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Review Article

The Interplay of Environmental, Socio-Cultural, and Community-Based Interventions in Reducing Cardiovascular Disease Risk in Indonesia: A Systematic Review

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Abstract. Cardiovascular disease (CVD) represents a profound global health challenge, contributing to an estimated 17.9 million deaths annually worldwide. In Indonesia, the burden of CVD is particularly significant, with coronary heart disease prevalence at 1.5% and Non-Communicable Diseases (NCDs), including CVD, accounting for 73% of all fatalities. Community-based programs, such as Prolanis, have been implemented as key intervention strategies. This systematic review analyzes the effectiveness of these programs in reducing CVD risk factors among NCD patients in Indonesia, examining their impact within the complex environmental and socio-cultural context. The methodology involved collecting articles from Google Scholar, PubMed, and ScienceDirect, applying keywords in PICO format, and filtering using the PRISMA flow diagram, ultimately including six articles for detailed analysis. Findings indicate that community-based programs generally contribute positively to controlling cardiovascular risk factors through health education and regular monitoring. However, effectiveness varies, influenced by intervention duration, participant adherence, and individual health conditions. This variability underscores the profound influence of broader environmental factors, including air and water quality, food environment, green space access, waste management, and noise pollution, all prevalent challenges in Indonesia. Furthermore, socio-cultural factors, such as traditional health beliefs, communal habits like *gotong royong*, and socioeconomic disparities, significantly mediate program acceptance and adherence. This analysis highlights the imperative for holistic, context-specific, and interdisciplinary approaches to CVD prevention in Indonesia, integrating public health interventions with environmental improvements and culturally sensitive strategies to enhance overall program effectiveness and sustainability.

Keywords: Prolanis, cardiovascular risk factors, community-based interventions, health education, environmental determinants, socio-cultural context.

1. Introduction

Cardiovascular disease (CVD) stands as a leading cause of morbidity and mortality across the globe, with an estimated 17.9 million individuals succumbing to its effects each year (Harmadha et al., 2023; Maharani & Tampubolon, 2014; World Health Organization (WHO), 2021) Over the past two decades, the burden of CVD has notably shifted from developed to developing countries, a trend starkly evident in Indonesia, where coronary heart disease affects 1.5% of adults and Non-Communicable Diseases (NCDs), including CVD, account for 73% of all fatalities (Riskesdas, 2018) CVD is primarily linked to modifiable risk factors such as hypertension, diabetes mellitus, obesity, hyperlipidemia, and unhealthy lifestyles (smoking, physical inactivity). While community-based programs aim to address these, their effectiveness is often mediated by underlying cultural, economic, and environmental barriers that prevent consistent preventive action (Francula-Zaninovic & Nola, 2018; Psaltopoulou et al., 2017; Zakaria et al., 2022).

CVD arises from a complex interplay between genetic predisposition and environmental influences, including natural conditions and social environments like pollution and the built environment (Esser et al., 2014; Pradhan et al., 2001; Zakaria et al., 2022). In Indonesia, widespread environmental degradation significantly compounds CVD risk, challenging community-based health programs. Pervasive air pollution from urbanization and industrial activities contributes to respiratory and cardiovascular disorders. Contaminated water sources and inadequate sanitation lead to nutritional

deficiencies and increased disease risk. The shift towards processed and fast foods undermines healthy dietary efforts, driving obesity and related NCDs. Furthermore, reduced urban green spaces limit physical activity, while poor waste management and escalating noise pollution add to health stressors (Bhatnagar, 2017). Climate change impacts, including temperature changes and increased PM2.5 levels, further worsen chronic illnesses and introduce mental health issues. These environmental issues are active determinants of health, requiring integrated strategies for effective CVD prevention (Pramono et al., 2025).

The success of community-based health programs in Indonesia is also profoundly shaped by deeply ingrained cultural practices and socioeconomic realities (Brontowiyono et al., 2022). The communal spirit of *gotong royong* offers a powerful opportunity for enhancing program engagement through collective activities and peer support. However, programs must also navigate the widespread reliance on traditional medicine, which is often preferred or combined with modern biomedicine due to its accessibility and cultural resonance (Cipta et al., 2024). A culturally sensitive approach that acknowledges and, where safe, integrates these traditional practices is crucial to prevent non-adherence. Socioeconomic disparities, including varying income levels, education, and limited access to health facilities, create significant barriers to public health services, necessitating robust outreach strategies and targeted policies Mutmainnah, 2025). Additionally, urbanization-induced dietary shifts and environmental conditions in urban slums can create a disconnect between health knowledge and actual behaviors. Successful interventions require a paradigm shift towards a deep anthropological and sociological understanding of health behavior change, ensuring programs are culturally integrated and socioeconomically feasible (Rusyda, 2025)

In response to this escalating public health concern, community-based intervention programs, such as the Chronic Disease Management Program (Prolanis), have been implemented across Indonesia to mitigate CVD complications and reduce healthcare burdens (Assupina & Rahmiwati, 2013; Khoe et al., 2020). These programs support NCD patients through health education, routine monitoring, social support, and healthy lifestyle promotion (Alkaff et al., 2021). However, comprehensive evaluation of their effectiveness remains limited, with a scarcity of long-term data and variations in study design hindering robust conclusions. Therefore, this systematic review aims to synthesize and analyze existing data to provide a more complete understanding of the effect of community-based programs on CVD risk factors within Indonesia's unique environmental and socio-cultural context. This review also seeks to identify specific barriers and facilitators to program implementation, informing the development of more effective and context-specific policies and interventions.

