

# Assessing the Outcomes of a Community Health Program in Papua New Guinea: A Cross-Sectional Descriptive Study

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DOI: <https://doi.org/10.47772/IJRISS.2026.100600957>

Received: 21 June 2026; Accepted: 26 June 2026; Published: 09 July 2026

## ABSTRACT

Community health programs are vital for improving health outcomes in rural and underserved settings. Papua New Guinea (PNG) faces severe health challenges, including high maternal mortality, infectious diseases, and shortages of essential health personnel. The EDEN program (Effective Development Empowering the Nation) was introduced to empower communities through environmental reorganisation, behavioural change, and participatory development. This cross-sectional study assessed EDEN's impact in the Yawar community of Madang Province. Quantitative data were collected via structured surveys (n = 116), while qualitative insights were derived from open-ended questions. Outcomes were examined across four domains: environment, public health, behaviour, and participation. Descriptive statistics summarised quantitative findings, and thematic analysis supported qualitative interpretation. Findings revealed perceived reductions in malaria, pneumonia, and skin diseases, with malaria showing the most consistent improvement. Environmental order improved through structured pathways, family boundaries, and sanitation practices, fostering respect and social cohesion. Behavioural transformation was evident, though variability in responses suggested the need for longer-term exposure and institutional support. Key challenges included shortages of health workers, limited training, and inadequate rural infrastructure. Despite these barriers, EDEN demonstrated consistent positive impacts on community well-being and social organisation. The EDEN program effectively enhanced quality of life, public health, and community cohesion in a resource-constrained rural setting. Its community-driven approach is replicable in similar contexts worldwide. Integrating EDEN into primary healthcare services and embedding it within national development plans will be critical to sustaining its impact. Greater government recognition and long-term support are essential to reinforce behavioral change and ensure sustainability.

**Keywords:** health promotion, primary healthcare, public health, Papua New Guinea

## INTRODUCTION

Enhancing community health and living standards is a fundamental goal of health systems worldwide (Johnston et al., 2024). To achieve this, health managers and policymakers continually adapt policies, strategies, and resources. Yet, despite these efforts, rural areas in many low- and middle-income countries continue to experience poor health outcomes (WHO, 2025). For instance, in South Africa, preventable diseases such as tuberculosis and HIV/AIDS remain leading causes of illness and death, exacerbated by weak health systems characterized by inadequate infrastructure, shortages of health workers, and frequent stockouts of essential medicines and supplies (Azevedo, 2017).

Papua New Guinea (PNG) faces some of the most severe health challenges among Pacific Island nations (Ibrahim et al., 2018; Newland et al., 2022). These include high maternal mortality, widespread infectious diseases such as tuberculosis, malaria, and HIV, low immunization coverage, and critical shortages of doctors, nurses, and midwives. PNG has also struggled to meet its national health goals and policy targets. Reports from International partners reveal that approximately 25% of the population experiences multidimensional poverty,

affecting education, health, and living conditions (Asian Development Bank (ADB), 2020; McKay & Lepani, 2010).

Recognizing these challenges, the PNG government has emphasized primary health services as central to its 2021–2030 National Health Plan (Government of Papua New Guinea, 2021). This priority is reflected in community health initiatives supported by national and international partners. Notable among these is the Healthy Islands concept, introduced regionally in 1995 through the Yanuca Island Declaration in Fiji (World Health Organization, 2013). These initiatives, which PNG has adopted and integrated into its health policies promote community-led actions to combat preventable diseases such as malaria and filariasis. This framework remains embedded in the current health plan. More recently, the EDEN program (Effective Development Empowering the Nation) was launched to empower local communities to manage their health, actively involving multiple health sectors and facilities (Yeung & Selep, 2016). Despite several years of implementation, limited systematic evaluation exists regarding EDEN's effectiveness and its impact on community health and behavior.

