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Designing and evaluating training for female community health volunteers to promote physical activity in semi-urban Nepal: a co-designed approach

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Abstract

Background Physical inactivity is a growing concern in Nepal, contributing to the emerging burden of non-communicable diseases (NCDs). Community-based interventions led by Female Community Health Volunteers (FCHVs) hold the potential to promote physical activity (PA) effectively. This study reports on the development of educational materials, training procedures, and the outcome of the training on FCHVs' knowledge and awareness about PA and its relationship with NCDs, as well as their feedback on training and intervention implementation.

Methods This study is part of a community-based trial promoting PA. This paper reports on the development process, training, and evaluation of the intervention. A co-design approach was employed for active participation of end-users in developing educational materials and training programs for FCHVs in Pokhara, Nepal. Fourteen FCHVs participated in a three-day, five-hour interactive training program, which offered workshops, role-play, followed by supervised practice sessions, using a co-designed pictorial flip chart, brochure, manual, and session register. Pre- and post-training tests measured changes in PA-related knowledge, and qualitative data from interviews and focus group discussions captured feedback on training and implementation.

Results We developed pictorial flip charts as the main educational material, followed by a brochure and program implementation guideline for FCHVs. The training significantly improved FCHVs' knowledge of PA, its health benefits, and their confidence to do home visits. Knowledge of PA benefits rose from 14.3% (95% CI 1.85% – 42.8%) to 64.3% (95% CI 35.1% – 87.2%) ($p = 0.039$). Knowledge of health effects associated with physical inactivity increased from 21.4% (95% CI 4.7% – 50.8%) to 85.7% (95% CI 57.2% – 98.2%) ($p = 0.004$). In terms of program implementation, FCHVs reported that pictorial flip charts were an effective tool for educating community people. However, meeting people and their expectations for medical services was a challenge.

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Conclusion The study demonstrates that well-structured training and locally relevant educational materials can be co-designed, engaging end-users to enhance the capacity of FCHVs to promote PA in the community. These findings may guide future community-based PA promotion initiatives in similar low- and middle-income settings.

Keywords Physical activity, Female community health volunteers, Community-based intervention, Training, Nepal, Non-communicable diseases

Text box 1. Contribution to the literature

- This research highlights the need for a low-cost and culturally acceptable physical activity promotion programme tailored to the Nepalese and similar communities in LMICs.
- This study outlines how the development of physical activity interventions engages both end users and experts. This collaboration ensures the interventions are scientifically sound and locally acceptable, making them replicable for future physical activity promotion efforts in similar contexts.
- We engaged female community health volunteers and shared their experiences, which could inform future task shifting to promote physical activity and reduce the burden of NCDs in Nepal and similar contexts.
- This study demonstrated that co-designed educational training using contextually tailored materials can enhance FCHVs' knowledge and confidence in promoting community-based physical activity.

Background

Globally, 31.3% of adults have insufficient physical activity, below WHO-recommended 150 min of at least moderate intensity physical activity (PA) per week [1, 2]. Meeting these recommendations is associated with a lower risk of all-cause mortality [3–5]. It reduces the risk of chronic conditions such as cardiovascular disease, diabetes, obesity, and certain cancers [6–8] and supports better sleep, emotional well-being, and quality of life [9, 10]. Lack of sufficient PA increases the risk of serious health issues like heart disease, diabetes, stroke and cancer, resulting in 0.83 million global deaths [11]. The burden of insufficient PA in South Asia is 45.4%, which is expected to reach up to 54.7% in 2030 [2]. In low- and middle-income countries (LMICs) like Nepal, this challenge is exacerbated by rapid urbanisation, changes in occupational structure, and limited access to recreational areas [12, 13]. National data show that approximately 7.4% of the population engages in insufficient PA, which is as high as 43% in semi-urban areas in Nepal [14, 15]. PA is primarily focused on occupational activities; however, leisure-time PA is crucial for health benefits [14, 16]. Those who participated in more leisure-time PA not only lived longer but also enjoyed better health, experiencing greater happiness, increased energy, and reduced stress [17, 18]. Despite the health benefits of PA, its promotion is not given enough attention in Nepal. Insufficient PA is prevalent among people living in semi-urban areas of Nepal, influenced by rapid urbanisation and changing lifestyles [19, 20]. There is a need for suitable programs that promote PA in the community using existing health resources [21–23].

Community-based programs led by community health workers (CHW) are also one of the culturally appropriate PA promotion strategies [24]. These programs help communities take ownership, making them easier to implement and sustain [25, 26]. Community health workers have successfully promoted lifestyle changes and PA in LMICs, with evidence from Bangladesh, CHW-led education lowered blood pressure in hypertensive patients over two years; and in Brazil, such programs increased physical activity among older adults [27, 28]. Broadly, CHW-led NCD programs increase PA when they are properly trained and supervised [29]. In Nepal, Female Community Health Volunteers (FCHVs) are trusted community members who effectively deliver NCD management programs [30–33]. Their ties to households enable them to effectively promote PA in the community by improving knowledge and motivation [34–36]. However, structured training and contextually relevant educational resources to enable FCHVs to address PA promotion, are lacking.

One approach to creating such solutions is co-design, which is a method that involves working closely with local people and health workers [37]. Various forms of co-design have been widely used in health interventions to ensure that programs are contextual and well-accepted by the community [38, 39]. This approach improves the practicality, cultural appropriateness, and effectiveness of health interventions [40, 41]. In Nepal and other LMICs, PA is often limited by low awareness, limited motivation, and a lack of supportive environments [34, 36, 42]. PA interventions based on Theory of Planned Behaviour (TPB) can enhance their effectiveness in LMIC settings where knowledge, motivation and social norms strongly influence PA practices [35, 43–46]. This theory emphasize the role of attitudes, subjective norms, and perceived behavioural control in shaping intentions and behaviours, strengthening attitudes, norms, and confidence [43]. Our study uses this framework combined with co-designing to address community barriers and promote sustainable PA.

This article presents the co-design and evaluation of a context-specific PA promotion program delivered by trained FCHVs in semi-urban Nepal. The goals are to understand the perspectives and preferences of the people, develop a community-based intervention, train

volunteers to carry out the intervention, and explore FCHVs' perspectives on training and its implementation. The findings will provide useful information for future PA promotion efforts in similar low- and middle-income countries.

