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RESEARCH ARTICLE

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CARDIOMETABOLIC RISK BURDEN IN DAR ES SALAAM: FINDINGS FROM GSM FOUNDATION COMMUNITY SCREENING PROGRAM

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ABSTRACT

Background: Cardiometabolic diseases are escalating in low- and middle-income countries undergoing rapid urbanization. In Tanzania, hypertension, obesity, and diabetes have emerged as major public health threats, yet a substantial proportion of affected individuals remain undiagnosed and untreated. This study aimed to determine the prevalence and distribution of key cardiometabolic risk factors among adults who participated in a community-based screening initiative in urban Dar es Salaam. **Methods:** We conducted a cross-sectional analysis of secondary data from a community outreach program carried out in Dar es Salaam in December 2025. Adults aged 18 years and older with complete blood pressure, anthropometric, or random blood glucose measurements were included in the study. Hypertension was defined as systolic blood pressure ≥ 140 mmHg or self-reported use of antihypertensive medication. Overweight or obesity was defined as a body mass index ≥ 25 kg/m², and elevated random blood glucose was defined as ≥ 11.1 mmol/L or self-reported diabetes. Associations between cardiometabolic risk factors and participant characteristics were examined using Pearson's chi-square tests. **Results:** A total of 635 adults were enrolled, with a mean age of 45.0 years and a predominance of female participants (64.1%). Overall, 67.2% of participants presented with at least one cardiometabolic risk condition. Elevated systolic blood pressure was observed in 32.3% of the cohort, comprising 14.0% newly identified cases and 18.3% previously diagnosed individuals. Overweight or obesity was documented in 56.2% of participants. Hyperglycaemia was detected in 4.9% of cases, of which 0.5% were newly identified and 4.4% were previously known. Cardiometabolic risk was significantly associated with older age and female sex ($p < 0.05$). **Conclusion:** Cardiometabolic risk conditions are highly prevalent among adults attending community-based screenings in urban Dar es Salaam, with over two-thirds of participants affected. Community outreach programs play a critical role in the early detection of undiagnosed hypertension and diabetes. To translate screening into tangible health gains, these initiatives must be reinforced by robust referral pathways and sustainable continuity-of-care systems.

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INTRODUCTION

Non-communicable diseases (NCDs) are the leading cause of mortality worldwide and now account for a growing share of premature deaths in low- and middle-income countries (LMICs), where health systems remain heavily skewed toward acute, infectious, and maternal childcare. Among the principal drivers of this epidemiological burden are cardiometabolic conditions namely hypertension, obesity, and dysglycaemia which collectively underpin the rising incidence of cardiovascular disease, stroke, and type 2 diabetes globally (1-3).

Urbanization has further accelerated this transition, as cities increasingly foster sedentary lifestyles, greater reliance on energy-dense processed foods, and heightened psychosocial stress, all which compound cardiometabolic vulnerability (4-6). In Tanzania, population-based surveys and community studies paint a consistent picture of high and escalating cardiometabolic risk, particularly within urban centers. National and sub-national data reveal substantial prevalence of overweight obesity, elevated blood pressure, and impaired glucose regulation, alongside persistently low awareness, suboptimal treatment coverage, and poor long-term disease control (7, 8).