PNG continues to face persistent health challenges, including preventable diseases, poor infrastructure, and limited human resources (Asian Development Bank (ADB), 2020; Brown & Gilbert, 2014). While programs such as EDEN have been implemented to address these issues, there is insufficient evidence on their effectiveness in improving community health outcomes and behavioral change. Without systematic evaluation, policymakers and health managers lack the data needed to guide resource allocation and strengthen community-based health strategies. Evaluating the EDEN program provides an opportunity to understand how community-driven interventions can address health gaps in rural PNG. By examining both quantitative and qualitative outcomes, this study contributes evidence on the role of environmental reorganization, behavioral transformation, and participatory development in improving health and well-being.

This study is significant because it highlights the potential of community-led health promotion programs to deliver measurable improvements in underserved settings with minimal resources (Arxer, 2025; Simpson et al., 2025). Findings will inform health managers, policymakers, and development partners on strategies to integrate EDEN into primary healthcare services and embed it within national and subnational development plans. The results also provide insights into how community empowerment can foster resilience, cohesion, and sustainable behavioral change. The objective of this cross-sectional study is to assess the impact of the EDEN program on community health and behavior in Yawar, Madang Province. Specifically, the study examines outcomes related to environmental order, disease prevention, behavioral transformation, and social organization, with the aim of generating evidence to strengthen community health initiatives and inform policy development.

## METHODS

### Study Design, Population, and Setting

This cross-sectional study was conducted among community members in Yawar, Madang Province, Papua New Guinea, over a six-month period from June to December 2025. The sample size was calculated using a standard formula for cross-sectional studies, with a 95% confidence level and a 5% margin of error (Imam et al., 2019; Trajman et al., 2019).

A total of 116 participants were recruited through non-probability convenience sampling. This approach was selected due to logistical constraints, limited capacity, and the need to ensure adequate representation of community members actively engaged in the EDEN program. While convenience sampling limits generalizability, it is appropriate for program evaluation as it prioritizes internal validity and provides rapid feedback on outcomes among current participants. Participants included a diverse range of community members: leaders (male and female), youth, women, health workers, and individuals who had attended EDEN program training sessions. Inclusion criteria required participants to be aged 18 years or older, residents of Yawar with direct exposure to the health promotion intervention, and willing to provide informed consent.

The study was conducted in the Yawar community, located within Rai Coast District, Madang Province, Papua New Guinea. Rai Coast is one of six districts in Madang Province, situated along the northern mainland coast and characterized by its mountainous terrain (Yati & Bazakie, 2006). Yawar is a rural, underserved village

approximately a 60-minute drive from Madang's provincial capital. The community was deliberately selected because the EDEN program was launched there in mid-2024. Around 20 community members participated in two weeks of EDEN training, which was introduced to address socio-cultural and health challenges, particularly those affecting children and women.

### Data Collection and analysis

Data collection was structured across several domains to comprehensively assess the effectiveness of the EDEN program. The first domain captured demographic and socioeconomic characteristics, including age, gender, occupation, educational level, and area of residence. The second domain focused on program-specific outcomes, such as knowledge and awareness of EDEN, community disease risk preparedness, disease patterns, and levels of participation. Data collection took place in December 2025 and was carried out by an experienced research team with expertise in mixed-methods evaluation, qualitative research, and health promotion programs.

Data collected through structured survey questionnaires were analyzed using IBM SPSS Statistics (version 29; Armonk, NY, USA) (Dabas, 2024). Non-respondents were excluded, yielding a final sample size of N=116. Frequency distributions were generated for socio-demographic variables (age, gender, ethnicity, and residence) and professional categories (health workers, youths, women representatives, and community leaders).

Descriptive statistics were used to summarize the dataset (Dabas, 2024). For continuous variables, measures such as mean (M), standard deviation (SD), and range (minimum–maximum) were calculated. Key variables included knowledge of the program, disease risk preparedness, perceived changes in disease patterns, and community participation. Categorical variables were described using frequencies and percentages.

## RESULTS

### Participants Demographics

Table 1 summarizes the demographic profile of the study participants (n = 116). The mean age was 42.3 years (SD = 10.1), reflecting a moderately dispersed, middle-aged cohort. The sample included community leaders (n = 55), women's representatives (n = 44), and others such as youth and permanent residents (n=17). Most participants reported primary-level education. All were members of the Yawar community in the Rai Coast District.

