ORIGINAL ARTICLE

Enhancing Cardiovascular Risk Awareness among High School Students: The Cluster Randomized Controlled Trial of School-Based Educational Interventions

Maitree Thronsao, MPH[1], Ranee Wongkongdech, PhD[2], Kongkarn Chancharusiri, MD[3], Nirun Intarut, PhD[2]

[1] PhD in Health Science, Faculty of Medicine, Mahasarakham University, Maha Sarakham, Thailand; [2] Department of Health System Sciences, Faculty of Medicine, Mahasarakham University, Maha Sarakham, Thailand; [3] Department of Psychiatry, Suddhavej Hospital, Faculty of Medicine, Mahasarakham University, Talat, Maha Sarakham, Thailand

Objective: To examine the effects of an educational program on enhancing awareness of cardiovascular disease (CVD) risk factors among high school students.

Materials and Methods: A cluster randomized controlled trial was conducted between July and November 2024. Thirty-five high schools in Mahasarakham Province were considered, from which eight schools were selected using simple random sampling and then randomly assigned to either the intervention group (four schools) or the control group (four schools). The intervention consisted of a 2-hour participatory classroom session that included PowerPoint presentations, educational videos, infographics, and video interviews with real patients CVD to enhance engagement and contextual learning. Following the classroom session, participants were invited to join a dedicated LINE application group for 30 days. In this group, they received ongoing educational content and motivational messages. Participants were encouraged to engage actively by asking questions and discussing health-related topics. Outcome assessments were conducted at a 12-week follow-up to evaluate changes in CVD-related awareness, knowledge, and attitudes. Data was analyzed using a generalized estimating equation (GEE) model to compare outcomes between the intervention and control groups while adjusting for potential confounding factors.

Results: The present study involved 1,352 students, with 683 in the intervention group and 669 in the control group, with an average age of 16.1 years. The majority were female (67.5%) and in Grade 10 (54.2%). A comparison of the baseline characteristics between the experimental and control groups revealed no significant differences. The intervention group showed significantly higher improvements in awareness of 2.47 (95% CI 2.23 to 2.70), knowledge of 3.24 (95% CI 2.40 to 4.07), and attitude of 3.55 (95% CI 2.61 to 4.49) regarding exposure to risk factors of CVD.

Conclusion: The findings suggest that the educational intervention was effective in significantly improving students' raising awareness of risk, knowledge, and attitudes toward CVD among high school students.

Keywords: Cardiovascular risk; Awareness; High school students

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Diseases caused by lifestyle behaviors in today's world are mostly chronic non-communicable diseases (NCDs), which account for as much as 68% of global health problems and the leading health issue worldwide and in Thailand[1]. The four major NCDs include cardiovascular diseases (CVDs), cancer, chronic obstructive pulmonary disease, and diabetes.

Correspondence to:

Intarut N.

Faculty of Medicine, Mahasarakham University, Mahasarakham 44150, Thailand.

Phone: +66-43-021021

Email: nirun.i@msu.ac.th

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It is found that 32% of deaths worldwide are due to CVDs, which equals approximately 17.9 million people[2]. In Thailand, approximately seven people die every hour from CVDs, and the cases is increasing, especially among younger individuals[3]. This is due to changes in lifestyle, including overeating, consumption of sweet, fatty, and salty foods, reduced intake of vegetables and fruits, and decreased physical activity due to increased convenience in daily life. Social activities, such as drinking alcohol and smoking, have also increased, particularly among the younger population, influenced by changing social norms. These lifestyle factors contribute to conditions such as obesity, high blood pressure, high cholesterol, and diabetes, which can lead to chronic diseases[1].

Preventing NCDs is most effective by reducing the behavioral risk factors contributing to their development. Reducing these risk factors from a

young age decreases the likelihood of developing NCDs in adulthood[4]. It has been stated that promoting healthy behaviors in children and adolescents at the crucial period leads to lifelong healthy habits[5]. Adolescence is an important phase when individuals develop habits and behaviors that will affect their future health, and NCDs such as CVDs are lifestyle-related and preventable. Therefore, creating awareness and positive attitudes toward disease prevention among adolescents or high school students is crucial. Learning about CVDs helps teenagers understand the importance of maintaining healthy behaviors, such as eating balanced diet, exercising regularly, avoiding smoking and excessive alcohol consumption, and getting sufficient rest[6].

