

Non-Communicable Diseases Preventive Program Outcomes at Elementary Schools Using the Whole School, Whole Community, Whole Child Model

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Abstract

Background: Lifestyle behaviors are established during childhood periods. Unhealthy lifestyle behaviors are contributing to non-communicable diseases (NCDs). **Aim:** This study aimed to assess the outcomes of NCDs preventive program at elementary schools using the Whole School, Whole Community, Whole Child (WSCC) model. **Methods:** A quasi-experimental study design was conducted in two governmental elementary schools as intervention and control during the academic year 2023-2024. A total of 488 first-grade schoolchildren, their mothers and 45 schoolteachers participated in the study. **Data collection** was carried out across the ten WSCC components through four parts. Part I: Assessment of sociodemographic characteristics of the study participants, and school environment. Base-endline assessments (parts II, III and IV): II- First-grade schoolchildren were assessed through five tools: tool I to assess health lifestyle-related behaviors and Tool II-V to assess the relevant life skills related to prevention of NCDs modifiable risk factors. III- Schoolchildren mothers assessed for health lifestyle-related behaviors and their general knowledge regarding NCDs. IV- Schoolteachers were assessed for health-promoting behaviors profile. **Results:** Most schoolchildren's mothers reported not having enough family income, schools were lacking health educational materials related to the NCD risk factors. Significant improvements ($p \leq 0.05$) were shown in the intervention school among first-grade schoolchildren in lifestyle-related behaviors and relevant life skills, schoolchildren mothers' health lifestyle-related behaviors and general Knowledge of NCDs, as well as schoolteachers health-promoting lifestyle profile. **Conclusions:** The NCDs preventive program at elementary schools across the ten WSCC model can improve adoption of healthy lifestyle-related behaviors and relevant life skills necessary to prevent NCDs modifiable risk factors.

Keywords: NCDs preventive program; WSCC, schoolchildren; Health lifestyle-related behaviors; relevant life skills. school nurse; Egypt

Noncommunicable Diseases during and beyond the COVID-19 Pandemic: A Rapid Review, n.d.).

Introduction

Noncommunicable diseases (NCDs) are responsible for 74% of all deaths worldwide, with 77% in low- and middle-income countries. In Egypt, 84% of deaths were due to NCDs in 2016. NCDs pose a significant challenge to achieving the 2030 Agenda for Sustainable Development. However, poverty is linked to NCDs; in low-resource environments, the financial burden of NCDs can rapidly deplete household finances (WHO, 2023).

People of all age groups are all vulnerable to the risk factors contributing to NCDs. These risk factors include unhealthy lifestyle choices, such as poor eating habits, sedentary behavior, tobacco smoke exposure, hazardous alcohol use, and air pollution (WHO, 2023). Habits and behaviors are established during childhood period. The impact of lifestyle factors during these formative years can affect long-term health outcomes (Responding to

Schools play a critical role in promoting the health and safety of young people and helping them establish lifelong healthy behaviors. The Whole School, Whole Child, Whole Community (WSCC) model components are designed to address the unique needs of school children across ten components, especially components that cut across multiple layers (e.g., school, home, and community).

Across the 10 components of the WSCC model there is value in addressing more than one component of WSCC, 6 clearly address the health needs of students (physical education and physical activity; nutrition environment and services; health services; health



Centers for disease control and prevention. 2019. Available from: <https://www.cdc.gov/healthyschools/about.htm> (Figure 1)

education; employee wellness and counseling, psychological, and social services); while 4 are cross-cutting are essential to support healthy behaviors among students (social and emotional school climate, physical environment, family engagement, and community involvement) (CDC, 2019; CDC, 2024; Lewallen et al., 2015). The Framework for 21st-Century School Nursing Practice aligns with the WSCC model, demonstrating that school nurses are well-positioned to lead and coordinate implementation and evaluation (National Association of School Nurses, 2020).

Significance of the study:

In 2023/2024, enrollment in primary governmental schoolchildren in Egypt was 13.6 million, 5.4 million of them were first-grade students aged 6-7 years (Administrator, 2024). This age category is a significant community segment in need of holistic care. Good health and education are crucial for achieving Sustainable Development Goals (SDGs). Controlling noncommunicable diseases (NCDs) requires reducing risk factors associated with these diseases (WHO, 2023, *Protecting School Children from the Serious Threat of Non-Communicable Diseases*, n.d.). However, a presidential initiative in Egypt was launched in 2021/2022 to detect malnutrition among primary school students, with anemia prevalence estimated at 17% (Administrator, 2024; El-Saadani et al., 2021).

Nurses are key providers in education and skill building of preventive care for non-communicable diseases (NCDs). They provide behavioral and lifestyle interventions that consider social determinants of health

and build on individual, family, and community strengths (CDC, 2019).

Aim of the study:

The aim of the study was to assess outcomes of non-communicable diseases preventive program at elementary Schools using the Whole School, Whole Community, Whole Child (WSCC) model.

Specific objectives

1. To assess the baseline knowledge, attitude, and habits (KAH) towards four lifestyle-related components, as well as relevant life skills (perceived stress, coping management, social and emotional skills, and pro-environmental behaviors) of first-grade schoolchildren.
2. To assess the baseline health lifestyle-related behavior and general knowledge regarding NCDs among first-grade schoolchildren mothers.
3. To assess the baseline health-promoting lifestyle among schoolteachers.
4. To design and implement NCDs preventive program at elementary schools using the WSCC model
5. To assess the endline outcomes of study variables (specific objectives 1-3)
6. To compare the endline to the baseline outcomes using the same tools within group and between intervention and control groups.

Research Hypothesis:

H1: KAH towards four lifestyle-related components and relevant life skills among first-grade schoolchildren will be improved at the endline of the NCDs preventive program in the intervention group.

H2: Health lifestyle-related behavior and general knowledge regarding NCDs among first-grade schoolchildren mothers will be improved at the endline of the NCDs preventive program in the intervention group.