This composition closely mirrors the qualitative sample, where youth, women's representatives, and permanent residents were most frequently represented, thereby enhancing internal validity. The predominance of adult community decision-makers strengthens the credibility of findings related to sustainability, behavior change, governance, and accountability. Moreover, the high proportion of female participants aligns with qualitative evidence highlighting women's leadership roles within EDEN, reinforcing the consistency of results across methods.

**Table 1** Research participants' socio-demographic details (n=116)

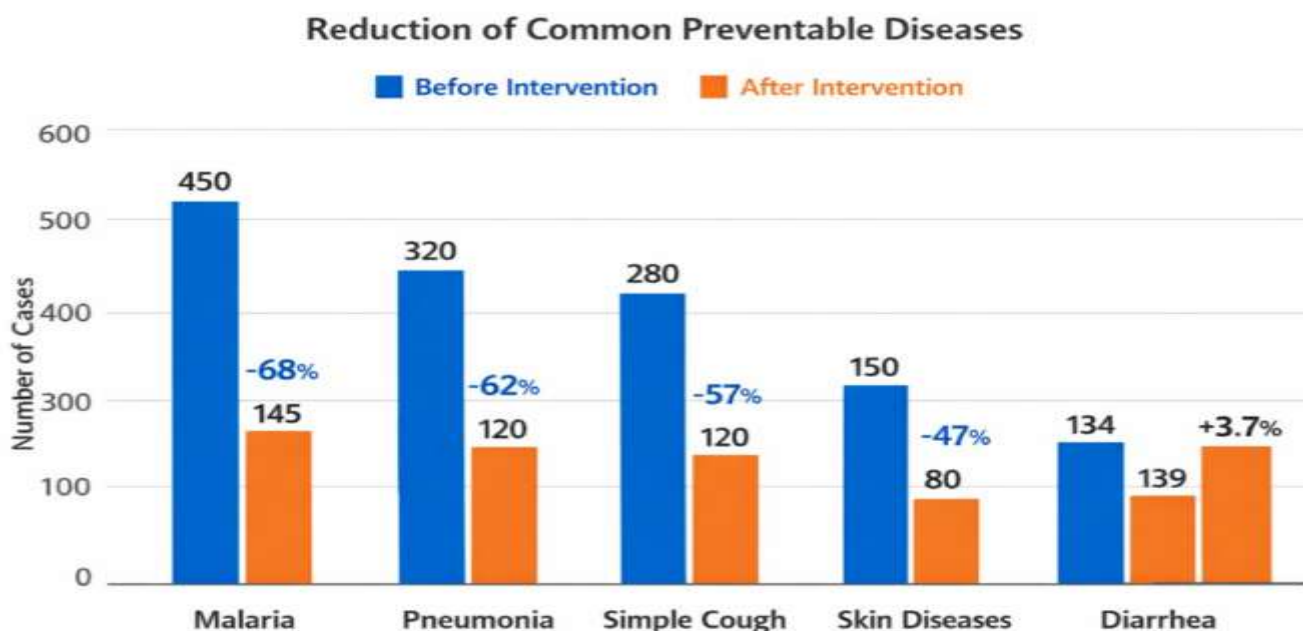
| Variable        | Category             | Frequency | Percentage |
|-----------------|----------------------|-----------|------------|
| Age group       | Youth (18–25 years)  | 17        | 15%        |
|                 | Adults (26–35 years) | 15        | 13%        |
|                 | Adults (36–45 years) | 20        | 17%        |
|                 | Adults (46–55 years) | 44        | 38%        |
|                 | Adults (56+ years)   | 20        | 17%        |
| Gender          | Male                 | 50        | 43%        |
|                 | Female               | 66        | 57%        |
| Marital status  | Single               | 17        | 15%        |
|                 | Married              | 95        | 82%        |
|                 | Widowed/Divorced     | 4         | 3%         |
| Education level | Primary              | 95        | 82%        |

|                |                          |    |     |
|----------------|--------------------------|----|-----|
|                | Secondary                | 21 | 18% |
| Community role | Village/community leader | 55 | 47% |
|                | Women representative     | 44 | 38% |
|                | Youth representative     | 17 | 15% |

