INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

PERCEPTION AND BEHAVIOR RELATED TO NON-COMMUNICABLE DISEASES (NCD'S) AMONG URBAN SLUM DWELLERS IN RAWALPINDI: A CROSS-SECTIONAL STUDY

Original Research

Abid Javaid[1]*, Muhammad Usman[2], Waheed Ahmed[2], Ahmad Khalid[3], Khan Abdul Ghafar Khan[4], Muhammad Suleiman[4]
[1]MBBS, MSc (Hospital Administration), MSPH, Commandant, Combined Military Hospital (CMH) JMR, Pakistan.
[2]Classified Medical Specialist, Pakistan.
[3]Classified Dermatologist, Pakistan.
[4]MBBS, Pakistan.
Corresponding Author: Abid Javaid, MBBS, MSc (Hospital Administration), MSPH, Commandant, Combined Military Hospital (CMH) JMR, Pakistan, abidjaved887@gmail.com
Acknowledgement: The authors acknowledge all study participants for their time and cooperation.

Conflict of Interest: None
Grant Support & Financial Support: None

ABSTRACT

Background: Non-communicable diseases (NCDs) represent a rapidly escalating public health challenge, particularly in low-income urban slum settings where poverty, low literacy, and limited healthcare access intersect. In such environments, inadequate awareness, misconceptions about disease causation, and poor preventive practices contribute to delayed diagnosis and adverse health outcomes. Understanding community-level knowledge, perceptions, and behaviors related to NCDs is therefore essential for designing effective, context-sensitive prevention and control strategies.

Objective: This study aimed to assess knowledge, perceptions, and health-related behaviors concerning non-communicable diseases among slum dwellers in Rawalpindi, Pakistan, and to identify socio-demographic and cultural factors influencing these outcomes.

Methods: A mixed-methods cross-sectional study was conducted among 400 adult residents of selected urban slums in Rawalpindi. Quantitative data were collected using a structured questionnaire adapted from the World Health Organization STEPwise approach, covering socio-demographics, NCD awareness, risk behaviors, and screening practices. Qualitative data were obtained through focus group discussions and in-depth interviews to explore cultural beliefs, barriers to care, and health-seeking behavior. Quantitative data were analyzed using SPSS version 26, applying descriptive statistics, chi-square tests, and logistic regression, while qualitative data underwent thematic analysis.

Results: Of the participants, 59% were female, with a mean age of 37.2 ± 10.8 years. Overall, 75.5% had heard of at least one NCD; hypertension (61%) and diabetes (58%) were the most commonly recognized. Only 26.5% correctly defined NCDs, and 21% perceived them as preventable. Tobacco use was reported by 35.5%, low physical activity by 57.3%, and unhealthy dietary practices by 80%. Only 22.5% had ever undergone NCD screening, while 52.5% preferred traditional remedies. Education level was significantly associated with NCD knowledge ($p < 0.001$) and screening uptake ($p = 0.007$), and gender was significantly associated with tobacco use ($p = 0.003$). Qualitative findings revealed widespread misconceptions, financial constraints, and limited trust in formal healthcare services.

Conclusion: The study revealed critical gaps in NCD knowledge, preventive behaviors, and service utilization among urban slum dwellers, underscoring the urgent need for culturally sensitive health education, accessible screening services, and community-based interventions to reduce NCD burden and promote health equity.

Keywords: Behavior, Health Education, Noncommunicable Diseases, Pakistan, Population Surveillance, Socioeconomic Factors, Urban Population.

