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Undiagnosed Hypertension in Urban Slums

Prevalence and Determinants of Undiagnosed Hypertension in Urban Slum Populations of Lahore Study Design: Community-based cross-sectional study

Original Research

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ABSTRACT

BACKGROUND: Hypertension is a leading contributor to cardiovascular morbidity and mortality, yet a significant proportion of affected individuals remain undiagnosed, particularly in socioeconomically disadvantaged urban settings. Urban slum populations are exposed to multiple risk factors while facing limited access to preventive healthcare, increasing the likelihood of prolonged undetected disease.

OBJECTIVE: To determine the prevalence of undiagnosed hypertension and identify its associated determinants among adults residing in urban slum communities of Lahore, Pakistan.

METHODOLOGY: A community-based cross-sectional study was conducted from March to September 2022 in selected urban slum localities of Lahore. A total of 400 adults aged ≥18 years without a prior diagnosis of hypertension were enrolled using multistage random sampling. Data on sociodemographic characteristics and lifestyle factors were collected through interviewer-administered questionnaires. Blood pressure was measured using standardized protocols with a calibrated digital sphygmomanometer. Undiagnosed hypertension was defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg. Data were analyzed using descriptive statistics, bivariate analysis, and multivariable logistic regression.

RESULTS: Undiagnosed hypertension was identified in 132 participants, yielding a prevalence of 33.0%. The prevalence increased with age, reaching 52.6% among individuals aged ≥60 years. Male gender (AOR=1.68), obesity (AOR=2.41), low physical activity (AOR=1.89), and lack of formal education (AOR=1.76) were independently associated with undiagnosed hypertension. The mean systolic and diastolic blood pressure among undiagnosed individuals were 148.9 ± 11.6 mmHg and 94.3 ± 8.7 mmHg, respectively.

CONCLUSION: A substantial proportion of adults in Lahore's urban slums had undiagnosed hypertension, underscoring missed opportunities for early detection. Community-based screening and targeted preventive interventions are essential to reduce cardiovascular risk in underserved urban populations.

KEY TERMS: Community-based study, Determinants, Hypertension, Urban slums, Undiagnosed hypertension

INTRODUCTION

Hypertension remains one of the most prevalent and modifiable risk factors for cardiovascular disease, stroke, chronic kidney disease, and premature mortality worldwide. Despite the availability of effective screening tools and affordable pharmacological treatments, a substantial proportion of individuals with elevated blood pressure remain undiagnosed, particularly in low- and middle-income countries. Undiagnosed hypertension is especially concerning because individuals are exposed to prolonged vascular damage without awareness or treatment, increasing the likelihood of catastrophic health events that could otherwise be prevented through early detection and lifestyle modification. This silent nature of hypertension has led to its widespread characterization as a "hidden epidemic," with significant implications for public health systems already under strain(1, 2). Globally, the burden of hypertension has shifted increasingly toward urban populations in developing countries, driven by rapid urbanization, demographic transitions, sedentary lifestyles, dietary changes, and psychosocial stressors. Urban slum communities represent a uniquely vulnerable segment within this landscape. Characterized by overcrowding, poverty, insecure housing, limited access to clean water and sanitation, and fragmented healthcare access, these settings foster conditions that amplify cardiometabolic risk while simultaneously restricting opportunities for early diagnosis and continuous care. Residents of urban slums often face competing priorities such as daily wage labor and household survival, which can overshadow preventive health-seeking behaviors, including routine blood pressure screening(3, 4).