## Reduction of Common Preventable Diseases

Figure 1 presents changes in reported cases of common preventable diseases before and after program implementation. Overall infection rates declined by 41%, dropping from 1,034 to 610 cases. Specific conditions showed substantial reductions: malaria decreased by 68%, pneumonia by 62%, and simple cough by 57%. These reductions indicate strong program effectiveness in addressing vector-borne and respiratory infections. Descriptive statistics further highlight the impact. The mean reduction across these three major conditions was 62.3% (SD = 5.5), suggesting consistently high effectiveness across disease categories. Skin disease prevalence also declined, supporting the inference that improved access to water and hygiene contributed to better outcomes.

However, not all indicators improved. Diarrhea cases increased slightly by 3.7%, pointing to gaps in water safety, sanitation, and nutrition interventions. Malnutrition rates remained unchanged, underscoring the need for longer-term, sustained efforts in nutrition programming. Taken together, these descriptive findings demonstrate EDEN's significant impact on reducing infection burdens, while also identifying critical areas—particularly diarrhea and malnutrition—where program reinforcement is required. Strengthening initiatives in water safety, sanitation, and nutrition will be essential to achieving broader and more sustainable health improvements.



**Figure 1.** Reduction of common preventable diseases before and after EDEN program implementation.

## Community Awareness and Understanding of the EDEN Program

Quantitative results indicate that the majority of participants demonstrated a strong understanding of the EDEN program. Approximately 64% (n=74/116) reported adequate awareness and understanding, while 21% (n=24/116) described themselves as somewhat familiar. The mean awareness score was  $2.48 \pm 0.75$  (SD), indicating a generally high level of perceived understanding of the program, with moderate variability among respondents. A smaller proportion (16%) reported being unaware of the program, highlighting uneven information dissemination within the community and the need for targeted outreach to improve coverage.

A chi-square test of independence was conducted to examine whether gender was associated with awareness of the EDEN program. The analysis revealed no significant relationship,  $\chi^2(2, N = 116) = 0.55, p = 0.76$ . This finding suggests that both male and female participants exhibited comparable levels of awareness and understanding, indicating that EDEN's outreach and training activities effectively reached the broader community regardless of gender. Overall, these descriptive and inferential results demonstrate that the EDEN program has achieved substantial community penetration and comprehension. Continued emphasis on targeted communication strategies and inclusive outreach will help ensure equitable awareness across all demographic groups.

### Reduction in Vector Control and Disease Prevention Impact in the Community

Table 2 summarizes the respondents' perceptions of disease reduction. Quantitative results indicate a strong perceived impact of the EDEN program on disease prevention and vector control. A large majority of respondents—79% ( $n=92/116$ )—strongly agreed that diseases such as malaria, diarrhea, and skin infections had decreased significantly since the program's introduction. An additional 16% ( $n=18/116$ ) agreed, while only 5% ( $n=6/116$ ) expressed uncertainty.

The mean score for perceived disease reduction was  $2.67 \pm 0.60$  (SD), representing the highest mean and lowest variability among all program outcome measures. This suggests a consistently strong and immediate perceived effect of EDEN's interventions across the community. The narrow standard deviation indicates that participants' views were relatively homogeneous, reinforcing the reliability of the program's perceived success in reducing common preventable diseases. Overall, these descriptive findings demonstrate that EDEN's integrated approach to vector control and disease prevention has achieved widespread community recognition and measurable impact. Continued reinforcement of community-based health education and environmental management practices will help sustain these positive outcomes.

**Table 2.** Community Perceptions of Disease Reduction Following EDEN Program Implementation

| Response Category | Frequency (n) | Percentage (%) |
|-------------------|---------------|----------------|
| Strongly Agree    | 92            | 79%            |
| Agree             | 18            | 16%            |
| Unsure            | 6             | 5%             |

### Social Reorganization and Long-Term Behavioral Impact

Quantitative findings reveal that the EDEN program has contributed to sustained behavioral change within the community. A majority of respondents—62% ( $n=72/116$ )—agreed that long-term behavioral change had occurred, while 38% ( $n=44/116$ ) strongly agreed. No respondents reported disagreement, underscoring broad consensus on the program's influence.

