EMPOWERING ADOLESCENTS FOR NON-COMMUNICABLE DISEASES AND CARDIOPULMONARY RESUSCITATION AWARENESS: PARTICIPATORY MULTINATIONAL PROGRAM

Capacitar adolescentes para a consciencialização sobre doenças não transmissíveis e suporte básico de vida: programa multinacional participativo

Capacitar adolescentes para la concienciación sobre enfermedades crónicas no transmisibles y reanimación cardiopulmonar: programa multinacional participativo

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ABSTRACT

Background: non-communicable diseases are the leading cause of global mortality, with many risk behaviors emerging during adolescence. **Objectives:** this study aimed to co-develop, implement and evaluate the Sudden Death Prevention Program, a multinational participatory initiative targeting adolescents in five European countries. The program sought to enhance health literacy and foster behavioral change in non-communicable diseases prevention and cardiopulmonary resuscitation. **Methodology:** using a Participatory Action Research framework, in three phases: (1) a scoping review to establish the theoretical basis; (2) co-creation of educational and digital resources with adolescents and stakeholders; (3) implementation and evaluation via a pre-/post-test design, independent samples and mixed-methods approach combining quantitative quiz data and qualitative feedback. **Results:** a total of 2,908 adolescents completed the pre-test and 2,231 the post-test. Knowledge scores increased significantly from a mean of 12.85 (SD = 4.22) to 14.53 (SD = 3.92) ($p < 0.01$). Furthermore, 57% reported improved eating habits, 41% increased physical activity and 45% felt prepared to perform basic life support. **Conclusion:** the program proved effective in enhancing adolescent health literacy and promoting healthier behaviors. Its participatory and digital format demonstrated adaptability and cultural relevance. Future work should examine long-term behavioral outcomes, curricular integration and objective digital metrics.

Keywords: health literacy; adolescent; noncommunicable diseases; community-based participatory research

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Resumo

Enquadramento: as doenças não transmissíveis são a principal causa de mortalidade global, sendo muitos comportamentos de risco adquiridos durante a adolescência. **Objetivos:** codesenvolver, implementar e avaliar o Programa de Prevenção da Morte Súbita, uma iniciativa multinacional participativa dirigida a adolescentes, para aumentar a literacia em saúde e os comportamentos relacionadas com a prevenção das doenças não transmissíveis e a reanimação cardiopulmonar. **Metodologia**: recurso à Investigação Ação Participativa , desenvolveu-se em três fases: (1) revisão exploratória; (2) Cocriação de materiais educativos e recursos digitais; e (3) implementação e avaliação através de um desenho pré/pós teste com amostras independentes. **Resultados:** participaram 2 908 adolescentes no pré-teste e 2 231 no pós teste. As pontuações médias de conhecimento aumentaram significativamente de 12.85 (SD = 4.22) para 14.53 (SD = 3.92) ($p < 0.01$). Além disso, 57 % relataram melhoria nos hábitos alimentares, 41 % aumento da atividade física e 45 % sentiram-se preparados para realizar suporte básico de vida. **Conclusão:** o programa demonstrou eficácia na melhoria da literacia em saúde e na promoção de comportamentos saudáveis entre adolescentes. A sua abordagem participativa e digital mostrou-se adaptável e culturalmente relevante. Investigações futuras deverão explorar resultados comportamentais a longo prazo, integração curricular e métricas digitais objetivas.

Palavras-chave: literacia em saúde; adolescente; doenças não transmissíveis; pesquisa participativa de base comunitária

Resumen

Marco contextual: las enfermedades no transmisibles son la principal causa de mortalidad global, y muchos comportamientos de riesgo surgen durante la adolescencia. **Objetivos:** este estudio tuvo como objetivo co-desarrollar, implementar y evaluar el Programa de Prevención de Muerte Súbita, una iniciativa multinacional participativa dirigida a adolescentes en cinco países europeos. El programa buscó mejorar la alfabetización en salud y fomentar cambios de comportamiento en la prevención de enfermedades no transmisibles y en reanimación cardiopulmonary. **Metodología:** basado en un marco de Investigación-Acción Participativa, el estudio se desarrolló en tres fases: (1) revisión de literatura para establecer la base teórica; (2) co-creación de recursos educativos y digitales con adolescentes y partes interesadas; (3) implementación y evaluación mediante diseño pre-/post-test, muestras independientes y enfoque mixto, combinando datos cuantitativos de cuestionarios y retroalimentación cualitativa. **Resultados:** participaron 2.908 adolescentes en el pre-test y 2.231 en el post-test. Los puntajes de conocimiento aumentaron significativamente, de una media de 12,85 (DE = 4,22) a 14,53 (DE = 3,92) ($p < 0,01$). Además, el 57% reportó mejoras en hábitos alimentarios, el 41% aumentó la actividad física y el 45% se sintió preparado para realizar soporte vital básico. **Conclusión**: el programa fue eficaz en mejorar la alfabetización en salud y promover comportamientos más saludables, mostrando adaptabilidad y relevancia cultural. Investigaciones futuras deberían evaluar resultados conductuales a largo plazo, integración curricular y métricas digitales objetivas.