H3: The total scores of health-promoting lifestyle profile-II of schoolteachers will be improved at the endline of the NCDs preventive program in the intervention group.

Subjects and methods

Research Design

A before-after quasi-experimental design was utilized to conduct the present study.

Study setting

The study was implemented in two governmental elementary schools for both sexes selected as a convenient setting, 1.8 KM is the distance between schools. These schools are situated at Al-haram district - authorized to Al-Haram educational administrative sector-Giza governorate -Egypt. In simple random selection, one school was assigned for the intervention group and one for control group. The study was conducted during the academic year 2023-2024.

Population and sample size

The study participants consisted of first-grade schoolchildren (6-7 years old), their mothers, and schoolteachers. The total number of first-grade schoolchildren were (756), and (380) in the intervention and control respectively. To calculate the sample size the following equation for schoolchildren was used

$$n = \frac{Z^2 NP (1 - P)}{D^2 (N - 1) + Z^2 P (1 - P)}$$

Where,

N = stands for the size of the population

Z = refers to the critical value of the confidence level (1.96)

P = the population proportion (0.50)

D = the degree of accuracy expressed as a proportion (0.05)

According to the sample size calculation, the minimum samples required and in account for possible drop out were (255 increased to 336) and (192 increased to 228) of first-grade schoolchildren of the intervention and control group respectively. The total number of (288) and (200) first-grade schoolchildren were completed the endline assessment of the intervention and control group respectively. A systematic random sample was done per/class based on first-grade schoolchildren's attendance.

A total of 488 first-grade schoolchildren's mothers participated in the study, which was convenient as they are escorting their schoolchildren back and forth to the school.

In addition, the study participants, including thirty and fifteen schoolteachers, participated in the intervention and control group respectively.

The inclusion criteria:

Schoolchildren mothers agreed to participate in their first-grade schoolchildren in the study and participate with them.

The exclusion criteria:

Absence of any medical condition that interferes or limits the program implementation such as a

cardiovascular disease as schoolchild's mothers were reporting

Data Collection Tools:

After reviewing related literature and building upon value in addressing more than one component of WSCC that cut across multiple layers (8), the following data collection four parts were demonstrated:

Part I: Included two sections

Section A: Assessment sheet of sociodemographic characteristics of schoolchildren; sex, medical history as their mothers' reporting, mothers' age, level of education, income, work, and schoolteachers' age, sex, income, social status, medical history as self-reported were assessed.

Section B: An observational checklist to assess and describe the schools' environment versus criteria that addressing NCDs risk factors e.g. diet, physical education and physical activity, health education, safety ...etc.

Part II:

A- Base-endline assessment of schoolchildren's health lifestyle-related behaviors

Tool I: Knowledge, attitude, and habits (KAH) questionnaire towards Four lifestyle-related components: diet, physical activity, understanding the body and heart, and management of emotions developed for schoolchildren (6-7 years old) by (Santos-Beneit et al., 2015). It consists of 48 items divided into four components, three choices/items, adapted with a cartoon character to keep children's attention. Scoring was two points for correct responses, one point for intermediate responses and zero for incorrect responses, the overall KAH scores range from 0 to 96 points, with the total scoring classified as poor (0-32), moderate (33-64), and good (65-96).

B- Base-endline assessment of schoolchildren's relevant life skills

Tools II: Perceived stress scale for children developed by (White, 2014), consisting of 13 questions. A higher value on all 13 scored questions equated to higher stress perception. Each question was answered on a scale with 4 options, ranging from never to a lot. The total scoring classified the stress level as no stress, mild, moderate, or high.

Tool III: Kid cope, a tool developed by (Abdelmageed et al., 2022) for children aged (5 to13), this tool is useful for understanding coping strategies

among schoolchildren. It consists of 15 items divided into 10 categories, including active, avoidant, and negative coping. Response options were "Yes/No", with a value of zero for "No" and one for "Yes." Frequency responses to each strategy are computed, and total scores are interpreted as most frequently and least frequently of each coping strategy.

Tool IV: A tool designed to measure elementary school students' social and emotional skills, specifically self-control, persistence, and social competence, has been developed by (**Measuring Elementary School Students' Social and Emotional Skills: Providing Educators with Tools to Measure and Monitor Social and Emotional Skills That Lead to Academic Success, n.d.**). The tool was completed by first-grade schoolteachers after training by researchers. It consists of 12 items ranging from 1 to 4 and measures how each item describes the student's behavior. The scoring system scores each item on a scale from (none= 1 to always= 4), with higher scores indicating better skill performance. The tool's skill level is interpreted as low (1-11), moderate (12-23), and high (36-48).

Tool V: Pro-environmental behaviors of schoolchildren scale developed by (**Eyup Artvinli & Zulfiye Melis Demir, 2018**), it consists of two sub-dimensions: attitude towards the environment (15 items) and environmental awareness (15 items). Items cover consumption, protecting creatures, environmental pollution, and recycling. The children were shown pictures of two situations and asked to respond using colored cards. The scoring system classified as, if the child chose "always/right" for a positive behavior, two points were awarded, if they chose "sometimes/I don't know/I have no idea", one point was awarded, and 0 points were awarded for negative behaviors. The total scores ranged from 0-60, with scores of 0-30 considering negative environmental behaviors and scores of 31-60 positive ones.

Part III: Base-endline assessment of schoolchildren mothers

Tool I: self-administration questionnaire for mothers about general knowledge of NCDs, developed by the researchers. It consisted of 50 questions about noncommunicable diseases (NCDs) definition, characteristics, risk factors, and prevention. Correct

answers were scored (1) and incorrect answers (0). The score ranges from 0 to 50, with a cut-off $\geq 60\%$ for satisfactory level and $< 60\%$ for unsatisfactory.