Currently, the health education and physical education curriculum follows the standards and indicators of the core curriculum for basic education, covering topics such as human growth and development, life and family, movement, exercise, Thai and international sports, health promotion, fitness, disease prevention, and life safety. However, because health education is part of students' daily lives and not perceived as something important, they often neglect proper health behaviors and practices that will affect their future health. The performance in health education is often below 70%, and students demonstrate lack of interest in the lessons as they do not perceive these issues as relevant to themselves[7].

Literature has examined adolescents' perceptions and preventive behaviors regarding CVD[8]. The findings revealed that adolescents often lack knowledge and do not perceive themselves as being at risk of developing CVD. These findings highlight the importance of targeting this age group, as adolescence is a critical period when lifestyle choices begin to solidify. Therefore, early intervention focusing on modifiable risk factors is essential[9]. Schools are considered conducive environments for implementing interventions, as these can significantly influence students' health behavior choices[10]. It is believed that cultural, social, and economic factors affect risk perception regarding CVDs. Key strategies identified in the literature for preventing CVD risk include providing education, conducting school-based campaigns, and organizing debates[11,12]. However, studies show that even when adolescents receive knowledge, if they lack risk awareness, they are unlikely to engage in preventive behaviors. One study utilized the Intergenerational Mobile Technology Opportunities Program (IMTOP) to support older adults with type 2 diabetes in enhancing self-management skills and knowledge through mobile technology, alongside educational support[13].

In the digital age, utilizing media and interactive, motivational, and health counseling approaches through platforms like the LINE application facilitates greater engagement with adolescents. Moreover, sharing real-life experiences of individuals affected by unhealthy behaviors can serve as powerful examples. These stories may evoke concern and enhance awareness about potential future health risks, thereby fostering greater consciousness and motivation among adolescents to adopt preventive behaviors against CVD.

Materials and Methods

Ethical approval for the present study was obtained from the Human Research Ethics Committees of Mahasarakham University approval number 163-059/2567 and permission to conduct clinical research was also obtained by registering the study with the Thai Clinical Trials Registry (TCTR), registration number TCTR20241031005.

Design and population

The present study used a clustered randomized controlled trial design. The present study was conducted between July 2024 and November 2024, and the recruitment process proceeded as follows. First, the researchers recruited 35 high schools from the Mahasarakham Secondary Educational Service Area. Second, we randomly assigned eight schools to either the intervention group or the control group. All students in Grade 10, 11, and 12 were included in the study. One thousand three hundred fifty-two students participated, with 683 students in the intervention group and 669 students in the control group. The CONSORT diagram is shown in Figure 1.

Intervention program

Theoretical framework and application:

The present study applied the Protection Motivation Theory (PMT) as a guiding framework to develop an intervention focused on promoting awareness and prevention of CVD[14]. PMT emphasizes the role of threat appraisal and coping appraisal in motivating protective health behaviors. The theory was operationalized through the use of fear appeals, in which individuals' knowledge, past health experiences, and perceived susceptibility to disease were highlighted to foster risk awareness and behavioral change. To enhance motivation and

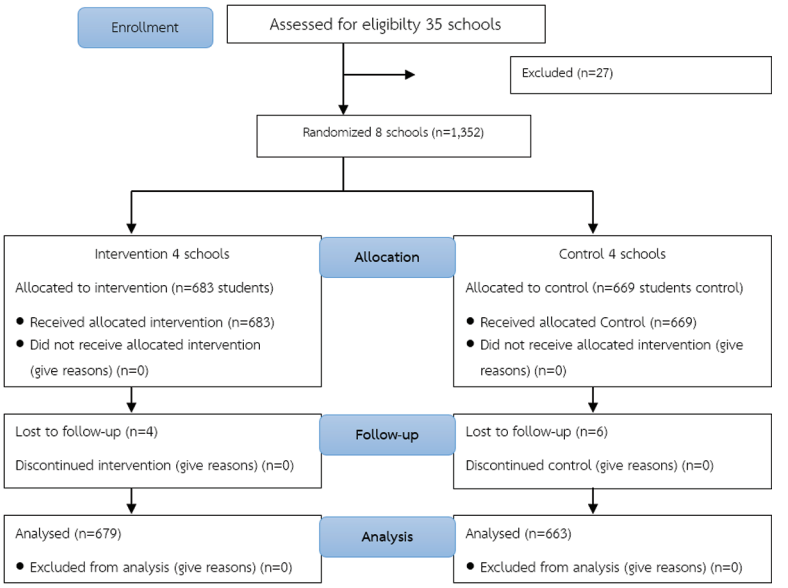

Figure 1. Consort flow diagram.