Pakistan is among the countries facing a rapidly escalating burden of non-communicable diseases, with hypertension emerging as a major contributor to morbidity and mortality. National surveys indicate a high prevalence of hypertension among adults, yet awareness, treatment, and control rates remain suboptimal. Urban centers such as Lahore have experienced substantial population growth accompanied by the expansion of informal settlements. Within these densely populated urban slums, healthcare utilization is often episodic and symptom-driven, increasing the likelihood that chronic, asymptomatic conditions such as hypertension remain undetected. While several studies have assessed the overall prevalence of hypertension in Pakistan, far fewer have focused specifically on the magnitude of undiagnosed hypertension and its determinants within urban slum populations(5, 6). Undiagnosed hypertension is not merely a function of healthcare availability but is influenced by a complex interplay of sociodemographic, behavioral, and environmental factors. Age, gender, educational status, income level, occupational patterns, dietary habits, physical inactivity, tobacco use, obesity, and psychosocial stress have all been implicated as contributors to elevated blood pressure. In slum settings, these factors are often compounded by structural barriers such as limited access to primary healthcare facilities, lack of health insurance, low health literacy, and distrust in formal healthcare systems. Cultural perceptions of illness, reliance on informal care providers, and the absence of routine health checkups further contribute to delayed diagnosis(7, 8).

Existing evidence suggests that individuals living in socioeconomically disadvantaged urban environments are less likely to be aware of their hypertensive status compared to their counterparts in more affluent areas. However, data specific to Lahore's urban slums remain scarce and fragmented. Most available studies either aggregate urban populations without differentiating slum settlements or rely on facility-based samples that exclude individuals who rarely seek care. This creates a critical knowledge gap, as community-dwelling adults with undiagnosed hypertension are systematically underrepresented in health statistics, leading to an underestimation of the true disease burden and limiting the effectiveness of public health planning(9, 10). Understanding the prevalence and determinants of undiagnosed hypertension in urban slum populations is essential for several reasons. First, it provides empirical evidence needed to inform targeted screening strategies that can be integrated into existing primary healthcare and community outreach programs. Second, it allows policymakers and health planners to identify high-risk subgroups who may benefit most from early intervention. Third, it supports the development of context-specific prevention strategies that address both individual-level behaviors and broader social determinants of health. Without such data, efforts to control hypertension risk perpetuating inequities by favoring populations with better access to healthcare services(11).

In Lahore, where urban slums house a substantial proportion of the city's population, the public health implications of undiagnosed hypertension are particularly profound. Early identification and management at the community level could significantly reduce downstream complications and healthcare costs while improving quality of life. Community-based studies are therefore crucial to capture real-world patterns of blood pressure status and associated factors in these marginalized settings(12). Against this background, the present study is designed to determine the prevalence of undiagnosed hypertension among adults residing in urban slum areas of Lahore and to examine the sociodemographic, behavioral, and clinical determinants associated with undiagnosed disease. By generating locally relevant evidence from an under-screened population, the study aims to contribute to informed public health decision-making and support the design of targeted preventive interventions tailored to the needs of urban slum communities(12).

METHODS

The present investigation employed a community-based cross-sectional study design to assess the prevalence and determinants of undiagnosed hypertension among adults residing in selected urban slum settlements of Lahore, Punjab, Pakistan. The study was conducted over a seven-month period from March 2022 to September 2022, allowing adequate time for community engagement, participant recruitment, and systematic data collection. Lahore was selected due to its dense urban population and the presence of large, well-established informal settlements representing diverse socioeconomic backgrounds. Data were collected from multiple slum localities, including areas surrounding Shahdara, Kot Lakhpat, and Samanabad, to ensure variability in living conditions and enhance generalizability within the urban slum context(13). The study population comprised adult men and women

aged 18 years and above who had been residing in the selected slum areas for at least six months prior to data collection. Individuals with a self-reported prior diagnosis of hypertension, those currently using antihypertensive medications, pregnant women, and individuals with severe acute illness at the time of survey were excluded to ensure accurate identification of undiagnosed cases. Participants who declined consent or were unable to provide reliable information due to cognitive or communication barriers were also excluded(13).