Tool II: The mothers health lifestyle-related behaviors (PHLB) is a self-administered questionnaire designed by researchers to assess mother's lifestyle-related behaviors impact their schoolchild. It consists of 70 items, including components of diet (30 items + an open question to identify barriers to healthy diet facing schoolchildren mothers); physical activity (14 items); sleeping habits and screen time (13 items); substance and medicine use (3 items); second-hand tobacco use (5 items); injury prevention (5 items). Mothers were asked to indicate the number of days per week for each item. Adhering to WHO guidelines, frequency no. of days/ week ranged from 1-3. It composites of frequency (0-2) = 1 (bad), (3-5) = 2 (regular), (6-7) = 3 (good). Bad lifestyle choices were given a reverse score. The total scores are interpreted as: $PHLB \geq 2$ indicates very unhealthy lifestyle behaviors, $PHLB \geq 3$ and ≤ 5 indicates healthy lifestyle behavior that needs improvement, and $PHLB \geq 6$ indicates adequate healthy lifestyle behavior.

Part IV: Base-endline assessment of schoolteachers'

Health-Promotion Lifestyle Profile-II (HPLP-II) is a questionnaire developed by (**Walker et al., 1995**) to measure employee wellness. It consists of 52 items and measures six domains: health responsibility, physical activity, nutrition, spiritual growth, interpersonal relations, and stress management. The questionnaire also measures the frequency of adopting specific health-promotion behaviors. habits on a four-point Likert scale ranging from never = (1), sometimes = (2), often = (3), and routinely = (4). The total HPLP-II scores range from 52 to 208 and are classified into four levels: poor (52-90), moderate (91-129), good (130-168), and excellent (169-208).

Content Validity and Reliability:

Two independent bilingual certified professional translators translating scales from English or Spanish into Arabic and back into the original language. Six academic nursing and medical professors evaluated the content validity and provided suggestions for improvement. The study materials were updated with these changes. Cronbach's value for the base-endline assessment tools were as following; for first-grade schoolchildren five tools α value were (0.79, 0.84, 0.74, 0.92, and 0.93) respectively, for schoolchildren mothers' tools were (0.97 and 0.92) respectively, and for schoolteachers', the original

HPLP II's overall scale yielded a Cronbach's alpha of 0.94.

Ethical considerations:

The study was approved by the Faculty of Medicine for Girls (FMG) – Al-Azhar University Ethical Committee, FMG-IRB-ID 1856 on 15/4/2023. Participants were informed about the study's objectives and given written informed consent. **All schoolchildren who participated in the study had the informed consent form signed by their mothers.** All participants assured that the data would be used confidentially for research purposes only. The researcher ensured anonymity and confidentiality of the subjects' data, and participants were allowed to withdraw at any time.

Pilot study

A pilot study was carried out to evaluate the tools' clarity and applicability on (10%) of the study participants. Meanwhile the research tools were not modified, those who participated in the pilot study were included in the study.

Fieldwork

Permission was obtained from the director of educational administration in Al-Haram region to conduct the study in selected schools. The researchers met with school administrators and teachers in September 2023, and with schoolchildren and their mothers after the first week of the academic year in October 2023 to build rapport and familiarity. The intervention took place from October 2023 to April 2024.

Description of the intervention:

Six phases of the PRECEDE/PROCEED Model (PPM) (Community Toolbox, 2018) were used to assess, design, implement, and evaluate the outcome of a non-communicable diseases (NCDs) preventive program using the WSCC model.

The study involved 288 first-grade schoolchildren divided into 18 groups, with 16 schoolchildren per group. Each group received fourteen sessions, while their mothers (288) attended eight sessions, and thirty schoolteachers were divided into two groups of 15 each. The sessions lasted 45-60 minutes. Baseline assessment was conducted in October 2023, with the endline assessment done in April 2024, taking formal holidays into consideration.

The intervention package was developed after reviewing related literature (Asia, 2020; School Health Promotion Manual, 2019; Egyptian Ministry of Health and Population for School Health Services: Guidelines for Practical Activities; MSEZANE, 2021; Sibiya et al., 2014; Kindergarten 5. Healthy Lifestyle Practices, n.d.; Grade 1 5. Healthy Lifestyle Practices, n.d.; A, 2019; Guan et al., 2020; Healthy Diet, n.d.; Health & Centre, n.d.) and analyzing the baseline assessment.

The intervention for first-grade schoolchildren covered two sections: promotion of healthy lifestyle and prevention of NCD risk factors, including healthy diet, physical activity, hygiene, dental care, rest, sleep, environmental pollution and protection, injury prevention, harmful substances at home and school, screen time, and electronic device use. These sessions included both individual and group knowledge and practice. Section II focused on teaching relevant life skills through the practice and interactions of section I, including stress management, peer mediation, managing emotions, and using active coping strategies. Interactive learning sessions using PowerPoint, pictures, cartoons, videos, stories, and scenarios were adapted for readability and comprehension at the first-grade level with the help of education experts. The power of repetition and learning through practice and play were emphasized.

First-grade schoolchildren received sessions during the school day, without disrupting the school schedule, while schoolchildren's mothers and schoolteachers had sessions at the end of the school day.

In addition to actively participating in their children's activities at home, such as making posters and recycling, schoolchildren's mothers received PowerPoint presentations on general knowledge of NCDs and their risk factors, as well as health-related behaviors aligned with the NCD preventive program.

Statistical design

The study utilized IBM SPSS version 27 for data analysis, including descriptive statistics, inferential statistics. The Chi-square test was used for categorical data comparison, while the McNemar test was used to compare base-endline assessment within the same group. The Repeated-Measure ANOVA test was used to compare the intervention and control groups. The level of significance was determined at a p-value of 0.05.