engagement, the intervention integrated several PMT-informed components, including health education materials, motivational interviews through video media, patient narratives sharing real-life experiences with CVD, and short motivational messages. In conjunction with PMT, the Behavioral Change Theory was utilized to facilitate the adoption of preventive behaviors[15], particularly through a stage-mismatched intervention approach. This model is appropriate for adolescent populations who may not yet exhibit readiness for health behavior change[16]. Accordingly, the intervention targeted high school students, a demographic often under-engaged in proactive health maintenance.

Intervention components:

The intervention included a structured educational session designed to improve CVD prevention knowledge and awareness. The session was delivered using an active participatory lecture format, consisting of a 90-minute interactive presentation followed by a 30-minute question-and-answer segment. Instructional materials included PowerPoint slides, educational videos, infographics, and video interviews with CVD patients. These sessions were integrated into the standard health education curriculum and conducted within a two-hour classroom period.

Following the classroom session, participants were enrolled in a dedicated LINE application group to receive continued support and motivational content for a duration of 30 days. The schedule for content delivery was as follows:

- 07:00 a.m.: Motivational messages and key points related to CVD prevention.
- 12:00 p.m.: Educational video clips and infographics focusing on CVD risk reduction.
- 07:00 p.m.: Supplementary educational material to reinforce preventive knowledge.

Participants were encouraged to interact within the LINE group, ask questions, and share their thoughts on health-related topics at any time. At the conclusion of the four-week intervention, and again at a three-month follow-up, assessments were conducted to evaluate changes in participants' awareness, knowledge, and attitudes regarding CVD prevention.

Engagement metrics:

Participant engagement was assessed through both in-class and digital components of the intervention. Attendance and active participation during the classroom sessions were documented by sign-in sheets and observation of contributions during discussions. For the digital component, interaction with the LINE group content was monitored through participants' responses, specifically by "liking" educational messages and optionally submitting comments or questions. All participants agreed to the terms of participation and were expected to engage with the materials as scheduled. The results indicated a high level of engagement, with over 80% of participants consistently responding to the LINE content and engaging in discussions throughout the

30-day period. This sustained interaction suggested that the combination of structured education and ongoing digital reinforcement was effective in maintaining participants' interest and promoting health awareness.

Measurements

Demographic data were collected, including gender, age, school grade, weight, height, chronic diseases, exercise history, smoking status, and alcohol consumption status.

Primary outcome:

Awareness score, which was assessed using a CVD prevention questionnaire adapted from Awareness of CVD associated risk factors among Saudis in Riyadh City[17]. The questionnaire consists of 15 items using a 5-point Likert rating scale[18], with the following scoring criteria: Strongly agree 5 points, Agree 4 points, Neutral 3 points, Disagree 2 points, and Strongly disagree 1 point. Therefore, the maximum possible score is 75 points, while the minimum possible score is 15 points. The reliability was measured using the Cronbach's alpha coefficient, which was 0.81.

Secondary outcomes:

The knowledge scores were assessed using a questionnaire adapted from public knowledge of CVD and its risk factors in Kuwait: a cross-sectional survey, which studied knowledge about CVD and risk factors in Kuwait[19]. The questionnaire consisted of 15 questions, with a potential total score of 15 points. Each question had three possible answers: "yes", "no", and "don't know". A score of 1 point was awarded for a correct answer, while 0 point was given for an incorrect answer or when "don't know" was selected. The total score ranged from 0 to 15 points. The reliability analysis showed a Cronbach's alpha coefficient of 0.86.

The attitude assessment was adapted from the research of Knowledge, attitude, and practice regarding the risk of CVDs in patients attending outpatient clinic in Kuantan, Malaysia[20]. The questionnaire included both positive and negative statements, formatted as 5-level rating scale questions based on Likert (1967). The questionnaire consisted of 20 items using a 5-point Likert rating scale[21], including both positively and negatively worded statements. The scoring criteria for each response level were as follows: Strongly agree 5 points, Agree 4 points, Neutral 3 points, Disagree 2 points, Strongly disagree 1 point. Accordingly, the maximum possible score was 100 points, and the minimum possible score was 20 points. The reliability analysis showed a Cronbach's alpha coefficient of 0.87.

