ORIGINAL ARTICLE

Development of a health promotion intervention in managing behavioral risk factors for Non-Communicable Diseases in adolescents: An Intervention Mapping Approach

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ABSTRACT

Introduction: In promoting positive behavior changes in adolescents, behavior change intervention is a crucial factor that requires attention. The aim is to develop an evidence-based social cognitive theory intervention. This paper details the intervention development, which is part of the broader NCD prevention program, targeting adolescents and motivating them to adopt healthy lifestyles. **Methods**: Intervention mapping is a systematic approach to developing health promotion programs and has six steps. (1) To assess the need, (2) to specify objectives and outcomes, (3) to design programs, (4) to develop intervention, (5) to plan an intervention implementation, and (6) to evaluate. Stakeholders were engaged actively to improve program feasibility. The needs assessment identified barriers to healthy lifestyle practices among adolescents. **Results**: Identified barriers among school management and teachers were lack of awareness, noncompliance to regular dietary practices and physical activities, time constraints, lack of motivation, space for physical activities, and guidance for healthy food choices. Interventions components were designed based on the social cognitive theory to address these barriers, involving role models and peer leaders, and providing tailored health information and activities. **Conclusion**: The intervention aims to motivate adolescents to adopt healthy lifestyles and promote peer support.

KEYWORDS

Intervention Mapping, Behavioural Intervention, Social Cognitive Theory, Self-Efficacy, Lifestyle, Behaviour Risk Factors, Adolescents

INTRODUCTION

Lifestyle behaviours, influenced by societal, economic, and cultural factors, are crucial for long-term health(1,2). These behaviours, such as unhealthy diet(3,4), tobacco use, and physical inactivity, start young and can lead to Noncommunicable diseases (NCDs) in adulthood if not addressed(5,8). NCDs,

including heart disease, chronic respiratory diseases, diabetes, and cancer, are the leading causes of global mortality and disability(5,9). They are increasing in adolescents and young adults(10,11), and early interventions are needed to reduce future NCD risks(5,13–16). However, comprehensive interventions for adolescents are lacking(8,10,17).

Behavior change intervention is essential to foster positive behaviours in adolescents and prevent NCDs(16,24–27). It involves planning early interventions(15,28,29), setting goals, selecting methods, and ensuring implementation, oriented toward intervention fidelity (30). A framework is needed for effective program development, considering behavioral, personal, and environmental factors(3). Theory-based interventions have proven effective(31–37), but systematic planning is required, using an intervention mapping (IM) approach. IM is a planning framework for intervention development, implementation, and evaluation(40). This approach aligns with Universal Health Coverage (UHC) and Primary Health Care (PHC). It has six steps which are discussed in method section to develop a comprehensive theory-based health promotion intervention

Aim:

develop an evidence-based social cognitive theory intervention targeting adolescents.

Material & Methods

The intervention is part of a broad school-based program for adolescents. The details of design, development and application of intervention are described in subsequent sections. The intervention mapping protocol is developed using a six-step process.

Step 1: **Study Type and Study Design**: The initial step involves conducting Qualitative research, needs assessment, and literature review.

Step 1.1: Planning group/program stakeholder setup.

Before initiation of the development of an intervention, a planning group was established to optimize the intervention implementation which will continue till the end of the intervention phase. The planning group was led by a PhD scholar and included a wide range of professionals: program developer (NCD and implementation research expert), adolescent psychiatrist, teachers, and principals. Frequent meetings were conducted with the group members to brainstorm potential strategies, evaluate the possible barriers and facilitators in achieving the program's objective, and monitor development progression; and include findings from the existing literature review.

Study Setting: Educational institutions (schools) of urban and rural areas were contacted to conduct the focus group discussions (FGDs), and in-depth interviews (IDIs).

Step 1.2: Conduct needs assessment represented using Logic model of the problem. This identifies the health problem (Noncommunicable diseases risk behaviours among adolescents) and assesses behaviours and environmental conditions related to the context.

Study population and Data Collection: Based on purposive sampling, we conducted FGDs, and IDIs till data saturation with adolescents and schoolteachers separately to explore the current situation, needs, and preferences of the target group. Totally four FGDs were conducted with five adolescents in each group and three FGDs with five schoolteachers in each group, which lasted for <60 minutes. Then face-to-face, semi-structured interviews lasting 20– 30 minutes were conducted among adolescents (n=10) and teachers (n=6). The interviewer was guided and trained prior to the interview.