Results:

Part I:

Section I: The sociodemographic characteristics of the study participants in both groups shows that the total of 488 first-grade schoolchildren with no significant difference in sex, and 488 schoolchildren mothers (288 intervention and 200 control). All participants' schoolchildren were not having NCDs as reported by their mothers. Mothers mean age was 29.92 ± 2.87 and 29.87 ± 2.55 , and mothers' educational level were between basic and diploma. All mothers were housewives, most of the mothers reported family income not enough. Concerning schoolteacher, 70% and 60% of them were females out of 30 intervention and 15 control, their mean age 38.40 ± 4.99 and 37.73 ± 4.22 , 80% and 93.3 were married, majority were reported of not enough income, as well as 56.7% and 53.3 of having one of the NCDs in the intervention and control group respectively, (Table 1).

Section II: The school environment assessment compared criteria addressing NCD risk factors in intervention and control groups. The intervention school is almost double the size of the control school. Both intervention and control schools are governmental, located near a highway, and experience high levels of overcrowding in terms of school size, classroom space, and distance from whiteboards. In terms of health services facilities, there is a health visitor room equipped with basic screening instruments and incomplete first aid kits. A part-time doctor and nurse are available, and they adhere to the health insurance coverage policies. Regarding the school nutrition services, both schools provide students with two pieces of biscuit daily, offer tap potable water, allow students to bring their own meals, and have school canteens, Vendors outside the schools sell unhealthy snacks. In terms of physical education and activity, both schools have scheduled 90-minute physical education classes with two consecutive sessions on a court (formerly a playground) using a tiled area without sports equipment. Both groups have one physical education teacher for grades 1-6. Additionally, safety measures include exits. At the baseline assessment in both schools, written school policies and procedures of comprehensive health insurance coverage system and referral had not been informed, likewise, visual health education messages-related to NCD risk factors were lacking in both schools. These materials were delivered through banners, posters, collages, samples, models and distributed in classrooms and on school boards and walls by the end of the intervention period for the intervention group.

When asked about barriers to a healthy diet, schoolchildren's mothers mentioned peer advertising and the availability of unhealthy snacks in school canteens,

groceries, and supermarkets, making it challenging for them to resist purchasing these options instead of expensive fruits and vegetables.

Part II: Shows first-grade schoolchildren baseline and endline assessments comparing between intervention and control groups regarding lifestyle-related behaviors (KAH) and life-skills.

Figure 2: Shows schoolchildren's health lifestyle-related behaviors (KAH), which were 81.9% poor at baseline and 97.2% good at endline in the intervention group, and 75% and 72% poor at baseline and endline in the control group. Significant differences were found between the baseline and endline assessments within the same group and between the intervention and control groups

Schoolchildren's life-skills:

Figure 3 illustrates the psychological and social components of the WSCC through schoolchildren's perceived stress levels. At baseline, schoolchildren's perceived stress levels were high (96.5%), mild (45.5%), and moderate (54.5%) at end-line in the intervention group. In the control group, stress levels were high at both baseline (80.5%) and end-line (95%). Significant differences were found between the baseline and endline assessments within the same group, as well as between the intervention and control groups.

Table 3: Reveals that the most frequent coping strategies used by schoolchildren were avoidant, negative, and active at baseline in the intervention group (94.8%, 67.7%, and 44%). By the endline, the most common coping strategy was active, while avoidant and negative coping remained consistent (73.6%, 30.2%, and 30.2%). In contrast, the control group's most frequent coping strategies at baseline were avoidant, negative, and active (95%, 69.5%, and 20%). At the endline for the control group, the most common coping strategies remained the same (70.5%, 55.5%, and 28%). Significant differences were found between the baseline and endline assessments within the same group, as well as between the intervention and control groups.

Figure 3 illustrates the psychological and social components of the WSCC through schoolchildren's perceived stress levels. Initially, in the intervention group, schoolchildren reported high levels of stress (96.5%), with some reporting mild stress (45.5%) and moderate stress

(54.5%). By the end of the study, there was a decrease in stress levels, with fewer reporting high stress (95%) and more reporting mild and moderate stress. In the control group, stress levels remained high throughout the study, with 80.5% reporting high stress at baseline and 95% at end-line. Significant differences were observed between baseline and end-line assessments within each group, as well as between the intervention and control groups.

Figure 4 shows that among schoolchildren, 88.5% exhibited negative environmental behaviors at baseline, while 95.8% showed positive environmental behaviors at the end of the intervention. In contrast, in the control group, negative environmental behaviors persisted among schoolchildren, with 79.5% at baseline and 88.5% at the end of the study. Significant differences were observed between baseline and endline assessments within the same group, as well as between the intervention and control groups.

Part III: Explaining the schoolchildren's mothers' base-endline assessments:

Figure 5: In terms of general knowledge about NCDs, their risk factors, and prevention, the percentages were 91.7% (<60%) at baseline and 95.5% (≥60%) at endline in the intervention group. Meanwhile, it was 91% (<60%) at baseline and 88.5% (<60%) at endline in the control group. Significant differences were observed within, and between the intervention and control groups.

Figure 6: Regarding the lifestyle behaviors of schoolchildren's mothers, it was found that 77.8% of them had very unhealthy behaviors at baseline and 82.3% showed the need for improvement in healthy behaviors at the endline in the intervention group. In comparison, 78% and 82% were reported to have very unhealthy lifestyle behaviors at both baseline and endline in the control group. Significant differences were observed between baseline and endline assessments within the same group, as well as between the intervention and control groups.

Part IV: Schoolteachers' Health-Promotion Lifestyle Profile-II at base-endline assessments

Figure 7: The total Health-Promotion Lifestyle Profile-II at base-endline assessments was compared between the intervention and control groups. The Total Health-Promotion Lifestyle Profile-II (HPLP-II) showed poor (43.3%) and moderate (56.7%) at baseline, and moderate (13.3%) and good (86.7%) at the endline in the intervention group, while poor (40%) and moderate (60%) in the control group. None of the schoolteachers in either

group scored excellent in HPLP-II. Significant differences were observed between the intervention and control groups.