INSIGHTS-JOURNAL OF
HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

INTRODUCTION

Non-communicable diseases (NCDs), including cardiovascular diseases, cancers, diabetes, and chronic respiratory illnesses, have emerged as a major public health challenge globally, with a particularly disproportionate burden in low- and middle-income countries (LMICs) (1). Rapid urbanization, demographic transitions, and lifestyle changes have significantly altered health profiles in these settings, leading to increased exposure to behavioral and metabolic risk factors such as unhealthy diets, physical inactivity, tobacco use, and harmful alcohol consumption. As a result, the socioeconomic and healthcare system impacts of NCDs continue to escalate worldwide, threatening sustainable development and straining already fragile health infrastructures in LMICs (2,3). NCDs typically arise from long-term and cumulative exposure to modifiable risk factors, underscoring the importance of prevention strategies that begin early in life and are sustained across the life course (4). However, preventive health services and community-based interventions remain limited in many LMIC contexts, particularly for vulnerable and younger populations, including adolescents and young adults (5). This gap is further compounded by the growing coexistence of infectious and non-communicable conditions. Among people living with HIV (PLHIV), NCDs demonstrate high comorbidity rates, posing a significant threat to the long-term gains achieved through widespread access to antiretroviral therapy (ART) and improved survival (6). Urban slums represent a critical but under-researched setting in the NCD epidemic. In South Asian megacities, rapid rural-to-urban migration has led to the expansion of informal settlements characterized by overcrowding, poverty, poor housing, and limited access to quality healthcare services. Evidence from Bangladesh highlights this pattern, with Dhaka alone hosting nearly half of the country's slum population, reflecting broader regional urban health inequities (7,8). Although NCDs were once perceived as diseases of affluence, they are now recognized as major causes of morbidity and mortality across all socioeconomic strata. Notably, individuals from lower socioeconomic backgrounds experience higher NCD-related mortality and worse outcomes compared to wealthier populations, largely due to delayed diagnosis, poor health literacy, and barriers to care (9). Globally, NCDs account for more than 70% of all deaths, with over two-thirds occurring in LMICs, emphasizing the urgent need for context-specific prevention and control strategies (10).

Beyond clinical outcomes, NCDs also affect broader dimensions of well-being and quality of life. Frameworks such as Gross National Happiness (GNH) highlight the interconnectedness of health with psychological well-being, living standards, community vitality, governance, and environmental conditions. In marginalized urban communities, the growing NCD burden threatens not only physical health but also social cohesion, productivity, and overall life satisfaction (11,12). Despite this, awareness, risk perception, and adoption of preventive behaviors remain low in many urban slum populations, contributing to late presentation and poor disease outcomes. In Pakistan, low-income urban slums such as those in Rawalpindi face similar challenges, where adverse living conditions, limited healthcare access, and low health literacy increase vulnerability to NCDs. Despite the rising prevalence of NCDs in these communities, little is known about how residents perceive these diseases, understand their risk factors, or engage in preventive and health-seeking behaviors. This lack of community-level evidence represents a critical gap in the literature and limits the development of effective, culturally appropriate interventions. Therefore, the objective of this study is to assess the perceptions, knowledge, and behaviors related to non-communicable diseases among slum dwellers in Rawalpindi, with the aim of identifying key barriers and facilitators to prevention and care to inform targeted health education, screening, and policy initiatives.

METHODS

A mixed-methods cross-sectional study was conducted to comprehensively assess community knowledge, attitudes, and practices related to non-communicable diseases (NCDs) among urban slum dwellers in Rawalpindi. The study integrated quantitative and qualitative approaches to capture both measurable patterns and contextual insights. Data were collected from a total of 400 adult residents living in selected slum areas. Ethical approval for the study was obtained from the Ethical Review Board of Combined Military Hospital (CMH), Rawalpindi, and the study was conducted in accordance with ethical principles governing human research. Written informed consent was obtained from all participants prior to enrollment, and confidentiality and voluntary participation were ensured throughout the study period. The study population comprised adult residents aged 18 years and above who had been residing in the selected slum communities for a minimum duration of six months. A multistage sampling technique was employed to ensure adequate representation. In the first stage, four slum areas in Rawalpindi were selected using purposive sampling based on population density and accessibility. In the second stage, households within each selected slum were identified through systematic random sampling. In the third stage, one eligible respondent was randomly selected from each household to minimize selection bias. Individuals who were temporarily visiting the area, had lived in the community for less than six months, were unable to participate due to physical or mental illness, or declined to provide

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

informed consent were excluded (5,8). Participants who were repeatedly unavailable during data collection visits were also excluded to maintain data completeness.

