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COMMUNITY HEALTH SCREENING FOR CARDIOMETABOLIC RISK THROUGH BLOOD PRESSURE, GLUCOSE, AND LIFESTYLE ASSESSMENT

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ABSTRACT

Introduction: Cardiometabolic diseases, particularly hypertension and diabetes, are rising in prevalence among adults in semi-urban regions of low- and middle-income countries. Early detection at the community level is essential to reduce complications and promote preventive action. This study aimed to identify early indicators of cardiometabolic risk through a nurse-led community health screening in Bukittinggi, West Sumatra, Indonesia.

Methods: A descriptive cross-sectional design was conducted as a one-day service-learning outreach involving nursing faculty, undergraduate students, local health cadres, and community leaders. Adults aged 18 years and above were recruited using consecutive sampling. Preparations included coordination with local stakeholders to ensure community participation. Screening activities comprised blood pressure measurement, random blood glucose testing, body mass index (BMI) calculation, and structured interviews on behavioral risk factors. A total of 80 participants completed the screening, and data were analyzed descriptively.

Results: 80 participants, 64 (80%) had elevated blood pressure ranging from prehypertension to hypertensive crisis, 21 (26.3%) showed abnormal blood glucose levels consistent with prediabetes or diabetes, and 42 (52.5%) were overweight or obese. Additionally, 77 participants (96.3%) reported low physical activity and inadequate fruit and vegetable intake, indicating a high clustering of modifiable cardiometabolic risk factors.

Conclusion: This study highlights the burden of modifiable cardiometabolic risks in semi-urban communities and demonstrates the feasibility of nurse- and community-led health screenings for early detection. For sustainability and broader impact, future programs should be strengthened through collaboration with health cadres, primary health centers, and community leaders, combined with follow-up education and integration into primary healthcare services.

KEYWORDS

cardiometabolic risk; diabetes mellitus; health promotion; hypertension; screening.

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1. INTRODUCTION

Cardiometabolic diseases, particularly hypertension and type 2 diabetes mellitus, are among the top contributors to global morbidity and mortality, especially in low- and middle-income countries like

Indonesia. These diseases often develop silently and are driven by preventable lifestyle factors such as obesity, smoking, poor diet, and inactivity (Liu, 2025; World Health Organization, 2024). As their prevalence rises, they place increasing pressure on national healthcare systems and hinder sustainable

development. Comprehensive and early prevention strategies are needed to mitigate their impact.

Globally, the number of people living with diabetes increased from 200 million in 1990 to 830 million in 2022, with prevalence rising more rapidly in low- and middle-income countries, while an estimated 1.4 billion adults aged 30–79 years (33%) were living with hypertension in 2024 (World Health Organization (WHO), 2023). In Indonesia, hypertension prevalence was reported at 34.1% among adults (Ministry of Health of the Republic of Indonesia, 2018), and diabetes affected 11.3% or 20.4 million adults (International Diabetes Federation (IDF), 2025), whereas the Indonesia Health Profile 2024 documented 40,454 reported cases of hypertension and 2,885 cases of type 2 diabetes mellitus, likely underestimating the true burden (Ministry of Health of the Republic of Indonesia, 2024). At the local level, the Bukittinggi City Health Profile 2020 recorded 5,422 cases of hypertension (22.55%) and 2,815 cases of diabetes (10.02%), with priority analysis ranking hypertension first (score 35.28) and diabetes second (score 28.14), confirming their urgent public health impact at the community level (Meilisa et al., 2023).

Community-based health screenings have been a key component in detecting early signs of disease. However, many of these screenings rely mainly on physiological parameters like blood pressure and random blood glucose. While these indicators are important, they may not capture the full picture of cardiometabolic risk, particularly among asymptomatic individuals. A narrow focus on biomedical factors may lead to missed opportunities for preventive care (Mousavi et al., 2025; Sunkara et al., 2017).