Inclusion Criteria: Adolescents aged 13- 15 years and teachers aged 30- 50 years from schools were included.

Exclusion Criteria: Those participants who did not consent and were not present on the day of the interviews were excluded.

Sampling method: Based on convenience sampling, school adolescents were selected and interviewed. They provided their opinions about self-monitoring on the risk factors. The interviews were analysed and codes were identified and grouped.

Ethical Issues & Informed Consent: Prior to the start of the interview, ethical approval was obtained from the Institutional Ethics Board of Medical College (MSRMC/EC/AP-02/11-2022). Accent from adolescents and consent from parents and teachers were obtained prior to the start of the interview.

Step 2: Specify Program Outcomes and Objectives using Logic Model of Change.
After specifying the goal of intervention, we established specific objectives at the behavioural level, based on the logic model of change. These were termed as performance objectives (PO). Subsequently, for each PO, behavioural determinants derived from the SCT were selected through literature in coordination with the planning group. The planning group used literature, interviews, and expert advice to guide the selection of determinants. These determinants, along with PO, were used to create measurable and action-oriented matrices of change objectives (COs), which identifies the intervention targets.
Step 3: Design Program: SCT was used as a theoretical framework with major constructs outcome expectations, reciprocal determinism, self-esteem, self-efficacy, social support, and self-regulation. Results from step 1 (needs assessment) and step 2 (matrix of change) are used to select methods and practical strategies to influence the determinants of the target behaviours.
Step 3.1: Identification of the determinants to formulate CO. The selection of methods was from literature and the advice of the planning group by considering reference population, feasibility, and changeability of determinants. Experts in behaviour change contributed their insights and experiences about effective strategies for promoting behaviour change.
Step 3.2: Selection of the appropriate theory-based methods to influence the determinants and achieve the CO. Social Cognitive Theory (SCT) was selected to achieve the CO.
Step 3.3: Translate the methods into practical applications. The planning experts converted each method into practical application appropriate to the intervention context and the adolescent group.
Step 4: Intervention development.
The planning experts developed key components by combining with practical applications, which included various display information platforms, a role model group, and peer support group. These platforms are used to disseminate health education materials, and visual presentations will be provided for teachers. This development process includes assessing whether the intervention's content and materials are feasible considering time and budget constraints, and whether they will effectively reach the adolescent group.
Step 5: Plan Program Implementation:
A smooth implementation plan is needed to modify behavioural risk factors of NCDs in adolescents through teachers.
Step 5.1: Identification of barriers from stakeholders:
Outcomes of the interaction with implementers of the intervention (research staff of public health division, dean, and school heads) revealed that barriers in implementing intervention.
Step 5.2: Establishment of collaborative communication:
A collaborative communication was established between the planning and implementing group, school heads, and teachers to facilitate information exchange. Since the prime goal is to prevent NCDs in the adulthood, reliable information through interventions is needed. This will support intervention implementation and also scalability. This will involve regular meetings with stakeholders, obtaining consent from parents, and ensuring the availability of necessary resources.
Step 5.3: Information to teachers to roll out intervention:
The last step will be to train the teachers through a training program. Teachers can be role models and will play an active role in rolling out the intervention for adolescents. They motivate adolescents to modify their lifestyle risk factors and serve as key persons for adolescents and their parents and planning group. Periodic evaluation from adolescents will be obtained after implementation. Feedback and perspectives will be collected to

understand the feasibility and acceptability of the intervention program.

Step 6: Evaluation

We will plan to evaluate the program at different stages by formative and summative evaluation. A mixed-methods study with a quasi-experimental design will be used to assess the effectiveness of the program on behavioural outcomes and psychosocial determinants. We also have planned to conduct a process evaluation to monitor the quality and fidelity of the program implementation.

RESULTS

A planning group was established to assess needs through qualitative research and literature review. Broad themes were grouped using a logic model (Figure 1).