For the quantitative component, data were collected using a structured questionnaire developed in line with the World Health Organization STEPwise approach to NCD surveillance. The tool captured socio-demographic characteristics, knowledge of common NCDs such as diabetes, hypertension, and cardiovascular diseases, risk perception, health-seeking behavior, lifestyle practices including diet, tobacco use, alcohol consumption, and physical activity, as well as access to healthcare and screening services. The questionnaire was translated into Urdu to enhance comprehension and was pre-tested on 30 participants from a similar population to assess clarity, reliability, and content validity. Trained data collectors conducted face-to-face interviews using mobile-based data collection platforms to reduce data entry errors and improve data quality. The qualitative component consisted of focus group discussions and in-depth interviews to explore perceptions, attitudes, beliefs, and perceived barriers related to NCD prevention and management. Four focus group discussions were conducted, comprising two male and two female groups, each with six to eight participants, to encourage open discussion in gender-appropriate settings. In addition, ten in-depth interviews were conducted with community health workers, local healthcare providers, and community representatives selected through purposive sampling to ensure diversity in perspectives. Semi-structured interview guides were used, focusing on community understanding of NCDs, preventive behaviors, healthcare utilization, and trust in health systems. All interviews and discussions were conducted in Urdu, audio-recorded with participant consent, and transcribed verbatim for analysis. Quantitative data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 26. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize participant characteristics and key variables. Inferential analyses, including chi-square tests and logistic regression, were applied to examine associations between socio-demographic factors, perceptions, and preventive behaviors related to NCDs. Qualitative data were analyzed thematically through systematic coding of transcripts to identify recurring themes and patterns that complemented the quantitative findings.

RESULTS

A total of 400 adult residents from urban slum areas of Rawalpindi participated in the study. Females constituted the majority of the sample (59%), while males accounted for 41%. The mean age of respondents was 37.2 ± 10.8 years, with the largest proportion belonging to the 31–45-year age group (44.5%), followed by those aged 18–30 years (31.0%) and those above 45 years (24.5%). Most participants were married (70.5%). Educational attainment was generally low, with nearly two-thirds of respondents (62.5%) reporting no formal education, while 20.0% had completed primary education and only 17.5% had secondary or higher education. More than half of the households (55.0%) reported a monthly income below PKR 25,000, reflecting substantial socioeconomic disadvantage. Regarding awareness and knowledge of non-communicable diseases (NCDs), 302 respondents (75.5%) reported having heard of at least one NCD. Hypertension (61.0%) and diabetes (58.0%) were the most commonly recognized conditions. Despite this general awareness, only 26.5% of participants were able to correctly define NCDs, and just 21.0% believed that these diseases are preventable. Knowledge gaps were therefore prominent, particularly concerning the chronic and modifiable nature of NCDs. Behavioral risk factors were widely prevalent in the study population. Tobacco use, either through smoking or chewing, was reported by 35.5% of respondents. More than half (57.3%) reported low levels of physical activity, and an overwhelming majority (80.0%) described dietary patterns characterized by low fruit intake and high consumption of fats or processed foods. Preventive health practices were notably limited, as only 22.5% of participants reported ever undergoing screening for NCDs such as blood pressure or blood glucose measurement. Additionally, 52.5% indicated a preference for traditional remedies over formal clinical consultations.

Statistical analysis demonstrated significant associations between selected socio-demographic factors and NCD-related outcomes. Education level was strongly associated with knowledge of NCDs, with higher educational attainment linked to better awareness ($p < 0.001$). Gender showed a significant association with tobacco use, with higher prevalence observed among males ($p = 0.003$). Furthermore, respondents with higher levels of education were significantly more likely to have undergone screening for NCDs compared to those with little or no formal education ($p = 0.007$). Qualitative findings further illustrated the quantitative patterns observed. Only 38% of participants demonstrated a basic understanding of NCDs, and most knowledge was limited to commonly named conditions such as diabetes and hypertension. Misconceptions were widespread, with 62% attributing NCDs primarily to stress or fate rather than modifiable lifestyle factors. Health-seeking behavior was largely reactive, as 71% reported seeking medical care only when symptoms became severe, while routine check-ups were uncommon, reported by just 18%. Financial barriers were frequently cited, with 65% avoiding formal healthcare due to consultation costs, transportation expenses, or medication prices. Alternative care-seeking

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

practices were common, with 42% relying on traditional healers, unlicensed practitioners, or home remedies. Gender and cultural dynamics also influenced care-seeking behaviors. Among female participants, 59% reported requiring permission from male family members to access healthcare, and 48% delayed or avoided treatment due to household responsibilities or social constraints. Dissatisfaction with public healthcare services was reported by 67% of respondents, primarily due to overcrowding, medicine shortages, and perceived poor staff behavior. Consequently, 53% preferred private clinics or local pharmacies despite higher costs.