Recent studies emphasize the value of integrating behavioral assessments such as smoking status, physical activity, dietary intake, and family history into screening protocols. These factors can significantly influence the development of

cardiometabolic diseases and are often modifiable through targeted health education. Including these components enhances risk detection and allows for tailored interventions. This holistic approach has gained traction in several low-resource settings (Baechle et al., 2023; Vadiveloo et al., 2023)

This current initiative adopts such an approach by incorporating both physiological and behavioral screenings during a community outreach program. Blood pressure, blood glucose, and BMI were measured alongside interviews on physical activity, dietary intake, smoking, and family history. The purpose was not only to identify physiological abnormalities but also to understand lifestyle patterns that contribute to cardiometabolic risks. Such integration allows for a more complete health profile of community members (García-Sánchez et al., 2020; Misra et al., 2016).

In contrast to traditional interventions, this program did not rely on formal health counseling sessions. Instead, participants identified as at-risk received educational leaflets with simple, culturally appropriate messages about healthy living. This method minimizes the need for trained personnel and provides sustainable health promotion tools in resource-limited areas (Barik et al., 2019). It also encourages individuals to reflect on their health behaviors independently.

The screening was conducted in Bukittinggi, West Sumatra, a semi-urban region that reflects the broader epidemiological transition in Indonesia. The area has seen rising cases of NCDs, particularly among women and older adults. Its demographic characteristics made it a suitable setting to pilot a multifactorial screening approach. The involvement of nursing students and faculty also contributed to capacity building and community empowerment.

In summary, this study presents the findings of a descriptive screening of 80 adults using both physiological indicators (blood pressure, random blood glucose, and body mass index) and behavioral

indicators (physical activity, smoking status, fruit and vegetable intake, and family history of diabetes or hypertension). The aim was to highlight the prevalence of modifiable risk factors and assess the feasibility of a nurse-led, community-based approach to early detection. The results provide valuable insights to inform future public health initiatives in Indonesia and other similar LMIC settings.

2. MATERIAL AND METHODS

This descriptive cross-sectional community screening was conducted through a one-day outreach in Bukittinggi, West Sumatra, with preparations including instrument testing and coordination with community leaders and local health cadres. Participants were recruited using non-probability consecutive sampling, in which all eligible individuals attending the screening site who met the inclusion criteria were enrolled in sequence until the activity ended. This method is commonly applied in community health programs where a complete

population list is unavailable and randomization is not feasible, such as in a one-day outreach event. A total of 80 adults aged 18 years and above participated in the screening. Inclusion criteria were adults aged 18 years and above, residents or active in the community, able to communicate in the Indonesian language, and willing to participate. Exclusion criteria were acute illness requiring referral, pregnancy, inability to complete measurements, or refusal to participate.

Because this program was designed as a service-learning community screening rather than a probability-based survey, consecutive sampling was considered the most practical method to capture a real-world snapshot of attendees. The findings therefore describe the health profile of the screened participants and cannot be generalized to the entire population. As context, the Bukittinggi City Health Profile (2020) recorded 5,422 cases of hypertension (22.6%) and 2,815 cases of diabetes mellitus (10%), ranking them as the two leading non-communicable



Figure 1. Community Service Team From The Faculty



Figure 2. Visiting by Bukittinggi City Government



Figure 3. Data Recording and Health Screening



Figure 4. Brief Counselling

diseases locally (Meilisa et al., 2023). These background data highlight that the 80 participants in this study represent only a small subset of a larger at-risk population, reinforcing the importance of community-based early detection initiatives.