Dar es Salaam, the country's largest metropolis, exhibits some of the most pronounced risk profiles, reflecting a confluence of demographic ageing, rapid lifestyle shifts, and limited access to preventive care services (9, 10). Evidence from community-based screening initiatives across Tanzania and the broader East African region indicates that a considerable proportion of adults with hypertension or dysglycaemia remain undiagnosed when surveillance relies exclusively on facility-based case detection (11, 12). Consequently, outreach-based screening has gained traction as an evidence-informed strategy to identify asymptomatic individuals harboring cardiometabolic risk, especially in urban LMIC settings where routine access to primary care is often fragmented (13). Nonetheless, the public health utility of such programs hinges not solely on the number of cases identified, but equally on their capacity to inform targeted prevention planning, facilitate effective referral, and ensure continuity of care a critical consideration given the well documented attrition along hypertension and diabetes care cascades in Tanzania (8, 14). Despite a growing body of literature on cardiometabolic risk in Tanzania, most existing studies draw on household surveys or facility-based populations, leaving a notable gap in empirical evidence regarding the burden and distribution of risk factors specifically among adults reached through single session community medical outreach programs. Yet, these outreach platforms are increasingly serving as vital entry points for preventive services, particularly for individuals who do not routinely interact with the formal health system. Characterizing the cardiometabolic risk profiles of outreach attendees is therefore indispensable for quantifying unmet prevention needs, tailoring health education interventions, and strengthening the integration of community-generated data into urban NCD control strategies. Against this backdrop, the present study sought to estimate the prevalence of three key cardiometabolic risk indicators elevated blood pressure, overweight or obesity, and elevated random blood glucose among adults attending a community medical outreach program in Dar es Salaam, Tanzania, and to examine their sociodemographic correlates.

METHODS

Study Design and Setting: This study employed a cross-sectional design, drawing on secondary data from a community-based health outreach program conducted in Dar es Salaam, Tanzania, during December 2025. The outreach was implemented in urban communities across multiple sites within the city, targeting adult residents irrespective of prior health-seeking behavior or known cardiometabolic status.

Study Population and Eligibility Criteria: All adults aged 18 years and older who attended the screening event and had at least one complete cardiometabolic measurement namely blood pressure, body mass index (BMI), or random blood glucose were considered eligible for inclusion in this analysis. Participants with incomplete data for all three parameters were excluded.

Measurements

Blood Pressure: Blood pressure was measured using an automated sphygmomanometer following standardized protocols, with both systolic and diastolic values recorded. Hypertension was defined as systolic blood pressure ≥ 140

mmHg and/or diastolic blood pressure ≥ 90 mmHg, or self-reported use of antihypertensive medication, in line with the World Health Organization and International Society of Hypertension guidelines. Among participants with elevated readings, severity was categorized as Stage 1 (systolic 140–159 mmHg and/or diastolic 90–99 mmHg), Stage 2 (systolic 160–179 mmHg and/or diastolic 100–109 mmHg), or Stage 3 (systolic ≥ 180 mmHg and/or diastolic ≥ 110 mmHg). Notably, blood pressure was assessed during a single outreach encounter, without repeat measurements on separate days; as such, elevated values identified in this screening context require confirmatory clinical evaluation before a definitive diagnosis of hypertension can be established.

Anthropometric Assessment: Body mass index (BMI) was computed as weight in kilograms divided by height in meters squared (kg/m^2). Overweight and obesity were combined into a single category, defined as BMI $\geq 25 \text{ kg/m}^2$, in accordance with World Health Organization criteria.

Glycaemic Assessment: Random blood glucose was measured using point-of-care devices. Elevated random blood glucose was defined as a value $\geq 11.1 \text{ mmol/L}$ or self-reported diabetes mellitus.

Composite Cardiometabolic Risk: A composite outcome for cardiometabolic risk was constructed, defined as the presence of at least one of the following conditions: hypertension, overweight/obesity, or elevated random blood glucose.

Statistical Analysis: A composite cardiometabolic risk outcome was constructed, defined as the presence of at least one of the following conditions: elevated systolic blood pressure ($\geq 140 \text{ mmHg}$ or self-reported antihypertensive use), overweight or obesity (BMI $\geq 25 \text{ kg/m}^2$), or elevated random blood glucose ($\geq 11.1 \text{ mmol/L}$ or self-reported diabetes). This composite outcome was derived using a complete-case approach, restricted to participants with non-missing data for all three component variables blood pressure, BMI, and random blood glucose yielding an analytical sample of 604 individuals. Participants with missing values for any of these measurements were excluded from the composite analysis.