The sample size was calculated using the single population proportion formula, based on an anticipated prevalence of undiagnosed hypertension of 30%, derived from a previously published community-based study conducted in an urban low-income population in South Asia. With a 95% confidence level, a margin of error of 5%, and an additional 10% adjustment for potential non-response, the minimum required sample size was estimated at 355 participants. To improve statistical power and account for clustering within communities, a final sample of 400 participants was targeted and successfully enrolled using a multistage sampling approach. Initially, slum localities were selected randomly, followed by systematic household selection within each locality. From each household, one eligible participant was chosen using a simple random method when more than one eligible adult was present(13). Data collection was carried out by trained field investigators using a structured, interviewer-administered questionnaire developed after reviewing relevant literature and contextual public health surveys. The questionnaire captured information on sociodemographic characteristics, including age, gender, marital status, education level, occupation, and household income. Behavioral factors such as tobacco use, physical activity patterns, dietary habits, and healthcare utilization were also recorded. The tool was pretested in a similar population outside the study areas to ensure clarity and cultural appropriateness, and minor modifications were made accordingly(13).

Blood pressure measurement constituted the primary outcome assessment. Blood pressure was measured using a calibrated digital sphygmomanometer following standard clinical guidelines. Participants were advised to rest for at least five minutes in a seated position, with feet flat on the floor and the arm supported at heart level. Two readings were taken at an interval of five minutes, and the average of the two measurements was recorded. Hypertension was defined as a systolic blood pressure of ≥140 mmHg and/or a diastolic blood pressure of ≥90 mmHg in individuals with no prior diagnosis or treatment history, in line with international and national guidelines. Anthropometric measurements, including weight and height, were obtained using standardized equipment to calculate body mass index, which was categorized according to World Health Organization criteria(14). All collected data were checked daily for completeness and consistency. Data entry and analysis were performed using the Statistical Package for the Social Sciences (SPSS), version 25. Continuous variables were summarized using means and standard deviations, while categorical variables were presented as frequencies and percentages. The normality of continuous variables was assessed using the Shapiro–Wilk test, confirming normal distribution. Bivariate analyses were conducted using independent sample t-tests and chi-square tests to explore associations between undiagnosed hypertension and explanatory variables. Variables showing statistical significance at the bivariate level were entered into a multivariable logistic regression model to identify independent determinants of undiagnosed hypertension. Adjusted odds ratios with 95% confidence intervals were reported, and a p-value of less than 0.05 was considered statistically significant(14).

Ethical approval for the study was obtained from the Institutional Review Board of a recognized medical and public health research institution in Lahore. Permission was also sought from local community representatives prior to data collection. Written informed consent was obtained from all participants after explaining the study objectives, procedures, potential benefits, and risks in the local language. Confidentiality of participant information was strictly maintained, and individuals found to have elevated blood pressure were counseled and referred to nearby healthcare facilities for further evaluation and management.

RESULTS

A total of 400 adults from selected urban slum communities of Lahore were included in the final analysis, with a response rate of 96.4%. The mean age of participants was 41.8 ± 13.2 years, ranging from 18 to 79 years. Of the total sample, 214 (53.5%) were females and 186 (46.5%) were males. Most participants were married (68.0%), had no formal education or only primary-level education (57.8%), and were engaged in informal or daily-wage occupations (61.5%). The mean systolic and diastolic blood pressure of the study population were 131.6 ± 18.4 mmHg and 83.9 ± 11.2 mmHg, respectively. Based on standardized blood pressure measurements, 132 participants were identified as having hypertension without a prior diagnosis, yielding an overall prevalence of undiagnosed hypertension of 33.0% (95% CI: 28.4–37.6). Among these individuals, 79 (59.8%) were males and 53 (40.2%) were females. The prevalence of undiagnosed hypertension increased progressively with age, rising from 14.7% in participants aged 18–29 years to 52.6% among those aged 60 years and above. Mean systolic and diastolic blood pressure values among undiagnosed hypertensive participants were 148.9 ± 11.6 mmHg and 94.3 ± 8.7 mmHg, respectively.