Statistical analysis

Descriptive statistics were used to summarize the data, with categorical variables presented as frequencies and percentages, and continuous variables as means with standard deviations (SDs). Demographic characteristics between the intervention and control groups were compared using chi-square tests or Fisher's exact tests, as appropriate. The effects of the intervention on awareness, knowledge, and attitude scores were analyzed using generalized linear models (GLMs), with adjustments for relevant covariates. To account for the cluster randomized design, the analysis incorporated methods that adjusted for clustering effects. All analyses were performed using R version 4.4.2[22].

Results

The present study included 1,352 high school students, with 683 in the intervention group and 669 in the control group. In the intervention group, 66.2% were female, aged 15 to 18 years, with a mean age of 16.2 years. Most were in Grade 10 (Mathayom 4) at 53.1% and had an average body mass index (BMI) of 21, with 85.2% falling within the normal BMI range. The majority reported no chronic diseases at 90.6%, exercised one to two times per week in 42.8%, while 34.0% reported no physical activity. Most participants had never smoked in 88.1%, occasionally consumed alcohol in 53.9%, or had never consumed alcohol in 43.2%. In the control group, 68.9% were female, with a similar age range and a mean age of 16.1 years. Most were also in Grade 10, at 55.3% with an average BMI of 20.7, and 86.5% were within the normal BMI range. The majority had no underlying diseases for 88.0%, exercised one to two times per week in 46.5%, and 31.4% reported no exercise. Regarding substance use, 90.7% had never smoked, 49.6% had never consumed alcohol, and 49.4% drank alcohol occasionally. No statistically significant differences in baseline characteristics were found between the two groups (Table 1).

Table 2 presents the descriptive statistics of the outcome measures. In the intervention group, the mean awareness score increased from 59.4 (SD 10.2) at baseline to 62.6 (SD 8.1) after the intervention. The mean knowledge score rose from 8.9 (SD 2.4) to 11.8 (SD 2.1), while the mean attitude score increased from 73.1 (SD 8.4) to 78.2 (SD 10.4). In contrast, the control group showed a slight decrease in the mean

Table 1. Participants' demographic data of intervention and control group

Variables	Total (n=1,352)	Intervention (n=683)	Control (n=669)	p-value
Sex; n (%)				0.284[a]
Male	439 (32.5)	231 (33.8)	208 (31.1)	
Female	913 (67.5)	452 (66.2)	461 (68.9)	
Age (years); mean [SD]	16.1 [0.9]	16.2 [0.9]	16.1 [0.9]	0.273[b]
Grade; n (%)				0.267[a]
Grade 10	733 (54.2)	363 (53.1)	370 (55.3)	
Grade 11	424 (31.4)	211 (30.9)	213 (31.8)	
Grade 12	195 (14.4)	109 (16.0)	86 (12.9)	
BMI; mean [SD]	20.8 [4.3]	21 [4.4]	20.7 [4.3]	0.142[a]
Normal weight; n (%)	1,161 (85.9)	582 (85.2)	579 (86.5)	
Obesity; n (%)	191 (14.1)	101 (14.8)	90 (13.5)	
Chronic diseases; n (%)				0.123[a]
No	1,208 (89.3)	619 (90.6)	589 (88.0)	
Yes	144 (10.7)	64 (9.4)	80 (12.0)	
Exercise; n (%)				0.054[a]
Do not exercise	442 (32.7)	232 (34.0)	210 (31.4)	
Exercise 1 to 2 times per week	603 (44.6)	292 (42.8)	311 (46.5)	
Exercise 3 to 4 times per week	182 (13.5)	84 (12.2)	98 (14.6)	
Exercise >4 times per week	125 (9.2)	75 (11.0)	50 (7.5)	
Smoking history; n (%)				0.063[a]
No	1,209 (89.4)	602 (88.1)	607 (90.7)	
Currently smoke	88 (6.5)	55 (8.1)	33 (4.9)	
Former smoke	55 (4.1)	26 (3.8)	29 (4.3)	
Alcohol drinking history; n (%)				0.098[a]
Never drank	657 (48.6)	325 (43.2)	332 (49.6)	
Drink occasionally (rarely)	668 (49.4)	338 (53.9)	330 (49.4)	
1 to 2 days per week	15 (1.0)	11 (1.6)	4 (0.6)	
3 to 4 days per week	12 (0.9)	9 (1.3)	3 (0.4)	