Data collection included demographic information (age, sex), behavioral and lifestyle factors (smoking status, physical activity (World Health Organization, 2016), fruit and vegetable intake (World Health Organization, 2023), family history of diabetes or hypertension), and physiological measurements. Structured interviews were conducted first to gather behavioral data. These were followed by on-site physical measurements: 1) Blood Pressure (BP) was measured in a seated position using a validated digital sphygmomanometer. Results were categorized based on International Society of Hypertension Global Hypertension (ISHGH 2020) classification into normal ($<120/80$ mmHg), prehypertension ($120\text{--}139/80\text{--}89$ mmHg), hypertension stage 1 ($140\text{--}159/90\text{--}99$ mmHg), stage 2 ($160\text{--}179/100\text{--}119$ mmHg), and hypertensive crisis ($\geq 180/\geq 120$ mmHg) (Unger et al., 2020); 2) Random Blood Glucose (RBG) was measured using a glucometer with capillary finger-prick sampling. RBG values were interpreted using Diabetes Care 2023 diagnostic criteria: normal (<140 mg/dL), prediabetes ($140\text{--}199$ mg/dL), and diabetes (≥ 200 mg/dL) (ElSayed et al., 2023); 3) Body Mass Index (BMI) was calculated by dividing body weight (kg) by height (m^2), based on WHO standards. Categories included underweight (<18.5), normal ($18.5\text{--}24.9$), overweight ($25.0\text{--}29.9$), and obese (≥ 30.0) (World Health Organization, 2019).

In addition to data collection, this community service activity served as a form of preventive intervention. Participants with abnormal findings, such as elevated blood pressure, abnormal blood glucose levels, or excess body weight, were provided with immediate feedback on their results. Brief counselling was given individually, along with simple verbal advice on lifestyle modification tailored to

local context, such as reducing salt and sugar intake, increasing physical activity, and consuming more fruits and vegetables. Participants also received printed educational leaflets containing culturally appropriate health messages that could be easily understood and shared within their families. The activity was not only aimed at screening but also at raising awareness and encouraging self-care practices among community members.

As part of the service-learning approach, nursing students were directly involved in conducting interviews, performing measurements, and delivering health messages, thereby integrating their academic learning with community service. Importantly, this screening was also organized as part of the National Health Day (Hari Kesehatan Nasional) celebration, strengthening its community relevance and visibility. The program was conducted in collaboration with local health cadres, community leaders, and primary health centre ensuring smooth mobilization of participants and acceptance of the program. To enhance documentation and transparency, six photographs of the activity were taken, illustrating the preparation, the screening process, and the involvement of both students and community members (Fig 1 to 6). These visual records highlight the participatory and collaborative nature of the outreach, underscoring its dual role in providing a snapshot of cardiometabolic risk while simultaneously building health awareness and capacity at the community level.

All instruments used were field-appropriate and operated by trained nursing students under direct faculty supervision. Participants identified as having abnormal values in any of the three physiological measurements received brief counseling and printed leaflets containing culturally tailored health messages. No formal educational session was conducted, in order to maintain feasibility and reduce dependence on trained health personnel.

Data were entered and analyzed descriptively using Microsoft Excel. Variables were summarized in terms of frequency and percentage. No inferential or multivariate statistical analysis was conducted, as the primary objective was to provide a community health profile rather than to test hypotheses.

Although no formal ethical approval was required, the program followed public health ethical standards. Verbal consent was obtained, no invasive procedures were used beyond capillary blood sampling, and participant confidentiality was preserved. The activity posed minimal risk and adhered to the principle of non-maleficence ("do no harm"). This initiative also served as a supervised service-learning opportunity for nursing students.

3. RESULTS

The community-based screening program revealed a variety of cardiometabolic risk indicators among 80 adult participants. The general characteristics of respondents—including age, gender, blood pressure, body mass index (BMI), random blood glucose (RBG), physical activity, smoking status, fruit and vegetable intake, and family history of chronic diseases—are summarized in Table 1. Selected key variables are further illustrated in Figures 7-10 to highlight major public health concerns.

