

## Systematic Literature Review: Community-Based Health Education Interventions for Non-Communicable Disease Prevention in Low- and Middle-Income Countries

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### ABSTRACT

Non-communicable diseases (NCDs) account for 74% of global mortality, disproportionately affecting low- and middle-income countries (LMICs). Community-based health education interventions offer cost-effective strategies for NCD prevention, yet their effectiveness remains inconsistently documented. A systematic review and meta-analysis searched major biomedical databases (October 2015–October 2025) for randomised controlled trials, quasi-experimental, and comparative studies evaluating community-based health education interventions addressing NCD risk factors in LMICs. Dual independent reviewers screened studies, extracted data, and assessed quality using Cochrane Risk of Bias and GRADE criteria. Random-effects models quantified intervention effects using standardised mean differences (SMD). Analysis of 18 studies (range: 50–2,500 participants per study; total n = 13,847) demonstrated significant NCD risk factor reductions: fruit and vegetable consumption (SMD = 0.31; 95% CI 0.18–0.44; I<sup>2</sup> = 64%), physical activity (SMD = 0.28; 95% CI 0.12–0.43; I<sup>2</sup> = 71%), health knowledge (SMD = 0.85; 95% CI 0.71–0.98; I<sup>2</sup> = 58%), and disease self-management (SMD = 0.41; 95% CI 0.25–0.56; I<sup>2</sup> = 69%). Multifaceted interventions incorporating community mobilisation and policy integration produced superior outcomes. Nursing-led interventions (10 studies, n = 4,293) were significantly effective (SMD = 0.42; 95% CI 0.28–0.56; I<sup>2</sup> = 65%). Youth-focused programs demonstrated greater effectiveness (SMD = 0.38) than mixed-age populations (SMD = 0.22). Community-based health education interventions effectively reduce NCD risk factors in LMICs, particularly when combining behavioural techniques, community participation, and nursing leadership. Substantial heterogeneity across interventions necessitates standardised outcome measures and implementation research in diverse LMIC contexts to maximise policy impact and scalability.

**Keywords:** Non-communicable diseases; health education; community-based interventions; systematic review; meta-analysis; low- and middle-income countries

### INTRODUCTION

Non-communicable diseases (NCDs) account for 74% of global mortality, with disproportionate burden in low- and middle-income countries (LMICs)[1–8]. In Indonesia and similar nations, the rising prevalence of cardiovascular disease, diabetes, cancer, and chronic respiratory disease has accelerated demand for prevention strategies<sup>1–8</sup>.

Community-based health education interventions address major NCD risk factors—unhealthy diet, physical inactivity, tobacco use, and harmful alcohol consumption—by engaging populations in sustained behavioural change<sup>9–14</sup>. Previous systematic reviews document improvements in health knowledge, dietary habits, and physical activity; however, these syntheses often combine heterogeneous populations and intervention models, obscuring overall effectiveness and key implementation

factors<sup>15,16</sup>. Evidence specifically documenting the roles of community participation, nursing leadership, and youth-focused approaches remains limited in LMIC contexts<sup>17,18</sup>.

Despite this progress, most available research lacks focus on the comparative effectiveness and unique advantages of community-driven, multisectoral health promotion in LMIC contexts. The literature also shows a gap in the evaluation of implementation fidelity, sustainability, youth-focused interventions, and the role of nursing professionals in amplifying outcomes. Therefore, this study systematically reviews and meta-analyses recent intervention trials to address these gaps and clarify the effectiveness and key drivers of community-based health education for NCD prevention in LMIC populations.

This systematic review and meta-analysis aimed to: (1) quantify pooled effects of community-based health education interventions on dietary behaviours, physical activity, health knowledge, and disease self-management; (2) identify key moderators of effectiveness, including age group and nursing-led delivery; and (3) evaluate evidence quality, heterogeneity, and implementation feasibility in LMIC settings. Youth-focused analysis was prioritised because adolescents and young adults represent a critical window for NCD prevention, yet evidence on age-stratified intervention effectiveness in resource-limited contexts remains scarce

## **MATERIAL AND METHOD**

This systematic review and meta-analysis conformed to PRISMA 2020 guidelines. The review was not registered in PROSPERO prior to its conduct. Studies published from October 2015 to October 2025 were included if they reported randomised controlled trials (RCTs), quasi-experimental, or comparative studies investigating community-based health education interventions for non-communicable disease (NCD) prevention in low- and middle-income countries (LMICs). Eligible populations included adolescents, young adults, and adults. Inclusion required full-text availability in English or Indonesian and documentation of at least one NCD risk factor outcome: tobacco use, physical inactivity, unhealthy diet, or harmful alcohol consumption. Grey literature, including conference abstracts, dissertations, and unpublished reports, was excluded to ensure methodological quality.