Table 1: Socio-Demographic Characteristics of Respondents (n = 400)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	164	41.0%
	Female	236	59.0%
Age Group	18–30 years	124	31.0%
	31–45 years	178	44.5%
	> 45 years	98	24.5%
Marital Status	Single	118	29.5%
	Married	282	70.5%
Education Level	No formal education	250	62.5%
	Primary	80	20.0%
	Secondary and above	70	17.5%
Monthly Household Income	< PKR 25,000	220	55.0%
	PKR 25,000 – 40,000	112	28.0%
	> PKR 40,000	68	17.0%

Table 2: Knowledge, Perception, and Risk Behaviors Related to NCDs (n = 400)

Variable	Response	Frequency (n)	Percentage (%)
Heard of any NCD	Yes	302	75.5%
	No	98	24.5%
Correctly defined NCDs	Yes	106	26.5%
	No	294	73.5%
Belief that NCDs are preventable	Yes	84	21.0%
	No/Not sure	316	79.0%
Aware of hypertension as an NCD	Yes	244	61.0%
Aware of diabetes as an NCD	Yes	232	58.0%
Tobacco use (smoking or chewing)	Yes	142	35.5%
Physical inactivity (low activity reported)	Yes	229	57.3%

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

Variable	Response	Frequency (n)	Percentage (%)
Unhealthy diet (low fruits, high fats)	Yes	320	80.0%
Ever screened for NCDs (BP, sugar, etc.)	Yes	90	22.5%
Prefer traditional remedies over clinic visits	Yes	210	52.5%