Methods

Study design, setting and data collection

This study was a mixed-methods implementation study that used a co-design approach to develop a community-based PA intervention and evaluate the outcomes of training FCHVs. Quantitative pre-post assessments measured changes in knowledge, while qualitative interviews and focus group discussions (FGD) explored their confidence, challenges, and experiences during programme implementation. This study is part of an ongoing community-based PA promotion trial in the semi-urban areas of Pokhara Metropolitan city (previously Lekhnath Municipality) in Gandaki Province, Nepal, which aims to test the effectiveness of community-based education intervention provided by FCHVs on PA-related knowledge and behaviour. This municipality has 15 wards (clusters), a population of 64,118 in 24,883 households, an 88.1% literacy rate, a life expectancy of 59.7 years, and a sex ratio of 84 males per 100 females [47]. There are 133 FCHVs providing services under health facilities located in the study area, whereas 58 of them are working in the intervention area. They are trained for community-based maternal and child health promotion and normally serve 500 people per FCHV [48]. Their work is not salaried and fully voluntary; however, each FCHV engaged in this program was provided with US $5 per day from the study team as travel compensation.

FCHVs' PA knowledge was tested before and after training, and feedback on the training and intervention implementation was collected using interviews and FGDs. We used purposive sampling, specifically criterion-based selection, recruiting 14 FCHVs who lived and worked in the research area to make the intervention delivery feasible. Our sample size was determined pragmatically, guided by what was feasible for implementation rather than by formal power calculations. We recruited enough FCHVs to enable them to deliver the intervention across the selected clusters effectively. Depending on the number of households to be visited and the geographic coverage required, 1–4 FCHVs were recruited for each cluster. The criteria used for FCHVs' selection were (i) resided and served in the study clusters, (ii) were available for a 3-day training and subsequent home visits/education sessions, and (iii) provided informed consent. The selection process was supported by local health facility staff in the study area, who provided a list of FCHVs working in each cluster, their contact details, and their ability to conduct home visits and deliver education sessions.

Data were collected by Principal Investigator (PI) and research assistants using a semi-structured questionnaire and FGD guidelines. The evaluation form was developed by the study team and underwent expert review by three field specialists (public health, health education, and qualitative methods). Experts rated each item for relevance, clarity, and feasibility for FCHV's use, and recommended revisions (simplified wording, alignment of response options, and improved layout). The form was translated into Nepali using forward translation and team reconciliation to ensure plain-language phrasing appropriate for community delivery. We then piloted the form in a comparable ward not included in the study, using brief cognitive debriefing and timed administration to check comprehension and completion time. Minor edits were made before data collection.

Intervention co-designing

This study used a co-designed approach to develop a community-based PA intervention by actively involving end users throughout various stages of its development. To guide the creation of intervention materials, we followed the P-Process, a strategic framework for planning evidence-based health communication programs. This widely used tool has been instrumental in designing effective health communication strategies across the globe [49]. Intervention designing process is illustrated in Fig. 1.

Step 1. Enquire

We conducted a baseline survey among adults living in the study area to gain knowledge about sociodemographic factors, PA environment, and people's attitudes about PA. We performed two FGDs with end users, adults living in the study area for whom the intervention is being developed, to learn about their knowledge and perspectives on PA. Each FGD consisted of seven participants with a 3:4 male-female ratio, comprising 4 general adults, 2 FCHVs and one health worker. Two qualified field researchers were facilitating the sessions, one taking the notes and another asking the questions. Each member of the FGD was requested to participate actively in the discussion. The session was recorded on a recorder, and note-taking was also done. Verbatim was transcribed, translated, and thematic analysis was done to obtain end users' perspectives on PA, barriers, and facilitators, as well as their preferences for PA programs. We also did a literature review to learn about different interventions used for PA promotion.

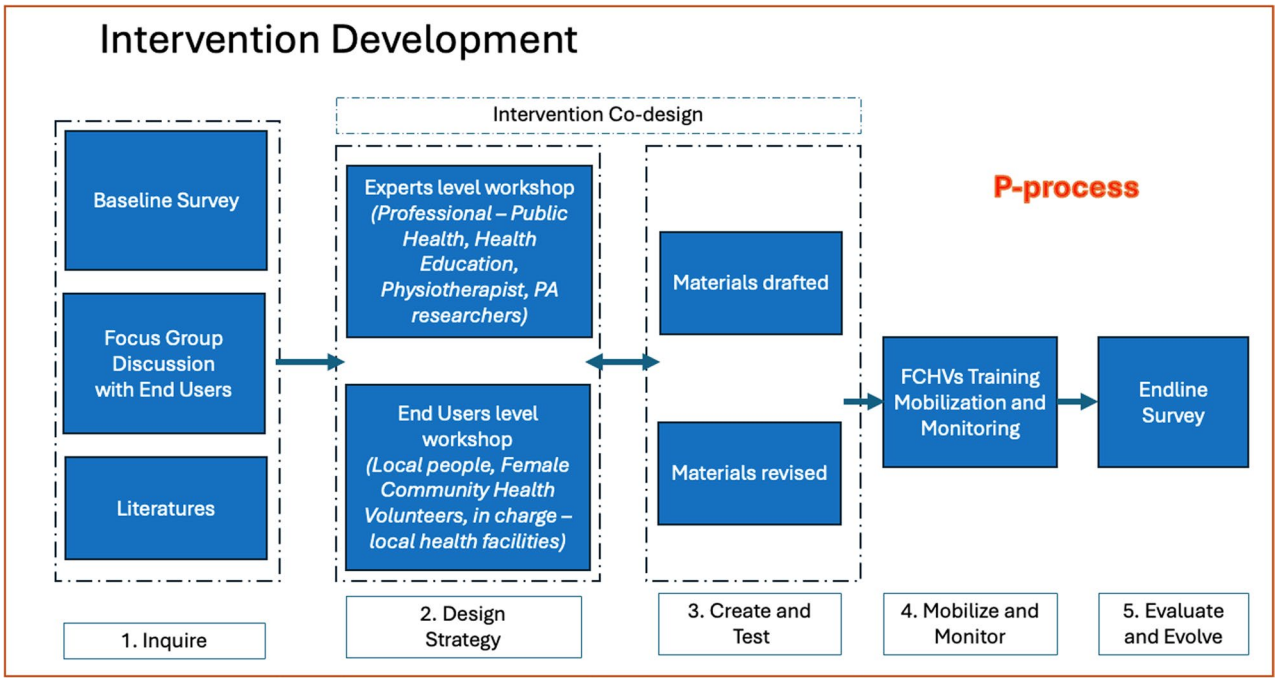

Fig. 1 Steps in intervention development process for community-based PA promotion in Nepal*. * This study was carried out during April-December 2024