2. Method

2.1. Study Design

The method used in this study is a systematic review. Research articles were collected from three main sources: Google Scholar, PubMed, and ScienceDirect. The article search process applies keywords arranged in the PICO format as follows: P (Population): (Non-Communicable Disease OR Chronic Disease), I (Intervention): (Community-based intervention OR Indonesian Chronic Disease Management Program OR Prolanis), C (Comparison): No comparison was made in this study, and O (Outcome): (Cardiovascular risk OR Framingham Score OR WHO/ISH OR ASCVD OR (Blood pressure AND Blood glucose AND (Cholesterol OR LDL OR HDL) AND Obesity AND Smoker)). Meanwhile, the equivalent words in Indonesian can be used as keywords such as (Non-Communicable Disease) AND (Prolanis) AND (Cardiovascular Disease Risk).

2.2. Inclusion and Exclusion Criteria

The inclusion criteria applied include: 1) Articles available in full text, 2) Articles in English or Indonesian, 3) Articles published in the last 10 years (2015-2024), 4) Articles with research objects of people with NCDs who participate in community-based programs, 5) Articles that assess cardiovascular disease risk outcomes, and 6) Articles using quantitative or mixed research designs. While the exclusion criteria include: 1) Articles are literature reviews or meta-analyses, 2) Paid articles or not open access.

2.3. Data Collection, Processing, and Analysis

Each retrieved title and abstract was screened using the Mendeley application to assess the article's eligibility in the text review stage after the duplicate removal process. Articles that passed the selection for text review were then

examined to determine eligibility based on the inclusion and exclusion criteria. The PRISMA flowchart was used in the article's screening process.

Data were extracted into tables to summarize the findings presented in the narrative results. Data were analysed based on study title, author, year of study publication, study design, population, intervention, study outcomes, and results related to the relationship between community-based program interventions and cardiovascular disease risk in participating patients.

Data analysis was conducted based on the synthesis without meta-analysis (SWiM) guidelines, which consist of nine guideline items. The first step was to evaluate each retrieved article from the title and abstract to assess its eligibility by grouping the studies. The selected articles were grouped based on author, year, study design, population, intervention, and outcome. Duplicate studies were then removed. Next, a full-text review was conducted on all included studies to answer the review questions. The extracted data were then presented in a table to summarize the findings regarding the relationship between community-based program interventions and cardiovascular disease risk in patients who followed.