Table 1: Depicts NCDs preventive program across WSCC components,

Baseline Assessment in October 2023						Contr ol group
Intervention group (Intervention across the WSCC component)					Outcome Indicator	
WSCC Component	Modules	Tools required	Assessment Method	Outcome Indicator		
Target: Whole school						
Health Services	Orientation to the policies and procedures of a comprehensive health insurance coverage system and referral	Written school policies and procedures outline a comprehensive health insurance coverage system and referral process	Delivering visual messages through banners, posters collages, samples, and models	- Increasing percentages of visual health education messages are being delivered through banners, posters, collages, samples, and models. These messages are disseminated in classrooms, school boards, and on walls. Additionally, there is an orientation on policies and procedures related to the comprehensive health insurance coverage system and referral.		
Health education	Risk factors for NCDs such healthy diet, physical activity,	- Stationery and supplies				
Community involvement	The collaboration between the school and nursing college resulted in a win-win community participation. Volunteer nursing students conducted interactive presentations on climate change, health, and recycling.	-Rinsed empty food containers such as jars, cans, bottles, tubs, and so on -Used food wrappers, other waste materials - Scissors, glue, Stationery				
Physical environment	- Injury prevention	- First aid kits				
Target: First-grade Schoolchildren: section I: promotion of healthy lifestyle and prevention of NCD risk factors						
Physical activity.	Physical activity includes understanding the body and heart, as well as the management of emotions, including anger.	-Laptop and projector for videos and cartoons, role play, and scenarios are available. Comfortable sportswear and shoes, balls, ropes, and mats are also provided.	- Researchers' observation -Participation, question-answers - Activities (e.g coloring, competitions)	- An increasing percentage of schoolchildren are achieving high scores on the Knowledge, Attitude, and Habits (KAH) questionnaire in relation to four lifestyle-related components		
Nutrition Environment and services	Healthy diet	- Laptop and projector for videos and cartoons	- Knowledge, attitude, and habits (KAH) questionnaire towards Four lifestyle-related component			

Five months from November 2023 to March 2024 period

Target: First-grade Schoolchildren: section II was concerned with teaching relevant life skills				
Counseling, psychological and social services	Teaching stress management Stress management	Laptop & projector (Videos, cartoon), role play, scenarios	- Researchers observation -Participation, question-answers Perceived stress scale	-Decreasing percentages of schoolchildren who perceive high stress
	Coping strategies use		- Researchers observation -Participation, question-answers Kidcope scale	--An increasing percentage of schoolchildren who have most frequently use active coping strategy
Social and emotional climate	Teaching peer mediation and managing emotions	Laptop & projector (Videos, cartoon), role play, scenarios	- Teacher observation - Social and emotional skills survey	-An increasing percentage of schoolchildren who Have high social and emotional skills
Physical environment	- Environmental pollution and protection - Recycling - Safety: Injury prevention, harm / dangerous substance at home and school	Mothers' participation Laptop & projector (Videos, cartoon), role play, scenarios	-Participation, question-answers - Pro-environmental behaviors	-An increasing percentage of schoolchildren who have positive Pro-environmental behaviors
Target: Schoolchildren mothers' General knowledge of NCDs risk factors and health lifestyle- related behaviors				
Family engagement	- General knowledge of NCDs and their risk factors,	Laptop & projector	-Participation, question-answers - Questionnaire	-An increasing percentage of schoolchildren who have satisfactory knowledge on NCDs risk factors and prevention
	- Health lifestyle- related behaviors	Laptop & projector (Videos, cartoon), role play, scenarios	- Health lifestyle-related behaviors questionnaire	-A significant improvement in schoolchildren's mothers' health lifestyle- related behaviors questionnaire
Target: Schoolteachers: health-promoting behaviors				
Employee wellness	- Promoting health behavior	Laptop & projector (Videos), role play, scenarios	Health-Promotion Lifestyle Profile-II (HPLP-II)	- Significant improvement of schoolteachers on total HPLP-II
Endline Assessment in April 2024				

Part I:

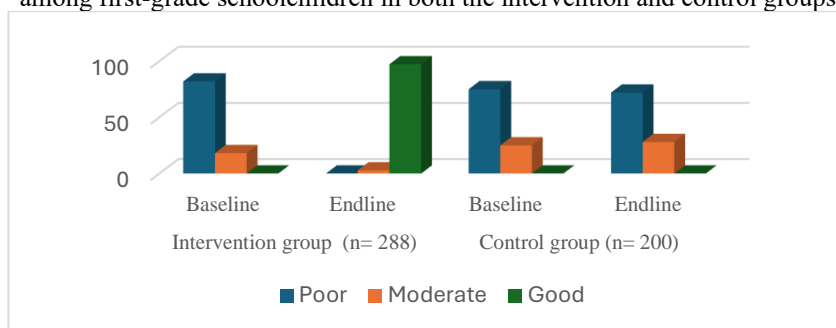
Table 2: The sociodemographic characteristics of the study participants in both groups

Participants /variables		Intervention group	Control group
Schoolchildren		Intervention (n= 288)	Control (n= 200)
		n(%)	n(%)
Sex	boys	141 (49)	103(51.5)
	girls	147(51)	97 (48.5)
		Chi-Square (P-value)	3.59 (0.06) (N.S) *
Schoolchildren mothers		Intervention (n= 288)	Control (n= 200)
		n (%)	n(%)
Mothers age /year	25-29	116 (40.3)	80 (40)
	30-34	154(53.5)	108 (54)
	35-39	18 (6.3)	12 (6)
	Mean ± SD	29.92±2.87	29.87±2.55
Level of education	Basic	90 (31.2)	62 (31)
	Diploma	198 (68.8)	138 (69)
Family Income	Not Enough	277(96.2)	190 (95)
	Enough	11 (3.8)	10 (5)
Schoolteachers		Intervention (n= 30)	Control (n= 15)
sex	Male	9(30)	6 (40)
	Female	21 (70)	9 (60)
Age/year	30-39	19 (63.3)	10(66.7)
	40-49	11 (35.7)	5(33.3)
	Mean ± SD	38.40±4.99	37.73±4.22
Marital status	Single	6 (20)	1 (6.7)
	Married	24 (80)	14 (93.3)
Income	Not Enough	29(96.7)	15 (100)
	Enough	1 (3.3)	0 (0.00)
Reporting of having any NCDs	No	13 (43.3)	7(46.7)
	Yes	17 (56.7)	8 (53.3)