Palabras clave: alfabetización en salud; adolescente; enfermedades no transmisibles; investigación participativa basada en la comunidade

INTRODUCTION

Non-Communicable Diseases (NCDs) remain one of the most pressing global health challenges of the 21st century. Their growing prevalence and long-term impact on morbidity, mortality and quality of life highlight the importance of early and sustained prevention across the life course. Although traditionally associated with adulthood, there is increasing recognition that many of the behavioral risk factors contributing to NCDs—such as unhealthy eating patterns, physical inactivity, substance use and compromised mental well-being established during adolescence. This developmental stage is therefore a critical window for fostering health-promoting behavior's and strengthening young people's capacity to make informed decisions about their health.

Despite the centrality of adolescents shaping future population health, current preventive strategies frequently fall short of addressing their specific needs. Many interventions adopt traditional, adult-driven models of health education that are poorly aligned with the lived realities, digital habits and motivational drives of young people. Schools and community settings have significant potential to act as catalysts for health promotion, yet programs often remain fragmented, sporadic or insufficiently participatory.

Promoting health literacy and empowering adolescents to engage actively in disease prevention and emergency response are essential components of contemporary public health strategies. Integrating digital tools, interactive learning and youth participation holds promise for increasing engagement, relevance and long-term impact.

In response to these challenges, the Sudden Death Prevention Program (SuDeP2) was developed within the EU-funded "Prevention in Action" initiative. Implemented across five European countries, SuDeP2 combines in-person training with digital resources to promote NCD prevention, healthy lifestyles and basic life support skills. Built on a participatory approach and co-created with adolescents and Red Cross staff, the program seeks to address identified gaps in youth-centered health promotion and contribute to more responsive and culturally attuned educational strategies.

BACKGROUND

Scientific evidence unequivocally demonstrates that NCDs represent the leading cause of death and disability in Europe, accounting for approximately 90% of mortality in the region (Armocida et al., 2025). Although traditionally linked to aging populations, the emergence of behavioral risk factors among adolescents has contributed to the earlier onset of NCD-related health trajectories (Almuqbil et al., 2025). This early exposure underscores the need for preventive strategies tailored to younger age groups.

Across Europe, substantial disparities persist in the prevalence of risk factors and the effectiveness of existing health promotion efforts. In Portugal, overweight and obesity affect more than one-third of school-aged children (Rito et al., 2023). In Spain, despite comprehensive governmental strategies promoting healthy eating, adolescents show resistance to behavioral change (Martínez-Milán et al., 2022). Italy continues to report high rates of childhood obesity and low levels of adolescent engagement in health promotion and first aid literacy (Spinelli et al., 2023). Slovenian studies highlight the absence of programs that integrate technology, gamification and

participatory learning—approaches shown to resonate strongly with young people (Rozman et al., 2025). In Hungary, although innovative fiscal reforms such as sugar-sweetened beverage taxation have been implemented, they remain insufficient in shifting behaviors without complementary educational interventions (Andrade et al., 2023).

Furthermore, many health promotion initiatives directed at adolescents are described as sporadic, adult-centric and poorly adapted to the digital and social contexts in which young people operate (Partridge et al., 2025). Evidence underscores the importance of health literacy in empowering adolescents to adopt protective behaviors and navigate health information effectively (Asari et al., 2025). Digital health tools—such as mobile applications, interactive platforms and wearable devices—offer additional opportunities for monitoring health indicators, promoting lifestyle changes and training in cardiopulmonary resuscitation (CPR) (Mancone et al., 2024; Mousazadeh et al., 2025).