SD=standard deviation; BMI=body mass index
(a) Chi-square test, (b) Independent sample t-test

Table 2. Summary of study outcome at baseline and follow-up (week 12) in intervention and control groups

Outcomes	Group	Baseline mean (SD)	Follow-up (week 12) mean (SD)	Within-group mean difference (95% CI)	Between-group mean difference (95% CI)
Awareness of CVD prevention	Intervention	59.4 (10.2)	62.6 (8.1)	3.2 (2.26 to 4.23)	3.5 (2.22 to 4.66)
	Control	60.2 (7.8)	59.9 (7.5)	–0.3 (–1.09 to 0.55)	
Knowledge of CVD prevention	Intervention	8.9 (2.4)	11.8 (2.1)	2.9 (2.64 to 3.11)	2.4 (2.13 to 2.70)
	Control	8.2 (1.8)	8.7 (1.9)	0.5 (0.25 to 0.65)	
Attitude toward CVD prevention	Intervention	73.1 (8.4)	78.2 (10.4)	5.1 (4.13 to 6.15)	3.6 (2.46 to 4.66)
	Control	73.3 (4.8)	74.8 (5.5)	1.5 (1.00 to 2.11)	

CVD=cardiovascular disease; SD=standard deviation; CI=confidence interval
Within-group differences were calculated from baseline to follow-up at 12 weeks. Between-group differences represent adjusted estimates using generalized linear models controlling for school, gender, age, grade, BMI, chronic disease status, exercise, smoking, and alcohol drinking.

awareness score, from 60.2 (SD 7.8) to 59.9 (SD 7.5). The knowledge score showed a modest increase from 8.2 (SD 1.8) to 8.7 (SD 1.9), and the attitude score increased from 73.3 (SD 4.8) to 74.8 (SD 5.5).

As shown in Table 3, results from the GLM, adjusted for school, gender, baseline scores, age, BMI, underlying disease, physical activity, smoking status, and alcohol consumption, demonstrated statistically significant improvements in the intervention group compared to the control group. The adjusted mean

Table 3. Adjusted effects of the intervention on study outcomes using generalized estimating equation (GEE) model

Outcomes	Estimate (intervention-control)	95% CI	p-value
Awareness of CVD prevention	2.47	2.23 to 2.70	<0.001
Knowledge of CVD prevention	3.24	2.40 to 4.07	<0.001
Attitude Toward CVD prevention	3.55	2.61 to 4.49	<0.001

CVD=cardiovascular disease; CI=confidence interval

Estimates were adjusted for school, gender, age, grade level, body mass index (BMI), chronic disease status, exercise frequency, smoking status, and alcohol consumption.

Model: GEE, assuming a normal distribution with identity link function

difference in awareness scores was 2.47 (95% CI 2.23 to 2.70), in knowledge scores was 3.24 (95% CI 2.40 to 4.07), and in attitude scores was 3.55 (95% CI 2.61 to 4.49).

Discussion

The present study demonstrated that educational interventions yielded positive outcomes, leading to improvements in awareness, knowledge, and attitudes related to the prevention of CVD.

The experimental results showed that the mean awareness score of the experimental group before the intervention was 59.4 (SD 10.2), which increased to 62.6 (SD 8.1) after the intervention. At the same time, both knowledge and attitudes also improved. When comparing the mean scores between the experimental and the control groups after the intervention, it was found that the experimental group had a score of 62.6, while the control group scored 59.9, indicating higher awareness in the experimental group.

These findings are consistent with previous studies, which have found that educational programs can enhance learners' knowledge, awareness, and attitudes toward CVD prevention[23]. Moreover, such programs can lead to positive behavioral changes as a result of increased awareness and adequate knowledge for managing health and choosing appropriate preventive measures[24]. To promote awareness and ensure that students in the current generation can access health knowledge effectively, the educational approach incorporated familiar technologies into the teaching and counseling process. This included the use of motivational messages and modern learning materials via the LINE application platform, as well as experiential learning from real patients who had experienced negative health behaviors. Additionally, instructional methods such as video-based learning and participatory activities allowed for greater student engagement. Participatory and hands-on learning approaches have been shown to effectively enhance awareness and shift attitudes among students[25]. Furthermore, simulation and real-life skills training can help students better understand and apply knowledge in daily life[26]. For example, one activity in the LINE group involved teaching students how to read the sugar and sodium content on product labels, thereby promoting health awareness and self-responsibility. Active participation in such practical activities not only increases students' confidence but also motivates them to take responsibility for their own health, contributing to long-term sustainability.