(N.S) * non-significant differences

Part II:

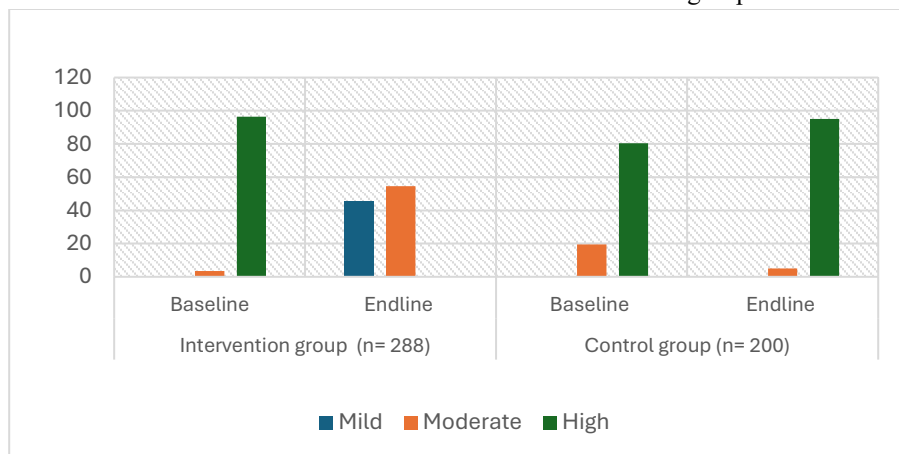
Figure2: Compare the percentages of knowledge, attitude and habits related to healthy lifestyle among first-grade schoolchildren in both the intervention and control groups



Test (P-value)	Intervention Base-endline	Control group Base-endline
Chi-Square (P-value)	5.68 (0.04) *	171.43 (0.03) *
ANOVA (P-value)	0.00*	

* Significant

Figure 3: Compare the percentages of perceived stress levels among first-grade schoolchildren in both the intervention and control groups



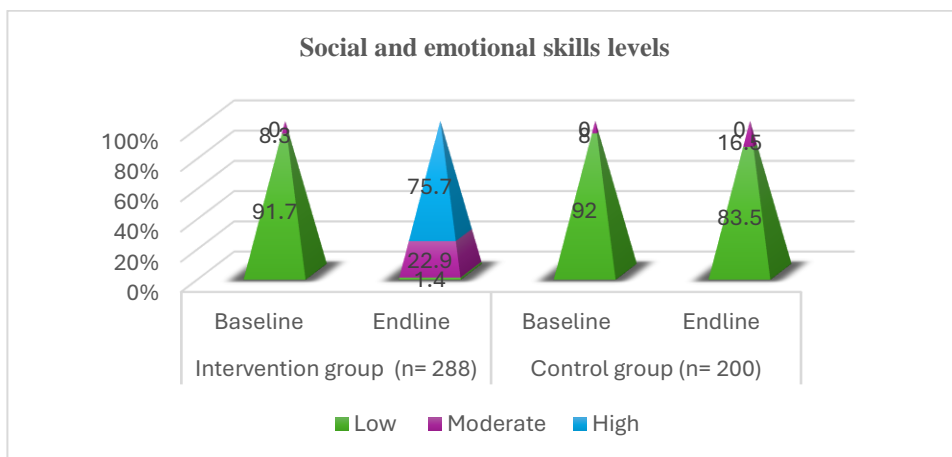
Test (P-value)	Intervention Base-endline	Control group Base-endline
Chi-Square (P-value)	8.28 (0.04)*	43.45 (0.00) *
ANOVA (P-value)	0.00*	

* Significant

Table 3: Compare the coping strategies used by the first-grade schoolchildren in the intervention and control groups

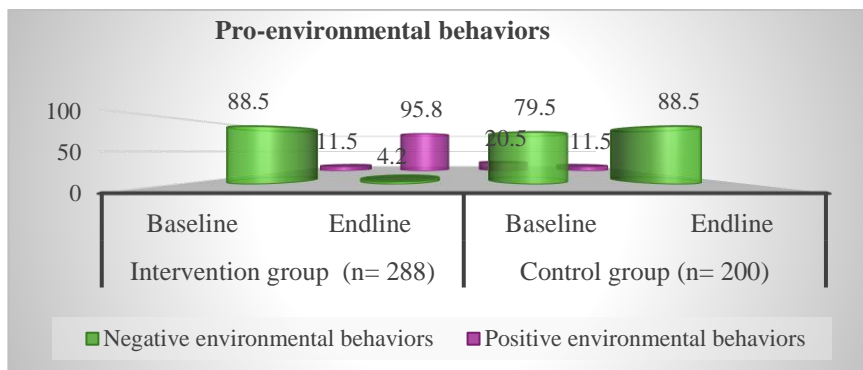
Variables	Intervention (n= 288)		Chi-Square (P-value)	Control group (n= 200)		Chi-Square (P-value)	ANOVA P-value	
	Baseline n (%)	Endline n (%)		Baseline n (%)	Endline n (%)			
Active Coping								
Least frequent	190 (66)	76 (26.4)	29.17 (0.00) *	160(80)	144(72)	0.223 (0.04) *	0.00*	
Most frequent	98(34)	212 (73.6)		40 (20)	56(28)			
Avoidant Coping								
Least frequent	15 (5.2)	201(69.8)	6.85 (0.00) *	10(5)	59(29.5)	25.156 (0.00)		
Most frequent	273(94.8)	87(30.2)		190(95)	141(70.5)			
Negative Coping								
Least frequent	93(32.3)	201 (69.8)	151.39 (0.00) *	61(30.5)	89(44.5)	59.01 0.00		
Most frequent	195(67.7)	87(30.2)		139(69.5)	111(55.5)			