Sociodemographic profile as shown in Table 1, the majority of the participants were female ($n = 62$, 77.5%), while males accounted for only 22.5% ($n = 18$). Most respondents ($n = 41$, 51.25%) were

Table 1. Frequency Distribution of Sociodemographic and Cardiometabolic Risk Factors among Participants ($n = 80$)

Category	Frequency	Percentage
Gender		
Female	62	77.5
Male	18	22.5
Age Group		
18–44 years	21	26.3
45–59 years	41	51.2
≥60 years	18	22.5
Body Mass Index (WHO)		
Underweight	5	6.3
Normal	32	40.0
Overweight	24	30.0
Obese	18	22.5
Blood Pressure (WHO)		
Normal	16	20.0
Prehypertension	26	32.5
Hypertension Stage 1	23	28.8
Hypertension Stage 2	13	16.3
Hypertensive Crisis	2	2.5
Random Blood Glucose (WHO)		
Normal	59	73.8
Prediabetes	15	18.8
Diabetes	6	7.5
Smoking Status		
Smoker	19	23.8
Non-smoker	61	76.2
Physical Activity Level		
Low	77	96.25
Moderate	3	3.75
High	0	0.0
Fruit and Vegetable Intake		
Adequate	3	3.75
Inadequate	77	96.25
Family History of DM or HT		
Yes	56	70.0
No	24	30.0

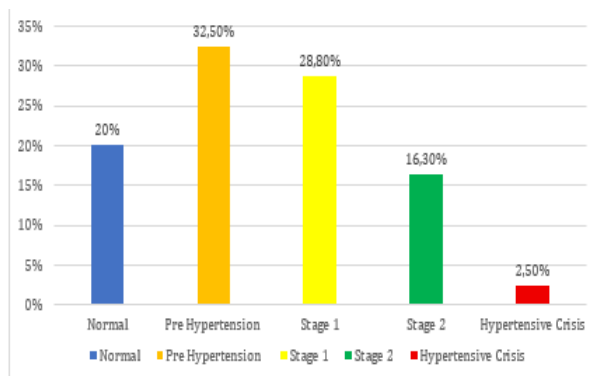


Figure 1. Distribution of Blood Pressure

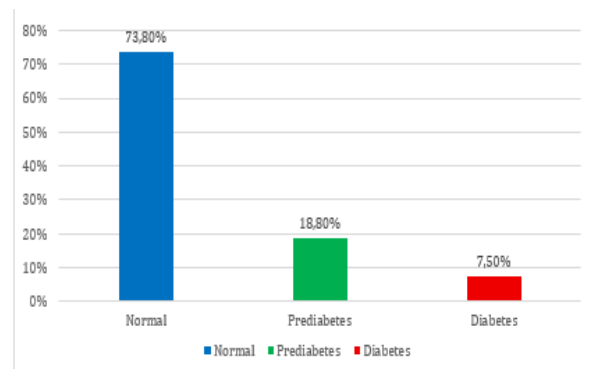


Figure 2. Distribution of Random Blood Glucose

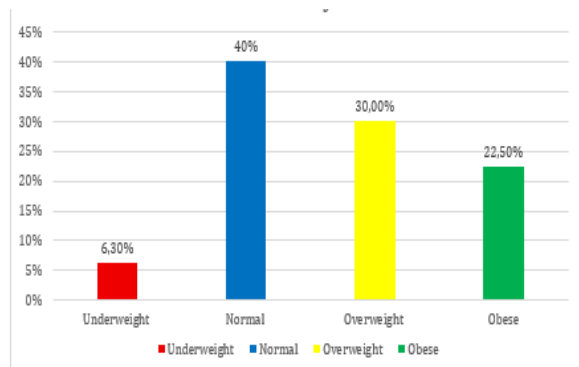


Figure 3. Distribution of Body Mass Index

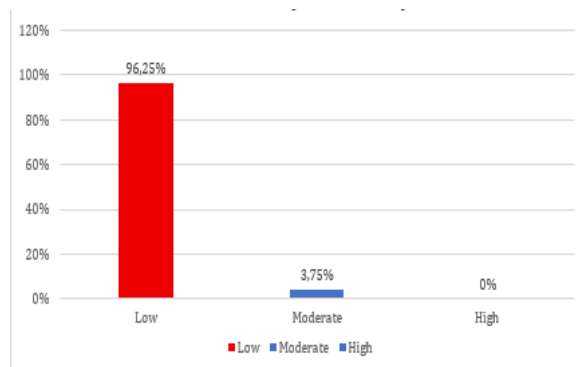


Figure 4. Distribution of Physical Activity Level

between 51 and 65 years old, an age group known for elevated risk of hypertension and metabolic diseases due to age-related physiological changes.