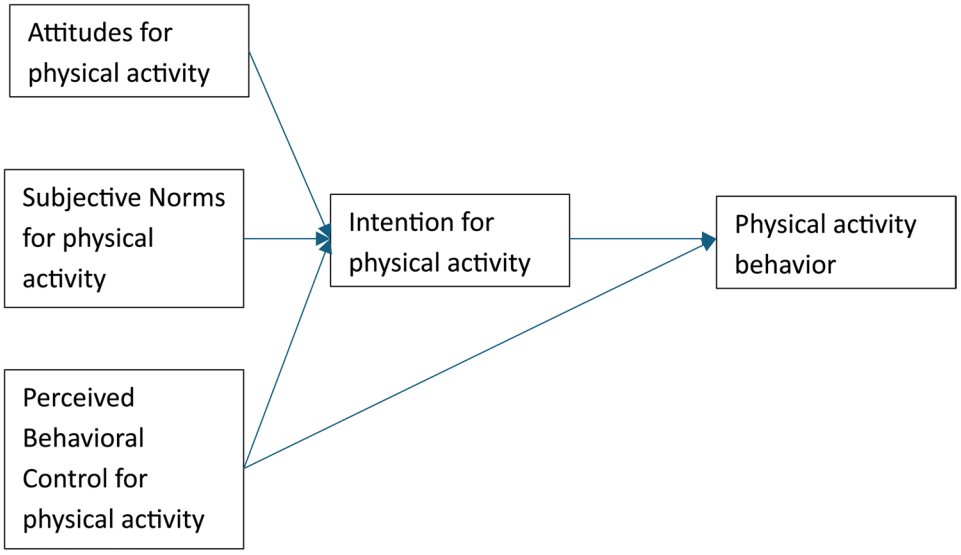

Fig. 2 Conceptual framework based on TPB guiding the community-based PA intervention in Pokhara, Nepal*. * This study was carried out during April-December 2024

Step 2. Design strategy

We used the information gathered through baseline findings, FGD results, and available literature in Step 1 to draft the intervention strategy and contents. Additionally, materials from other community-based management of non-communicable disease in Nepal (COBIN) interventions led by FCHVs were adapted [31].

We employed TPB as a theoretical framework, which is beneficial in behaviour modification interventions [43]. As stated by the theory, the intervention aimed to increase participants' attitudes, subjective norms, perceived behavioural control, and intention to engage in PA, to promote PA. These constructs act as key determinants of health behaviour, including participation in PA [50–53]. The theoretical framework for this study, based on TPB, is illustrated in Fig. 2.

Step 3. Create and test

We organised two workshops, one with experts and another with end users, to formulate strategies and develop interventions. An expert-level workshop was conducted in Kathmandu, comprising subject experts, including one public health expert, two health promotion and education experts, and three community physiotherapists, to design the intervention strategy and contents. The end-user level workshop was conducted in Pokhara, which comprises five community members, two FCHVs and two health workers working in the study area. The details of the workshops are as follows:

Expert-level workshop

One one-day expert-level workshop was conducted in Kathmandu. The workshop was facilitated by PI (RS). The objectives, target group, study area and other relevant findings from the baseline study and FGD were shared with the participants a week before the workshop and presented at the beginning of the workshop. During the workshop, the facilitator distributed the draft materials to participants to start the discussion. The draft materials consist of initial work for community-based PA promotion based on literature review, theoretical framework, and previous material developed for FCHVs for NCD management in Nepal [31, 35, 43, 54]. The draft work consists of initial outlines, messages, relevant pictures, instructions and guidelines for FCHVs for program implementations. Participants discussed methods and media, and content for community-based PA promotion. The discussion on content was done in terms of correctness, understanding, acceptability and contextual as well as layout in terms of clarity, attractiveness, and readability.

End-user level workshop

One one-day end-user level workshop was conducted in Pokhara. This workshop was facilitated by PI (RS). At the beginning, the objectives, socio-demographic characteristics and PA-related findings, findings of FGDs, and draft materials refined after the expert-level workshop were shared with the participants to further contextualise the draft materials to the local context and make them more acceptable to the local context. The participants were divided into two groups of 5 participants, each of which discussed the entire draft during the first half of the workshop. During the second half of the workshop, each participant provided their understanding of the draft materials and their contents and provided their suggestions on methods and media of health education. They helped to change a few words to locally used and understandable words.

Another essential component of the intervention was the capacity building of FCHVs, who would deliver the intervention to the participants. It contained a three-day intensive training program for FCHVs, with each session lasting five hours per day, focusing on PA, non-communicable diseases (NCDs), their risk factors, the health impacts of insufficient PA, the benefits of regular PA, and effective strategies for engaging community members. The training incorporated interactive workshops, role-playing exercises, and hands-on practical sessions to ensure FCHVs acquired the necessary skills and knowledge. The training team included PI (RS), a general physician, and a local public health professional with experience in community-based NCD training and supervision. FCHVs also received hands-on practice conducting home visits in the vicinity of the training area before being deployed to the intervention sites. (See Supplementary file 1 for Training details).

Step 4. Mobilise and monitor

The intervention was implemented through home visits performed by trained FCHVs after receiving a three-day interactive training on community-based PA promotion. Households were selected randomly from the intervention group. Besides the main participant, all available family members were requested to attend the education session. Field supervision of the home visits was conducted by PI (RS) to ensure the fidelity of the intervention.

Step 5. Evaluation

Evaluations were conducted using both quantitative and qualitative methods. Trained research assistants conducted pre- and post-training interviews with FCHVs using a semi-structured questionnaire, informed by existing literature, to assess their change in knowledge and skills. Additionally, post-training interviews were also conducted with FCHVs to gather their feedback on the training methods and content. To further understand their experiences and perspectives on program implementation, an FGD was conducted by research assistants at the end of the intervention implementation with all 14 FCHVs engaged, exploring in-depth insights and feedback on the overall process. These interviews were conducted face-to-face and lasted for about 45 min. This qualitative feedback from FCHVs provides valuable insights into their experiences, challenges, and observations while implementing a PA intervention through home visits.