The present study also revealed positive behavioral changes, such as increased physical activity, based on school activity participation records provided by health education instructors in schools. A reduction in sugary drink consumption was reported by school vendors, and a decrease in the use of electronic cigarettes was observed based on data from the school disciplinary departments. These findings are in line with the previous research showing that educational programs can effectively foster awareness and shift attitudes[27].

Limitation

The present study focuses on high school students with personal smartphones and the ability to use the LINE application and the internet. Therefore, the findings may not apply to students not equipped with internet access. Another limitation discovered was that teachers influenced students' responses regarding personal information during data collection. Additionally, an intervention must be introduced at the beginning of the course when implementing the study in schools. However, the present research concentrated on providing knowledge for prevention, offering health counseling, and emphasizing understanding to increase knowledge, improve attitudes, and raise awareness about self-prevention from CVDs.

What is already known about this topic?

CVD is a leading global health concern, with risk factors often developing during adolescence. Educational programs have been shown to improve

health awareness, but their effectiveness in school settings remains variable. Prior studies suggest that knowledge, attitude, and awareness play crucial roles in shaping preventive behaviors, yet more evidence is needed on structured interventions for high school students.

What does this study add?

This study demonstrates that a structured educational intervention significantly enhances awareness, knowledge, and attitudes toward CVD prevention among high school students. The findings provide strong evidence supporting school-based learning programs as effective tools for early prevention, reinforcing the need for integrating such initiatives into adolescent health education.

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Conflicts of interest

The authors declare no conflict of interest.

References

1. Department of Disease Control Ministry of Public Health, Thailand. The 20-year national disease and health hazard control and prevention action plan (2018-2037) - Revised edition 2021 [Internet]. 2019 [cited 2025 May 13]. Available from: https://datariskcom-ddc.moph.go.th/en/project-plan/.
2. World Health Organization (WHO). Cardiovascular diseases [Internet]. 2022 [cited 2025 May 13]. Available from: https://www.who.int/health-topics/cardiovascular-diseases#tab=tab_1.
3. Chalisarapong W. Hypertension in Thailand: Burden and challenges in its control [Master of Science in International Health]. Amsterdam, The Netherlands: Royal Tropical Institute Vrije Universiteit Amsterdam; 2022.
4. Budreviciute A, Damiati S, Sabir DK, Onder K, Schuller-Goetzburg P, Plakys G, et al. Management and prevention strategies for non-communicable diseases (NCDs) and their risk factors. Front Public Health 2020;8:574111. doi: 10.3389/fpubh.2020.574111.
5. Fernandez-Jimenez R, Santos-Beneit G, Tresserra-Rimbau A, Bodega P, de Miguel M, de Cos-Gandoy A, et al. Rationale and design of the school-based SI! Program to face obesity and promote health among Spanish adolescents: A cluster-randomized controlled trial. American Heart Journal. 2019;215:27-40.
6. Huang HR, Chen CW, Chen CM, Yang HL, Su WJ, Wang JK, et al. A positive perspective of knowledge, attitude, and practices for health-promoting behaviors of adolescents with congenital heart disease. Eur J Cardiovasc Nurs 2018;17:217-25.
7. Chaichana S, Limtasiri O. A study of learning achievement in health education on life safely for Matthayomsuksa 3 students in The Demonstration School of Ramkhamhaeng University by using the instructional package on life safety. Journal of Legal Entity Management and Local Innovation 2022;8:89-100.
8. Al-Mohaissen MA, Alohali S, Alhariqi A, Alotaibi A, Almedbal H, AlMehisen R, et al. Awareness and knowledge of cardiovascular disease and their associations with the lifestyles of 8-16-year-old girls: a perspective from Saudi Arabia. BMC Public Health 2024;24:2256. doi: 10.1186/s12889-024-19698-x.
9. Odunaiya NA, Adesanya T, Okoye EC, Oguntibeju OO. Towards cardiovascular disease prevention in Nigeria: A mixed method study of how adolescents and young adults in a university setting perceive cardiovascular disease and risk factors. Afr J Prim Health Care Fam Med 2021;13:e1-9.
10. Santos-Beneit G, Fernández-Alvira JM, Tresserra-Rimbau A, Bodega P, de Cos-Gandoy A, de Miguel M, et al. School-based cardiovascular health promotion in adolescents: A cluster randomized clinical trial. JAMA Cardiol 2023;8:816-24.
11. Kang M, Choo J. Effects of a School-based health education for cardiovascular disease prevention among high school girls. Research in Community and Public Health Nursing (RCPHN) 2024;35: 363-74.
12. Ray M, Guha S, Ray M, Kundu A, Ray B, Kundu K, et al. Cardiovascular health awareness and the effect of an educational intervention on school-aged children in a rural district of India. Indian Heart J 2016;68:43-7.
13. Hsiao HY, Chen Y, Yu PL, Tseng JT, Kuo S, Hu YH, et al. Health awareness, attitudes, and behaviors among young-adult tutors in the intergenerational mobile technology opportunities program in Taiwan. Journal of the Society for Social Work and Research. 2020;11:83-102.
14. Prentice-Dunn S, Rogers RW. Protection Motivation Theory and preventive health: beyond the Health Belief Model. Health Educ Res 1986;1:153-61..
15. Mair JL, Salamanca-Sanabria A, Augsburger M, Frese BF, Abend S, Jakob R, et al. Effective behavior change techniques in digital health interventions for the prevention or management of noncommunicable diseases: An umbrella review. Ann Behav Med 2023;57:817-35.
16. Quinlan KB, McCaul KD. Matched and mismatched interventions with young adult smokers: testing a stage theory. Health Psychol 2000;19:165-71.
17. Mujamammi AH, Alluhaymid YM, Alshibani MG, Alotaibi FY, Alzahrani KM, Alotaibi AB, et al. Awareness of cardiovascular disease associated risk factors among Saudis in Riyadh City. J Family Med Prim Care 2020;9:3100-5.