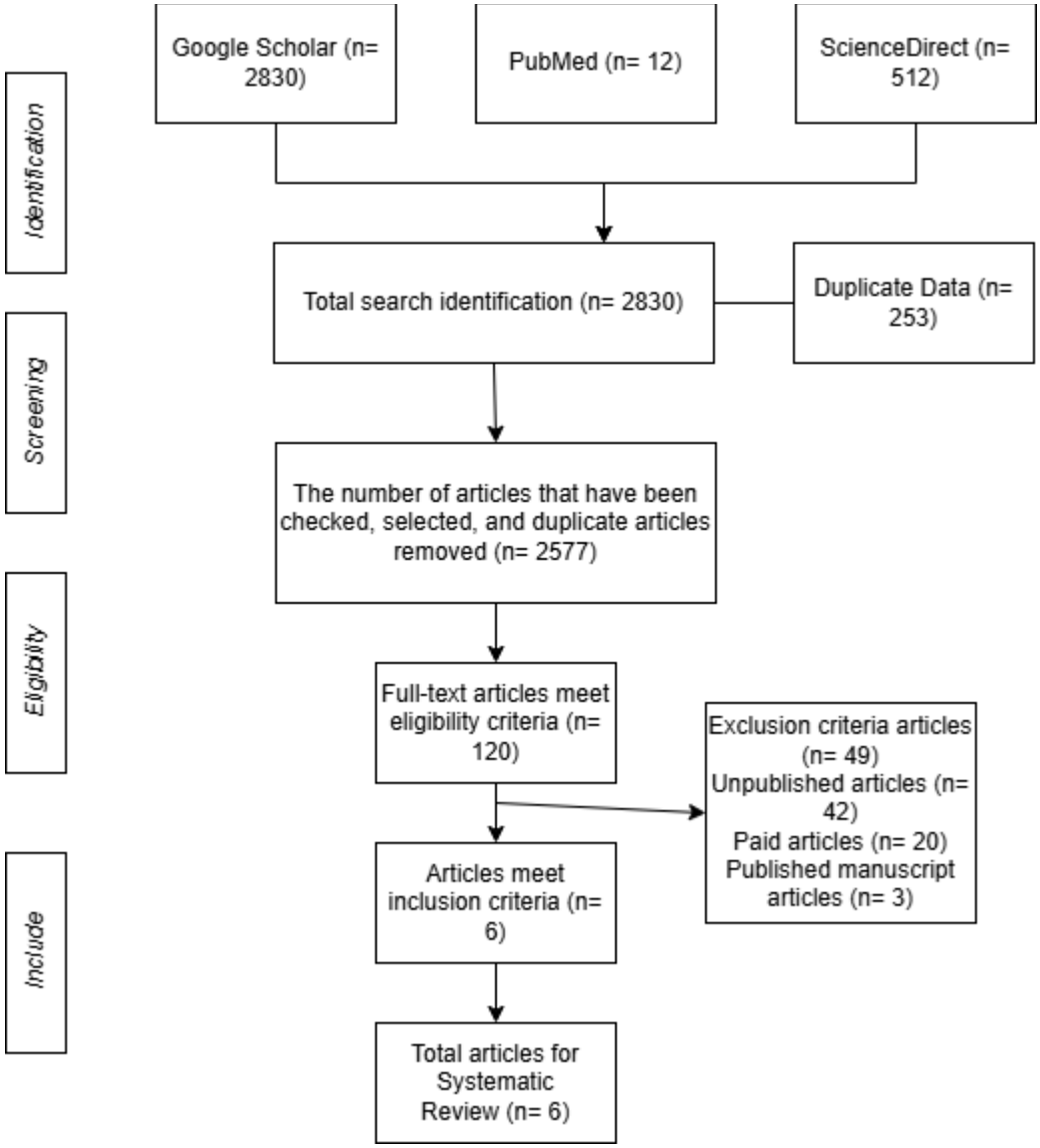

Figure 1. PRISMA Flow Diagram

3. Results and Discussion

3.1. Data Result

The systematic search, employing the specified keywords across Google Scholar, PubMed, and ScienceDirect, initially yielded 2830 relevant articles (2306 from Google Scholar, 12 from PubMed, and 512 from ScienceDirect). Following

the removal of 253 duplicate articles, 2577 unique articles underwent screening based on their titles and abstracts, which resulted in 120 articles being selected for further full-text review. During the full-text review, 114 articles were excluded because they did not meet the predefined inclusion criteria, primarily due to not being published, being paid access, or being unpublished manuscripts. Ultimately, six articles met all criteria and were selected for comprehensive review and analysis.

The characteristics of the included studies revealed that most involved both male and female participants, although one study exclusively focused on women. Participants in the included studies were appropriately selected, consisting of individuals diagnosed with non-communicable diseases (NCDs) such as hypertension, diabetes mellitus, or both. All participants across the analyzed studies were over 18 years of age, indicating a focus on the adult population with cardiovascular risk factors. Of the six articles reviewed, five specifically examined patient interventions within the Chronic Disease Management Program (Prolanis), while one focused on non-Prolanis community-based interventions. The research designs varied, with two articles employing cohort study designs (one retrospective and one prospective) and four utilizing cross-sectional designs.

The overarching finding from the review indicates that Prolanis programs and other community-based interventions generally contributed positively to controlling cardiovascular risk factors, particularly concerning blood pressure, lipid profiles, and adherence to physical activity. However, the effectiveness of these interventions was observed to vary, influenced by factors such as the duration of the intervention, the level of participant adherence, and other individual factors like lifestyle and initial health conditions. Specific results highlighted significant reductions in diastolic blood pressure and cholesterol levels, alongside an increase in physical activity in some studies. Conversely, other studies showed fluctuations in several health indicators, suggesting a need for further evaluation and a deeper understanding of the contextual factors at play.

Table 1. Research Results of Articles Reviewed

No	Research Title (Author (Year of Publication))	Research Design	Population, Intervention, and Outcome	Research result
1	Effectivity of Indonesia Chronic Disease Management Program (PROLANIS) to Control Hypertension and its Comorbidities at Primary Health Care (Alkaff et al., 2020)	The study design used a retrospective observational cohort.	Population: Since April 208, all hypertensive patients have participated in Prolanis at Wates Health Centre, Mojokerto City, East Java, Indonesia. Intervention: Participating in Prolanis activities from April 2018 to October 2019 was evaluated every 6 months. Outcome: Measurement of cardiovascular disease risk factors: BMI, blood pressure (systolic and diastolic), lipid profile (TC, HDL, LDL, TG).	There was no significant difference in the patient's systolic blood pressure from the beginning of the examination to the three evaluations; the median blood pressure of the patients was within the normal range. At the end of the examination, there was a significant difference in the patient's diastolic blood pressure, triglyceride levels, and total cholesterol, showing results within the normal range. There was a significant difference in the patient's BMI, HDL, and LDL, but the results of each evaluation showed fluctuations and did not reach the normal range.

2	Effect of Two Community-Based Exercise Programs on Adherence, Cardiometabolic Markers and Body Composition in Older People with Cardiovascular Risk Factors: A Prospective Observational Cohort Study (García-sánchez et al., 2020)	The study design used a prospective observational cohort.	Population: 51 participants with cardiovascular risk factors. Intervention: Short and long-term exercise programs. Outcome: Exercise adherence is measured by physical activity level, based on the IPAQ-S questionnaire, BMI, blood pressure, and lipid profile.	Respondents who followed a longer exercise program had greater adherence to exercise and decreased diastolic blood pressure. LDL and insulin levels decreased in both groups.
3	The association of six-minutes walking test (6MWT) with cardiovascular disease risk among older women with type 2 diabetes mellitus in a rural primary health care: A pilot observational study (Wibowo et al., 2020)	The research design used a cross-sectional design.	Population: Women aged >55 with Type 2 DM registered in Prolanis at Banguntapan II Health Centre, Bantul. Intervention: Patients who participated in Prolanis underwent a six-minute walking test (6MWT). Outcome: Cardiovascular risk measurement with ASCVD risk estimator plus Blood pressure (systolic and diastolic), total cholesterol, LDL, and HDL.	The average diastolic blood pressure, total cholesterol, HDL, and LDL reached the normal range, while systolic blood pressure still showed the hypertension category. There is a relationship between 6MWT and systolic and diastolic blood pressure variables.
4	Risiko Penyakit Kardiovaskuler Pada Peserta Program Pengelolaan Penyakit Kronis (PROLANIS) di Puskesmas Kota Bima: Korelasinya Dengan Ankle Brachial Index dan Obesitas (Martiningsih & Haris, 2019)	The type of research is descriptive-analytical research with a cross-sectional design.	Population: Patients who actively participate in Prolanis activities in the working area of 5 Health Centres in Bima City. Intervention: Active in participating in Prolanis. Outcome: Assessment of risk factors for CVD in 10 years using the	Prolanis patients in 5 Health Centres in Bima City showed 40.7% of respondents with high risk of CVD, 34.6% with medium risk, and 24.7% with low risk. The average total cholesterol and systolic blood pressure still showed abnormal values.