Analysis

Quantitative findings were analysed using descriptive statistics, with results presented as mean (standard deviation) and percentages to measure changes in knowledge and skills among FCHVs before and after training. McNemar test was applied to find out the change in

participants' responses in pre- and post-test. All statistical tests were two-sided, with a significance threshold of $p < 0.05$. Given the small sample size ($n = 14$), multivariable adjustment for sociodemographic covariates such as age, education, or years of experience was not feasible, and results should be interpreted as descriptive of the training group rather than adjusted causal estimates. Data analysis was conducted using the R program.

For qualitative analysis, data from interviews and FGDs were transcribed verbatim and translated into English from the Nepali language. A grounded thematic analysis approach was used to identify key patterns, recurring themes, and insights regarding FCHVs' experiences, training effectiveness, and challenges faced during implementation. In addition, Word clouds were generated from the transcripts to visually represent frequently mentioned terms, providing a supplementary overview of salient themes alongside thematic analysis. Participants were coded as AxxEdxxExx where Axx is Age in years, Edxx is completed years of school, and Exx is years of experience as FCHV. A single coder conducted inductive thematic analysis in NVivo. We maintained an audit trail and analytic memos and held a team review of codes and theme definitions to enhance credibility. Because analysis was undertaken by one coder, inter-coder reliability was not performed.

Results

Intervention development

Overview of participants and engagement

A total of 6 subject experts participated in expert-level co-designing workshops, with a mean age of 37 years (range 35–40) and 33.33% female participation. Two-thirds were affiliated with a university and one-third with a social organisation working for the community. The mean years of experience they have was 5.5 years (range 4 to 7 years). The participants in the end-user level workshop had 10 local members comprising five community members, two FCHVs, two health workers and a local research coordinator having years of experience in coordinating NCD management trials in the study area. The mean age of the participants was 46.7 years (range 38 to 58).

Co-designed outputs

After expert-level and end-user level workshops, the materials we created were a manual, a pictorial flip chart, a brochure and a recording register. A manual for community-based PA for FCHVs to use during home visits as a guideline. This manual included program objectives, intervention delivery methods, guidelines for using educational materials, and instructions for recording and reporting recording participants' data. A pictorial flip chart was the primary educational tool to facilitate participant learning, ensuring suitability for illiterate individuals as well by incorporating illustrative images and local language. A brochure containing key messages about PA was also designed for distribution. Furthermore, a recording register was developed for FCHVs to document participant details and session information during home visits (See supplementary file 2 for FCHV's manual and supplementary file 3 for flip chart).

Reflection on the process

Participants in the expert-level workshop provided their subject-specific inputs and suggested including local-level participants, which was part of our plan. Participants in the end-user level workshop were happy to be part of the material development process and provided inputs suitable to their local context. They suggested adding some services, Blood Pressure and blood sugar measurement, to the intervention to make it accepted by the community people. However, we could only provide the community people with blood pressure measurement services due to resource limitations.

Training FCHVs on community-based PA promotion

The study involved 14 FCHVs with a mean (SD) age of 41.5 (8.31) years. The majority (93%) had completed grade 10 or higher education. The median years of experience as an FCHV were 5, ranging from 1 to 29 years.

Training evaluation

Following the training program, significant improvements were observed in the FCHVs' knowledge about PA. Knowledge about PA increased from 71.4% to 85.7%, and understanding of its importance rose from 71.4% to 92.9%. Knowledge regarding the benefits of PA improved notably, from 14.3% to 64.3% ($p = 0.039$). Moreover, awareness of the health effects of insufficient PA increased from 21.4% to 85.7% after training ($p = 0.004$). These results indicate that the training effectively enhanced the FCHVs' understanding of PA (Table 1).

Feedback after training

The feedback from 14 FCHVs on the three-day training program was assessed using a Likert scale ranging from 1 to 4, with higher scores indicating more positive responses. The mean scores at different aspects assessed ranged from 3.71 to 4.00. Participants reported that the training significantly enhanced their knowledge and skills in PA, with a mean score of 4.00 (Table 2).

Qualitative findings on training

Useful training

FCHVs recognised all the aspects of the training as useful. The initial part of the training, providing knowledge about PA, the benefits of PA and the negative health

Table 1 Knowledge among female community health volunteers about PA before and after training, Pokhara, Nepal*

Variable	Correct answer Pre-test *n* (%)	Correct answer Post-test *n* (%)	McNemar *p*-value
What is physical activity?	10 (71.43)	12 (85.71)	0.625
Why physical activity is required?	10 (71.43)	13 (92.86)	0.375
Among the following, which is the benefit of physical activity?	2 (14.29)	9 (64.29)	0.039
Which of the following is physical activity done at home?	2 (14.29)	10 (71.43)	0.008
What health issue could result due to physical inactivity?	3 (21.43)	12 (85.71)	0.004
How to increase physical activity at home?	2 (14.29)	10 (71.43)	0.021
How much is the minimum physical activity per day?	13 (92.86)	13 (92.86)	1.000
How physical activity helps in mental health?	6 (42.86)	13 (92.86)	0.039
What needs to be considered while starting physical activity?	3 (21.43)	11 (78.57)	0.021
What is the effect of physical inactivity?	4 (28.57)	11 (78.57)	0.065

* This study was carried out during April-December 2024

Table 2 Feedback from female community health volunteers after PA training, Pokhara, Nepal

Aspect	Mean (SD)
Satisfaction Level	3.71 (0.47)
Knowledge & Skill Enhanced	4.00 (0.00)
Confidence After Training	3.79 (0.43)
Usefulness of Training Materials	3.86 (0.36)

SD Standard deviation

* This study was carried out during April-December 2024

effects of physical inactivity, was perceived as a useful aspect of the training for them.

> *"Every aspect of the training was useful, however first part was more useful for me" [A38Ed12E6]*
> *"The most useful thing is the flip chart. It has pictures which can be used effectively while counselling" [A42Ed10E5]*

Challenging part of the training

Some participants found certain aspects of the training difficult, particularly in applying the knowledge in real-life scenarios.

> *"It is challenging to educate people during home visits" [A29Ed12E2]*
> *"Challenge to get good response from the participants" [A42Ed12E3]*

Areas for improvement

Participants found the training was well organised. However, the addition of content related to nutrition could be beneficial.