Within this evidence landscape, the SuDeP2 program emerges as a timely and innovative intervention. By integrating participatory methodologies, culturally contextualized content and technology-enhanced learning, SuDeP2 directly addresses the gaps identified in current approaches to adolescent health promotion. Its dual focus on NCD prevention and basic life support training aligns with the documented needs of this population and reinforces the importance of preparing adolescents to act both as informed health agents and as capable responders in emergency situations.

METHODOLOGY

Study design and setting

The study adopted a Participatory Action Research design, selected for its iterative and cyclical structure that allowed for continuous feedback and real-time adaptation across the five participating countries. Grounded in principles of collaboration and reflexivity, this approach actively engaged participants as co-researchers, bridging the gap between knowledge production and practical action (Baum et al., 2006). Following the International Collaboration for Participatory Health Research (ICPHR) framework, the design prioritized the co-creation of scientifically robust and socially relevant knowledge (ICPHR, 2013). Through iterative cycles of reflection and action, the study addressed both expressed and latent needs (Kemmis et al., 2014), ensuring that the intervention remained responsive to diverse cultural contexts and lived experiences while fostering mutual learning and empowerment.

Through Participatory Action Research, this study aims to co-develop, implement, and evaluate the SuDeP2 under the EU4Health-funded *Prevention in Action* project. The project spanned 24 months and focused on primary prevention of NCDs, particularly cardiovascular disease and diabetes, through education, digital tools, and community engagement. The study was developed in 3 phases: 1) Literature Review and Theoretical Framework; 2) Co-creation and Program Development; and 3) Implementation and Evaluation, this last one with 2 cycles of action.

- Phase 1: Literature Review and Theoretical Framework

From a methodological standpoint, the scoping review followed Arksey and O'Malley's (2005) five-step

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framework, including: (1) identifying the research question; (2) identifying relevant studies; (3) study selection; (4) charting the data; and (5) collating, summarizing, and reporting results. The following inclusion criteria were: children between the ages of 10 and 18; studies of children with risk factors for developing non-communicable diseases; studies in English, Spanish and Portuguese; time limit. Were used CINAHL, MEDLINE and ProQuest databases.

Importantly, the review served a dual methodological purpose: grounding the study in existing evidence and providing a conceptual framework to guide the co-creation phase. Theoretical models identified in this phase directly informed instrument design, discussion guide structure, and content focus for the intervention materials.

- Phase 2: Co-creation and Program Development

The methodological framework for co-creation was underpinned by principles of design thinking and qualitative participatory techniques, integrated with the theoretical framework lens from phase 1. The use of semi-structured focus groups, stratified by stakeholder type (Red Cross Focal Points, two adolescents, and two stakeholders from each participating National Society), allowed triangulation of perspectives and ensured theoretical saturation.

A constant comparative approach was used during data analysis of the focus groups, supporting inductive theme generation. Validation techniques such as member checking were systematically applied during international workshops, strengthening credibility and trustworthiness. This phase adopted a participatory approach to ensure that the perspectives and lived experiences of all actors were integrated into the program design. Four national focus groups and one international focus group were conducted between March and April 2024. Each session followed a semi-structured guide developed by the research team, and reviewed by experts from each National Society, designed to explore participants' knowledge, perceptions, and needs regarding non-communicable diseases (NCDs), sudden death, and health education. The guiding questions addressed topics such as: i) Understanding of sudden death and its determinants; ii) Children and adolescents' knowledge of how to respond to cardiac arrest; iii) Perceived importance of awareness and education on NCDs; iv) Role of schools and communities in promoting prevention and response. Validation within the workshops was grounded in a consensus-based approach.

Focus groups were conducted online via Microsoft Teams, with informed consent obtained in advance. Sessions were recorded and supported by observers to assist with linguistic clarification when needed. Discussions were held in English or the national language, depending on participants' preferences. Following the focus group sessions, preliminary findings were presented to the Research Team. A facilitated dialogue allowed members to validate interpretations, express additional insights, and identify gaps. This iterative process ensured that the analysis was both participatory and contextually grounded. Based on the findings from the scoping review and focus groups, the Research Team conducted a series of structured monthly online workshops. These co-creation sessions led to the development of the core components of the SuDeP2 program: i) A Training Manual on NCD prevention and cardiopulmonary ressuscitation; ii) A set of digital educational resources; iii) A mobile health (mHealth) application designed to support self-monitoring of

health parameters and heart rhythms, compatible with wearable devices.