Figure 1: Logic model of the problem regarding risk behaviours of adolescents

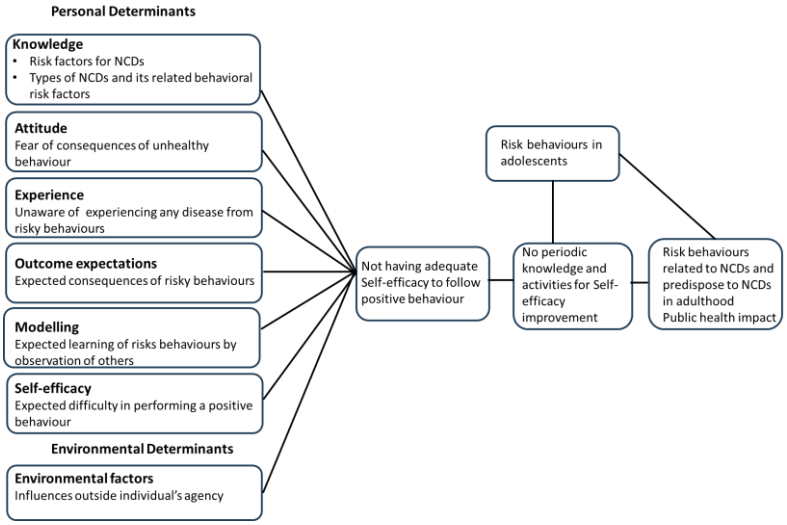

Table 1: Barrier and facilitators to engaging in healthy behaviours identified in the focus groups.

Barrier	Themes/ determinants	Facilitator
Limited knowledge about behaviour risk factors	Knowledge and awareness	Enthusiastic teachers
Lack of content on specific risk behaviour	Attitude	Supportive school management
Not aware of the consequences	Individual Determinants	Doing things of interest
Perceptions of low susceptibility to health risks or severity of unhealthy behaviours	Modelling	Availability of teachers as role models
Time constraints	Experiences	Peer support
Academic pressure	Outcome expectation	Setting a goal
Peer pressure	Self-efficacy	
Noncompliance to regular lifestyle factors	Influences from socio-environmental factors	
Influence of friends		
Convenience		
Willpower affecting lifestyle choices		
Tiredness		
Lack of teacher engagement in health promotion efforts		
Lack of motivation		
Low expectation		
Fear of consequences		
Self-doubt		
Low self-confidence		
Continuous difficulty		
Availability and accessibility of resources (healthy foods at school and home, physical activity facilities, and peer support)		
Lack of content, guidance, and applications.		

The literature search results are embedded in introduction. Qualitative research helped identify barriers and feasible methods to enhance self-efficacy activities. Barriers included lack of awareness of NCD behavioral risk factors, noncompliance to dietary practices and physical activities, lack of time, motivation, self-confidence, space for physical activities, and guidance for healthy food choices. Similar barriers were reported in evidence, indicating a need for multisectoral efforts. Specific objectives were set at behavioral level based on a logic model of change (Table 1).

The main outcome was to develop a regular behavioral modification for NCD prevention. COs were formulated for each determinant, including personal, social, and environmental factors. For each determinant and CO, a method was chosen, such as "tailoring" for knowledge (Table 2).

Table 2: Performance objectives and change objectives to promote healthy behaviours.

Performance Objectives	**Determinants**					
	Knowledge	Attitude	Experience	Outcome expectation	Modelling	Self-efficacy/ skills
Teachers decides to get training to roll out behaviour change intervention for NCD prevention.	Elucidate the need for teachers training to roll out the intervention	Acknowledge the benefits of training the teachers				Express teachers confidence in agreeing to be role models and undergo training to support adolescents.
Teachers request for training kit and health education material hem	Narrate how to utilize the training kit and HEM	Acknowledge the advantages and importance of using training kit and HEM				
Adolescents utilizes health education materials according to the teachers instruction and performs healthy behaviour	State how the HEM are utilized by adolescents	Acknowledge the emotions involved in learning the HEM by adolescent in combating NCD risk behaviours (Ex: fear)	Apply past experiences in handling new situations Apply the learned behaviour into real life situation	Influencing adolescents to follow healthy behaviours. Decision making by adolescents to perform learned healthy behaviours	Motivate influence adolescents by providing training through role models	Express confidence in ability to perform learnt behaviours
Adolescents complies with training platforms learnt prevention	Narrate how information and activities are utilized by adolescents in their day-to-day activities for selection of		Explain how by providing training to adolescents through role models (teachers) motivates them. Explain the long term			Express confidence in following the positive health behaviours lifelong.

healthy behaviour	benefits my following role models

Information platforms like flipcharts, videos, and posters will be developed and tailored to improve knowledge and awareness (Table 3). Specific classroom and home-based activities will be developed to enhance active learning with the support of role models and peer groups. Posters will be displayed and flipcharts given to teachers as suggested by adolescents during interviews. These platforms and activities are expected to enhance knowledge and lead to lifestyle changes (Table 1).