			Framingham Risk Score (FRS) instrument, consisting of sub-variables of age, total cholesterol, HDL, systolic blood pressure, history of DM, and smoking history, assessed based on gender.	
5	Gambaran Tingkat Risiko Penyakit Kardiovaskular pada Pasien Diabetes Melitus Tipe 2 di Puskesmas Kota Denpasar (Putri et al., 2020)	The study used a descriptive observational study design with a cross-sectional design.	Population: Diabetic patients in Community Health Centres spread across Denpasar City. Intervention: Patients who follow Prolanis. Outcome: The risk level of cardiovascular disease is determined using the WHO/ISH risk prediction chart.	A CVD risk assessment showed that 66% had low risk, 12.8% had moderate risk, and 21.3% had high risk. The male gender has a high risk of CVD; along with increasing age, the risk level of experiencing CVD also increases. Higher systolic blood pressure, obesity, and uncontrolled blood sugar can increase the risk of CVD.
6	Tingkat Risiko Kejadian Kardiovaskular pada Penyandang Diabetes Melitus Tipe 2 (Aini et al., 2020)	The research design is a descriptive study with a cross-sectional design.	Population: People with type 2 diabetes in the 3 Health Centre, Sleman, Yogyakarta. Intervention: Patients were registered as Prolanis participants. Outcome: The risk of cardiovascular events was determined based on the WHO/ISH risk prediction diagram, including age, sex, smoking status, diabetes, total cholesterol, and systolic blood pressure.	From the results of the categorization of cardiovascular risk events, it was shown that 56.1% of people with type 2 diabetes who followed Prolanis had a low risk of developing cardiovascular events in the next ten years. There was a degradation for moderate risk levels (30.3%), high risk (9.1%), and very high risk (4.5%). The risk level of cardiovascular events in women tended to be higher than in men. The average blood pressure of respondents reached the normal range. Respondents with dyslipidemia status had the potential for increased cardiovascular risk.

3.2. Effectiveness of Community-Based Programs on CVD Risk Factors

3.2.1. The Effect of Lifestyle Interventions on the Risk of Cardiovascular Disease

Community-based programs, such as Prolanis, have demonstrated effectiveness in reducing key CVD risk factors, including blood pressure and lipid levels. This effectiveness is largely attributed to a holistic approach that integrates health education, promotion of healthy lifestyles, and ongoing health monitoring. From a mechanistic standpoint, lifestyle interventions—particularly dietary modifications leading to weight loss and increased physical activity—contribute to improved insulin sensitivity. Enhanced insulin sensitivity, in turn, helps to reduce chronic vascular inflammation, a major contributor to atherosclerosis in individuals at high cardiovascular risk. Furthermore, a healthy diet that lowers low-density lipoprotein (LDL) and triglyceride levels can reduce the accumulation of atherosclerotic plaque on blood vessel walls, thereby slowing the progression of cardiovascular disease (García-sánchez et al., 2020; Karthijekan & Cheng, 2022).

Evidence suggests that primary prevention programs that combine hospital-based lifestyle interventions with consistent primary care follow-up are more effective in reducing cardiovascular risk scores compared to isolated approaches (Bird & Hawley, 2017; Dimitriadis & Newsholme, 2003; Papakonstantinou et al., 2022). This integrated strategy supports patients in maintaining long-term lifestyle changes. Prolanis programs, in particular, have consistently shown a positive impact on reducing cardiovascular risk among participants. This positive effect is observable not only in clinical parameters such as blood pressure and lipid levels but also in long-term health behavior changes, including increased adherence to treatment regimens and reduced consumption of unhealthy trans fats (Papakonstantinou et al., 2022; Paquin et al., 2021). An additional benefit of the sustainability of these programs is the potential for reduced healthcare costs, as a decrease in cardiovascular complications translates to fewer emergency medical interventions.(Lo et al., 2023).

All five reviewed studies that focused on programs like Prolanis indicated a positive impact on the development of CVD risk in participants. This reinforces the crucial role of collaboration between health service providers and the community in achieving favorable health outcomes (Garg et al., 2017; Grundy et al., 2019; Schwalm et al., 2019; Sun et al., 2019; Xie et al., 2022). However, the noted variability in program effectiveness across studies suggests that success is not uniform across all contexts or populations. This implies that broader environmental and socio-cultural factors, which are highly heterogeneous across Indonesia, likely play a significant mediating or moderating role in how these programs are received and sustained (Septiasary et al., 2024; Septiani et al., 2024). For example, adherence to physical activity might vary based on access to safe green spaces or the quality of local air, while dietary changes could be influenced by the local food environment or prevailing cultural eating habits (Bell & Culp, 2022; Minari et al., 2023; Susiani & Magfiroh, 2020; Williams et al., 2022). This highlights the importance of considering contextual influences when evaluating and designing interventions.