This collaborative development process ensured that the program was guided by a logic model approach, linking inputs, activities, outputs, and expected outcomes, thus enhancing methodological clarity, implementation fidelity, evidence-informed, culturally relevant, and tailored to the needs of the target population.

- Phase 3: Implementation and Evaluation

The two cycles implementation design allowed for a pilot-testing phase that functioned as a formative evaluation. Methodologically, this design supported real-time refinement and minimized risk during full-scale rollout. The use of a pre-test/post-test design with same data collection instruments offered within-subject comparisons, increasing statistical power despite modest sample sizes. The pre-test was employed, with data collected at baseline (prior to implementation session) and the post-test one month after completion. Evaluation focused on four key dimensions: i) Applicability: relevance and appropriateness of the program content and delivery; ii) Feasibility: practicality of implementation within the operational context of each National Society; iii) Acceptability: participant engagement, satisfaction, and perceived value; iv) Effectiveness: changes in knowledge, attitudes, and self-reported behaviors related to NCD prevention and cardiac arrest. No adaptations were required in data collection instruments after pilot, only some simplification of the content of the "set of digital educational resources". Methodological rigor was further enhanced by standardized administration protocols and facilitator training to ensure inter-site consistency. Importantly, a mixed-methods evaluation approach (quantitative quiz data and qualitative facilitator observations) enabled methodological triangulation, thereby increasing the validity of findings regarding program effectiveness.

Data collection instruments

A structured online Quiz was developed and administered to adolescent participants to assess knowledge acquisition. The quiz included 10 multiple-choice questions, validated by one expert from each National Society, covering key topics addressed in the program, such as: i) Identification and prevention of non-communicable diseases (NCDs); ii) Healthy lifestyle habits (e.g., diet, physical activity, mental well-being); iii) Risks associated with tobacco and alcohol use; iv) CPR.

Ethical requisites

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and followed European Union and national regulations regarding research involving minors. Participation was voluntary, with written informed consent obtained from parents or legal guardians and assent from adolescent participants. Data confidentiality and anonymity were guaranteed at all stages of the study. The research protocol received approval from the Ethics Committee of a Health School of North of Portugal. Their independent review ensured that methodological and ethical safeguards were rigorously addressed, particularly in relation to the involvement of adolescents and the use of digital tools in health education.

Participants and recruitment

The participants defined as target group for this project were youngsters (aged 10 – 18), reached in strategic schools from each National Society. Inclusion criteria

comprised residence in participating countries, ability to engage in presential and online training, and capacity to provide informed consent. Exclusion criteria encompassed inability to complete online questionnaires. Recruitment used local Red Cross branch outreach via digital and community channels. The number of people reached (by target group) was defined in the project application Key Performance Indicator, involving 100 Red Cross staff/volunteers, and 2100 people receive complete information and health promotion services.

Data management and statistical analysis

Data management adhered to the FAIR principles (Findable, Accessible, Interoperable, and Reusable), enhancing methodological accountability. A centralized, encrypted database was developed for multi-country access and ensured General Data Protection Regulation compliance.

Data were analyzed using IBM® SPSS® Statistics, version 26 (IBM Corp., Armonk, NY, USA). Descriptive statistics were calculated for all variables. For the continuous variable (Quiz knowledge score), measures of central tendency (mean, median) and dispersion (standard deviation, and range [minimum–maximum]) were computed. For categorical variables, absolute and relative frequencies (%) were reported. Score distributions were visually assessed using frequencies and bar charts, complemented by skewness and kurtosis coefficients, given the large sample size and the limitations of formal normality tests under these conditions.

As pre- and post-intervention responses were obtained from independent samples, comparisons between groups were performed using independent-samples tests. The choice of statistical test was based on the assessment of distributional shape and verification of homogeneity of variances using Levene's test. In the presence of marked asymmetry or variance heterogeneity, the non-parametric Mann–Whitney U test was used, reporting medians and p-values, with corresponding 95% confidence intervals.

Effect sizes were calculated for all inferential analyses. Specifically, the effect size r for the Mann–Whitney U test was calculated based on the Z-standardized test statistic derived from SPSS (using the formula $r = Z / \sqrt{N}$). A significance level of 5% ($p < 0.05$) was adopted for all tests.