> *"Food is as important as exercise" [A40Ed10E5]*
> *"Need to improve confidence to talk with others" [A33Ed12E5]*

Suggestions for future training

Participants suggested ways to make the training more effective, emphasising the need for continuity and additional resources.

> *"We need the training again and need to increase training days as well" [A49Ed10E20]*
> *"Need to add weighing machine, BP and Sugar measurement as well" [A41Ed10E5]*

Implementation of a community-based PA promotion program

Qualitative findings on the implementation of a community-based PA intervention by FCHVs

This thematic analysis presents key findings, including direct quotations from the volunteers to illustrate their perspectives.

Effectiveness of home visits and community engagement

FCHVs expressed confidence in conducting home visits and educating individuals about PA. The majority of FCHVs reported that the intervention was well-received and found beneficial to the community people.

> *"This programme is beneficial for the community. People should understand the importance of physical activity, and we can educate them effectively." [A53Ed10E20]*
> *"I was able to explain the concepts in a way that people could understand, and they responded positively." [A49Ed10E20]*

However, some challenges were encountered, particularly in reaching community people due to their work schedules. People expressed their expectations for medical services.

> *"During the first visit, it was difficult to meet people, but after repeated visits, they started engaging more actively." [A47Ed10E4]*
> *"Many people wanted medical check-ups, such as blood pressure and blood sugar tests, which we were unable to provide." [A47Ed10E4]*

Usefulness of educational materials

Most FCHVs found the flip charts to be an effective tool for delivering health messages. Many emphasised that the visual aids were particularly beneficial for individuals with lower levels of literacy:

> *"The flip chart was very easy to use, and people understood better when they saw pictures." [A53Ed8E29]*
> *"It made explaining key messages much easier, especially for those who cannot read." [A53Ed10E20]*

Community response

The intervention was generally well-received, with several community people demonstrating increased awareness and behaviour change:

> *"Some participants mentioned that they have started morning walks following our visits." [A53Ed8E29]*
> *"Many individuals have realised that a lack of physical activity is contributing to their health issues." [A49Ed10E8]*

However, it was easy for FCHVs to educate less educated people:

> *"It is easier to convince individuals with lower levels of education than those who are more educated, as they tend to listen more attentively." [A53Ed10E20]*

Challenges and resource limitations

While most FCHVs reported that they were comfortable conducting home visits, some encountered challenges related to time constraints of the community people and their expectations:

> *"Many people were occupied with work and had little time to listen to us." [A53Ed8E29]*
> *"Some community members responded positively, but others were more interested in receiving medicines rather than advice." [A47Ed10E4]*

Although some volunteers felt adequately equipped, others identified a need for additional resources:

> *"It would be beneficial to have blood pressure and blood sugar measurement devices, as people frequently request these tests." [A47Ed10E4]*
> *"More training is needed, particularly in using medical devices for basic health screening." [A38Ed12E6]*

Influence on FCHV s' own perspectives

Beyond the community-level effect, the intervention also influenced the FCHVs' perspectives and behaviours:

> *"I have realised that physical inactivity is a major risk factor for many diseases. I need to be more physically active myself." [A26Ed10E9]*
> *"I need to spare some time for physical activity for my health." [A53Ed10E20]*

Suggestions for programme improvement

FCHVs offered several suggestions to improve the effectiveness of future interventions. The most notable recommendation was to expand the program to include basic health screenings, such as blood pressure and blood sugar monitoring, in addition to PA education. They also suggested using more audio-visual materials to make health education more engaging. Most FCHVs advised the continuation and scaling up of this program.

> *"Program should be scaled up, and additional training and knowledge is required." [A53Ed10E20]*

FCHVs overburdened?

Almost all FCHVs responded that they are engaged in most of the health programs in the community. However, they do not feel overburdened. They want to be engaged in more programs in the future.

> *"We are mostly engaged in Health programs and want more programs" [A38Ed12E6]*
> *"It is sometimes difficult to manage time when two programs coincide, but no need to reduce programs" [A49Ed10E8]*

Remuneration

FCHVs expressed that the travel allowance they get is very minimal and needs to be increased.

> *"I live far from the training venue; bus fare is also expensive. The travel allowance is not adequate for me" [A42Ed10E5]*
> *"We also need to take an accompanying person sometimes when doing home visits, the allowance is very low compared to the time and our efforts" [A33Ed12E5]*

Word clouds of training and implementation transcripts are provided in Supplementary Figures S1 and S2. The most frequently mentioned terms highlighted FCHVs' focus on confidence, educational flip charts, community engagement, and the challenges of household visits.

Discussion

This study focuses on the development of educational materials, training programs for FCHVs, examines their knowledge after training, and their experience in promoting PA in semi-urban Nepal, which could be beneficial for future community-based interventions. While the training improved FCHVs' knowledge and confidence, it is important to note that this evaluation was limited to the implementers themselves, not the community members they serve.

Training outcome

We conducted a comprehensive training program for FCHVs using methods and media similar to those employed in previous FCHV training programs [54, 55]. This well-structured training program, including easy-to-understand local-language content, flip charts, and interactive sessions, was helpful for FCHVs, which significantly enhanced knowledge, skills and confidence to promote PA in semi-urban Nepal. This pattern is consistent with evidence that CHWs in LMICs acquire durable cardiometabolic-prevention skills when training is systematic and context-tailored, though effects depend on supervision and programme design [56]. The observed improvement in specific knowledge areas, such as the benefits of PA and consequences of inactivity, suggests that community health actors are highly responsive to structured, culturally relevant educational materials. However, the change in knowledge may be temporary. The FCHVs were eager to grasp the training program, which is an advantage for the training and implementation. Other studies done in the same area also showed their ability to grasp the training and utilize it effectively in the implementation [31–33]. The government of Nepal is now enrolling educated volunteers, which is making the community health programs more effective. These findings are consistent with previous research showing that well-planned training improves community health workers' ability to effectively promote healthy behaviours [55, 57, 58]. This study's involvement of FCHVs in promoting PA aligns well with task-shifting strategies for implementing the WHO PEN package for NCD care and HEARTS package in Nepal [59]. These human resources from the community could be a low-cost additional health human resource that could support the prevention and management of NCD and its risk factors.