Figure 4: Compare the percentages of social and emotional skills levels among first-grade schoolchildren in both the intervention and control groups



Test (P-value)	Intervention Base-endline	Control group Base-endline
Chi-Square (P-value)	11.027 (0.01) *	88.011 (0.00) *
ANOVA (P-value)	0.00*	

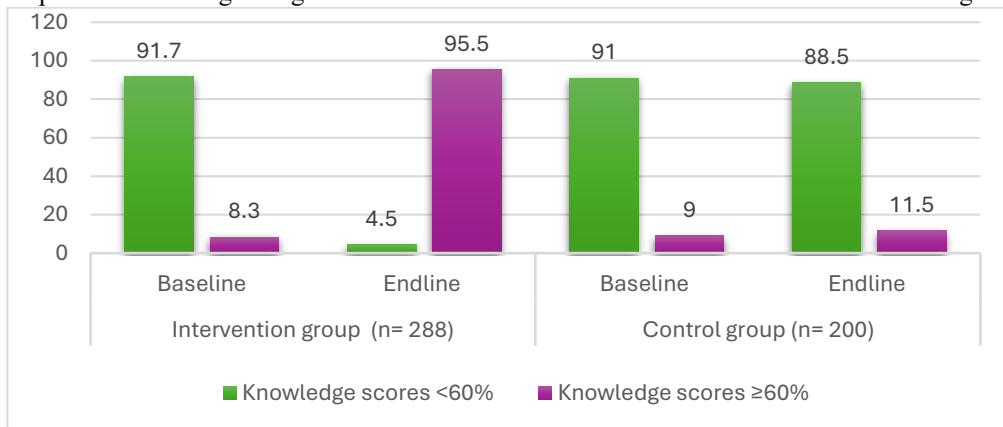
Figure 5: Compare the percentages of pro-environmental behaviors among first-grade schoolchildren in both the intervention and control groups



Test (P-value)	Intervention Base-endline	Control group Base-endline
Chi-Square (P-value)	0.121 (0.00) *	18.89 (0.00) *
ANOVA (P-value)	0.00*	

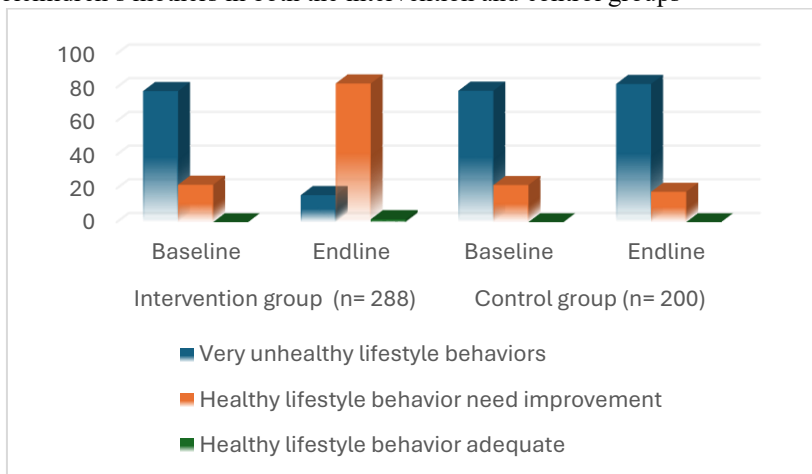
Part III:

Figure 6: Compare the percentages of general knowledge regarding NCDs, their risk factors and prevention among first-grade schoolchildren’s mothers in the intervention and control groups



Test (P-value)	Intervention Base-endline	Control group Base-endline
Chi-Square (P-value)	1.24 (0.00*)	152.22 (0.03) *
ANOVA (P-value)	0.00*	

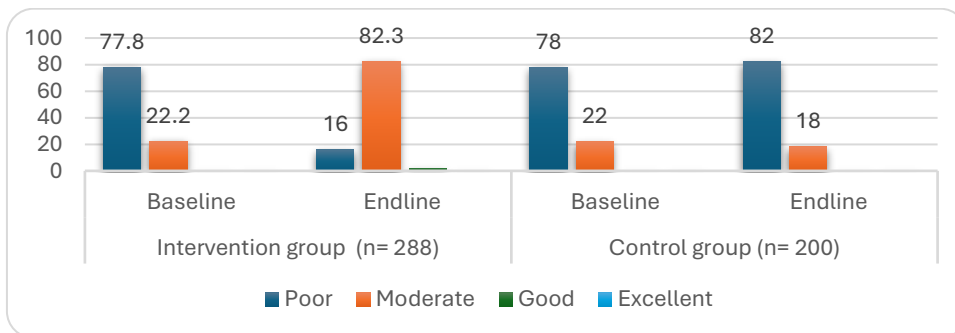
Figure 7: Compare the percentages of health lifestyle-related behaviors among first-grade schoolchildren’s mothers in both the intervention and control groups



Test (P-value)	Intervention Base-endline	Control group Base-endline
Chi-Square (P-value)	6.88 (0.02)*	155.65 (0.01) *
ANOVA (P-value)	0.00*	

Part IV:

Figure 8: Comparison of Total Health-Promotion Lifestyle Profile-II among schoolteachers at the baseline and endline in both groups



Test (P-value)	Intervention Base-endline	Control group Base-endline
Chi-Square (P-value)	6.04 (0.03) *	15.00 (0.00) *
ANOVA (P-value)	0.00*	

Discussion

The study examines the effectiveness of a preventive program for non-communicable diseases (NCDs) in elementary schools using the WSCC model. The WSCC model emphasizes promoting healthy behavior and supporting students through its ten components (CDC, 2024; Lewallen et al., 2015).