RESULTS

The SuDeP2 program, including a training manual on NCD prevention and CPR, provides a summary of insights gained from the national and international focus groups, supported by the Scoping Review and Theoretical Framework. The resulting training program (Table 1) comprised theoretical and practical components delivered over a 3 hour's session. Initial modules focused on Prevention in Action (PIA) project introduction and the global burden of the four major NCDs (cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes). This was followed by prevention strategies, addressing healthy lifestyles, nutrition, physical activity, mental health and well-being, and regular health check-ups. The second part of each session provided a lecture on cardiopulmonary resuscitation with automated external defibrillation, complemented by a practical, hands-on workshop. With regard to the training with automatic external defibrillation, it was necessary to adapt to the legislation of each country.

Table 1

SuDeP2 program

Time		SuDeP2 Session
90 min	5 min	PIA Project presentation
	20 min	Presentation of the four NCDs Cardiovascular diseases Cancer Chronic respiratory diseases Diabetes
	45 min	Prevention of NCD Healthy living essentials Nutrition and diets Physical activity Mental Health and Well-being Regular health check-ups
	20 min	Lecture - Cardiopulmonary Resuscitation with Automated External Defibrillation (CPR/AED)
	10 min	Break
90 min		Hands on Cardiopulmonary Resuscitation with Automated External Defibrillation (CPR/AED)

SuDeP2 program was applied by each National Societies of Red Cross, in school's context.

A total of 2908 adolescents participated in the study, completed the pre-SuDeP2 program assessment and n = 2231 completed the post-SuDeP2 program assessment, which represents 76,7% of return rate. Participants were recruited from five different countries, as shown in figure 1.