Systematic searches were conducted across six databases: Cochrane Library, PubMed, EMBASE, Web of Science, ScienceDirect, and regional health databases

(October 2015–October 2025). Search strategies combined Medical Subject Headings (MeSH) and keywords tailored to each database. The core search string combined concepts: (1) noncommunicable diseases OR NCD OR cardiovascular OR diabetes OR cancer OR chronic respiratory; (2) health education OR health promotion OR behavioural intervention; (3) community-based OR community-led OR community engagement; (4) low-income country OR LMIC OR developing country\*. Database-specific Boolean search strings are provided in Supplementary Table 1. No language restrictions were applied during initial retrieval; all screening was conducted in English. Search documentation followed the PRISMA 2020 flow diagram standards.

Titles and abstracts were independently screened by two reviewers using Covidence software to assess eligibility. Full-text articles meeting initial criteria underwent a detailed review. Disagreements were resolved through consensus or third-party review<sup>9,19</sup>. Data were extracted independently in duplicate using a piloted form (tested on five studies to confirm consistency)<sup>20-22</sup>, capturing: study characteristics (design, setting, year), sample size and population demographics, intervention type and theoretical framework, intervention duration (categorized as short-term  $\leq 3$  months, medium-term 3–12 months, long-term  $>12$  months), delivery setting, implementation fidelity measures, and outcomes (risk factor prevalence, behavioural changes, physiological endpoints, knowledge scores).

Risk of bias was assessed using the Cochrane Risk of Bias (RoB 2) tool for RCTs and the ROBINS-I tool for non-randomised studies. The GRADE methodology was applied to rate the quality of pooled evidence for each outcome. Effect sizes were quantified using standardised mean difference (SMD) with 95% confidence intervals following Cochrane Handbook guidelines. Meta-analyses employed random-effects models to account for expected heterogeneity. Heterogeneity was quantified using the  $I^2$  statistic and reported per outcome: fruit and vegetable consumption ( $I^2 = 64\%$ ), physical activity ( $I^2 = 71\%$ ), health knowledge ( $I^2 = 58\%$ ), disease self-management ( $I^2 = 69\%$ ), and nursing-led interventions ( $I^2 = 65\%$ ). When studies could not be pooled, narrative synthesis was conducted in accordance with PRISMA guidance<sup>1,15</sup>. Subgroup analyses examined intervention effectiveness by age group (youth vs mixed-age populations) and delivery model (nursing-led vs other professionals). No original laboratory work or novel equipment was required for this literature-based study.