When comparing the overall school environment assessments of criteria addressing NCD risk factors in intervention and control schools, it is evident that both schools are encountering similar challenges. These challenges include overcrowding, limited classroom space, and proximity to a highway. The written policies and procedures for referral systems related to health services under the umbrella of comprehensive health insurance were not communicated through visual materials or written messages for students. Furthermore, both schools lacked visual health education materials addressing NCD risk factors. By the end of the intervention period, these materials, including banners, posters, and models, were distributed in classrooms, on walls, and borders in the intervention school. When it comes to a healthy diet, both schools have school canteens, and vendors outside the schools sell unhealthy snacks. Physical education, scheduled for 90 minutes, was limited due to inadequate teacher support. Physical activity is a key component of the WSCC model, with proven benefits for overall life-skills, such as reducing stress, improving emotional and social resilience, and fostering pro-environmental behaviors. All these challenges have an impact on the holistic development of schoolchildren, which was consistent with other results that previously examined school related factors affecting non-communicable diseases risk factors (Kaur et al., 2024; Kedar & Gupta, 2019; Mahajan et al., 2021; World Health Organization, 2020).

The study showed significant improvements in the intervention group regarding knowledge, attitudes, and habits (KAH) among schoolchildren. In contrast, the control group showed minimal changes, with

nearly three-quarters of students maintaining poor KAH levels from baseline to endline.

Significant improvements in life-skills were found in the intervention group of schoolchildren including decreased stress, more active coping, improved social and emotional skills such as self-control, persistence and self-competency, as well as better management of emotions skills and pro-environmental behavior. These life-skills are integral to NCDs preventive program with a positive effect on group interaction through physical activities, playing together, competition, storytelling, and modeling. Studies emphasize the critical role of evidence-based interventions in preventing NCDs risk factors among schoolchildren, especially during the formative years between ages 6 and 9 highlighting the importance of establishing healthy behaviors early in life to prevent the accumulation of NCD risk factors in adulthood. The early school years are crucial for imparting knowledge and promoting healthy behaviors (Bowen & Ebi, 2017; Pulimeno et al., 2020; Ronit Jakobovich et al., 2023). Children are highly receptive during this developmental stage, making it an optimal time for interventions aimed at addressing unhealthy diets, lack of physical activity, and inadequate life skills. Establishing lifelong behaviors during this period is more effective and sustainable than trying to modify behaviors in adulthood (Bowen & Ebi, 2017; López et al., 2021; Matthews et al., 2024; “Parental Involvement in Constructing Practical Guidelines to Enhance Pre-School Age Development Using Developmental Surveillance and Promotion Manual,” 2024”; Zhang et al., 2015;)

Regarding schoolchildren’s mothers, most of the intervention group showed improved general knowledge of NCDs, their risk factors, and prevention, transitioning from an unsatisfactory level at baseline to a satisfactory level at endline. In contrast, the control group remained at an unsatisfactory level from baseline to endline.

A study conducted by (Mukaddes Örs, 2024) concluded that the intervention package implemented among schoolchildren, involving

mothers and teachers, is an effective model for school-based behavior-change interventions.

In terms of health lifestyle-related behaviors, the present study's intervention revealed significant improvements among mothers in the intervention group, transitioning from very unhealthy behaviors at baseline to healthier behaviors at endline. Despite these improvements, only a small percentage of mothers demonstrated adequate healthy lifestyle behaviors, indicating progress and limitations in the intervention's impact. In contrast, the control group showed no significant changes, with over three-quarters of mothers maintaining very unhealthy behaviors at both baseline and endline. The WSCC model showed potential for improving mothers' health-related behaviors, emphasizing family engagement as a critical component.

Economic constraints, particularly limited income among schoolchildren's mothers, were identified as a key barrier to behavior change. This limitation affects mothers' ability to purchase essential healthy foods like fruits and vegetables. This aligns with broader research indicating that socioeconomic factors significantly influence dietary behaviors. Additionally, external factors such as peer advertising and the availability of sweetened and salty snacks in school canteens, groceries, and supermarkets contribute to unhealthy behaviors among schoolchildren, making it challenging for them to resist purchasing these unhealthy options.

A study aimed to determine the levels of health promotion lifestyle behavior among teachers working in public primary schools (Mukaddes Örs, 2024). Based on their research findings, the researchers recommended making plans to introduce health promotion lifestyle behaviors. Schoolteachers in the intervention group, reflected notable improvements in their health-promoting behaviors according to HPLP-II, in contrast, the control group showed no significant change in HPLP-II. Despite no teacher in either group reaching an "excellent"

level on the HPLP-II, several contextual factors may have prevented teachers from achieving the highest levels of health-promoting behaviors: Insufficient income: Limited financial resources likely constrained teachers' ability to fully adopt lifestyle changes, such as purchasing healthier food or accessing fitness resources. Busy schedules: The dual demands of teaching responsibilities and personal obligations may have limited teachers' time to prioritize health-related activities, despite improved awareness and support.

Conclusion

For the whole school, visual health education messages related to health services, NCDs risk factors and prevention were disseminated. The first-grade schoolchildren showed the intervention's success in improving KAH, stress management, coping, social and emotional skills, and pro-environmental behaviors highlighting the effectiveness of a multifaceted WSCC framework. While the intervention showed significant progress in changing unhealthy lifestyle behaviors among mothers to healthier practices. The improvements in HPLP-II scores among teachers in the intervention group highlight the effectiveness of the WSCC model in fostering healthier behaviors. Hence, it can be concluded that study hypothesis is validated.

Recommendations:

The NCDs preventive program at elementary schools using WSCC can be replicated in other settings and include all grades. Integrating the intervention package into the school extracurricular activities should be tried, which can be delivered by health professionals for sustainable behavior change. Future studies should study factors and tailored interventions that impact promoting healthy behaviors

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