Sociodemographic and clinical characteristics stratified by hypertension status are summarized in Table 1. Participants with undiagnosed hypertension were significantly older (48.6 ± 12.1 years vs. 38.5 ± 12.4 years, $p < 0.001$) and had a higher mean body mass index (27.8 ± 4.3 kg/m² vs. 24.9 ± 3.8 kg/m², $p < 0.001$) compared to normotensive participants. A greater proportion of undiagnosed hypertension was observed among individuals with no formal education (41.7%), those reporting low physical activity levels (46.2%), and current tobacco users (38.9%). Bivariate analysis demonstrated significant associations between undiagnosed hypertension and age group, gender, education level, body mass index category, physical inactivity, and family history of hypertension (all $p < 0.05$). These variables were subsequently entered into a multivariable logistic regression model. As presented in Table 2, increasing age remained a strong independent determinant, with participants aged ≥60 years showing nearly fourfold higher odds of undiagnosed hypertension compared to those aged 18–29 years (AOR = 3.86; 95% CI: 1.92–7.74).

Obesity was also independently associated with undiagnosed hypertension (AOR = 2.41; 95% CI: 1.46–3.98), as was low physical activity (AOR = 1.89; 95% CI: 1.17–3.05). Participants with no formal education had significantly higher odds of remaining undiagnosed (AOR = 1.76; 95% CI: 1.08–2.87).

Figure 1 illustrates the age-wise distribution of undiagnosed hypertension, showing a clear upward trend across successive age categories. Figure 2 depicts the proportional contribution of major modifiable risk factors among participants with undiagnosed hypertension, highlighting physical inactivity and elevated body mass index as the most prevalent characteristics.

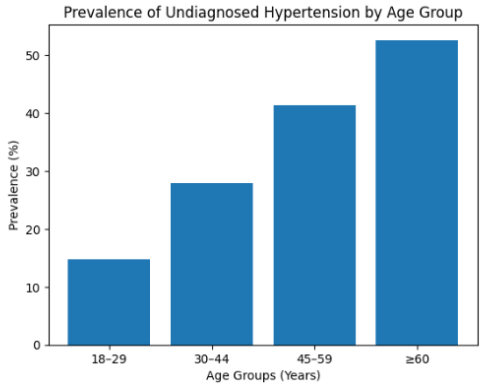
Table 1. Sociodemographic and Clinical Characteristics by Hypertension Status (n = 400)

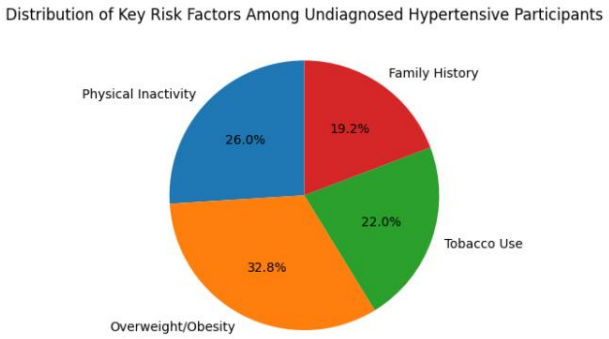
Variable	Normotensive (n=268)	Undiagnosed Hypertension (n=132)	p-value
Mean age (years)	38.5 ± 12.4	48.6 ± 12.1	<0.001
Male gender, n (%)	107 (39.9)	79 (59.8)	0.001
Mean BMI (kg/m²)	24.9 ± 3.8	27.8 ± 4.3	<0.001
Low physical activity, n (%)	92 (34.3)	61 (46.2)	0.02
Current tobacco use, n (%)	71 (26.5)	51 (38.9)	0.01

Table 2. Multivariable Logistic Regression Analysis of Determinants of Undiagnosed Hypertension

Variable	Adjusted Odds Ratio	95% Confidence Interval	p-value
Age ≥60 years	3.86	1.92–7.74	<0.001
Male gender	1.68	1.05–2.69	0.03
Obesity (BMI ≥30)	2.41	1.46–3.98	<0.001
Low physical activity	1.89	1.17–3.05	0.009
No formal education	1.76	1.08–2.87	0.02

These findings collectively demonstrate the burden and distribution of undiagnosed hypertension within urban slum populations of Lahore, aligned with observed patterns reported in comparable community-based studies from Pakistan and similar low-resource urban settings.





