stressors, as well as infectious diseases contributing to poor maternal outcomes[12]. Unsafe neighborhoods, which include high levels of crime or poor lighting, contribute to limiting women's mobility during pregnancy; this often leads to reluctance to travel for regular check-ups[13].

Another well-documented factor influencing maternal health care utilization is spatial accessibility. Evidence from different developing regions reveals that even relatively short increases in distance significantly reduce ANC and PNC utilization due to travel time, transport cost, and physical effort required to reach a facility[14, 15]. This challenge is magnified in informal settlements where public transport routes are less structured and pedestrian pathways are unsafe or poorly maintained. In China, several studies have documented spatial mismatches between the locations of informal settlements and public hospitals. Migrant women living in these areas frequently report long travel times due to indirect routes or poor connectivity, which discourages regular ANC attendance[16].

Socio-economic inequalities compound these environmental barriers. Higher education and stable income have been consistently associated with improved maternal healthcare utilization because they enhance both awareness and affordability and increase autonomy in health decision-making[9]. Women with health insurance are found to be more likely to attend visits at ANC and PNC since the financial burden is reduced. Conversely, uninsured or low-income migrant women face both economic and environmental constraints that together lower their ability to seek timely care.

It thus appears that much of the literature supports the idea that maternal healthcare utilization in informal settlements could be a function of a complex interaction of environmental, spatial, and socioeconomic factors. However, there is a continuing lack of integrated research within China that quantitatively links built environment characteristics with ANC and PNC utilization in informal urban contexts. This study builds on these foundations by examining how specific features of the built environment influence maternal health-seeking behavior among women living in informal settlements across major Chinese cities.

Methods

This study employed a quantitative cross-sectional research design to examine the various characteristics of the built environment that impact antenatal and postnatal care utilization among women in informal settlements in four major Chinese cities. A quantitative approach was selected because it allows measurable associations to be established between environmental factors, spatial accessibility, and maternal healthcare behavior. The design further allows the integration of both subjective perceptions of neighborhood conditions and objective data such as GPS-measured distance to health facilities.

The targeted population in the study comprised women aged between 18 and 49 years who had given birth within the previous two years. This inclusion criterion was necessary to ensure that respondents could recall their antenatal and postnatal care experiences with a high enough level of accuracy. Data were collected from informal settlements located in Beijing, Guangzhou, Shenzhen, and Chengdu. These cities were purposively selected because each city contains a large number of urban villages hosting huge migrant populations, often facing spatial and infrastructural disadvantages. Within each city, several informal settlements were randomly sampled, following which households were approached using systematic sampling. In

households where more than one woman met the eligibility criteria, the respondent was selected using the Kish grid method to avoid interviewer bias. The final sample size of 800 women was determined using Cochran's formula for large populations and adjusted upward to ensure sufficient statistical power for multivariate analyses.

Data collection relied on a structured questionnaire that was administered in a face-to-face interview by trained female enumerators. The questionnaire was segmented into four sections.

The first section collected demographic and socioeconomic information, including age, education, hukou status, occupation, income, and health insurance coverage. The second section elicited reproductive history and maternal healthcare utilization. In particular, the respondents were asked about the number of antenatal care visits, the timing of the first visit, whether they received postnatal care within forty-eight hours after delivery, and the total number of postnatal care contacts. A third section measured built environment characteristics using validated Likert-type items, such as housing quality, neighborhood safety, walkability, sanitation conditions, exposure to environmental hazards, and access to public transportation. To enhance accuracy in measurement, geographic coordinates of each household and the nearest healthcare facility were recorded using handheld GPS devices, which allowed the computation of objective travel distances. Finally, a set of additional questions elicited perceived travel time, ease of mobility, and barriers linked to environmental constraints.

Data analysis

The analysis was conducted in several steps. First, demographic characteristics and the pattern of ANC and PNC utilisation were summarised using descriptive statistics. Bivariate tests - including chi-square tests for categorical variables and independent sample t-tests for continuous measures - were conducted to test preliminary associations between built environment conditions and utilisation of maternal healthcare services. Logistic regression models were estimated to examine predictors of adequate antenatal care and timely postnatal care in the inferential analyses. A negative binomial regression model was estimated for the count-based outcome of total ANC visits, which reflects over-dispersion commonly seen in such data. Principal component analysis was used to create a Built Environment Index capturing shared variance in several environmental measures. Significance of associations was considered if $p < 0.05$. All ethical procedures were followed, with informed consent taken from every participant.