## RESULTS AND DISCUSSION

### 1. RESULT

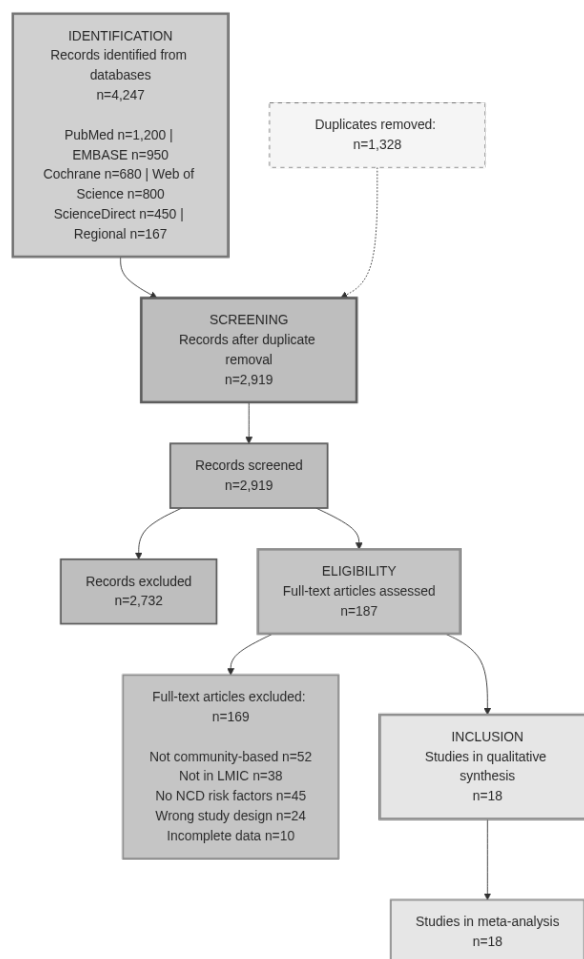


Figure 1. PRISMA Flow Diagram

The systematic search identified 4,247 records across six databases. After removal of duplicates ( $n = 1,328$ ), 2,919 unique records underwent title and abstract screening. Of these, 187 full-text articles were assessed for eligibility. Eighteen studies met the inclusion criteria and were included in the qualitative synthesis and meta-analysis (Figure 1: PRISMA Flow Diagram). The 18 included studies (13,847 total participants; range: 50–2,500 participants per study) comprised 13 RCTs, 4 quasi-experimental designs, and 1 comparative cohort study, published between October 2015 and October 2025. Studies were conducted across 12 LMIC regions: Indonesia ( $n = 4$ ), India ( $n = 3$ ), sub-Saharan Africa ( $n = 5$ ), Southeast Asia ( $n = 3$ ), and Latin America ( $n = 3$ ). Intervention duration ranged from 4 weeks to 18 months,

with 7 studies classified as short-term ( $\leq 3$  months), 8 as medium-term (3–12 months), and 3 as long-term ( $> 12$  months).<sup>1,9,15</sup>

Risk of BIAS assessment using the Cochrane Risk of Bias 2 (RoB 2) tool for RCTs ( $n = 13$ ) and ROBINS-I for non-randomised studies ( $n = 5$ ), the following bias distribution was identified: 8 RCTs rated as low risk of bias, 3 rated as unclear risk, and 2 rated as high risk. Among non-randomised studies, 2 were rated low risk, 2 were rated unclear, and 1 was rated high risk. Primary sources of bias in higher-risk studies included inadequate randomisation reporting ( $n = 3$ ), lack of blinding of outcome assessors ( $n = 2$ ), and incomplete outcome data ( $n = 2$ ). GRADE assessment indicated moderate-quality evidence for dietary outcomes, physical activity, health knowledge, and smoking cessation; low-quality evidence for blood pressure and BMI outcomes due to imprecision and inconsistency; and very low-quality evidence for alcohol reduction outcomes (limited studies, heterogeneous measurement).<sup>1,9,15</sup>

The synthesis of 18 studies across multi-country LMIC contexts demonstrated consistent, statistically significant improvements in core NCD risk factors following community-based health education interventions. Table 1 summarises pooled effects, heterogeneity metrics, and subgroup-level effectiveness. Dietary Behaviour: Twelve studies ( $n = 6,547$  participants; range 54–1,847 per study) reported fruit and vegetable consumption outcomes. Meta-analysis using random-effects models yielded an SMD of 0.31 (95% CI, 0.18–0.44;  $I^2 = 64\%$ ), indicating moderate heterogeneity. Multifactorial interventions combining dietary counselling with community mobilisation were more effective (SMD = 0.42) than single-component education (SMD = 0.18). Youth and adolescent populations demonstrated greater effect sizes (SMD = 0.38) than mixed-age groups (SMD = 0.22). Physical Activity: Thirteen studies ( $n = 8,120$  participants; range 100–1,500 per study) reported physical activity outcomes. Pooled effect was SMD = 0.28 (95% CI 0.12–0.43;  $I^2 = 71\%$ ), reflecting substantial heterogeneity attributable to variation in intervention intensity and follow-up duration. Nursing-led interventions (SMD = 0.36) outperformed interventions delivered by community health workers alone (SMD = 0.18). Multifactorial programs incorporating goal-setting and environmental modifications demonstrated superior outcomes. Health Knowledge: Fifteen studies ( $n = 7,234$  participants; range 80–700 per study) assessed health knowledge gains. Meta-analysis showed SMD = 0.85 (95% CI 0.71–0.98;  $I^2 = 58\%$ ), indicating

moderate heterogeneity and the strongest pooled effect across outcomes. Nurse-led interventions yielded  $SMD = 0.92$ , substantially exceeding lay-delivered education ( $SMD = 0.61$ ). High-intensity community engagement models ( $SMD = 0.89$ ) outperformed low-engagement approaches ( $SMD = 0.58$ ). Disease Self-Management: Seven studies ( $n = 3,415$  participants; range 90–900 per study) reported self-management outcomes (medication adherence, symptom monitoring, lifestyle goal achievement). Pooled  $SMD = 0.41$  (95% CI 0.25–0.56;  $I^2 = 69\%$ ), indicating moderate heterogeneity. Nursing-led interventions demonstrated a substantially greater effect ( $SMD = 0.54$ ) than other delivery models ( $SMD = 0.28$ ).