3.2.2. The Effect of Community-Based Programs on Blood Pressure

Community-based programs, including Prolanis, have demonstrated a positive impact on managing certain risk factors, with some studies indicating a low risk of developing CVD among most respondents. This suggests that these programs can be effective in blood pressure control, although a persistent challenge lies in managing systolic blood pressure, which often proves more difficult to control than diastolic blood pressure (Astuti et al., 2021; Fitriani et al., 2023; Yuziani & Sofia, 2023). This observation is supported by research where participants in Prolanis still exhibited a high-risk category for CVD, often due to elevated systolic blood pressure, even when diastolic readings were within normal ranges (Fuchs & Whelton, 2020; Garg et al., 2017; Hajar, 2017).

Systolic blood pressure holds significant importance in determining cardiovascular risk, particularly in the elderly population (Calano et al., 2019; Fuchs & Whelton, 2020; McCarthy & Natarajan, 2023; Vaduganathan et al., 2022). This is largely due to arterial stiffness resulting from the aging process and decreased elasticity of blood vessels, which increases the workload on the heart (Castelli et al., 2023; Kim, 2023; Kohn et al., 2015; Oliveros et al., 2020). Several studies reinforce this, showing that the average systolic blood pressure in respondents had not reached normal values, underscoring the difficulties in its management, especially in patients with comorbidities like diabetes and hypertension (Bozkurt et al., 2016; Petrie et al., 2018). The complexity of blood pressure control in these groups may also be influenced by external environmental stressors, such as noise pollution, which can lead to chronic stress and elevated blood pressure, making control harder even with program adherence (Jia & Sowers, 2021; Li et al., 2023; Olsen et al., 2021; Petrie et al., 2018).

In contrast, studies focusing solely on hypertensive patients without additional comorbidities suggest that hypertension can be more readily managed through appropriate interventions, including lifestyle modification and antihypertensive medication (Carey et al., 2018; Carey et al., 2021; Charchar et al., 2024). This indicates that the presence of comorbidities significantly complicates blood pressure management within community programs (Bays et al., 2021; Bays et al., 2024; Fuchs & Whelton, 2020). Therefore, effective CVD control strategies must adopt a holistic approach, focusing not only on blood pressure management but also on underlying comorbidities and broader lifestyle factors. This approach acknowledges that programs are not universally effective and that specific risk factors or patient groups require more intensive or specialized interventions, potentially incorporating considerations for environmental stressors that impact blood pressure regulation (Charchar et al., 2024; Rippe, 2019).

3.2.3. The Effect of Community-Based Programs on Obesity

Obesity is recognized as a primary risk factor contributing to the increased incidence of cardiovascular disease (CVD), with strong links to blood pressure regulation, glucose metabolism, and lipid profiles. Anthropometric measurements such as Body Mass Index (BMI), waist circumference, and neck circumference are positively associated with blood pressure, plasma glucose, and lipid levels (Aulia et al., 2022; "Diabetes, Obesity, Metabolic Syndrome," 2023). The mechanisms underlying this relationship involve obesity-induced insulin resistance, which contributes to elevated plasma glucose levels. As body cells become less responsive to insulin, the pancreas compensates by producing more insulin, leading to hyperinsulinemia. This, in turn, can increase blood pressure by stimulating the sympathetic nervous system and promoting sodium retention in the kidneys. Furthermore, chronic inflammation stemming from visceral adipose tissue accumulation increases the release of pro-inflammatory cytokines, which contribute to endothelial dysfunction and atherosclerosis (Azam et al., 2022; Mohajan & Mohajan, 2023).

Despite the efforts of community-based programs, some studies have reported fluctuating BMI results among participants. These fluctuations may be attributed to a lack of consistent adherence to lifestyle interventions, individual metabolic variations, or, crucially, limited access to resources that support healthy lifestyle changes. This observation directly connects to the broader food environment and socioeconomic conditions prevalent in Indonesia (Almaleki, 2019). Individual-level dietary and exercise advice from community programs can be undermined by the systemic availability of unhealthy, inexpensive foods and the lack of safe, accessible spaces for physical activity, particularly for low-income populations. If healthy food is expensive or unavailable, and safe places to exercise are scarce or polluted, then individual efforts to manage weight will face significant challenges, regardless of the quality of health education received (Martemucci et al., 2024; Nissa & Sari, 2022).

Improving BMI necessitates a comprehensive approach that includes ongoing education about healthy lifestyles, promotion of low-calorie diets, and increased physical activity. Community-based programs that integrate training on healthy eating patterns, stress management, and increased physical activity have demonstrated the potential to significantly reduce BMI and other cardiovascular risk factors (Martemucci et al., 2024). A diet rich in fiber, low in saturated fat, and abundant in polyunsaturated fatty acids can help lower blood lipid levels, while regular physical activity improves insulin sensitivity and aids in blood pressure control. For patients who do not respond adequately to lifestyle interventions, a medical approach, including weight loss medications and cognitive behavioral therapy, may be necessary to support sustained changes (Dietary Habit and Knowledge of Patients With Type 2 Diabetes Mellitus On Healthy, n.d.). Addressing obesity effectively therefore requires a multi-pronged approach that tackles both individual behavior and the environmental determinants that shape health.