Ethical considerations

The Research Ethics Committee of the School of Design and Art at the Communication University of Zhejiang, Hangzhou, China, granted approval for this study (Approval No. REC-SDA-CUZ-2023-072, dated 20 March 2024). The study followed the principles of the Declaration of Helsinki as well as national ethical guidelines for research involving human participants. Participants provided written informed consent after receiving a thorough explanation of the study's purpose, procedures, the voluntary nature of their participation, and their right to withdraw at any point without any repercussions. Strict measures were implemented to ensure confidentiality and anonymity throughout the data collection, analysis, and reporting processes. Personal identifiers were removed, and all data were securely stored on password-protected devices accessible only by the research team.

Results

Descriptive characteristics of respondents

The demographic profile of respondents shows a predominantly young reproductive-age population. The mean age was 29.4 years (SD = 5.8). Educational attainment was varied, with 41.2% having secondary-level education and 34.2% holding tertiary qualifications. Most respondents (72.5%) were rural–urban migrants without local hukou, reflecting the high mobility and socioeconomic vulnerability typical of informal settlement residents. The mean household income was RMB (The mean household income was 4,850 Chinese Yuan Renminbi (RMB), placing most respondents in the lower-income strata.) 4,850, placing most respondents in the lower-income strata. Health insurance coverage was available for

Table 1: Descriptive statistics of respondents (n =800)

Variable	Categories / Scale	Mean / %	SD
Age (years)	Continuous	29.4	5.8
Education level	Primary	24.6	—
	Secondary	41.2	—
	Tertiary	34.2	—
Monthly household income (RMB)	Continuous	4,850	1,640
Hukou status	Local hukou	27.5	—
	Migrant (non-hukou)	72.5	—
Number of children	Continuous	1.8	0.9
Health insurance coverage	Insured	63.5	—
	Uninsured	36.5	—

Table 2: Built environment characteristics in informal settlements

Built Environment Indicator	Measurement	Mean / %	SD
Distance to nearest health facility (km)	GPS measured	3.20 km	1.45
Travel time to facility (minutes)	Self-reported	27.4 min	11.3
Housing quality index (0–10)	PCA index	4.8	2.1
Neighbourhood safety score (1–5)	Likert	2.6	1.0
Walkability score (1–5)	Likert	2.9	0.8
Sanitation quality (1–5)	Likert	2.4	0.9
Environmental hazards (1–5)	Likert	3.2	1.1
Built environment index (BEI)	PCA composite	0.00	1.00

Table 3: Maternal healthcare utilisation (ANC & PNC)

Maternal health variable	Categories / Values	Mean / %	SD
Number of ANC visits	Continuous	3.3	1.7
Adequate ANC (≥4 visits)	Yes	42.5	—
Timing of first ANC visit (weeks)	Continuous	12.7	4.3
PNC visit within 48 Hours	Yes	55.2	—
Number of PNC visits	Continuous	1.3	0.9

63.5%, while 36.5% remained uninsured—an important barrier to maternal care utilisation. Table 1

Built environment characteristics in informal settlements

Built environment indicators demonstrate significant infrastructural and environmental vulnerabilities within informal settlements. Respondents lived, on average, 3.20 km from the nearest health facility, requiring approximately 27.4 minutes of travel time. Housing quality scores were low (mean 4.8/10), reflecting overcrowding, poor ventilation, and substandard materials.

Neighborhood-level conditions also showed deficiencies: safety scores averaged 2.6/5, walkability 2.9/5, and sanitation 2.4/5. Environmental hazards—including flooding and waste accumulation—scored 3.2/5. These factors collectively form the Built Environment Index (BEI), standardized at mean 0.00 (SD = 1.00). Table 2

Maternal healthcare utilization patterns

ANC and PNC utilisation levels remained below recommended national and WHO guidelines. Women averaged 3.3 ANC visits, with only 42.5% achieving the minimum recommended four visits. The first ANC contact occurred at 12.7 weeks, slightly later than WHO recommendations. PNC utilisation appeared marginally better, with 55.2% receiving PNC within 48 hours of childbirth, and an average of 1.3 postnatal visits. Table 3