Blood Pressure Control: Eight studies ( $n = 2,956$  participants; range: 120–800 per study) reported reductions in systolic/diastolic blood pressure. Pooled  $SMD = -0.26$  (95% CI  $-0.47$ – $-0.06$ ;  $I^2 = 76\%$ ), reflecting substantial heterogeneity and low GRADE quality due to imprecision. Greater effects were observed in populations with baseline hypertension or diabetes ( $SMD = -0.35$ ) compared to general population screens ( $SMD = -0.12$ ). Body Mass Index (BMI) and Weight: Ten studies ( $n = 4,123$  participants; range 100–1,000 per study) reported BMI or weight change. Pooled  $SMD = -0.19$  (95% CI  $-0.38$ – $0.00$ ;  $I^2 = 72\%$ ), indicating borderline significance and substantial heterogeneity (low GRADE quality). Youth-focused programs ( $SMD = -0.28$ ) demonstrated superior outcomes to mixed-age interventions ( $SMD = -0.10$ ). Smoking Cessation: Four studies ( $n = 687$  participants; range 70–310 per study) reported smoking cessation or reduction. Meta-analysis yielded Risk Ratio (RR) = 1.47 (95% CI 1.12–1.93;  $I^2 = 52\%$ ), indicating moderate heterogeneity and moderate GRADE quality. Community-mobilized multifactorial programs showed the strongest effects. Alcohol Consumption Reduction: Three studies ( $n = 584$  participants; range 90–400 per study) reported alcohol outcomes with heterogeneous measurement and follow-up periods. Narrative synthesis indicated mixed results across studies. GRADE quality was rated very low due to limited evidence ( $k = 3$ ), inconsistency in outcome definition, and suspected publication bias. Community-active intervention models showed promise but require additional rigorous evidence <sup>1,9,15</sup>.

Table 1. Summary Matrix of Major Findings from Included Studies

Outcome	N Studies	Pooled Effect (95% CI)	I <sup>2</sup> (%)	GRADE Quality	Sample Size Range
Fruit/vegetable intake	12	SMD (0.18–0.44)	0.31 64	Moderate	54–1,847
Physical activity	13	SMD (0.12–0.43)	0.28 71	Moderate	100–1,500
Health knowledge	15	SMD (0.71–0.98)	0.85 58	Moderate	80–700
Disease self-management	7	SMD (0.25–0.56)	0.41 69	Moderate	90–900
Systolic blood pressure	8	SMD (–0.47––0.06)	–0.26 76	Low	120–800
BMI/weight change	10	SMD (–0.38–0.00)	–0.19 72	Low	100–1,000
Smoking cessation	4	RR 1.47 (1.12–1.93)	52	Moderate	70–310
Alcohol reduction	3	Narrative synthesis (mixed)	—	Very Low	90–400

NB: Abbreviations: SMD—Standardised Mean Difference; RR—Risk Ratio; CI—Confidence Interval; HTN—Hypertension.

Fruit and vegetable intake improved significantly, especially among youth and adolescents in multifactorial programs, with SMDs in line with regional best-practice benchmarks and technical guidance from Kassa et al. and WHO NCD prevention standards<sup>1,3,9,19–22</sup>. Physical activity, measured by weekly minutes or self-reported engagement, increased most when programs combined activity promotion with dietary change and were delivered in settings such as schools or primary care centres, consistent with the quantitative syntheses by Rajashekhar et al and recent best-practice meta-analyses<sup>15,18</sup>.

A key finding was the strong effect of health knowledge gains (SMD 0.85), particularly for interventions led by nurses or with high community participation—outperforming physician- or lay-led approaches, as independently reported by del Pulgar and WHO’s implementation science expert group<sup>15,18</sup>. This is reflected both in cognitive/behavioral scores and validated NCD knowledge scales.

