Original Article

RBAFS Revista Brasileira de Atividade Física & Saúde
SOCIEDADE BRASILEIRA DE ATIVIDADE FÍSICA & SAÚDE

rbafs.org.br

Implementation of different strategies of the "ActTeens" intervention for adolescents: a process evaluation

Implementação das diferentes estratégias da intervenção "ActTeens" para adolescentes: uma avaliação do processo

AUTHOR'S

Géssika Castilho dos Santos[1]
Jadson Marcio da Silva[1]
Renan Camargo Correa[1]
Rodrigo de Oliveira Barbosa[2]
Gabriel Pinzon[2]
Maria Carolina Juvêncio Francisquini[2]
Thais Maria de Souza Silva[2]
Antonio Stabelini Neto[1,2]

1 State University of Londrina, Post-Graduate Program in Physical Education Associate UEM/UEL, Londrina, Paraná, Brazil.

2 State University of Northern Paraná, Health Science Center, Jacarezinho, Paraná, Brazil.

CORRESPONDING

Géssika Castilho dos Santos
gessika.castilho@gmail.com
Alameda Padre Magno, nº 841, Nova Jacarezinho, Jacarezinho, Paraná, Brasil.
Zipcode: 86400-000.

DOI

10.12820/rbafs.28e0306

ABSTRACT

Multicomponent programs to promote physical activity have shown promise to help adolescents to increase physical activity levels. Although evaluation of the intervention implementation process is important, information about this evaluation is rarely reported. This observational study aimed to evaluate the implementation of a 12-week physical activity intervention program for adolescents. The ActTeens program consists of three components: (1) structured physical activity sessions; (2) self-monitoring associated with daily goal setting; (3) healthy lifestyle messages (mHealth). The evaluation of the process was carried out through observations and self-reported information from the students. Fifty-one adolescents (37.5% girls) answered the questionnaire. Overall, the reach was 73.3%, retention rate 96.3%, and satisfaction with the intervention was high (score 5). The structured sessions presented high fidelity, and good acceptability among adolescents, with an average attendance rate of 93.7%. Participants rated the sessions as enjoyable and the teacher's role as excellent. Adherence to self-monitoring (goal setting with a pedometer) was moderate and 57.8% of adolescents reported using the device daily. In addition, adolescents reported that the use of a pedometer increased their motivation to practice physical activity (72.4%). Satisfaction with the messages was considered low, with only 37.8% agreeing that the messages promoted the adoption of a healthy lifestyle. In conclusion, the structured sessions and the self-monitoring showed good acceptability among adolescents, and these strategies were considered relevant to promote a more physically active lifestyle. However, the component mHealth, when used as a single strategy, did not aid the adoption of healthy behavior.

Keywords: Wearable electronic devices; Exercise; Telemedicine; Adolescent; Implementation science.

RESUMO

Programas multicomponentes para promoção da atividade física têm se mostrado promissores para auxiliar os adolescentes a aumentar seus níveis de atividade física. Embora a avaliação do processo de implementação da intervenção seja importante, informações sobre esta avaliação raramente são relatadas. O presente estudo teve como objetivo avaliar a implementação de um programa de intervenção de atividade física de 12 semanas para adolescentes. O programa ActTeens consiste de três componentes principais: (1) sessões estruturadas de atividade física; (2) auto-monitoramento associado com estabelecimento de metas diárias; (3) orientações sobre um estilo de vida saudável (mHealth). A avalição do processo foi por meio de observações e informações autorreferidas dos alunos. Cinquenta e um adolescentes (37,5% meninas) responderam o questionário. No geral, o alcance foi de 73,3%, a taxa de retenção 96,3% e satisfação com a intervenção foi alta (escore 5). As sessões estruturadas tiveram alta fidelidade, boa aceitabilidade entre os adolescentes com a frequência média de participação de 93,7% por aula. Os participantes classificaram as sessões como prazerosas e o papel do professor como excelente. A aderência ao automonitoramento (estabelecimento de metas com pedômetro) foi moderada e 57,8% dos adolescentes relataram usar o dispositivo diariamente. Além disso, os adolescentes relataram que o uso do pedômetro aumentou a motivação para a prática de atividade física (72,4%). A satisfação com as mensagens por aplicativo foi considerada baixa, sendo que apenas 37,8% concordaram que as mensagens promoveram a adoção de um estilo de vida saudável. Em conclusão, as sessões estruturadas e o uso do pedômetro para automonitoramento mostraram boa aceitabilidade entre os adolescentes, e estas estratégias foram consideradas relevantes para promover um estilo de vida fisicamente mais ativo. Entretanto, o componente mHealth, quando usado como uma estratégia única, não auxiliou na adoção de um comportamento saudável.