Intervention development

The co-design approach we used in this study involved both experts and end users, ensuring that the educational materials were culturally relevant and easily understood by the local community. Engagement of experts added scientific ground for behaviour change theories (TPB), the process of intervention development (P-process) and correctness of the messages, including the design that plays a critical role in health education. By involving local people in the design of the intervention, we were able to reframe the messages using familiar language (words) that effectively conveyed technical terms. It helps to design health messages that link PA to culturally meaningful daily routines like walking to the temple or market, traditional dances, household chores and climbing stairs. Interventions become more relatable and aligned with local context. This approach helps make the messages feel familiar, manageable, and socially acceptable rather than externally imposed. This engagement also fostered a sense of ownership over the program that was developed. The co-design approach added value in this study by adapting a locally suitable intervention and helped to make the intervention more interactive using educational material like brochures and flip charts having illustrative pictures, which is usable for all participants, even those with low literacy levels. Studies from other low- and middle-income countries have also shown that well-designed health promotion materials enhance knowledge retention and engagement [25, 60]. The positive feedback obtained after training from FCHVs highlighted the importance of using simple, visual-based materials for community education.

Implementation challenges

FCHVs reported that while the training materials were helpful, community members often expected additional healthcare services, such as medical screenings like blood sugar tests and medicine distribution, which were not included in the intervention. It highlighted the demand side of the health care system in Nepal, where health care delivery is challenging due to various reasons. The request for additional tasks, such as blood pressure and glucose screening, can be framed within the discussion on task-shifting and the roles of CHWs. Some studies had already demonstrated that FCHVs could be engaged in managing hypertension and diabetes in the community [31, 32]. Furthermore, community members expressed satisfaction with receiving services and medications instead of only educational materials. This situation highlights issues of fragmented primary care access and a trust gap in public health education. Additionally, the time constraints faced by participants made it challenging for some volunteers, leading to multiple attempts required for home visits. Future training programs should consider strategies to manage these expectations and provide additional support to FCHVs to ensure consistent community engagement. Feedback from the volunteers also emphasised the need for continuity of the program and refresher training to sustain the effect. Research suggests that ongoing refresher sessions improve knowledge retention and build confidence in

delivering community health interventions [56]. FCHVs are happy to be engaged in community programs and do not feel overburdened; however, they expect an increase in the allowance. Previous studies on NCD management training for FCHVs in Nepal have also reported similar dissatisfaction regarding inadequate financial compensation [54, 55].

Although this study was tailored to the Nepalese context, several aspects of the co-design and implementation process are likely to have relevance for other low- and middle-income settings. The participatory approach, emphasis on locally meaningful materials, and engagement of trusted community volunteers are strategies that can be adapted to promote PA in diverse community contexts. However, the success of such adaptations will depend on contextual factors including community structures, available supervision and training mechanisms, and local health system support. Recognising these contextual differences is essential for ensuring that future community-based PA promotion initiatives are appropriately tailored, feasible, and sustainable across settings.

Strengths and limitations

One strength of this study lies in its use of TPB as a theoretical framework to guide the development of the intervention. TPB includes key constructs such as attitude, subjective norms, perceived behavioural control, and intention, all of which are important predictors of behaviour and widely used in PA interventions [43]. This theory helped us in developing key messages that target improving attitude, norms, confidence and intention among community people and ultimately motivate them for PA. The present study reports the development of these TPB-informed materials and the preparation of FCHVs to deliver them to the community. Research shows that interventions based on TPB are effective in increasing intentions and behaviours related to physical activity [35, 51, 61]. Another strength was the qualitative findings on training and implementation process evaluation from FCHVs.

One of the limitations of this study was the low sample size, so we did not perform multivariable covariate adjustment; future larger-scale studies should account for key sociodemographic and experiential factors. FCHVs were homogeneous, and participant numbers were purposefully set to meet the trial's feasibility and coverage needs. This may restrict statistical power and limit the generalizability of its findings. There may be potential selection bias that limited diversity of participants may also have constrained the qualitative findings, and ceiling effects in feedback suggest possible social desirability bias. Furthermore, outcomes were limited to implementer-level knowledge, skills, and confidence, and community-level changes in PA will be reported in a separate paper.

Conclusion

This study demonstrates that well-structured training programs and culturally appropriate educational materials can successfully enhance the capacity of FCHVs in terms of knowledge, confidence and preparedness to encourage PA in their communities. These findings suggest that integrating PA promotion into the existing roles of FCHVs could provide a scalable, low-cost strategy for addressing the rising burden of non-communicable diseases in Nepal and similar LMICs by leveraging task shifting. Simple visual materials and periodic refresher training are essential for sustaining their confidence and effectiveness, while integration with basic health services may enhance community engagement. Future research should test the long-term health impact, cost-effectiveness and scalability of FCHV-led physical activity promotion within broader NCD-prevention strategies. These findings can help guide the development of scalable, community-based PA promotion programs in similar settings.

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

Supplementary Material 3.

Supplementary Material 4.

Supplementary Material 5.

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Authors' contributions

RS, PK, TBA conceptualised, designed, and contributed to the critical revision of the study. RS drafted and critically revised the manuscript. BK, AV, SP, LD, RON, SDS, KD, DN and AR contributed to successive drafts of the manuscript. All authors read and approved the final manuscript.

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Data availability

Relevant data and materials are attached as supplementary material.

Declarations

Ethics approval and consent to participate

The study was approved by Ethical Review Board of Nepal Health Research Council (726–2023). Written consents were obtained from all participants. The study was conducted in accordance with Declaration of Helsinki.

Competing interests

The authors declare no competing interests.