The mean score for long-term behavioral change was  $2.60 \pm 0.64$  (SD). While this reflects a generally positive perception, the slightly higher variability compared to other program outcomes suggests differences in how quickly or deeply subgroups are adopting behavioral changes. In public health evaluation, such variability is expected, as sustained behavioral change often requires prolonged exposure to interventions and supportive community systems. These results highlight EDEN's effectiveness in fostering social reorganization and long-term behavioral change. However, they also emphasize the importance of reinforcing community support structures and continuous engagement strategies to ensure that behavioral improvements are maintained and scaled across all demographic groups.

**Table 3.** Distribution of community responses on long-term behavioral change and social reorganization following EDEN program implementation.

| Response Category | Frequency (n) | Percentage (%) |
|-------------------|---------------|----------------|
| Agree             | 72            | 62%            |
| Strongly Agree    | 44            | 38%            |
| Disagree/Unsure   | 0             | 0%             |

### Challenges and Gaps in EDEN Implementation

Quantitative findings highlight several barriers to the effective implementation of the EDEN program. The majority of respondents—62% (n=72/116)—identified a shortage of health workers and limited community training as the most critical challenge. A smaller proportion, 12% (n=14/116), reported that inadequate rural infrastructure (e.g., roads and transportation access) remained a barrier, though most participants did not perceive it as a major concern.

Qualitative data corroborated these findings, with participants repeatedly emphasizing the need for government recognition and investment to improve roads, bridges, and other infrastructure to ensure long-term sustainability. Although these themes were derived from open-ended responses, their frequency was summarized using descriptive statistics ( $M = 38.67$ ,  $SD = 29.95$ ) to illustrate variability in perceptions of key barriers. The relatively large standard deviation relative to the mean indicates high variability in participants' views, suggesting heterogeneous insights and differing levels of understanding across the community. While the moderate mean score reflects recognition of challenges, the wide dispersion underscores the complexity of barriers to EDEN's implementation and the need for multi-sectoral collaboration, capacity building, and government investment to address these gaps effectively.

## DISCUSSION OF FINDINGS

### Summary of key findings

This cross-sectional study evaluated the implementation and outcomes of the EDEN program in the Yawar community of Madang Province, Papua New Guinea. The analysis spanned multiple domains, including the community environment, public health, behavioral change, and levels of participation. The findings demonstrate that EDEN has contributed to meaningful and sustained community-level transformation, particularly in reducing preventable diseases, strengthening community awareness, and fostering long-term behavioural change.

The evidence underscores the program's capacity to promote health system strengthening, enhance community resilience, and support social reorganization. These outcomes align with broader public health literature (Aslam & Eggum, 2024; World Health Organization., 2022), which emphasizes that community-driven interventions combining environmental management, health education, and participatory governance are more likely to achieve sustainable impact. At the same time, the study highlights persistent challenges—such as shortages of health workers, gaps in infrastructure, and uneven information dissemination—that must be addressed to ensure long-term sustainability.

By situating EDEN's results within the wider context of community-based health interventions, this evaluation provides evidence that integrated, locally tailored programs can deliver measurable improvements in health outcomes and community participation. However, the variability observed in behavioural change and perceptions of program challenges suggests that continued investment in capacity building, inclusive outreach, and government support will be critical to sustaining and scaling EDEN's achievements.

### Environmental Order and Community Wellbeing

The EDEN program contributed to notable improvements in environmental order and overall community wellbeing. Evidence from both quantitative and qualitative data indicates that the program significantly enhanced ecological quality and the physical layout of the Yawar community. Interventions such as the establishment of

defined family boundaries, planting flower beds, and creating structured pathways transformed a previously disorganized living space into a more orderly and aesthetically cohesive environment.