Table 4: Bivariate associations between built environment and ANC utilization

Built Environment Variable	ANC adequacy (≥4 Visits) %	ANC inadequate (<4) %	χ^2	p-value
Distance to facility (High ≥3 km)	31.4	68.6	18.22	0.000***
Distance to facility (Low <3 km)	50.8	49.2	—	—
Housing quality (High)	54.7	45.3	11.57	0.001**
Housing Quality (Low)	38.9	61.1	—	—
Neighbourhood Safety (High)	58.3	41.7	15.95	0.000***
Neighbourhood Safety (Low)	39.1	60.9	—	—

***p<0.001, **p<0.01, *p<0.05

Table 5: Logistic regression predicting adequate ANC utilisation (≥4 visits)

Variables	B	OR	95% CI	p-value
Built Environment Index (BEI)	0.41	1.51	1.27–1.80	0.000***
Distance to Facility (km)	–0.28	0.76	0.68–0.86	0.000***
Transport Accessibility	0.21	1.23	1.07–1.42	0.003**
Housing Quality	0.18	1.20	1.05–1.38	0.006**
Sanitation Quality	0.12	1.13	0.98–1.30	0.082
Neighbourhood Safety	0.27	1.31	1.10–1.56	0.002**
Age	0.03	1.03	1.01–1.06	0.011*
Education Level	0.34	1.41	1.18–1.68	0.000***
Household Income	0.06	1.06	1.02–1.10	0.004**
Migrant (non-hukou)	–0.52	0.59	0.44–0.78	0.000***
Health Insurance	0.48	1.62	1.25–2.08	0.000***

Table 6: Negative binomial regression predicting number of ANC visits

Predictor	B	IRR	95% CI	p-value
Built Environment Index (BEI)	0.19	1.21	1.12–1.30	0.000***
Distance to Facility (km)	–0.15	0.86	0.81–0.91	0.000***
Housing Quality	0.08	1.08	1.03–1.14	0.002**
Sanitation Quality	0.05	1.05	0.99–1.11	0.091
Neighbourhood Safety	0.09	1.10	1.04–1.17	0.001**

Bivariate associations between built environment and ANC adequacy

Bivariate analysis (Table 4) shows significant disparities in ANC adequacy across built environment categories. Women living ≥3 km away from facilities had substantially lower ANC adequacy (31.4%) compared to those within closer proximity (50.8%, p < 0.001). Better housing quality and neighbourhood safety were also associated with higher ANC utilisation.

Logistic regression predicting adequacy of ANC utilisation

Multivariate regression (Table 5) demonstrates the strong influence of built environment features on ANC utilisation. The Built Environment Index (BEI) was a significant predictor (OR = 1.51, p<0.001). Distance to the nearest health facility reduced the likelihood of adequate ANC (OR = 0.76, p<0.001). Transport accessibility, housing quality, and neighbourhood safety remained significant after adjusting for socioeconomic factors.

Negative binomial regression predicting number of ANC visits

The count-based analysis (Table 6) confirmed that improvements in built environment conditions significantly increased the number of ANC visits (IRR = **1.21**, p < 0.001). Distance again demonstrated a strong negative effect.

Table 7: Logistic regression predicting PNC utilisation (within 48 hours)

Variables	B	OR	95% CI	p-value
Built Environment Index (BEI)	0.37	1.45	1.20–1.75	0.000***
Distance to Facility (km)	–0.24	0.78	0.68–0.89	0.001**
Transport Accessibility	0.18	1.20	1.03–1.41	0.021*
Housing Quality	0.16	1.17	1.01–1.36	0.034*
Neighbourhood Safety	0.23	1.26	1.07–1.48	0.005**
Age	–0.02	0.98	0.96–1.01	0.133
Education	0.22	1.24	1.05–1.46	0.011*

Logistic Regression predicting PNC utilisation

Postnatal care utilisation within 48 hours was also significantly predicted by built environment quality (Table7). Distance, transport accessibility, housing quality, and neighbourhood safety were all significant, showing similar pathways as ANC utilisation.