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References

1. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World health organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020;54(24):1451–62.
2. Strain T, Flaxman S, Guthold R, Semenova E, Cowan M, Riley LM, et al. National, regional, and global trends in insufficient physical activity among adults from 2000 to 2022: a pooled analysis of 507 population-based surveys with 5.7 million participants. Lancet Global Health. 2024;12(8):e1232–43.
3. Feng H, Yang L, Liang YY, Ai S, Liu Y, Liu Y, et al. Associations of timing of physical activity with all-cause and cause-specific mortality in a prospective cohort study. Nat Commun. 2023;14(1):930.
4. Zhao M, Veeranki SP, Magnussen CG, Xi B. Recommended physical activity and all cause and cause specific mortality in US adults: prospective cohort study. BMJ. 2020;370:m2031.
5. Ekelund U, Tarp J, Steene-Johannessen J, Hansen BH, Jefferis B, Fagerland MW, et al. Dose-response associations between accelerometry measured physical activity and sedentary time and all cause mortality: systematic review and harmonised meta-analysis. BMJ. 2019;366:l4570.
6. Anderson E, Durstine JL. Physical activity, exercise, and chronic diseases: a brief review. Sports Med Health Sci. 2019;1(1):3–10.
7. Lee IM, Shiroma EJ, Lobelo F, Puska P, Blair SN, Katzmarzyk PT. Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy. Lancet. 2012;380(9838):219–29.
8. Reiner M, Niermann C, Jekauc D, Woll A. Long-term health benefits of physical activity–a systematic review of longitudinal studies. BMC Public Health. 2013;13:813.
9. Alnawwar MA, Alraddadi MI, Algethmi RA, Salem GA, Salem MA, Alharbi AA. The effect of physical activity on sleep quality and sleep disorder: a systematic review. Cureus. 2023;15(8):e43595.
10. Marquez DX, Aguiñaga S, Vásquez PM, Conroy DE, Erickson KI, Hillman C, et al. A systematic review of physical activity and quality of life and well-being. Transl Behav Med. 2020;10(5):1098–109.
11. Xu YY, Xie J, Yin H, Yang FF, Ma CM, Yang BY, et al. The global burden of disease attributable to low physical activity and its trends from 1990 to 2019: an analysis of the global burden of disease study. Front Public Health. 2022;10:1018866.
12. Atkinson K, Lowe S, Moore S. Human development, occupational structure and physical inactivity among 47 low and middle income countries. Prev Med Rep. 2016;3:40–5.
13. Ranasinghe PD, Pokhrel S, Anokye NK. The economics of physical activity in low-income and middle-income countries: protocol for a systematic review. BMJ Open. 2019;9(1):e022686.
14. Dhimal M, Bista B, Bhattarai S, Dixit L, Hyder M, Agrawal N, et al. Report of Non communicable disease risk factors: STEPS survey Nepal 2019. Kathmandu, Nepal: Nepal Health Research Council (NHRC); 2020.
15. Vaidya A, Krettek A. Physical activity level and its sociodemographic correlates in a peri-urban Nepalese population: a cross-sectional study from the Jhaukhel-Duwakot health demographic surveillance site. Int J Behav Nutr Phys Act. 2014;11(1):39.
16. Holtermann A, Krause N, van der Beek AJ, Straker L. The physical activity paradox: six reasons why occupational physical activity (OPA) does not confer the cardiovascular health benefits that leisure time physical activity does. Br J Sports Med. 2018;52(3):149–50.
17. Skurvydas A, Istomina N, Dadeliene R, Majauskiene D, Strazdaite E, Lisinskiene A, et al. Leisure-time physical activity improves happiness, health, and mood profile better than work-related physical activity. PLoS One. 2024;19(7):e0307744.
18. Nyberg ST, Frank P, Pentti J, Alfredsson L, Ervasti J, Goldberg M, et al. Health benefits of leisure-time physical activity by socioeconomic status, lifestyle risk, and mental health: a multicohort study. Lancet Public Health. 2025;10(2):e124–35.
19. Bhattarai K, Adhikari AP, Gautam SP. State of urbanization in Nepal: the official definition and reality. Environ Challenges. 2023;13:100776.
20. Aryal KK, Mehata S, Neupane S, Vaidya A, Dhimal M, Dhakal P, et al. The burden and determinants of non communicable diseases risk factors in Nepal: findings from a nationwide STEPS survey. PLoS One. 2015;10(8):e0134834.
21. World Health Organization. Global action plan on physical activity 2018–2030: more active people for a healthier world. 2018. https://www.who.int/publications/i/item/9789241514187
22. Ministry of Health and Population. Multi-sectoral action plan for prevention and control of NCDs 2021–2025. 2021. https://www.iccp-portal.org/resources/multi-sectoral-action-plan-prevention-and-control-ncds-2021-2025
23. Mishra SR, Neupane D, Bhandari PM, Khanal V, Kallestrup P. Burgeoning burden of non-communicable diseases in Nepal: a scoping review. Global Health. 2015;11(1):32.
24. Gagliardi AR, Morrison C, Anderson NN. The design and impact of culturally-safe community-based physical activity promotion for immigrant women: descriptive review. BMC Public Health. 2022;22(1):430.
25. Oli N, Vaidya A, Eiben G, Krettek A. Effectiveness of health promotion regarding diet and physical activity among Nepalese mothers and their young children: the Heart-health associated Research, Dissemination, and intervention in the community (HARDIC) trial. Glob Health Action. 2019;12(1):1670033.
26. Thapa R, Zengin A, Neupane D, Mishra SR, Koirala S, Kallestrup P, et al. Sustainability of a 12-month lifestyle intervention delivered by community health workers in reducing blood pressure in Nepal: 5-year follow-up of the COBIN open-label, cluster randomised trial. Lancet Glob Health. 2023;11(7):e1086–95.
27. Schwingel A, Selzer A, Felix DM, Chodzko-Zajko W, Umpierre D, Reichert F, et al. The transformative journey of community health workers in implementing a lifestyle intervention in Brazil: a qualitative study. J Clin Transl Sci. 2024;8(1):e158.
28. Chowdhury MAH, Siddiquee AT, Ahmed S, Alam DS. Effect of community health worker-provided targeted education with regular follow-up of hypertensive patients on blood pressure control: 24-month results of a longitudinal study in Bangladesh. Int J Noncommunicable Dis. 2016;1(3):105–15.
29. Guerra PH, Silvestre R, Mello THT, Carvalho A, Costa FFD, Florindo AA. Effects of community health worker-based interventions on physical activity levels in children: a systematic review. Rev Paul Pediatr. 2021;40:e2020232.
30. Department of Health Services. Annual Report FY 2079/80. Ministry of Health and Population; 2024.
31. Gyawali B, Sharma R, Mishra SR, Neupane D, Vaidya A, Sandbæk A, et al. Effectiveness of a female community health volunteer–delivered intervention in reducing blood glucose among adults with type 2 diabetes: an open-label, cluster randomized clinical trial. JAMA Netw Open. 2021;4(2):e2035799.
32. Neupane D, McLachlan CS, Mishra SR, Olsen MH, Perry HB, Karki A, et al. Effectiveness of a lifestyle intervention led by female community health