Descriptive statistics were employed to summarize participant characteristics and the prevalence of individual cardiometabolic conditions. Continuous variables are presented as means with standard deviations, while categorical variables are reported as frequencies with corresponding percentages. Prevalence estimates for each condition, as well as for the composite outcome, were calculated with Wilson 95% confidence intervals. Bivariate associations between the composite cardiometabolic risk outcome and selected demographic characteristics—namely age, sex, and district of residence—were examined using Pearson's chi-square tests, with statistical significance set at $p < 0.05$. To further explore independent determinants of cardiometabolic risk, multivariable logistic regression was performed, adjusting for the same set of demographic variables. Adjusted odds ratios (aORs) with 95% confidence intervals are reported to quantify the strength and precision of these associations. All statistical analyses were conducted using Jamovi version 2.3.

RESULTS

Participant Characteristics: A total of 635 adults participated in the community-based screening program. The mean age of participants was 45.0 years (SD 15.2), with females comprising most of the study population (64.1%). The mean systolic blood pressure was 134.2 mmHg (SD 26.7), and the mean random blood glucose level was 6.3 mmol/L (SD 3.0). Participants were drawn from multiple districts across Dar es Salaam, with the largest proportion residing in Ilala, followed by Temeke and Ubungu. Smaller proportions were from Kinondoni, Kigamboni, and areas outside the city.

Prevalence and Awareness of Cardiometabolic Risk Conditions

Blood Pressure: Elevated blood pressure was observed in 32.3% of participants based on screening measurements. Among those with elevated readings, 17.8% were classified as Stage 1 hypertension, 7.9% as Stage 2, and 6.6% as Stage 3, while the remaining 67.7% were normotensive. Notably, 14.0% of participants had elevated blood pressure detected for the first time during the screening, whereas 18.3% reported a prior diagnosis of hypertension, indicating that over two-fifths (43.4%) of those with elevated readings were previously undiagnosed.

Anthropometric Status: Among the 604 participants with complete BMI data, the mean BMI was 27.1 kg/m² (SD 6.22). The distribution of BMI categories revealed that 3.6% of participants were underweight (<18.5 kg/m²), 37.9% had normal weight (18.5–24.9 kg/m²), 29.3% were overweight (25.0–29.9 kg/m²), and 29.1% were classified as obese (≥30.0 kg/m²). Overall, more than half of the screened population (58.4%) had excess weight.

Glycaemic Status: Hyperglycaemia was detected in 4.9% of participants. Of these, 0.5% were newly identified through screening, while 4.4% had a self-reported prior diagnosis of diabetes. Thus, approximately one in ten (10.2%) of those with hyperglycaemia were previously undiagnosed.

Overall Cardiometabolic Burden: Overall, 67.2% of all screened participants had at least one cardiometabolic risk factor.

Factors Associated with Cardiometabolic Risk: Of the 635 participants, 604 had complete data for all three cardiometabolic measurements (blood pressure, BMI, and random blood glucose) and were therefore included in the composite outcome analysis. Among these, 66.4% (401/604) had at least one cardiometabolic risk factor. When stratified by sex, 67.0% of females (270/403) presented with at least one risk factor compared to 65.2% of males (131/201). Bivariate analysis revealed a statistically significant association between sex and cardiometabolic risk ($\chi^2 = 7.51$, $p = 0.006$), with a higher proportion of females affected. Age demonstrated a strong, graded association with cardiometabolic risk: the prevalence of having at least one risk factor increased markedly with advancing age, rising from 42.6% among participants under 30 years to over three-quarters among those aged 40 years and above. This association was highly statistically significant ($\chi^2 = 44.1$, $p < 0.001$). In contrast, no statistically significant association was observed between cardiometabolic risk and district of residence ($\chi^2 = 3.54$, $p = 0.617$). Although the prevalence of cardiometabolic risk varied modestly across districts, these differences were not

statistically significant, suggesting broadly similar risk profiles across urban districts within Dar es Salaam.