18. Likert R. The human organization: its management and values. New York: McGraw-Hill; 1967.
19. Awad A, Al-Nafisi H. Public knowledge of cardiovascular disease and its risk factors in Kuwait: a cross-sectional survey. BMC Public Health 2014;14:1131. doi: 10.1186/1471-2458-14-1131.
20. Mohammad NB, Rahman NAA, Haque M. Knowledge, attitude, and practice regarding the risk of cardiovascular diseases in patients attending outpatient clinic in Kuantan, Malaysia. J Pharm Bioallied Sci 2018;10:7-14.
21. Chomeya R. Quality of psychology test between Likert scale 5 and 6 points. J Soc Sci 2010;6:399-403.
22. R Core Team. R: A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing; 2024.
23. Yang X, Qin Q, Wang Y, Ma Z, Li Q, Zhang F, et al. Knowledge, attitudes, and practices regarding cardiovascular disease prevention among middle school students in China: a cross-sectional study. Front Public Health 2024;12:1301829. doi: 10.3389/fpubh.2024.1301829.
24. Vigneshwaran E, AlShahrani SM, Alanzi AR, Mohammad AAS, Sadiq MMJ, Khan NA, et al. Comparing knowledge, attitudes, and practices in cardiovascular disease prevention and health promotion between community and hospital pharmacists in Saudi Arabia: A cross-sectional study. Saudi Pharm J 2024;32:101890. doi: 10.1016/j.jsps.2023.101890.
25. Tong DH, Uyen BP, Ngan LK. The effectiveness of blended learning on students' academic achievement, self-study skills and learning attitudes: A quasi-experiment study in teaching the conventions for coordinates in the plane. Heliyon 2022;8:e12657.
26. Kong Y. The role of experiential learning on students' motivation and classroom engagement. Front Psychol 2021;12:771272. doi: 10.3389/fpsyg.2021.771272.
27. Bhat V, Coates R, Shanbhag D, Pillai N, Zacharias N, D'Souza R, et al. Impact of a simple educational intervention on awareness regarding cardiovascular disease among school-going adolescents in a rural area of Bengaluru district, India. J Educ Health Promot 2023;12:19. doi: 10.4103/jehp.jehp_965_22.