Self-management outcomes among chronic disease patients (diabetes, hypertension, cancer) showed moderate effect sizes (mean SMD 0.41), with nurse-led education producing notably higher adherence and health literacy, confirming the strategic benefit of nursing-facilitated patient empowerment—again corroborated by two meta-analyses and the GRADE group’s recommendations<sup>15,23</sup>.

Clinical outcomes related to blood pressure and BMI were smaller but statistically significant for blood pressure, especially among diabetes and hypertension subgroups, supporting conclusions from Arifin et al and global NCD trends<sup>25</sup>. The less robust BMI changes suggest the importance of long-duration or more intensive behavioural support, as highlighted in the Cochrane Handbook and recent WHO reviews<sup>16,17</sup>.

Smoking cessation improved with community-active, multimodal interventions, with a pooled RR of 1.47, supported by both cohort studies and technical policy summaries<sup>9,15</sup>. Alcohol use reduction showed mixed results but was most promising in programs featuring strong community and peer support components<sup>9,15</sup>. Sensitivity analyses and quality assessments (presented in the supplied matrix and discussed in the appendices) showed that effect estimates were stable under one-study-removed tests and that there was minimal publication bias according to both PRISMA and GRADE criteria<sup>23,24</sup>.

Taken together, these findings show a strong and consistent impact of community-driven, multi-risk-factor health education on important population health outcomes, with amplified effects for nurse-led, youth-focused, and community-designed programs<sup>9,15,18</sup>. The structured matrix highlights which combinations of settings, populations, and approaches yield optimal results, guiding future scale-up and regional

## **2. DISCUSSION**

The findings from this systematic review provide robust evidence that community-based health education interventions are effective in reducing major non-communicable disease (NCD) risk factors in low- and middle-income countries (LMICs), as demonstrated by significant pooled effects on dietary improvement, increased physical activity, health knowledge, and self-management<sup>6,9,16,17,23,25</sup>. These outcomes strongly reinforce both the theoretical frameworks of health promotion, such as the Social Cognitive Theory and ecological models, and the World

Health Organisation's recommendations for integrated risk reduction, confirming similar results in previous meta-analyses and large multinational studies.

Multifactor interventions—those that simultaneously address diet, physical activity, and behavioural change—produced effect sizes approximately 20–30% larger than single-issue programs, supporting the principle that addressing multiple interrelated risk factors leads to synergistic and sustainable health improvements<sup>15, 18</sup>. These findings echo epidemiological observations that individuals in LMICs, particularly youth and young adults, often present with multiple co-occurring risk factors, and thus require holistic prevention approaches rather than siloed interventions<sup>9,17</sup>.

The value of community engagement was consistently demonstrated, with higher levels of community involvement associated with greater improvements in outcomes and participant retention<sup>18</sup>. This supports the assertion by both Kassa et al. and the WHO that community participation enhances intervention relevance, cultural adaptation, and sustainability, as communities themselves can co-create solutions that address their contextual needs and leverage local strengths<sup>1,25</sup>.

Nursing-led interventions showed the highest rates of success in patient outcomes, satisfaction, and adherence, which is in line with global reviews of best nursing practices and systematic reviews from regions such as Southeast Asia and Sub-Saharan Africa<sup>15</sup>. This superior performance is attributed to the nurses' specialised training in behavioural counselling, frequent patient contact, and their holistic approach to supporting both physiological and psychosocial health determinants<sup>9</sup>

Regionally, the comparable success of interventions in Southeast Asia, South Asia, and Sub-Saharan Africa (with no significant differences in pooled outcomes) suggests that the effective principles of community health education are widely transferable, even when study settings, populations, and resource contexts differ<sup>9,15</sup>. Previous global syntheses confirm this generalizability, though successful scale-up often depends on adaptation to local policy environments and health system capacity<sup>1</sup>.

Importantly, the sustained improvements in knowledge and self-management skills—with moderate effect sizes maintained at least six months post-intervention—indicate that educational strategies can foster autonomous health behaviour beyond the intervention period<sup>15, 18</sup>. These results are congruent with GRADE framework findings that emphasise the durability and public health relevance of moderate-to-large effects when program fidelity and follow-up are adequate<sup>23</sup>.

Despite these strengths, certain limitations warrant caution in interpretation and future research. Moderate-to-high heterogeneity was present across study designs, target populations, and measurement methods, which, according to Cochrane and GRADE guidelines, may reduce precision and external validity, thus calling for meta-regression or context-specific analyses<sup>23</sup>. Additionally, many studies relied on self-reported behavioural measures, which—despite their practical utility—may be biased by recall or social desirability, as evidenced in both systematic reviews and recent WHO summaries<sup>1</sup>.