Nutritional status based on BMI is presented in Table 1 and visualized in Figure 9. While 32 participants (40%) had normal weight, more than half of the sample was either overweight ($n = 24$, 30%) or obese ($n = 18$, 22.5%), indicating a high prevalence of excessive body weight. Only 5 participants (6.25%) were underweight, suggesting that overnutrition is a more pressing concern in this population.

Blood pressure categories are detailed in Table 1 and further highlighted in Figure 7. Only 16 participants (20%) had normal blood pressure. The remainder were classified as prehypertensive ($n = 26$, 32.5%), stage I hypertension ($n = 23$, 28.8%), stage II hypertension ($n = 13$, 16.2%), and hypertensive crisis ($n = 2$, 2.5%). These results emphasize a substantial burden of elevated blood pressure in the community.

As shown in Table 1 and Figure 8, random blood glucose testing revealed that 59 participants

(73.75%) were within the normal range. However, 15 (18.75%) had prediabetic glucose levels, and 6 (7.5%) met criteria for diabetes. These findings suggest that nearly one-quarter of the population may already be experiencing or approaching glucose dysregulation.

Lifestyle behaviors—including smoking, physical activity, and dietary intake—are summarized in Table 1. Notably, physical activity, which is further depicted in Figure 10, was alarmingly low: 96.25% ($n = 77$) of participants reported low levels, and none reported high-intensity activity. Additionally, only 3 participants (3.75%) reported adequate daily intake of fruits and vegetables, while the remaining 96.25% had insufficient dietary habits. Smoking was also reported by 23.75% ($n = 19$) of participants, with the majority (76.25%) being non-smokers. These behavioral indicators represent critical modifiable risk factors. As reported in Table 1, a total of 56 participants (70%) had a positive family history of diabetes or hypertension. This reinforces the genetic and behavioral predisposition of the population to cardiometabolic conditions.

4. DISCUSSION

This community-based screening initiative aimed to assess early indicators of cardiometabolic risk through an integrated evaluation of blood pressure, random blood glucose, body mass index (BMI), and key behavioral factors. The findings reinforce growing evidence that multiple modifiable risk factors cluster within underserved populations, even in semi-urban areas like Bukittinggi, West Sumatra.

A striking finding was that 80% of participants exhibited elevated blood pressure, ranging from prehypertension to hypertensive crisis. These rates surpass the national average reported in the Basic Health Research (Riskesdas), which estimates the prevalence of hypertension among Indonesian adults to be around 34% (Ministry of Health of the Republic of Indonesia, 2018). The high burden of elevated blood pressure may be attributed to poor dietary patterns, physical inactivity, and age-related vascular changes, as over half the sample was aged 51–65 years (Charchar et al., 2024).

Similarly, more than half of the participants were classified as overweight or obese. This excess body weight increases the risk of insulin resistance and other components of metabolic syndrome, consistent with previous studies showing an urbanization-driven dietary shift towards energy-dense, nutrient-poor food (Bixby et al., 2019; Peters et al., 2019). Although there was no statistically significant relationship between BMI and blood glucose status in this sample, most individuals with abnormal glucose levels were overweight or obese, aligning with the established link between adiposity and impaired glucose metabolism. Abnormal blood glucose levels were detected in 26.25% of participants, with 18.75% in the prediabetic range and 7.5% in the diabetic range. This finding highlights the presence of undiagnosed hyperglycaemia in the community and emphasizes the importance of nurse-led screening efforts in non-clinical settings for early intervention (Makhfudli et al., 2025; Rajalakshmi et al., 2023)

Behavioral factors were equally concerning. Physical inactivity was reported by 96.25% of participants, and 96.25% reported inadequate fruit and vegetable intake. These lifestyle patterns significantly contribute to the development of non-communicable diseases and reflect trends seen in low- and middle-income countries (Ding et al., 2025; Pengpid & Peltzer, 2023). Although smoking prevalence was moderate (23.75%), smoking remains a known contributor to vascular and metabolic dysfunction (Benowitz & Burbank, 2016).