Beyond physical enhancement, these changes acted as catalysts for social cohesion and community infrastructure, reinforcing shared values of respect, ownership, and responsibility. This finding aligns with broader research on community development and public health interventions, which demonstrate that visible environmental improvements can drive macro-level social and behavioural transformation (Gizaw et al., 2022; Haldane et al., 2019). Consistent with White's (2013) recommendation to adopt a rural health framework to strengthen service delivery, our findings suggest that rural communities exposed to structured environmental interventions are likely to experience long-term improvements in behaviour, wellbeing, and organized community structure. These results underscore the importance of embedding EDEN within national health plans, primary health care strategies, and development policies to ensure sustainability and scalability across similar rural contexts.

### **Health Outcomes and Disease Prevention**

Analysis of pre- and post-EDEN evidence revealed a marked perceived reduction in malaria, pneumonia, and skin diseases (Figure 1), with malaria showing the most consistent improvement across both quantitative and qualitative strands. Participants attributed these reductions to improved sanitation, waste management, fewer mosquito breeding sites, and enhanced hygiene practices. This aligns with Putri & Asriwati (2025), who emphasized that access to adequate sanitation and hygiene facilities is closely associated with reductions in waterborne diseases and malaria.

Although the reported changes in health outcomes have not been clinically confirmed, the consistency of responses across methods provides strong evidence that the EDEN program has positively influenced the social determinants of health and overall community wellbeing. These findings corroborate existing literature on community health interventions, which highlight environmental and sanitation management as effective strategies for preventing communicable diseases in low-resource contexts (Bose et al., 2024; Charles-Rodriguez et al., 2023; Malusha, 2023; Mishra et al., 2022). Importantly, health promotion programs such as EDEN require strategic support and tailored information that reflect local community needs, alongside sustained community participation (Mishra et al., 2022; Zahnow, 2024). Embedding EDEN within broader rural health strategies and ensuring long-term investment will be critical to consolidating these gains and achieving sustainable improvements in disease prevention and health outcomes.

### **Behaviour Transformation and Social Organization**

The EDEN program had a significant impact on individual and collective behaviour, particularly by fostering respect among families and reducing undesirable conduct. Qualitative interview data revealed that interventions such as the establishment of physical boundaries (e.g., flower beds and structured pathways) promoted desirable behaviour and discouraged intoxicated individuals from trespassing or causing disruption. These findings illustrate how well-designed community and environmental settings can shape behaviour and reinforce social norms.

Quantitative data further support this conclusion, with a mean score of  $2.60 \pm 0.64$  (SD) indicating generally positive perceptions but slightly greater variability compared to other outcomes. This variability suggests that while behavioural transformation is evident, sustained change requires stronger institutional support and longer-term exposure to EDEN interventions. Importantly, the data demonstrate that social infrastructure—such as green spaces, communal pathways, and recreational areas—can influence attitudes and behaviours without reliance on formal government laws or regulations.

Consistent with public health research on social cohesion and community belonging (Chuang et al., 2013; Zahnow, 2024), our findings suggest that infrastructure promoting communal gatherings (e.g., shops, cafes, recreational spaces) fosters a sense of belonging, strengthens relationships, and enhances quality of life. The program's success in engaging youth also highlights the importance of community-led development platforms

in addressing unemployment and social disorder. Policies targeting youth should therefore prioritize models that promote responsibility, inclusiveness, and discipline.

Supporting evidence from Zahnnow (2024) and Charles-Rodriguez et al., (2023) emphasizes that adequate recreational spaces can shape social norms, encourage appropriate behaviour, and strengthen social bonds. Conversely, studies documenting the erosion of acceptable behaviour and social standards (Tomaszewski, 2018; Yamin et al., 2019) warn that weakening shared societal beliefs undermines compliance with social norms, leading to poor cohesion, increased violence, and disrespect within communities. The macro-level implication of these findings is clear: the erosion of unwritten social regulations gradually diminishes shared behavioural standards, thereby fostering antisocial behaviour.

### **Policy and Practice Implications**

The findings from this descriptive cross-sectional study highlight the potential of community-driven initiatives, such as the EDEN program, to improve health outcomes and social cohesion in resource-constrained rural settings. From a policy perspective, integrating EDEN into Papua New Guinea's primary healthcare framework would offer a scalable model for addressing persistent challenges, including high maternal mortality, the infectious disease burden, and shortages of health personnel. Embedding EDEN within national development plans could ensure that environmental reorganization, behavioral change, and participatory development are systematically supported and sustained. Government recognition and long-term investment are critical to institutionalizing these gains, particularly through workforce expansion, rural infrastructure development, and continuous community training.