3.2.4. The Effect of Community-Based Programs on BMI and Lipid Levels

While community-based programs have shown some success, fluctuations in parameters such as low-density lipoprotein (LDL) and Body Mass Index (BMI) have been observed in certain studies. These inconsistencies in LDL and BMI can be attributed to several factors, including non-compliance with dietary interventions, inconsistent physical activity, or genetic predispositions influencing lipid metabolism. Although community-based programs can effectively reduce hypertension and enhance health knowledge, their impact on LDL and BMI often remains inconsistent, particularly in populations characterized by low adherence or limited access to adequate health resources (Chu & Yee, 2018; Martemucci et al., 2024).

Several key factors significantly influence the overall effectiveness of these programs:

Duration of Participation: The length and tailoring of program participation play a critical role. Longer and more individually customized program engagement is associated with higher levels of adherence and more significant

positive outcomes. Short participation periods are often insufficient to foster sustainable behavior change (Ndejjo et al., 2021).

Multidisciplinary Approach: Programs that integrate health education, physical exercise, and consistent follow-up by healthcare professionals demonstrate superior results in reducing cardiovascular risk factors compared to interventions focusing on a single aspect. Comprehensive interventions that include nutrition education, regular exercise, and routine monitoring by health workers have been shown to significantly reduce LDL levels and improve BMI parameters in high-risk populations (Augusto Santos Silva et al., n.d.).

Resource Availability and Social Support: The presence of adequate resources and robust social support networks is a crucial determinant of program success. Community-based education and the strategic use of digital technologies, such as health monitoring applications, can serve as effective solutions in communities with limited access to traditional health services. These applications can improve adherence to treatment and lifestyle changes, especially in populations facing geographical or infrastructural barriers to healthcare facilities.(Kong, 2022)

Addressing Vulnerable Populations: More intensive approaches, such as individual counseling or group therapy, may be necessary for vulnerable populations, including the elderly and individuals with multiple comorbidities, to overcome specific barriers to adopting lifestyle changes. Patients at high cardiovascular risk often benefit from personalized counseling to enhance motivation and address psychological impediments (Stoica et al., 2020)

Genetic Differences: Variations in outcomes for parameters like LDL and BMI may also be influenced by genetic differences among individuals, which affect lipid metabolism and responses to interventions. In such cases, specific pharmacological approaches, such as lipid-lowering drugs, might be required for individuals who show resistance to lifestyle changes alone (Lee et al., 2021).

Family Involvement: Community-based interventions that actively involve family support have proven effective in improving health outcomes. Family participation in health programs can motivate individuals to remain committed to lifestyle changes, with strong family support correlating with higher adherence to healthy diets and physical activity, ultimately contributing to reduced cardiovascular risk (Nisa & Barsbay, 2022; Olaniyan, n.d.).

The reliance on factors such as "duration of participation," "adherence," "resources," and "social support" for program effectiveness highlights how deeply intertwined the success of health interventions is with the Indonesian sociocultural fabric. This implies that programs need to be designed not just for medical efficacy but also for cultural integration and socioeconomic feasibility, leveraging communal strengths like *gotong royong* and addressing disparities in access. This means program designers need to be more than just health experts; they need to be cultural facilitators who understand the community's existing social capital and belief systems and build upon them.

3.3. Environmental Influences on CVD Risk and Community Health in Indonesia: Implications for Interventions

The pervasive nature of environmental health challenges in Indonesia necessitates that community-based CVD prevention programs transcend a purely health education model. For true effectiveness and sustainability, these programs must evolve to incorporate elements of environmental health advocacy, community-led environmental improvement initiatives, and strategic collaboration with urban planners and policymakers.

Air Quality: Pervasive air pollution in Indonesian urban centers directly contributes to cardiovascular morbidity (Pramono et al., 2025). This reality has significant implications for community-based programs. For example, programs promoting outdoor physical activity need to integrate awareness of air quality, advising participants on safe times for outdoor exercise, promoting indoor alternatives, or even empowering communities to advocate for local air quality improvements. This expands the program's scope from individual behavior modification to broader environmental advocacy.

Water and Sanitation: The widespread issue of contaminated water sources and poor sanitation in Indonesia has indirect yet critical links to health, including chronic infections, nutritional deficiencies, and an increased risk of obesity (Brontowiyono et al., 2022). Consequently, health programs should broaden their scope to include education on safe water practices and advocate for improved sanitation infrastructure. Recognizing that basic environmental health is foundational, programs could integrate elements of hygiene promotion or collaborate with local authorities on water quality initiatives, thereby addressing root causes of health issues.

Food Environment: The shift towards processed and energy-dense foods, driven by economic growth and urbanization , inherently undermines dietary advice provided by health programs. This means that nutrition components of community programs must address the *availability, affordability, and cultural acceptance* of healthy food. This could involve promoting community gardens, supporting local markets for fresh produce, or engaging in policy advocacy for healthier food environments, such as advocating for regulation of unhealthy food advertising or subsidies for healthy

options. If the food environment promotes unhealthy eating, the program might need to engage in local food system initiatives (Rusyda, 2025)

Green Spaces: The documented beneficial effects of access to green spaces on cardiovascular and mental health are substantial. However, rapid urbanization in Indonesia often leads to a reduction in these vital spaces (Agustiyara et al., 2025; Liu et al., 2022). Therefore, community programs can actively utilize and advocate for the preservation and creation of green spaces for physical activity, stress reduction, and community gathering. This directly links health promotion efforts to urban planning and environmental conservation, recognizing that the physical environment profoundly shapes opportunities for healthy living.