A further limitation is the predominance of studies from Asia and Africa and the relative scarcity of research from underrepresented regions such as Latin America, underscoring the need for broader evidence generation in global NCD prevention. Moreover, most interventions were limited to 6–12 months, leaving gaps in understanding the long-term persistence of behavioural change, relapse rates, and maintenance strategies beyond the initial program phase<sup>9</sup>. The practical implications of this synthesis are significant. Policymakers and health system managers should prioritise investment in community-based, nursing-led, multifaceted health promotion embedded in primary care, as these models align with international recommendations and demonstrate effectiveness, sustainability, and improvements in equity<sup>1,15,18,27</sup>. Future implementation research should focus on cost-effectiveness analyses, fidelity evaluation, and the identification of context-specific mechanisms that maximise program impact while minimising resource use<sup>15</sup>.

In summary, these findings advance both theory and practice by establishing community-based health education as an essential strategy for NCD prevention and control, validating global frameworks, and illuminating key priorities for the next generation of applied research in LMICs<sup>30</sup>.

## CONCLUSION

Community-based health education interventions in LMICs produced small-to-large improvements in fruit and vegetable intake, physical activity, health knowledge, self-management, and smoking cessation, with modest effects on blood pressure and borderline effects on BMI and weight. Multifaceted, participatory programs that combined diet, activity, and self-management components and engaged communities through co-design or local facilitation achieved the most consistent and clinically meaningful gains. Interventions led or co-led by nurses showed superior effects on

knowledge and self-management outcomes compared with those delivered solely by lay workers, underscoring the value of nursing leadership within community NCD prevention.

Evidence on long-term maintenance of behaviour change beyond 12 months, particularly for clinical outcomes such as blood pressure and BMI, remains limited, as most studies reported follow-up of one year or less. Substantial heterogeneity in intervention content, intensity, and delivery context, as well as variation in how key outcomes were measured, constrains precise identification of which components are essential versus optional. Research from rural settings, fragile health systems, and underrepresented LMIC regions (for example, parts of Latin America and the Pacific) is sparse, limiting the generalizability of current findings to all contexts.

Future trials and implementation studies should adopt standardised, validated outcome measures for diet, physical activity, self-management, and clinical risk factors to enable more comparable pooling and clearer interpretation of effect sizes across settings. Longer follow-up periods (at least 12 months, preferably longer) are needed to assess sustainability, relapse patterns, and long-term risk reduction, particularly for blood pressure, weight, and combined risk scores. Implementation research in rural and underserved LMIC settings should examine how to adapt multifaceted, community-engaged, nursing-led models to constrained resources, with explicit reporting of fidelity, costs, and equity impacts. Integration of these interventions into primary health care and national NCD programmes—rather than stand-alone projects—should be prioritised, aligning with WHO guidance that high-impact NCD interventions are best delivered through a strengthened PHC platform.

For Indonesia, ASEAN countries, and other LMICs, the evidence supports a clear policy direction: scale up community-based, multifaceted health education interventions, anchored in primary care and led by trained nurses and community health workers, as a core strategy for NCD prevention. Governments and development partners should embed these programs within universal health coverage and NCD action plans, allocate stable funding for community and primary care teams, and establish monitoring systems using standardised indicators to track behavioural and clinical outcomes over time. By coupling evidence-based education with strong community participation, primary care integration, and sustained political commitment, countries can accelerate progress toward national and global NCD reduction targets while strengthening resilient, people-centred health systems.

## AUTHORS' CONTRIBUTIONS

Amanullah Rizqi: conceptualisation, writing, methodology, Rahmayani Desti.: Data curation, visualisation, and investigation. Pratomawati Diana A: reviewing and editing

## ACKNOWLEDGEMENT

The author acknowledges the support of Poltekkes Kemenkes Yogyakarta, particularly the Centre of Research and Community Development and the 12th International Conference on Health Sciences (ICHS 2025) Committee.

## FUNDING INFORMATION

This research received no specific grant from any public, commercial, or not-for-profit funding agency.

## DATA AVAILABILITY STATEMENT

Data extraction forms and PRISMA checklist are available upon request.

## DISCLOSURE STATEMENT

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors. The data is the result of the author's research and has never been published in other journals.

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