Notably, 70% of participants reported a family history of diabetes or hypertension. While not modifiable, this factor elevates risk and supports the need for family-centered prevention approaches (Abdulaziz Alrashed et al., 2023; Li et al., 2021). Integrating behavioral and physiological data allowed for a more holistic identification of at-risk individuals. This approach reinforces the role of community nurses in designing interventions that go beyond biomedical screening to encompass lifestyle counseling and health literacy strategies (Wilandika et al., 2023)

This screening initiative demonstrates the critical role of nurses in health promotion and early disease detection, especially in resource-constrained settings. Nurses can lead proactive community-based screening that identifies individuals with elevated cardiometabolic risks before clinical symptoms arise. Simple tools such as blood pressure cuffs, glucometers, and BMI assessments—when combined with brief lifestyle interviews—enable nurses to make meaningful health interventions at the grassroots level (Holloway et al., 2023; Xu et al., 2020).

Furthermore, this program empowered undergraduate nursing students by involving them in real-world data collection, health communication, and preventive care. Such experiential learning not only builds clinical competencies but also instills the

importance of public health advocacy in nursing education.

Although structured health education was not included in this initiative, the use of culturally appropriate printed leaflets proved feasible as a low-cost intervention. These materials can serve as entry points to promote self-care behavior, particularly in populations with limited access to formal health education or follow-up services. Moving forward, similar programs can incorporate regular monitoring and structured follow-up to strengthen behavior change and improve outcomes.

One of the major strengths of this initiative is its integrative approach—combining behavioral, familial, and physiological factors in a single community screening. This model provides a comprehensive risk profile and enables more targeted interventions by nurses. The use of standardized tools and collaboration with local stakeholders enhances the feasibility and scalability of this approach to other underserved settings.

However, there are notable limitations. First, the cross-sectional design limits causal interpretation and the ability to track changes over time. Second, behavioral data were self-reported and may be influenced by recall or social desirability bias. Third, the relatively small sample size from a single location restricts generalizability. Finally, while educational materials were distributed, the absence of structured counseling or follow-up may limit long-term behavior modification.

Despite these limitations, the study offers valuable insights into cardiometabolic risk in semi-urban communities and demonstrates a practical, nurse-led model for population-level screening and health promotion.

5. CONCLUSION

This study underscores the importance of addressing the clustering of modifiable cardiometabolic risk factors in semi-urban communities, where lifestyle changes are contributing to an increased burden of

non-communicable diseases. Nurse-led community screenings proved to be feasible and valuable in identifying individuals at risk, emphasizing the potential of integrating physiological and behavioral assessments into community-based health initiatives.

To enhance impact and sustainability, future programs should not rely solely on nurses and nursing students but should actively involve community health cadres, primary health centers (puskesmas), and local community leaders. Such multisectoral collaboration ensures stronger outreach, higher community acceptance, and continuity of health promotion beyond a one-time screening. From a policy perspective, embedding nurse- and community-led screening into primary healthcare programs can provide scalable, cost-effective models for early detection and prevention.

Furthermore, follow-up strategies, continuous health education, and longitudinal monitoring are recommended to assess long-term outcomes and behavior change. Strengthening this collaborative approach will not only improve population health but also reinforce the shared responsibility between academic institutions, healthcare providers, and community stakeholders in reducing the burden of hypertension, diabetes, and other cardiometabolic diseases.

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