volunteers versus usual care in blood pressure reduction (COBIN): an open-label, cluster-randomised trial. Lancet Glob Health. 2018;6(1):e66–73.
33. Shrestha AD, Gyawali B, Shrestha A, Shrestha S, Neupane D, Ghimire S, et al. Effect of a female community health volunteer-delivered intervention to increase cervical cancer screening uptake in Nepal: a cluster randomized controlled trial. Prev Med Rep. 2022;29:101948.
34. Paudel S, Owen AJ, Smith BJ. Socio-ecological influences of leisure-time physical activity among Nepalese adults: a qualitative study. BMC Public Health. 2021;21(1):1443.
35. Shrestha R, Pahari DP, Adhikari S, Khatri B, Majhi S, Vaidya A. Effect of educational intervention based on theory of planned behaviour on physical activity intention among secondary school teachers of Nepal. Biomed Res Int. 2022;2022:6953632.
36. Paudel S, Owen AJ, Smith BJ. Exploration of physical activity barriers and facilitators among adults in Kathmandu. Nepal. 2021;31(6):1183–95.
37. Iniesto F, Charitonos K, Littlejohn A. A review of research with co-design methods in health education. Open Educ Stud. 2022;4(1):273–95.
38. Slattery P, Saeri AK, Bragge P. Research co-design in health: a rapid overview of reviews. Health Res Policy Syst. 2020;18(1):17.
39. Constantin N, Edward H, Ng H, Radisic A, Yule A, D'Asti A, et al. The use of co-design in developing physical activity interventions for older adults: a scoping review. BMC Geriatr. 2022;22(1):647.
40. Gonsalves PP, Ansari S, Berry C, Gonsalves F, Iyengar S, Kashyap P, et al. Co-designing digital mental health interventions with young people: 10 recommendations from lessons learned in low-and-middle-income countries. Health Educ J. 2024. https://doi.org/10.1177/00178969241297821.
41. Norton L, Parkinson J, Harris N, Hart L. Disordered eating prevention: co-designing a brief intervention for use in community child health services. Health Mark Q. 2024;41(2):146–66.
42. Kadariya S, Aro AR. Barriers and facilitators to physical activity among urban residents with diabetes in Nepal. PLoS One. 2018;13(6):e0199329.
43. Ajzen I. The theory of planned behavior. Organ Behav Hum Decis Process. 1991;50(2):179–211.
44. Mirzaei E, Azar FEF, Ziapour A, Azadi NA, Qorbani M, Safari O, et al. The impact of educational intervention based on theory of planned behavior for promoting physical activity among middle-aged women referring to Karaj (Iran) health centers. Int Q Community Health Educ. 2021;41(4):419–26.
45. Mohamad Ali M, Hamid S, Abbas J. The effect of educational intervention based on the theory of planned behavior on the physical activity of office employees. Health Technol Assess Action. 2023;6(3).
46. Khani Jeihooni A, Layeghiasl M, Yari A, Rakhshani T. The effect of educational intervention based on the theory of planned behavior on improving physical and nutrition status of obese and overweight women. BMC Womens Health. 2022;22(1):13.
47. Central Bureau of Statistics. National Population and Housing Census 2011(National Report) – Central Bureau of Statistics. 2012. https://docs.censusnepal.cbs.gov.np/Documents/9c88048a-3642-4e8f-8f38-a3dd693d49c6__National%20Report%202011.pdf
48. Khatri RB, Mishra SR, Khanal V. Female community health volunteers in community-Based health programs of nepal: future perspective. Front Public Health. 2017;5:181.
49. Health Communication Partnership. The new P-Process, steps in strategic communication. Baltimore: Johns Hopkins Bloomberg School of Public Health/ Center for Communication Programs/ Health Communication Partnership; December; 2003.
50. Gholamnia Shirvani Z, Ghofranipour F, Gharakhanlou R, Kazemnejad A. Determinants of physical activity based on the theory of planned behavior in Iranian military staff's wives: a path analysis. Glob J Health Sci. 2014;7(3):230–9.
51. Abdi J, Eftekhar H, Estebsari F, Sadeghi R. Theory-based interventions in physical activity: a systematic review of literature in Iran. Glob J Health Sci. 2014;7(3):215–29.
52. Stolte E, Hopman-Rock M, Aartsen MJ, van Tilburg TG, Chorus A. The theory of planned behavior and physical activity change: outcomes of the aging well and healthily intervention program for older adults. J Aging Phys Act. 2017;25(3):438–45.
53. Parrott MW, Tennant LK, Olejnik S, Poudevigne MS. Theory of planned behavior: implications for an email-based physical activity intervention. Psychol Sport Exerc. 2008;9(4):511–26.
54. Gyawali B, Mishra SR, Neupane D, Vaidya A, Sandbæk A, Kallestrup P. Diabetes management training for female community health volunteers in Western nepal: an implementation experience. BMC Public Health. 2018;18(1):641.
55. Adhikari TB, Gyawali B, Rijal A, Sapkota A, Högman M, Karki A, et al. Community-based management of chronic obstructive pulmonary disease in Nepal—designing and implementing a training program for female community health volunteers. PLoS Glob Public Health. 2022;2(3):e0000253.
56. Abdel-All M, Putica B, Praveen D, Abimbola S, Joshi R. Effectiveness of community health worker training programmes for cardiovascular disease management in low-income and middle-income countries: a systematic review. BMJ Open. 2017;7(11):e015529.
57. Longworth GR, Erikowa-Orighoye O, Anieto EM, Agnello DM, Zapata-Restrepo JR, Masquillier C, et al. Conducting co-creation for public health in low and middle-income countries: a systematic review and key informant perspectives on implementation barriers and facilitators. Global Health. 2024;20(1):9.
58. Stoutenberg M, Esquives BSN, St Fleur RG, Koen SS, Watson ED, Portacio FG, et al. Assessing the physical activity training needs and preferences of community health workers in South Africa. BMC Public Health. 2025;25(1):120.
59. Gyawali B, Khanal P, Mishra SR, van Teijlingen E, Wolf Meyrowitsch D. Building strong primary health care to tackle the growing burden of non-communicable diseases in Nepal. Glob Health Action. 2020;13(1):1788262.
60. Chander P. Effectiveness of health education program on knowledge regarding health promotion strategies in the geriatric population of selected old age homes at Raipur, Chhattisgarh. J Family Med Prim Care. 2024;13(5):1688–95.
61. Rhodes RE, Boudreau P, Josefsson KW, Ivarsson A. Mediators of physical activity behaviour change interventions among adults: a systematic review and meta-analysis. Health Psychol Rev. 2021;15(2):272–86.

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