From a practice perspective, the program demonstrates that simple, community-led interventions—such as structured pathways, sanitation practices, and family boundary organisation—can yield measurable improvements in public health and social order. Health managers and practitioners should prioritise participatory approaches that empower communities to take ownership of their health environments. The variability observed in behavioural transformation underscores the importance of sustained exposure and reinforcement through ongoing health education, supervision, and integration with formal health services. Strengthening partnerships between local communities, provincial health authorities, and non-governmental organisations will be essential to scaling EDEN's impact and adapting it to diverse rural contexts.

In summary, the EDEN program offers a replicable model for improving rural health that bridges gaps between community action and formal health systems. Its success in Yawar suggests that similar participatory frameworks could be applied across Papua New Guinea and other underserved regions worldwide, provided policy support and institutional resources are mobilized to sustain behavioral change and infrastructure development.

### **Research strengths and Limitations**

#### **Strengths**

This study demonstrates several notable strengths, particularly in its clear focus on evaluating a community-driven health intervention in a rural, resource-constrained setting. The mixed-methods approach, combining quantitative survey data with qualitative insights, enhances the depth and credibility of the findings. The use of multiple outcome domains—environmental, behavioural, public health, and participation—offers a comprehensive assessment of the program impact. Additionally, the study provides well-structured statistical analysis with descriptive measures that support the interpretation. The inclusion of diverse community participants strengthens internal validity, while the contextual grounding in Papua New Guinea's health challenges increases the relevance and applicability of findings.

#### **Weaknesses**

Despite its contributions, the study has several limitations that undermine the robustness of its conclusions. The use of nonprobability convenience sampling reduces generalizability and may introduce selection bias. The

cross-sectional design limits the ability to establish causality or assess the long-term sustainability of outcomes. Reliance on self-reported and perceived health improvements, without clinical validation, may introduce reporting bias. Furthermore, the absence of a control or comparison group makes it difficult to attribute changes solely to the EDEN program. Some inconsistencies in data interpretation, such as increased diarrhea rates, remain underexplored, and variability in responses suggests uneven program exposure.

Future research should adopt a longitudinal or quasi-experimental design to better establish causal relationships and assess sustainability over time. Incorporating control communities would strengthen comparative analysis and program attribution. The study would benefit from integrating objective health indicators, such as clinical records or surveillance data, to validate perceived outcomes. Expanding the sample size and using probability sampling methods could improve generalizability. Additionally, a deeper analysis of unchanged or worsening indicators, such as malnutrition and diarrhea, is recommended.

## CONCLUSIONS

This cross-sectional evaluation provides deeper insights into the role of community health programs, such as EDEN, in enhancing quality of life, public health, well-being, and community cohesion. Evidence from both quantitative and qualitative strands reinforces the program's effectiveness and demonstrates that community-driven health promotion initiatives can deliver meaningful outcomes in socially and economically underserved settings, even with minimal resources.

The findings highlight the importance of integrating EDEN into primary healthcare services and embedding it within national and subnational development plans. Greater government recognition and sustained support are essential to ensure long-term program sustainability, foster behavioral change, and strengthen community resilience. By scaling and institutionalizing EDEN, health managers and policymakers can advance equitable health outcomes and reinforce the social fabric of rural communities.

### Ethical considerations

**Ethical Approval:** This study was approved by the Faculty of Medicine and Health Sciences Research Committee at Divine Word University (approval number FRC/MHS/224-25). Local research protocols were followed, and participants' confidentiality was ensured. Participants were informed that their participation was voluntary and that they could withdraw from the study or decline to answer any questions without any negative consequences.

**Conflict of Interest:** The authors have no conflict of interest to declare.

**Availability of data and materials:** The datasets used and/or analyzed in the current study are available from the corresponding author upon reasonable request.

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