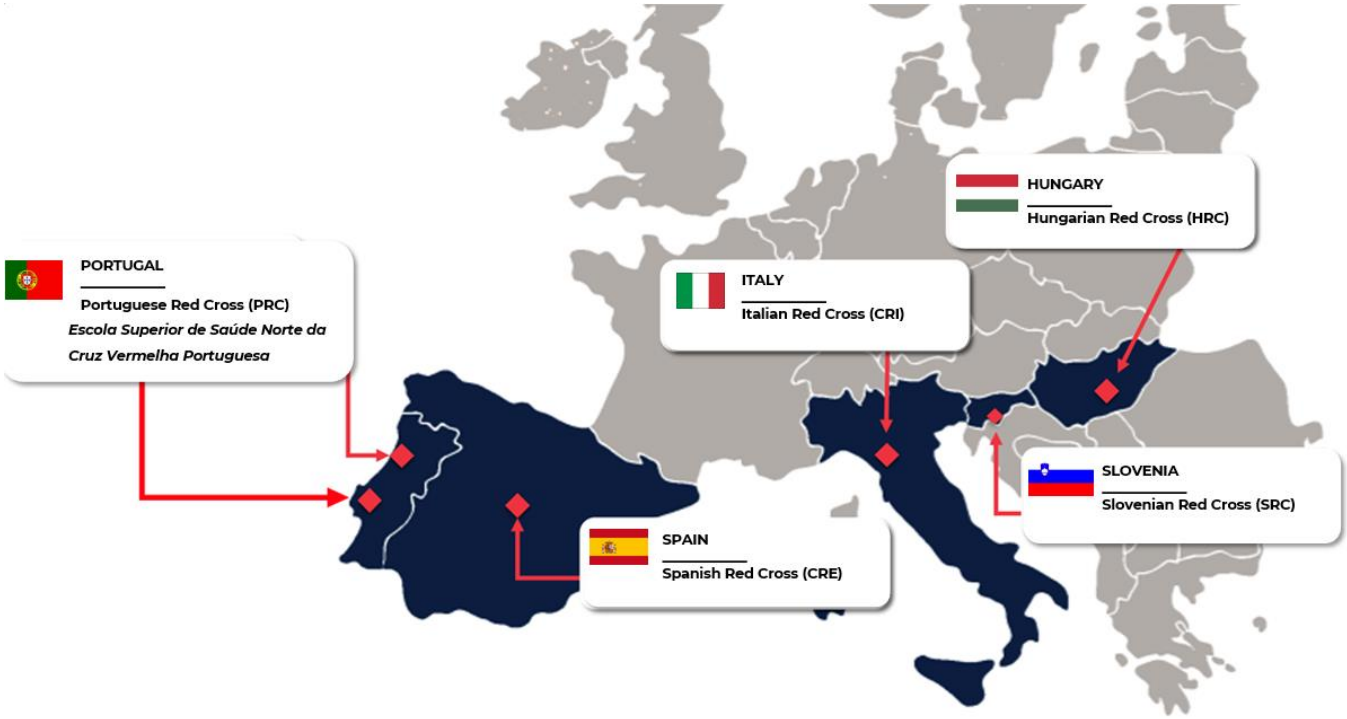

Figure 1

Participants in SuDeP2 program, per country, from each National Society

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The sample included majority females (53,2%), with an average age of 14,8 years (Standard Deviation = 1,63; min = 10; max = 18). The average score of Quiz knowledge at pre-program period was lower (M = 12,85; Standard Deviation = 4,22), compared with post-program (M = 14,53; Standard Deviation = 3,92) follow-up (Table 2).

Table 2

Pre and post statistic test related to the age of adolescents

	N		M		Mann–Whitney U test	sig
Age	**Pre-test**	**Post-test**	**Pre-test**	**Post-test**		
10-18	2908	2231	12,85	14,53	235,0	0,002**

*** sig ≤ 0,01*

Accordingly, the Mann–Whitney U test was applied to compare pre- and post-program scores. The analysis revealed a statistically significant increase in knowledge after the program (U Test = 235.0, p < 0.002, r = 0.41) (Table 2). The effect size (r), which falls between a moderate and a large magnitude, indicates that the SuDeP2 program produced not only a statistically detectable improvement but also a practically meaningful enhancement in adolescents' knowledge. The post-program score was higher than a pre-program score, underlining the substantive impact of the intervention.

In open questions regarding changes in eating habits, 57% (n=1261) of adolescents mentioned that they changed their eating habits after the program and 15% (n=337) reported that they did not change their eating habits (Figure 2).

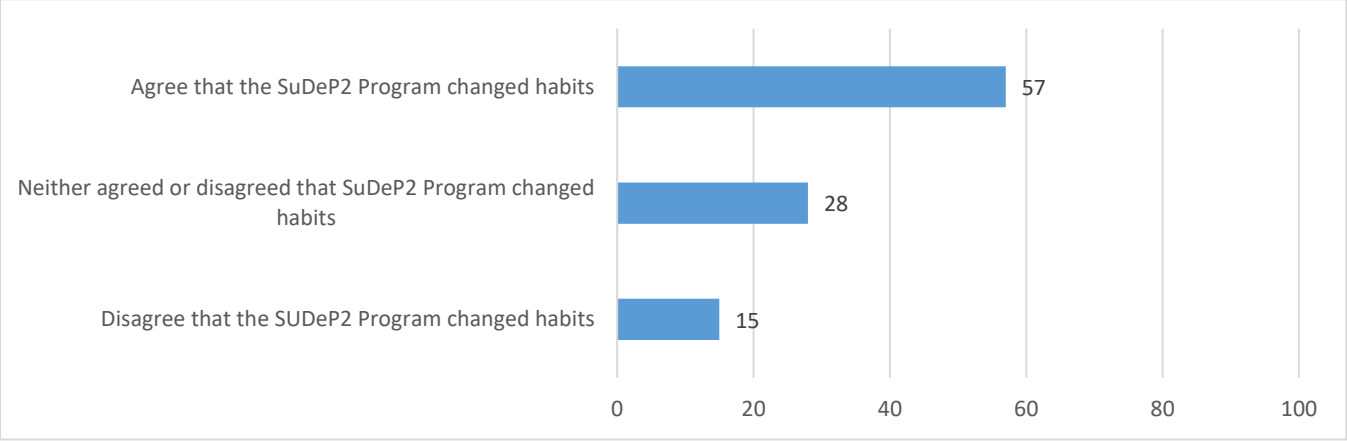

Figure 2

Participants' opinion about SuDeP2 program contributes on eating habits

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Regarding the question of whether they began exercising more regularly after the program, 41% (n=922) of adolescents mentioned that they began exercising more regularly, 24% (n=532) said they had not changed their exercise habits, and 35% (n=775) neither agreed nor disagreed with the need to change their exercise habits (Figure 3).