There is existing evidence highlighting importance of education in improving health knowledge, which is one key determinant to accomplish different change objectives(41–43). Attitude and self-efficacy are important determinants of behavior change(44–47). Positive attitude is important to promote healthy behavior for any intervention(48–50). Adolescents who have or develop high self-efficacy more likely to set goals for improved healthy behaviors(45,51). Hence improving self-efficacy through knowledge and activities will improve confidence and self-esteem. Evidence has shown improvement in self-efficacy prevents declining healthy behavior(51). The last step will be planned post-implementation. Regular monitoring and evaluation will be carried out in consultation with planning group.

Table 3: Examples of Social-cognitive theoretical methods and applications used

Determinant	Change objective	Parameters for use	Method	Application
Knowledge	Describe the need for understanding risk factors of NCD Identify how to choose healthy factors for health	Reinforcing/ tailoring variables to relevance Retention of the information.	Reinforcement/ tailoring Reinforcement	Information tailored to adolescent provided on flip charts/PowerPoint presentation/ poster and Classroom-based activities. Schematic information with images of different health factors.
Attitude	To accept the benefit from SCT based intervention.	Attention and identification with the model.	Role models	Role model or peers narrating about the self-monitoring experience.
Experience	Apply past experience to handle new situations or challenges in the current role	Outcome and the lessons learned from the past	Observational learning/ motivation	Maintain a reflective journal to record and reflect on past experiences, regular self-evaluation, and feedback sessions.
Outcome expectation	Influence behaviour and decision-making based on the expected outcomes	Perceived benefits of the expected outcome	Outcome Simulation	Scenarios of different outcomes are planned.
Modelling	Influence behaviour based on observed models	Outcome of model behaviour	Observational learning	Role-play from the successful model
Self-efficacy/ skills	Demonstrate on how to perform a behaviour.	Credible source Attention and identification with the model	Verbal persuasion Role models	Video education/ role model influence on how to perform a behaviour

Discussion

This study aimed to outline the systematic development of an evidence-based SCT intervention component, following the intervention mapping approach. A school-based health promotion intervention was developed using the same intervention mapping approach (6,52), grounded on SCT to reach adolescents. This encourage them to perform regular behavioural modification for Noncommunicable disease prevention with self-esteem and self-efficacy. The intervention has key components, which include various display information platforms (such as flipcharts, videos, and posters), a role model group, and a peer support group. This intervention includes a comprehensive package of awareness and knowledge part, classroom-based activities, and home-based activities.

IM is a systematic and SCT-based approach for planning, implementing, and evaluating health promotion interventions(38,53). As a first step, assessment of needs was carried out to identify the required modifications and the population targeted. Next, the development of change objectives, which combine performance objectives (sub-behaviours) with determinants. This included the key constructs of SCT as integral part of development. Subsequently, intervention methods are grounded in the SCT and aligned with the chosen determinants. These methods are then translated into strategies or applications that meet the effectiveness parameters of the chosen methods. Evidence exists on incorporation of strategies as part of classroom activities for adolescents is beneficial (54,55). These strategies are subsequently integrated into a structured program. Final steps include planning intervention adoption, implementation and evaluation in the school context. Evaluation will help in understanding the overall process and acceptability of intervention.

The strengths of this study is the use of intervention mapping in a systematic approach that ensures evidence-based, tailored interventions. It also enhances collaboration among research groups and stakeholders. Another strength is application of SCT which provides useful key constructs for designing interventions.

Limitation

The study has a few limitations. The developed intervention was not empirically tested, so its effectiveness is unknown. Future studies should conduct trials to assess its feasibility and efficacy. Another one is cultural and contextual differences may limit the intervention's applicability to adolescents in other regions. Thus, it may need adaptation for different contexts.

Conclusion

This study demonstrates the feasibility and effectiveness of using IM approach to develop a school-based health promotion intervention for NCD prevention in adolescents. The intervention, based on SCT aims to improve the adolescents' NCD risk behaviours, knowledge, attitude, and self-efficacy. The implementation plan will be planned by the research group and schoolteachers. This intervention can be integrated into the existing school system, adapted, and scaled up, contributing to SDG efforts to reduce the NCD burden and promote adolescent health and well-being.

Authors Contribution

All authors have contributed equally.

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Nil

Conflict of Interest

There are no conflicts of interest.

Declaration Of Generative AI And AI Assisted Technologies In The Writing Process

While preparing this work, we utilized Grammarly tools to correct grammatical errors and punctuation. After using the tool, we carefully reviewed and edited the content as

necessary, assuming full responsibility for the publication's content.

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