Table 1. Participant Characteristics (n= 635)

Characteristic	Value
Age, mean (SD), years	45.0 (15.2)
Systolic blood pressure, mean (SD), mmHg	134.2(26.7)
Random blood glucose, mean (SD), mmol/L	6.3(3.0)
BMI, mean (SD), kg/m ² *	27.1(6.22)
BMI (<18.5)	22 (3.7%)
(18.5-24.9)	229 (37.9%)
(25.0-29.9)	177 (29.3%)
(≥30.0)	176(29.1%)
Female	407(64.1%)
Male	228 (35.9%)
Ilala	281 (44.3%)
Temeke	131 (44.3%)
Ubungu	112 (17.6%)
Kinondoni	48 (7.6%)
Kigamboni	32 (5.0%)
Outside Dar es Salaam	31 (4.9%)

*BMI calculated among participants with complete measurements (n =604).

DISCUSSION

This community-based screening initiative in urban Dar es Salaam revealed a substantial burden of cardiometabolic risk factors among participating adults, with two-thirds of attendees presenting with at least one major risk condition. Elevated blood pressure and overweight/obesity emerged as the principal drivers of this burden, consistent with broader population trends documented across sub-Saharan Africa and Tanzania, where urbanization and associated lifestyle transitions have been linked to rising non-communicable disease risk profiles (3, 4, 10, 12). The observed prevalence of elevated systolic blood pressure (32.3%) aligns closely with previous community-based screening studies in Tanzania and the wider East African region, where hypertension prevalence among urban adult populations typically ranges between 20% and 40% (15). Of particular concern is the finding that 14.0% of participants were identified as newly hypertensive, underscoring a persistent and substantial "awareness gap" that continues to characterize hypertension care in many low resource settings. This observation echoes the results of the international May Measurement Month campaigns, which consistently reported that large proportions of adults with elevated blood pressure remain unaware of their status or inadequately treated (11). Overweight and obesity were prevalent in more than half of the study population, reflecting the ongoing nutritional and lifestyle transition occurring in Tanzania's urban centers (5, 7). Excess adiposity, a well-established determinant of both hypertension and dysglycaemia, plays a central role in the clustering of cardiometabolic risk factors(16). Comparable population-based surveys across East Africa have similarly documented high obesity prevalence, particularly among middle-aged and older adults, reinforcing the urgent need for integrated, multi-sectoral preventive strategies (17). Although the prevalence of elevated random blood glucose was comparatively low (4.9%), the detection of new hyperglycaemia cases, albeit a small proportion highlights the utility of point-of-care screening for identifying previously unrecognized dysglycaemia in community settings. This finding is consistent with evidence that opportunistic glucose testing during outreach program can reach individuals at risk who might otherwise remain undiagnosed (18).

Table 2. Distribution of Newly Identified and Previously Known Cases of High Blood Pressure and Hyperglycemia Following Screening (n = 635)

Blood Pressure Status	Male n (%)	Female n (%)	Total n (%)
Normal blood pressure	150(65.5)	208(69.0)	430(67.7)
Screen-detected elevated BP	36(15.7)	53(13.1)	89(14.0)
Known case of high BP	43(18.8)	73(18.0)	116(18.3)
Total	229(100.0)	406(100.0)	635(100.0)
Hyperglycemia	Male n (%)	Female n (%)	Total n (%)
Normal blood glucose	211(92.1)	393(96.8)	604(95.1)
High Random Blood Glucose (New case)	2(0.9)	1(0.2)	3(0.5)
Known Diabetic Cases	16(7.0)	12(3.0)	28(4.4)
Total	229(100.0)	406(100.0)	635(100.0)

High blood pressure was defined as systolic blood pressure ≥ 140 mmHg or self-reported use of antihypertensive medication, while high random blood glucose was defined as glucose ≥ 11.1 mmol/L or self-reported diabetic patient.