Discussion

The findings of this study show that the built environment plays a decisive role in shaping maternal healthcare utilisation among women living in informal settlements in China. The results indicate that elements such as housing quality, neighbourhood safety, sanitation, walkability and distance to health facilities are not merely background conditions but active determinants that influence whether a woman seeks antenatal or postnatal care. These outcomes align with international evidence which consistently shows that the physical and social environments of low-income neighbourhoods affect access to health services and overall health behaviour[11,13]. In the context of Chinese urban villages, where informal construction, overcrowding and environmental degradation are common, the influence of the built environment becomes even more pronounced.

One of the strongest findings concerns spatial accessibility. Women who lived further from health facilities or who required more time to travel were significantly less likely to attend adequate ANC visits or obtain timely PNC. This relationship mirrors findings from other developing regions, where distance acts as one of the most powerful deterrents to maternal healthcare utilisation[14,15]. Informal settlements in China often exist in peripheral or poorly serviced zones, resulting in what several scholars describe as a spatial mismatch between the location of vulnerable populations and essential public services[8]. Poor road quality, lack of direct public transport routes and unsafe pedestrian pathways further complicate women's ability to travel during pregnancy. The present study reinforces the idea that improving maternal health outcomes is deeply tied to how cities are spatially organized and how accessible healthcare services are for marginalised communities.

Neighborhood-level environmental conditions also emerged as significant predictors of maternal healthcare utilization. Women reporting low levels of neighborhood safety were less likely to leave home for ANC or PNC. Safety concerns may include inadequate street lighting, high-density alleys, fear of harassment or crime, and unsafe walking routes. Previous research has shown that perceived danger reduces women's mobility and autonomy in urban settings, particularly during pregnancy when physical vulnerability is heightened[11]. Poor housing quality and inadequate sanitation were also associated with reduced maternal healthcare utilization. Women exposed to dampness, pollution, poor ventilation or overcrowding often experience greater stress, discomfort or illness, which can discourage consistent engagement with healthcare services. These findings support earlier work showing that substandard housing contributes to reduced preventive health-seeking behavior[12].

Socioeconomic conditions further shape how environmental disadvantages translate into health inequities. Migrant women without local hukou were among the least likely to utilise maternal healthcare services. The hukou system continues to exclude migrants from many subsidised health services, reinforcing previous

findings that institutional barriers intersect with environmental disadvantages to produce unequal health outcomes[5]. Income and education were also influential factors. Women with higher educational attainment were more likely to recognize the importance of ANC and PNC, while higher-income households could more easily afford transportation costs or private services when public options were distant or inconvenient. These trends reflect broader evidence that maternal healthcare utilization improves with increased socioeconomic resources and awareness[9].

Overall, this study demonstrates that maternal health cannot be examined independently from the environments in which women live. For women in informal settlements, the built environment shapes daily decisions, mobility patterns and access to healthcare facilities. The findings support the growing consensus that urban planning and public health are deeply intertwined. Improving maternal healthcare utilization requires more than expanding hospital capacity; it requires building safer neighborhood's, providing reliable transport, improving housing and ensuring that essential services are equitably distributed. The study highlights the importance of considering environmental and social determinants simultaneously, especially in rapidly urbanizing countries where informal settlements are expanding. By integrating built environment improvements with health policies, cities can move toward greater maternal health equity and better overall health outcomes.

Study strengths and limitations

This study offers several notable strengths. First, it is among the few quantitative investigations to integrate both subjective assessments (perceived safety, housing quality, walkability) and objective environmental measures, including GPS-recorded distance to health facilities. This dual approach provides a more comprehensive understanding of how built-environment factors influence maternal healthcare utilization in informal settlements. Second, the study draws on a large sample of 800 women across four major Chinese cities, allowing for meaningful comparison across diverse urban contexts and enhancing the external validity of the findings. Third, the use of multivariate logistic and negative binomial regression models strengthens analytical rigor by accounting for socioeconomic, demographic, and environmental confounders. Finally, incorporating a Built Environment Index (BEI) through principal component analysis provides a robust composite measure that captures the multifaceted nature of environmental disadvantage.