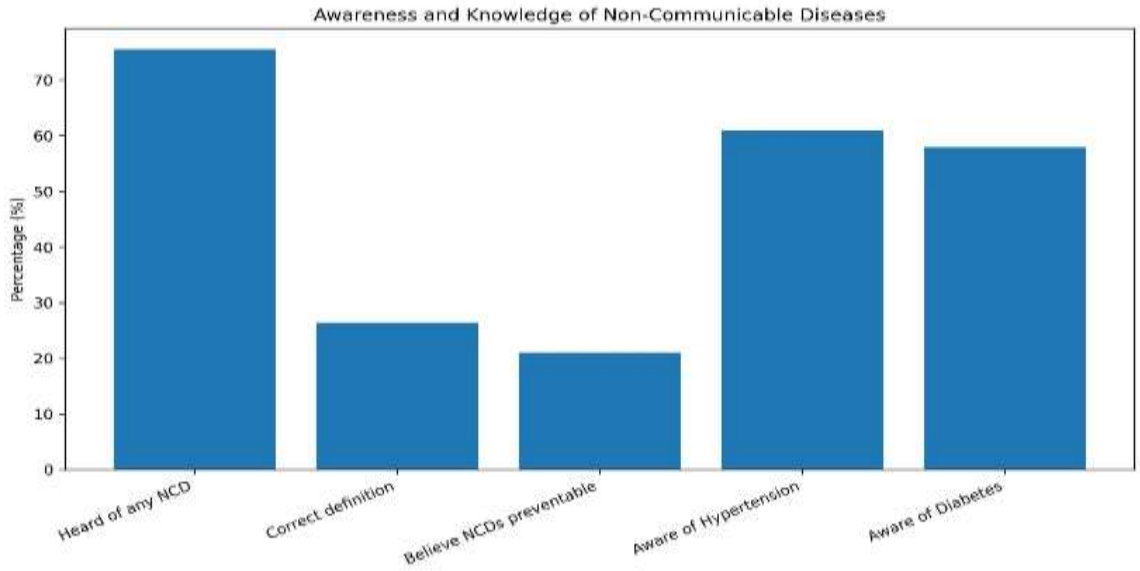

Figure 1 Awareness and Knowledge of Non-communicable Diseases

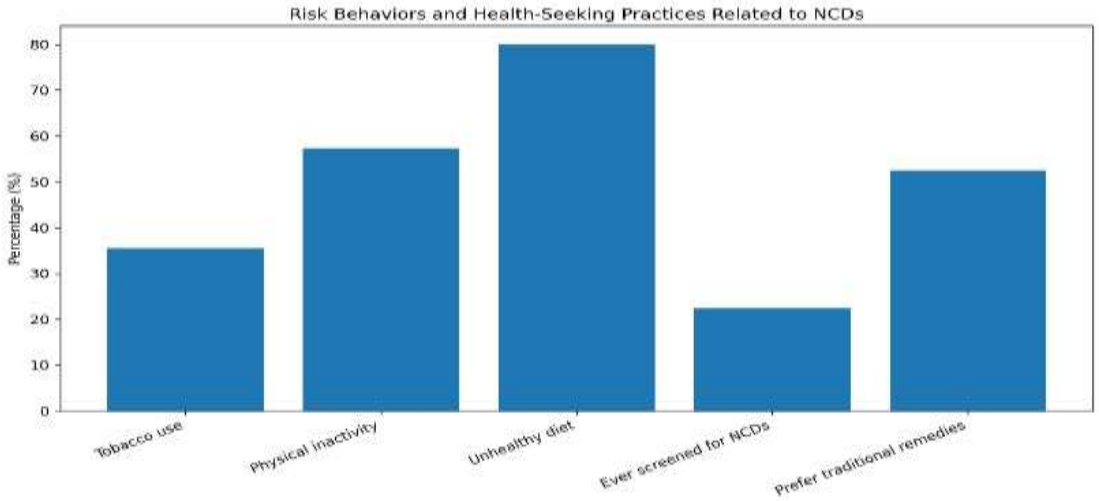

Figure 2 Risk Behaviors and Heath-Seeking Practices Related to NCDs

DISCUSSION

The findings of this study highlighted a substantial burden of social and structural disadvantage among urban slum dwellers in Rawalpindi, which appeared to directly influence awareness, behaviors, and preventive practices related to non-communicable diseases (NCDs). The predominance of female participants, low educational attainment, and limited household income reflected persistent inequities commonly observed in informal urban settlements. Similar demographic patterns have been reported in studies from other

INSIGHTS-JHR
INSIGHTS-JOURNAL OF HEALTH AND REHABILITATION

low-resource urban contexts, where poverty, low literacy, and unstable employment environments were shown to hinder access to accurate health information and integrated healthcare services, particularly for chronic infectious and non-communicable conditions (13). Although general awareness of at least one NCD was relatively high, detailed understanding remained limited. While hypertension and diabetes were frequently recognized, fewer than one-third of respondents could correctly define NCDs, and only a small proportion perceived these conditions as preventable. This gap between recognition and comprehension suggests that awareness alone does not translate into meaningful health literacy. Comparable findings have been reported in studies conducted in South Asian slums, where high exposure to risk factors coexisted with limited understanding of disease causation and prevention, particularly among socioeconomically marginalized and older populations (14-16). These patterns underscored the need for health education strategies that move beyond disease naming and focus on modifiable risk factors and long-term prevention.