Table 3. Association Between Sociodemographic Characteristics and Cardiometabolic Risk Among Adults Attending Community-Based Screening (n = 635)

Cardio metabolic risk	Independent factor	Total N (%)						P Value
	Sex	Female	Male					
Normal (No risk)		110(28.1)	86(37.6)	196(30.9)				
≥ 1 risk factor		296(71.9)	143(62.4)	439(69.1)				0.006
Total		404(100)	229(100)	635(100)				
		<30	30 – 39	40 – 49	50 – 59	≥ 60		
Normal (No risk)		35(57.4)	73(41.5)	63(22.8)	16(19.3)	9(23.1)		
≥ 1 risk factor	Age group (years)	26(42.6)	103(58.5)	213(77.2)	67(80.7)	30(76.9)		
Total		61(100)	176(100)	276(100)	83(100)	39(100)		
	District	Ilala	Kigamboni	Kinondoni	Outside DSM	Temeke	Ubungo	
Normal (No risk)		90(32.0)	13(40.6)	13(27.0)	11(35.5)	40(30.5)	29(25.9)	
≥ 1 risk factor		191(68.0)	19(59.4)	35(72.9)	20(64.5)	91(69.5)	83(74.1)	0.617
Total		281(100)	32(100)	48(100)	31(100)	131(100)	112(100)	

Cardiometabolic risk was defined as the presence of at least one of the following conditions: hypertension, overweight or obesity or elevated random blood glucose. Percentages are calculated within categories. P values were derived from Pearson's chi-square test.

Nevertheless, it is important to acknowledge that random glucose measurements are not diagnostically confirmatory; elevated values require follow-up fasting or oral glucose tolerance testing to accurately establish a diabetes diagnosis, with a limitation inherent to community-based screening designs. Overall, the co-occurrence of elevated blood pressure, excessive adiposity, and hyperglycaemia observed in this study aligns with the epidemiological concept of cardiometabolic risk clustering, a phenomenon well-documented in both community and clinical populations across sub-Saharan Africa (19). Such clustering not only amplifies individual risk for cardiovascular disease and type 2 diabetes but also poses formidable challenges for health systems, particularly in settings where preventive care and long-term management infrastructure remain limited. The strong, graded association between cardiometabolic risk and advancing age mirrors well-established epidemiological patterns, with older adults bearing a disproportionately higher risk burden likely reflecting cumulative exposure to lifestyle and metabolic stressors over the life course (1). The sex differences observed in risk distribution may reflect a complex interplay of biological, behavioral, and social determinants, including differential adiposity patterns, health-seeking behaviors, and varying access to care between men and women (20). From a public health perspective, these findings underscore the critical role of community-based outreach screening as a strategy for early detection of cardiometabolic risk conditions. While facility-based surveillance predominantly captures individuals who actively seek care, outreach programs extend the reach of preventive services to those who may not routinely access formal health systems, thereby helping to bridge gaps in awareness and early diagnosis. However, the public health impact of screening depends not only on case detection but also on the effective translation of screening findings into

sustained clinical action. Achieving this requires robust referral pathways and well-functioning follow-up systems, particularly given the well-documented attrition along hypertension and diabetes care cascades in Tanzania (8). Without such linkages, the potential benefits of early detection may not translate into improved long-term health outcomes.

CONCLUSION

This community-based screening in urban Dar es Salaam found a high burden of cardiometabolic risk factors, driven mainly by high blood pressure and overweight/obesity. One in seven participants had newly detected hypertension, and over half were overweight or obese, highlighting major gaps in awareness and early detection. While random glucose abnormalities were less common, their presence reinforces the value of point-of-care screening. These findings confirm that cardiometabolic risks cluster with age and sex, and they underscore the urgent need for integrated prevention and care strategies. Community outreach can effectively reach underserved populations, but its success ultimately depends on strong referral systems and sustained follow-up to turn early detection into lasting health gains.

Study Limitations: Several limitations warrant consideration. Blood pressure was measured on a single occasion, so estimates reflect screening-detected elevation rather than confirmed hypertension, with potential for misclassification. The self-selected nature of outreach attendees may limit generalizability to the broader adult population. The dataset lacked behavioral and lipid risk factors, and the cross-sectional design precludes causal inference. Additionally, random blood glucose measurements are subject to variability and require

confirmatory testing. Despite these limitations, the study provides valuable real-world evidence on the cardiometabolic risk profile of adults reached through community-based screening in an urban African setting.

Competing interest: The authors declare that they have no conflicts of interest regarding this work

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