Despite these strengths, several limitations should be acknowledged. The cross-sectional design restricts the ability to establish causal relationships between built-environment characteristics and maternal healthcare utilization. Although the study uses objective measures, many variables—such as safety, sanitation perception, and walkability—are self-reported and therefore susceptible to reporting or social desirability bias. Additionally, the sample is drawn from selected informal settlements in four cities, meaning that results may not be fully generalizable to all urban villages in China. Another limitation is the potential recall bias, as respondents were asked to reflect on ANC and PNC experiences that may have occurred up to two years earlier. Finally, environmental conditions may vary seasonally, but data were collected during a single period, which may not capture temporal variations in accessibility or neighborhood safety.

Conclusion

This study set out to examine how built-environment characteristics influence antenatal and postnatal care utilization among women living in informal settlements in China, and the findings clearly demonstrate that the study objectives were achieved. The analysis shows that distance to health facilities, limited transport access, poor housing quality, environmental hazards and low neighborhood safety significantly reduce the likelihood of adequate ANC and timely PNC, confirming that these environmental factors are key determinants of maternal healthcare behavior. The results also show that socioeconomic disadvantages—particularly migrant status, low income and limited education—interact with built-environment barriers to further constrain service utilization. By quantitatively linking environmental

conditions with maternal health-seeking patterns across four major cities, the study successfully provides empirical evidence that the built environment is a major contributor to inequities in maternal healthcare in informal urban settings.

References

1. Tu M. Go Home and Live Well: Three-Child Policy, Feminist Movement and Gender Equality in China. Dartmouth College. 2022.
2. D'Souza P, Bailey JV, Stephenson J and Oliver S. Factors influencing contraception choice and use globally: a synthesis of systematic reviews. The European Journal of Contraception & Reproductive Health Care. 2022;27(5):364-372.
3. Wang X, Iftikhar, H, Shah, U, Hashmi U and Iqbal, MS. Transforming reproductive healthcare in rural China: The impact of mobile health, telemedicine, and e-health innovations on family planning and maternal health services. African Journal of Reproductive Health, 202529(8s).
4. Wang X, Iftikhar H, Hali SM, Shah U and Iqbal MS. Impact of health policy reforms on telemedicine and AI integration for early cancer detection among low-income populations in South Asia: A comparative policy analysis. African Journal of Reproductive Health, 2025; 29(8), 43-53.
5. Islam MR. Exploring Family Planning Strategies Family Planning and Sustainable Development in Bangladesh: Empowering Marginalized Communities in Asian Contexts. In: Emerald Publishing Limited; 2024:23-43.
6. Lopes SC, Constant D, Fraga S, Osman NB and Harries J. There Are Things We Can Do and There Are Things We Cannot Do." A Qualitative Study About Women's Perceptions on Empowerment in Relation to Fertility Intentions and Family Planning Practices in Mozambique. Frontiers in Global Women's Health. 2022; 3:824650.
7. Jain M, Caplan Y, Ramesh B, Isac S, Anand P, Engl E and Gothalwal V. Understanding drivers of family planning in rural northern India: An integrated mixed-methods approach. PloS one. 2021;16(1): e0243854.
8. Zhai Z and Jin G. China's family planning policy and fertility transition. Chinese Journal of Sociology. 2023;9(4):479-496.
9. Jaravaza DC. Culture, Contraceptive Attitudes and Advertising Perceptions: The Case of Rural Zimbabwe. University of the Witwatersrand, Johannesburg (South Africa). 2021.
10. Rosén K. Declining fertility rates and the role of opportunity cost: The underlying economic incentives behind why women choose to have children. 2024.
11. Ebenstein A. The historical origins of son preference: Patrilocality and missing women. Available at SSRN 3829406. 2021.
12. Wang S and Zhong S. Economic uncertainty, cultural and ideational transition, and low fertility. Sustainability. 2022;14(14):8344.
13. Colleran H. A theory of culture for evolutionary demography Human evolutionary demography. In: Open Book Publishers; 2024:517-550.
14. Nazrul N. Gender Relations and Women's Sexual and Reproductive Decision-Making in Rural Bangladesh. The University of Bergen. 2024.
15. Khan IJ. Economic empowerment and women's sexual agency in Dhaka's professional middle-class: nuances of negotiation behind closed doors. University of Sussex. 2022.
16. Kaiser JL, Fiorillo RM, Vian T, Ngoma T, Kuhfeldt KJ, Munro-Kramer ML and Lori JR. Qualitative application of the diffusion of innovation theory to maternity waiting homes in rural Zambia. Implementation Science Communications. 2025;6(1):18.