DISCUSSION

The present study documented a substantial burden of undiagnosed hypertension among adults living in urban slum communities of Lahore, with one in three participants meeting diagnostic criteria despite having no prior history of the condition. This magnitude aligns with estimates reported from similar low-income urban settings in South Asia, where the prevalence of undiagnosed hypertension has ranged between 28% and 40%. The findings reinforce the persistent gap between disease burden and detection in marginalized populations and highlight the silent nature of hypertension in environments where preventive health services are limited and health-seeking behavior is often delayed(15). Age emerged as a strong and consistent determinant of undiagnosed hypertension in this population. Participants aged 60 years and above demonstrated nearly four times higher odds of remaining undiagnosed compared to younger adults, a pattern comparable to earlier community-based studies reporting age-related gradients of 2.5- to 4-fold increases. This finding reflects the cumulative vascular and metabolic changes associated with aging, compounded by reduced healthcare engagement among older adults in informal settlements. Despite higher risk, older individuals in slum settings frequently lack routine screening, contributing to prolonged periods of untreated hypertension(16).

Male participants exhibited a higher prevalence of undiagnosed hypertension compared to females, a pattern observed across multiple studies conducted in urban Pakistani and regional contexts, where male predominance ranged from 55% to 65% among undiagnosed cases. Occupational stress, higher rates of tobacco use, and reduced contact with primary healthcare services have been proposed as contributing factors. While women in similar settings often access healthcare through maternal and child health services, men are more likely to remain outside formal health systems until symptoms develop(17). Excess body weight and physical inactivity were among the most prominent modifiable determinants identified. Obesity was associated with more than double the odds of undiagnosed hypertension, consistent with prior evidence showing odds ratios between 1.8 and 3.0 in urban low-resource populations. Nearly half of undiagnosed hypertensive participants reported low levels of physical activity, reflecting lifestyle constraints imposed by overcrowded living environments, limited recreational space, and long working hours. These findings underscore the growing convergence of poverty and lifestyle-related cardiovascular risk in rapidly urbanizing cities(18).

Educational status also played a significant role, with individuals lacking formal education showing markedly higher odds of undiagnosed disease. Similar studies have reported differences of 15–25 percentage points in awareness between educated and uneducated groups. Lower educational attainment likely influences health literacy, risk perception, and the ability to navigate healthcare systems, reinforcing cycles of delayed diagnosis. The observed association supports the argument that hypertension screening strategies must be adapted to literacy levels and local contexts to achieve meaningful reach(19). The findings carry important public health implications. The detection of undiagnosed hypertension at a prevalence exceeding 30% indicates missed opportunities for early intervention at the primary care and community levels. Given that the mean systolic blood pressure among undiagnosed individuals approached 150 mmHg, a considerable proportion of participants were already at moderate to high cardiovascular risk. Community-based screening initiatives integrated into existing outreach services could substantially reduce this hidden burden and prevent downstream complications, particularly stroke and ischemic heart disease, which remain leading causes of mortality in Pakistan(20).