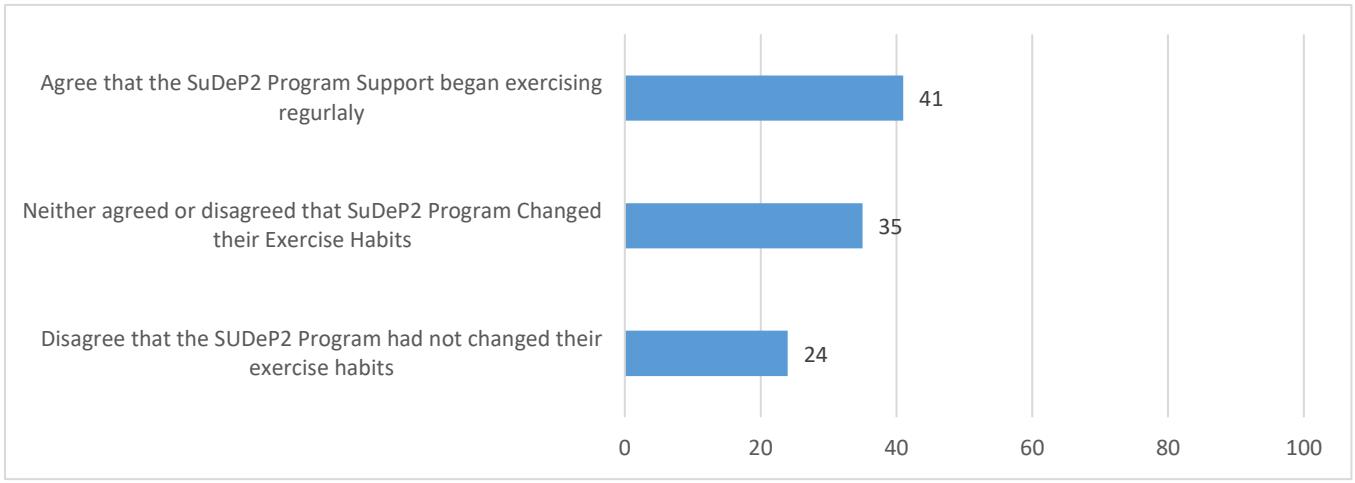

Figure 3

Participants' opinion about SuDeP2 program contributes on exercising habits

Regarding the question of whether they feel prepared to perform CPR after the program, 45% (n=895) of adolescents mentioned that they feel prepared to perform CPR, 26% (n=528) said they did not feel prepared to perform CPR if necessary, and 29% (n=572) had no opinion on whether they felt prepared to perform CPR (Figure 4).