The high prevalence of behavioral risk factors observed in this study, including tobacco use, physical inactivity, and unhealthy dietary practices, was consistent with evidence from urban slum populations across sub-Saharan Africa and South Asia. Previous research in similar settings demonstrated that individuals often accumulate multiple NCD risk factors due to constrained living environments, limited food choices, unsafe spaces for physical activity, and stress-related coping behaviors (17,18). The low uptake of screening services further emphasized the reactive nature of health-seeking behavior in these communities. Evidence from prior studies suggested that early, community-level interventions targeting food access, physical activity, and socioeconomic stability could substantially reduce future NCD burden if implemented at scale (19). The observed associations between education level and NCD knowledge, as well as between gender and tobacco use, highlighted important social gradients in health behavior. Higher education appeared to play a protective role by enhancing disease awareness and increasing the likelihood of screening uptake. Similar observations have been reported in low- and middle-income country settings, where traditional beliefs and limited health literacy were identified as key barriers to behavior change, reinforcing the importance of culturally tailored and community-engaged health promotion strategies (20,21). The higher screening rates among better-educated individuals further aligned with behavioral models suggesting that knowledge alone is insufficient without perceived self-efficacy and access to supportive health services. Comparable findings from Southeast Asian urban populations demonstrated that even in the presence of high-risk behaviors, empowerment-based interventions were more effective than information-only approaches in motivating preventive action (22).

This study benefited from a mixed-methods design, which strengthened the validity of findings by integrating quantitative estimates with qualitative insights into beliefs, cultural norms, and health system trust. The relatively large sample size enhanced the representativeness of the findings for similar urban slum settings. However, several limitations warranted consideration. The cross-sectional design limited causal inference between socio-demographic factors and NCD-related behaviors. Self-reported data may have introduced recall or social desirability bias, particularly for sensitive behaviors such as tobacco use. Additionally, the absence of objective clinical measurements, such as blood pressure, body mass index, or blood glucose levels, restricted the ability to directly link reported behaviors with actual disease burden. Future research would benefit from longitudinal designs to examine changes in knowledge and behavior over time and from incorporating biomedical assessments to strengthen risk profiling. Intervention-based studies evaluating community-led education, low-cost screening, and gender-sensitive health service delivery models would be particularly valuable. Overall, the findings reinforced the urgent need for integrated, context-specific NCD prevention strategies that address socioeconomic constraints, cultural beliefs, and health system trust in urban slum populations, while simultaneously empowering individuals to engage in preventive health behaviors.

CONCLUSION

This study demonstrated that urban slum dwellers in Rawalpindi face substantial gaps in understanding, risk perception, and preventive practices related to non-communicable diseases, despite general awareness of common conditions. The widespread presence of unhealthy lifestyles, low engagement with preventive screening, and strong reliance on traditional remedies reflected deep-rooted socioeconomic, cultural, and health system barriers. By highlighting these interconnected challenges, the study fulfilled its objective of identifying key obstacles to effective NCD prevention and care in marginalized urban settings. The findings emphasize the need for community-centered health education, improved access to affordable screening, and culturally sensitive service delivery models to reduce NCD burden and promote health equity in underserved populations.

AUTHOR CONTRIBUTIONS

Author	Contribution
Abid Javaid*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Usman	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Waheed Ahmed	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Ahmad Khalid	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Khan Abdul Ghafar Khan	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Suleiman	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

REFERENCES

1. King A, Tanumihardjo J, Ahn D, Zasadzinski L, Robinson E, Quinn M, et al. Assessing knowledge of end-stage kidney disease and treatment options in hospitalized African American patients undergoing hemodialysis. Chronic Illn. 2024;20(1):145-58.

2. Wang L, Zhou B, Zhao Z, Yang L, Zhang M, Jiang Y, et al. Body-mass index and obesity in urban and rural China: findings from consecutive nationally representative surveys during 2004-18. Lancet. 2021;398(10294):53-63.

3. Lurquin B, Kellou N, Colin C, Letrilliart L. Comparison of rural and urban French GPs' activity: a cross-sectional study. Rural Remote Health. 2021;21(3):5865.

4. Poitras ME, V TV, Canapé A, Boudreault A, Bacon K, Hatcher S. Culturally safe interventions in primary care for the management of chronic diseases of urban Indigenous People: a scoping review. Fam Med Community Health. 2022;10(Suppl 1).

5. Hossain MM, Roy A, Hanif AAM, Akter F, Hasan M, Khan MSA, et al. Distribution and disparities of healthy lifestyles and noncommunicable diseases risk factors between men and women aged 20-59 years in Bangladesh: Evidence from a nationwide survey. Chronic Dis Transl Med. 2024;10(4):312-26.

6. Zhou J, Wu Q, Wang Z. Effect of self-employment on the sub-health status and chronic disease of rural migrants in China. BMC Public Health. 2021;21(1):2250.