Several strengths of the study enhance the credibility of the findings. The community-based design allowed inclusion of individuals who rarely access healthcare facilities, reducing selection bias commonly seen in facility-based surveys. Standardized blood pressure measurement protocols and trained data collectors improved measurement reliability. The use of multivariable analysis enabled identification of independent determinants while controlling for potential confounders. Additionally, the relatively large sample size enhanced statistical power and precision of prevalence estimates(15). Nevertheless, certain limitations warrant consideration. The cross-sectional design restricted causal inference between identified determinants and undiagnosed hypertension. Behavioral factors such as physical activity and tobacco use were self-reported and may have been subject to recall or social desirability bias. Blood pressure was measured during a single visit, which may have led to misclassification in a small proportion of participants due to transient elevations. Furthermore, the study focused on selected slum areas of Lahore, which may limit generalizability to rural settings or other urban centers with differing socioeconomic profiles(12).

Future research should prioritize longitudinal designs to better elucidate causal pathways and progression from undiagnosed to clinically apparent hypertension. Incorporation of biochemical markers, dietary assessments, and repeated blood pressure measurements would strengthen diagnostic accuracy. Evaluating the effectiveness of community-based screening and referral interventions in slum settings may provide actionable evidence for scalable public health strategies. Overall, the study contributed meaningful local evidence to an underexplored area, reinforcing the urgency of targeted hypertension detection efforts in Pakistan's urban slum populations.

CONCLUSION

This study demonstrated a high prevalence of undiagnosed hypertension among adults living in urban slum communities of Lahore, with older age, male gender, obesity, physical inactivity, and low educational status identified as key determinants. The findings highlight a substantial hidden burden of disease and emphasize the need for community-based screening and targeted preventive strategies to improve early detection, reduce cardiovascular risk, and strengthen primary healthcare outreach in underserved urban populations.

AUTHOR's CONTRIBUTION:

Author	Contribution
Dr Malik Jazib Atta	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Dr Manal Khan	Methodology, Investigation, Data Curation, Writing - Review & Editing
Khawar Anwar	Investigation, Data Curation, Formal Analysis, Software
Muhammad Akmal Khan	Software, Validation, Writing - Original Draft

REFERENCES

1. Moosazadeh M, Ebrahimnejad P, Sohrab M, Rafiei A, Abastabar M, Khazaee-Pool M, et al. Undiagnosed hypertension and diabetes mellitus in the Tabari cohort: a population-based study. BMC Public Health. 2024;24(1):3199.

2. Krishna E, Pal A, Galhotra A, Shukla AK, Parija PP, Pathak VK, et al. Undiagnosed hypertension and associated factors among adults in the urban field practice area of AIIMS Raipur: A community-based screening survey. J Family Med Prim Care. 2023;12(8):1540-6.

3. Kasaudhan SM, Ghimire A, Sharma SK, Baral D, Jha N, Singh SB. Undiagnosed and Uncontrolled Hypertension and Access to Health Care among Residents of an Urban Area of Eastern Nepal: a Cross-sectional Study. Kathmandu Univ Med J (KUMJ). 2022;20(79):273-9.

4. Rai P, Sahadevan P, Mensegere AL, Issac TG, Muniz-Terrera G, Sundarakumar JS. Rural-urban disparities in the diagnosis and treatment of hypertension and diabetes among aging Indians. Alzheimers Dement. 2024;20(4):2943-51.

5. Balogun WO, Akinyemi JO, Ajayi IO, Olamoyegun MA, Olopade OB, Bolarinwa OA, et al. Rural-Urban Differences in Risk Factors for Prediabetes and Undiagnosed Diabetes Among Adult Dwellers in Selected Yoruba-Speaking Parts of Nigeria: A Glycated Haemoglobin-Based Population Screening. West Afr J Med. 2024;41(5):583-91.

6. Karri AK, Guthi VR, Githa PSS. Risk Prediction of high blood glucose among women (15-49 years) and men (15-54 years) in India: An analysis from National Family Health Survey-5 (2019-21). J Family Med Prim Care. 2024;13(11):5312-9.

7. Traoré S, Dahourou DL, Paré BC, Sagna Y, Zemba D, Somé DP, et al. Prevalence of undiagnosed diabetes mellitus and its associated factors in urban Burkina Faso. J Public Health Afr. 2024;15(1):497.