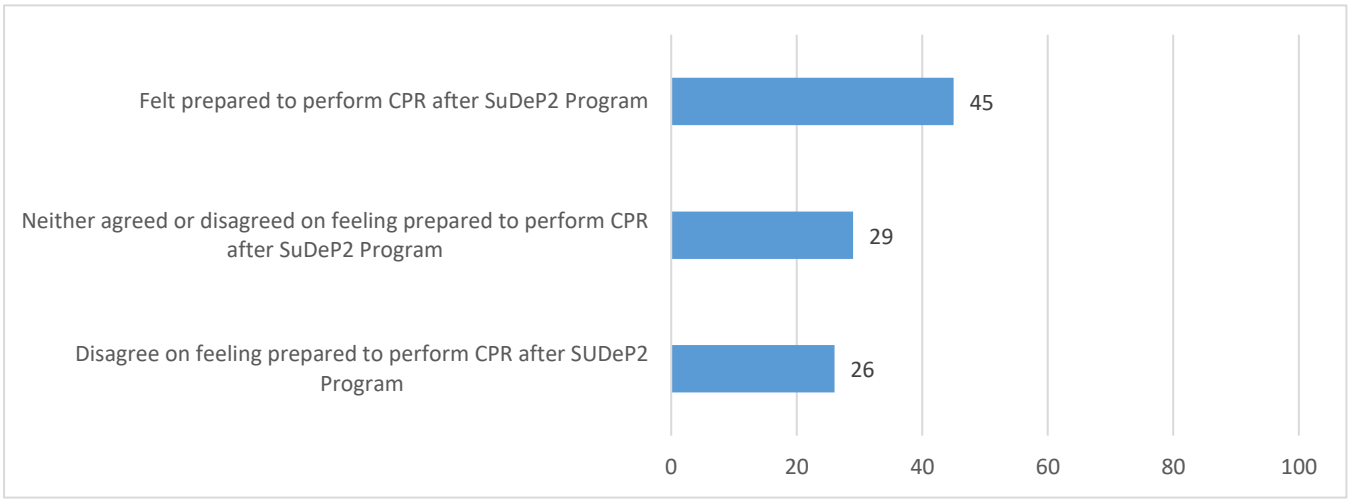

Figure 4

Participants' opinion about SuDeP2 program contributes on CPR performance

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DISCUSSION

The results of the SuDeP2 program demonstrate a positive impact on adolescents' health literacy, as evidenced by the statistically significant increase in knowledge regarding NCDs, healthy lifestyle habits, and CPR. This finding aligns with existing literature emphasizing the effectiveness of participatory and digitally mediated educational interventions in promoting youth health (Mancone et al., 2024; Mousazadeh et al., 2025).

The observed improvement in quiz scores (from M = 12.85 to M = 14.53) reinforces the relevance of youth-centered pedagogical approaches, such as co-creation and the use of mobile technologies. These strategies proved effective in adapting content to the cultural and digital realities of the participants (Partridge et al., 2025; Rozman et al., 2025). The use of Participatory Action Research not only enabled contextual adaptation but also empowered adolescents as active agents in their own health, as advocated by Baum et al. (2006) and ICPHR (2013).

Qualitative analysis of open-ended responses revealed meaningful behavioral changes, with 57% of adolescents reporting improved eating habits and 41% indicating increased physical activity. These findings suggest that the program had both cognitive and behavioral effects, albeit self-reported. This is particularly relevant in the European context, where, despite public policies and awareness campaigns, the prevalence of overweight and obesity among youth remains high (Rito et al., 2023; Spinelli et al., 2023).

The perception of preparedness to perform CPR (reported by 45% of participants) is another promising indicator, especially considering the low levels of first aid literacy previously identified in the literature (Asari et al., 2025; Spinelli et al., 2023). This underscores the importance of integrating practical skills into school health curricula, moving beyond mere knowledge transmission.

However, the analysis also highlights challenges. A significant proportion of adolescents reported no behavioral change or expressed indecision (28% regarding diet; 35% regarding physical activity; 29% regarding CPR). This suggests that attitude change requires more than a one-time intervention. Literature supports that sustained change depends on continuous reinforcement, community involvement, and curricular integration (Andrade et al., 2023; Partridge et al., 2025).

Moreover, the absence of objective indicators (e.g., usage metrics from the mobile health app) and the use of independent samples for pre and post-intervention assessments limit the robustness of causal inferences. Future studies should consider a longitudinal design with repeated measures and triangulation with digital data, as recommended by Mancone et al. (2024).

The cultural and operational diversity of national contexts proved to be an asset, allowing the program's adaptability to be tested. Methodological harmonization and facilitator training were essential to ensure implementation consistency, reinforcing the importance of shared protocols in multinational projects (Kemmis et al., 2014).

CONCLUSION

The SuDeP2 program successfully met its objectives of co-developing, implementing, and evaluating a participatory and digitally supported intervention to enhance adolescents' health literacy and promote behavioral change in NCD prevention and

cardiopulmonary resuscitation. The significant increase in knowledge and the reported improvements in health-related behaviors demonstrate that a participatory, youth-centered approach can effectively foster both cognitive and motivational engagement among adolescents across diverse European contexts.

Despite these promising results, limitations must be acknowledged. The reliance on self-reported behavioral outcomes and the use of independent samples constrain the capacity to infer long-term or causal effects. Furthermore, the absence of objective digital engagement metrics limits the evaluation of sustained behavioral impact.

The findings underscore the potential of participatory action research and digital co-creation methods to inform health education policies and curricular innovation in schools. Integrating first aid and NCD prevention content into educational systems can contribute to building a generation of health-literate, empowered young citizens.

Future research should adopt longitudinal and mixed methods designs, incorporating objective digital indicators to assess behavioral maintenance and scalability. Expanding transnational collaboration will also be key to strengthening the evidence base for culturally adaptable, equity-oriented adolescent health promotion programs in Europe.

CONFLICT OF INTEREST

The authors declare that there are no personal, commercial, academic, political, or financial conflicts of interest that could have influenced the impartiality of this study or the preparation of this manuscript.

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