7. Demmler KM, van der Steen S, Trevenen-Jones A, de Kanter E. Food Environments and Diet Quality Among Vendors and Consumers in Five Traditional Urban Markets in Kenya. Nutrients. 2024;17(1).

8. Gaffney AW, Hawks L, White AC, Woolhandler S, Himmelstein D, Christiani DC, et al. Health Care Disparities Across the Urban-Rural Divide: A National Study of Individuals with COPD. J Rural Health. 2022;38(1):207-16.

9. Shankar M, Joseph-Lumpkin G, Costa DK, Cebert M, Fenick AM, Sharifi M, et al. Health-Related and Social Drivers of Chronic Absenteeism in an Urban School District. Acad Pediatr. 2025;25(8):103113.

10. Loyfah N, Chamratrithirong A, Gray RS, Pattaravanich U, Thapsuwan S, Thongcharoenchupong N, et al. Lifestyle, nutritional, and health influences on consumption of artificially-sweetened beverages in educated urban populations. PLoS One. 2025;20(4):e0322553.

11. Aguiar RG, Simões D, Castro SS, Goldbaum M, Cesar CLG, Lucas R. Multimorbidity patterns and associated factors in a megacity: a cross-sectional study. Rev Saude Publica. 2024;58:26.

12. Syed Shamsuddin SM, Ahmad N, Idris IB, Aizuddin AN, Ibrahim R, Mustafa Din W, et al. Natural health product knowledge as a significant factor associated with health-promoting lifestyle in a low-income urban community in Kuala Lumpur. BMC Public Health. 2024;24(1):2146.

13. Lotfy N. Overall health knowledge in the Philippines, multilevel confirmatory factor analysis of the Philippine National Demography Health Survey 2022 data. Sci Rep. 2024;14(1):18725.

14. Peng W, Li K, Yan AF, Shi Z, Zhang J, Cheskin LJ, et al. Prevalence, Management, and Associated Factors of Obesity, Hypertension, and Diabetes in Tibetan Population Compared with China Overall. Int J Environ Res Public Health. 2022;19(14).

15. Forero AY, Morales GE, Forero LC. Relationship between physical activity, sedentarism and obesity in adults, Colombia, 2015. Biomedica. 2023;43(Sp. 3):99-109.

16. Raoofi A, Amirkhani M, Monjazeb M, Peykari N. The Slums in the Mirror of Health: A Systematic Review Analysis from Iran. Int J Prev Med. 2022;13:137.

17. Jakstis K, Fischer LK. Urban Nature and Public Health: How Nature Exposure and Sociocultural Background Relate to Depression Risk. Int J Environ Res Public Health. 2021;18(18).

18. Bonnell LN, Clifton J, Rose GL, Waddell EN, Littenberg B. Urban-Rural Differences in Mental and Physical Health among Primary Care Patients with Multiple Chronic Conditions: A Secondary Analysis from a Randomized Clinical Trial. Int J Environ Res Public Health. 2022;19(23).

19. Davies T, Meyrowitsch DW. Who Cares? A Pilot Study of Pandemic Influenza Risk Perception in an Urban Population. Disaster Med Public Health Prep. 2022;16(5):1982-9.

20. Kamei M, Wangmo T, Leibowicz BD, Nishioka S. Urbanization, carbon neutrality, and Gross National Happiness: Sustainable development pathways for Bhutan. Cities. 2021 Apr 1;111:102972.

21. Kohori-Segawa H, Dorji C, Dorji K, Wangdi U, Dema C, Dorji Y, Musumari PM, Techasrivichien T, Watanabe SP, Sakamoto R, Ono-Kihara M. A qualitative study on knowledge, perception, and practice related to non-communicable diseases in relation to happiness among rural and urban residents in Bhutan. PloS one. 2020 Jun 29;15(6):e0234257.

22. Bae SH, Hwang O, Jeong J, Yang Y. Risk Perceptions of Noncommunicable Diseases among Cambodian Adults: A Cross-Sectional Study. Research in Community and Public Health Nursing. 2022;33(2):259-68.