Waste Management & Noise Pollution: These pervasive environmental stressors contribute to the overall health burden, increase stress, and indirectly affect CVD risk and adherence to healthy behaviors. While not direct targets of health interventions, programs should acknowledge these broader environmental determinants. They can empower communities to advocate for better local waste management practices or noise reduction policies, fostering a sense of collective efficacy in improving the living environment for health. This approach recognizes that health is fundamentally shaped by the environment, and programs must interact with and influence the environmental systems in which they are embedded (Ilonka et al., 2025).

Climate Change: The impacts of climate change, such as heatwaves, surges in PM2.5 levels, volatile rainfall, and mental health impacts like eco-anxiety, can significantly influence health behaviors and the sustainability of community programs. Programs may need to adapt their strategies to changing climate conditions, for instance, by advising on safe times for outdoor activity during extreme heat. Integrating resilience-building components and addressing eco-anxiety could also become relevant aspects of mental health support within these programs, acknowledging the increasing environmental pressures on public health (Colozza et al., 2025).

The pervasive nature of these environmental issues means that individuals are exposed to multiple stressors simultaneously. For example, a community program promoting outdoor exercise might be undermined by poor air quality, or dietary advice could be ineffective if healthy food is inaccessible or unaffordable due to the prevailing food environment. This reveals that the environment is not merely a backdrop; it is an active determinant of health that can either enable or constrain the success of health interventions. Therefore, effective CVD prevention must consider and integrate environmental health strategies.

3.4. Socio-Cultural Context and Acceptance of Community-Based Programs in Indonesia: Enhancing Engagement and Adherence

In Indonesia, the effectiveness and sustainability of community-based health programs are profoundly shaped by deeply ingrained cultural practices and socioeconomic realities. The fundamental Indonesian cultural value of *gotong royong*, emphasizing communal cooperation and shared responsibility, presents a powerful opportunity for programs to enhance participant engagement and adherence by explicitly incorporating collective activities and peer support mechanisms (Cipta et al., 2024). However, programs must also navigate the widespread reliance on traditional medicine, particularly in rural areas, where it is often preferred or used in conjunction with modern biomedicine due to its accessibility, affordability, and deep cultural roots (Febriyanti et al., 2024). A culturally sensitive approach that acknowledges and respects these traditional practices, and where appropriate and safe, explores ways to integrate them, is crucial to prevent non-adherence and avoid alienating a significant portion of the population.

Socioeconomic factors, including family income, education levels, and the distance to health facilities, create significant barriers to accessing and adhering to health programs, contributing to health access inequalities between rural and urban areas. Despite Indonesia's progress in national health insurance coverage, disparities persist, necessitating robust outreach strategies like mobile clinics or community health workers to reach underserved populations. Policy recommendations should advocate for increased health education access and targeted subsidies to alleviate financial burdens on low-income communities, ensuring economic constraints do not impede participation (Mutmainnah, 2025).

Furthermore, economic expansion and urbanization have driven significant shifts in dietary patterns, leading to increased consumption of processed and energy-dense foods, which poses a substantial challenge to health promotion efforts. Nutrition education within community programs must therefore be culturally appropriate, practical, and sensitive to affordability, promoting traditional, healthy Indonesian foods and cooking methods. Additionally, rapid urbanization and specific conditions in living environments, such as urban slums, can create a disconnect between pro-environmental beliefs and actual health behaviors, as evidenced by low recycling rates or persistent waste-burning practices. Inadequate building designs, poor indoor air quality, and the urban heat island effect in renovated slums also pose significant health risks, particularly for low-income households (Rusyda, 2025).

Ultimately, the long-term success and sustainability of community-based health programs in Indonesia are contingent on their ability to adeptly navigate and strategically leverage or mitigate this complex interplay of cultural values, traditional beliefs, and socioeconomic realities. This necessitates a paradigm shift from a purely clinical model to one that incorporates a deep anthropological and sociological understanding of health behavior change within the local context. Program designers must act as cultural facilitators, understanding and building upon the community's existing social capital and belief systems to ensure interventions are not only medically efficacious but also culturally integrated and socioeconomically feasible (Abid et al., 2025; Laksono et al., 2019).

3.5. Synergies and Challenges: Towards a Holistic Approach to CVD Prevention in Indonesia

The combined analysis reveals that the effectiveness of community-based programs in Indonesia is ultimately constrained by, and must actively engage with, broader, systemic determinants of health. The pervasive environmental degradation, including poor air quality, contaminated water, an unhealthy food environment, reduced green spaces, noise pollution, and the impacts of climate change, exacerbates CVD risk factors and inherently complicates the effectiveness of community-based health programs. These environmental stressors create a challenging backdrop against which individual lifestyle changes are pursued.

Concurrently, the unique socio-cultural factors of Indonesia, such as the communal spirit of *gotong royong*, the widespread prevalence of traditional medicine, and persistent socioeconomic disparities, can either significantly facilitate or impede program acceptance, engagement, and long-term adherence. These factors are not merely passive influences but active mediators shaping how health interventions are perceived and adopted within communities.

The combined analysis highlights that a purely health-focused program is insufficient for sustained impact. The core implication is that health is not just a personal responsibility but a collective outcome shaped by the environment and society.

This integrated approach fosters a sense of collective efficacy in improving the living environment for health, recognizing that health is fundamentally shaped by environmental and social systems.