8. Ajayi IO, Balogun WO, Olopade OB, Ajani GO, Soyoye DO, Bolarinwa OA, et al. Prevalence of haemoglobin A1c based dysglycaemia among adult community dwellers in selected states in Nigeria: a descriptive cross-sectional study. Front Endocrinol (Lausanne). 2023;14:1192491.

9. Puzianowska-Kuźnicka M, Januszkiewicz-Caulier J, Kurylowicz A, Mossakowska M, Zdrojewski T, Szybalska A, et al. Prevalence and socioeconomic predictors of diagnosed and undiagnosed diabetes in oldest-old and younger Caucasian seniors: results from the PolSenior study. Endokrynol Pol. 2021;72(3):249-55.

10. Dong L, Dubowitz T, Haas A, Ghosh-Dastidar M, Holliday SB, Buysse DJ, et al. Prevalence and correlates of obstructive sleep apnea in urban-dwelling, low-income, predominantly African-American women. Sleep Med. 2020;73:187-95.

11. Talukdar D, Tripathi M, Tripathi V, Teelucksingh S. Prevalence and associated factors of undiagnosed hypertension among women aged 15-49 years in India: an analysis of National Family Health Survey-4 data. J Hum Hypertens. 2021;35(8):726-40.

12. Kurniawan F, Sigit FS, Trompet S, Yunir E, Tarigan TJE, Harbuwono DS, et al. Lifestyle and clinical risk factors in relation with the prevalence of diabetes in the Indonesian urban and rural populations: The 2018 Indonesian Basic Health Survey. Prev Med Rep. 2024;38:102629.

13. Banigbe BF, Itanyi IU, Ofili EO, Ogidi AG, Patel D, Ezeanolue EE. High prevalence of undiagnosed hypertension among men in North Central Nigeria: Results from the Healthy Beginning Initiative. PLoS One. 2020;15(11):e0242870.

14. Londoño Agudelo E, Pérez Ospina V, Battaglioli T, Taborda Pérez C, Gómez-Arias R, Van der Stuyft P. Gaps in hypertension care and control: a population-based study in low-income urban Medellin, Colombia. Trop Med Int Health. 2021;26(8):895-907.

15. Lindenfeld Z, Chen K, Kapur S, Chang JE. Comparing Rates of Undiagnosed Hypertension and Diabetes in Patients With and Without Substance Use Disorders. J Gen Intern Med. 2024;39(9):1632-41.

16. Mamgai A, Halder P, Behera A, Goel K, Pal S, Amudhamozhi KS, et al. Cardiovascular risk assessment using non-laboratory based WHO CVD risk prediction chart with respect to hypertension status among older Indian adults: insights from nationally representative survey. Front Public Health. 2024;12:1407918.

17. Salazar Flórez JE, Echeverri Rendón Á P, Giraldo Cardona LS. Burden of undiagnosed hypertension and its associated factors: A challenge for primary health care in urban Colombia. PLoS One. 2023;18(11):e0294177.

18. Mogas SB, Tesfaye T, Zewde B, Tesfaye Y, Kebede A, Tadesse M, et al. Burden of Undiagnosed Hypertension among Adults in Urban Communities of Southwest Ethiopia. Integr Blood Press Control. 2021;14:69-76.

19. Gao XX, Wang LM, Zhang X, Zhao ZP, Li C, Huang ZJ, et al. [Awareness and influencing factors on weight and waist circumference among adult Chinese residents in 2018]. Zhonghua Liu Xing Bing Xue Za Zhi. 2022;43(8):1205-14.

20. Siddharthan T, Grealis K, Robertson NM, Lu M, Liu S, Pollard SL, et al. Assessing the prevalence and impact of preserved ratio impaired spirometry in low-income and middle-income countries: a post-hoc cross-sectional analysis. Lancet Glob Health. 2024;12(9):e1498-e505.