Table 2. Key Environmental and Socio-Cultural Determinants of CVD in Indonesia and their Implications for Community-Based Programs

Determinant Category	Specific Factor	Link to CVD/Health Outcome	Implication for Community-Based Programs
Environmental	Air Pollution (PM2.5, NO2, CO)	Systemic inflammation, oxidative stress, respiratory diseases, cardiovascular disorders, heart attacks, chronic respiratory disease, headaches, nausea, dizziness, vomiting, long-term heart disease.	Integrate awareness of air quality (safe times for outdoor activity, indoor alternatives), empower communities to advocate for local air quality improvements.
Environmental	Contaminated Water & Poor Sanitation	Diarrhoeal diseases (cholera, typhoid), inadequate nutritional intake, stunting, increased risk of degenerative diseases (obesity), polluted water bodies.	Broaden scope to include education on safe water practices, advocate for improved sanitation infrastructure, integrate hygiene promotion, collaborate on water quality initiatives.
Environmental	Unhealthy Food Environment (Processed/Fast Foods, Sugar-sweetened beverages)	Rising obesity, hypertension, diabetes mellitus, cardiovascular diseases, cancer, metabolic syndrome, excessive energy intake.	Address availability, affordability, and cultural acceptance of healthy food; promote community gardens, local markets; engage in policy advocacy for healthier food environments.
Environmental	Reduced Green Spaces	Loss of benefits for cardiovascular/mental health, urban heat island effect, reduced physical activity opportunities.	Actively utilize and advocate for preservation/creation of green spaces for physical activity, stress reduction, and community gathering; link health promotion to urban planning.
Environmental	Poor Waste Management	Exposure to infectious waste, respiratory tract issues, groundwater pollution, increased disease burden.	Acknowledge broader environmental determinants; empower communities to advocate for better local waste management practices, fostering collective efficacy.
Environmental	Noise Pollution (Traffic, Loudspeakers, Construction)	Cardiovascular disorders, hypertension, sleep disturbances, mental health strain, stress, anxiety, aggression.	Acknowledge broader environmental determinants; empower communities to advocate for noise reduction policies; consider impact on adherence to healthy behaviors.
Environmental	Climate Change (Heatwaves, PM2.5 surges, volatile rainfall, eco-anxiety)	Worsening chronic illnesses, food insecurity, income loss, job scarcity, displacement, mental health issues (anxiety, PTSD, eco-anxiety).	Adapt strategies to changing climate conditions (e.g., safe times for outdoor activity); integrate resilience-building components; address eco-anxiety as part of mental health support.

Socio-Cultural	*Gotong Royong* (Communal Cooperation)	Strong communal bonds, shared responsibility, collective efficacy.	Explicitly incorporate communal activities, shared responsibilities, and peer support mechanisms; frame collective health efforts as *gotong royong* for enhanced engagement and adherence.
Socio-Cultural	Traditional Health Beliefs & Practices	Reliance on traditional remedies, potential non-adherence to modern medicine, cultural identity.	Adopt culturally sensitive approaches; acknowledge and respect traditional practices; explore integration where safe/appropriate; clearly communicate benefits of modern approaches in culturally resonant ways.
Socio-Cultural	Socioeconomic Disparities (Income, Education, Distance to Facilities)	Access inequalities, barriers to health services, limited adherence to programs.	Implement outreach strategies (mobile clinics, community health workers); advocate for increased health education access; recommend targeted subsidy policies to alleviate financial burdens.
Socio-Cultural	Dietary Habits & Urbanization-induced Behavioral Shifts	Increased consumption of processed/fast foods, gap between health knowledge and practice (e.g., waste burning).	Culturally appropriate nutrition education; promote traditional, healthy Indonesian foods; understand behavioral challenges of urban environments; develop feasible community-led solutions.

4. Conclusion

Community-based lifestyle interventions, exemplified by the Prolanis program in Indonesia, demonstrate effectiveness in reducing cardiovascular disease (CVD) risk factors. These programs contribute positively by managing blood pressure, body mass index (BMI), and lipid levels, and by fostering greater adherence to treatment and healthy lifestyles through a holistic approach that integrates education, health promotion, and ongoing monitoring.

However, the analysis reveals that while these interventions yield positive results, significant challenges persist. These include difficulties in consistently managing systolic blood pressure and obesity, as well as fluctuations in LDL and BMI levels. The effectiveness of these programs is profoundly influenced by factors such as the duration of participation, participant adherence, the presence of comorbidities, and the availability of social support. Furthermore, gender-based differences in CVD risk are a significant consideration, with postmenopausal women and older men facing distinct risk profiles due to physiological changes and behavioral factors.

Crucially, the success of these interventions is not solely dependent on individual behavior or clinical management. The pervasive environmental challenges in Indonesia, including air pollution, contaminated water, an unhealthy food environment, reduced green spaces, poor waste management, and noise pollution, actively contribute to CVD risk and can undermine the efficacy of community-based health programs. Similarly, the unique socio-cultural context of Indonesia, characterized by communal values like *gotong royong*, the widespread reliance on traditional health beliefs, and existing socioeconomic disparities, profoundly mediates program acceptance, engagement, and long-term adherence.

Therefore, successful interventions necessitate a multidisciplinary strategy that transcends a purely biomedical model. This requires active collaboration among health workers, environmental agencies, urban planners, social welfare departments, and community organizations. By integrating health interventions with environmental improvements and culturally sensitive strategies, and by leveraging communal strengths while addressing socioeconomic barriers, programs like Prolanis can become more effective and sustainable models for preventing and controlling cardiovascular disease in the Indonesian community. A sustainable and evidence-based approach that acknowledges and actively engages with these complex environmental and socio-cultural determinants is imperative for achieving lasting public health improvements.

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