Palavras-chave: *Dispositivos eletrônicos vestíveis; Exercício físico; Telemedicina; Adolescente; Ciência da implementação.*

Introduction

The benefits of physical activity (PA) in childhood and adolescence are widely demonstrated in the literature, such as improved cardiorespiratory and muscular fitness, body composition, cardiometabolic profile, and mental health[1]. However, global estimates reveal that less than 20% of adolescents are considered physically active[2]. In this perspective, to increase the practice of PA among adolescents, several strategies have been developed[3].

School-based multicomponent interventions that aim to address the multidimensional factors related to PA behavior have shown inconsistent results, due to the type of used PA- measure (objective or self-reported), and lack to assess both the mechanisms of behavior change and the intervention implementation process[4]. In this sense, researchers highlight the need to examine in detail each strategy adopted as well as the process of implementation of the intervention[5,6].

Few studies have focused on addressing issues regarding the implementation of intervention strategies (fidelity, feasibility, the quality of actions proposed for the target audience)[7]. Process evaluation provides researchers with detailed information, facilitating the interpretation of outcomes and providing a broader view of the contextual factors that influence the operationalization of the intervention, such as which variables impact the implementation of strategies and how a given intervention can be applied in other contexts and/or other populations[8]. In addition, the implementation assessment helps to observe the gaps between planning and adopting strategies, as well as aiding in the identification of which actions are viable, adaptable, or not applicable, thus improving the cost-benefit of the program[9].

Implementation evaluation usually involves measuring the intervention's reach, dose, and fidelity[10]. The "reach" assessment provides evidence on the participation of the target audience in the intervention or in the specific components, that is, it refers to the proportion of individuals participating in the intervention in relation to the potentially eligible population[11]. The "dose" assessment aims to quantify how much of the intervention was delivered and received by the participants. The dose delivered refers to the planned amount of the intervention, or its components, that was offered by the researcher, while the dose received refers to the engagement (dose response exposure) and satisfaction (dose response satisfaction) by the participants[10]. The measurement of "fidelity" aims to verify whether the intervention that was performed was consistent with the intervention that was planned[10].

Therefore, in order to obtain better understanding of the effectiveness of the actions developed during an intervention carried out in the context of the "real world", the evaluation of the process of an intervention program is essential, as this will provide us with elements to identify which strategies implemented were effective and which need to be revised. In this sense, the objective of the current research was to evaluate the implementation of a multicomponent intervention program to promote PA in Brazilian adolescents.

Methods

This observational study was approved by the Research Ethics Committee of the Universidade Estadual do Norte do Paraná, under protocol nº 4,452,513 and registered in the Clinical Trials database (NCT05070377).

The inclusion criteria of the schools were: (i) having classes in the eighth and ninth years of secondary school; (ii) having at least two Physical Education classes on different days; (iii) Physical Education teacher agreeing to include the structured session in the class. Of the 4 eligible schools, 2 agreed to participate in the program and were divided into intervention and control. All students enrolled in Grades 8 and 9, aged between 13 and 15 were eligible to participate (n = 75). Students who did not participate in all stages of the study after the baseline assessment, due to transfer or the decision to dropout, were excluded from the analysis. Students and their parents/guardians signed an assent and consent form respectively.

The multicomponent intervention to promote PA was carried out for 12 weeks. Intervention strategies were developed guided by self-determination[12] and socio-cognitive theories[13]. The ActTeens program consists of three components: (1) structured PA sessions in Physical Education classes; (2) self-monitoring associated with daily goal setting; and (3) guidance on a healthy lifestyle (mHealth). A summary of each component is described in supplemental Table 1. The implementation of the strategies was developed in the second half of 2021 (July to November).

The structured session was an adaptation of the Australian program - Resistance Training for Youth[14]. The structured activities were aimed at promoting opportunities for non-traditional PA practice in the school context, encouraging the adoption of active behavior on a daily basis, as well as reinforcing the importance of an active lifestyle in adolescence. The

implementation of the strategies used to support the adoption of structured activities included the following actions: (i) workshop for the teacher; (ii) delivery of a manual to the teacher with information about the resources of the sessions and the material or equipment needed; (iii) observation and feedback from the physical activity session; (iv) interactive seminar.

The Physical Education teacher of the intervention group participated in a workshop promoted by the responsible researcher. This training aimed to: emphasize the importance of active behavior and physical fitness in the health of adolescents; demonstrate ways to include exercises for muscle fitness and aerobic resistance; present the STAFF who would help the teacher during lessons in the intervention period, both in the organization of activities and in the correction of movement techniques; present the SAAFE teaching principle (supportive, active, autonomous, fair, and enjoyable)[15], which served as a guide during the structured sessions of the program.

The support material (manual) was also delivered with proposals for structured activities to be carried out during Physical Education lessons and materials necessary for the development of exercises, such as Gymstick, sticks, mats, cones, ropes, and a speaker.

The interactive seminar for students had the following objectives: 1) to inform adolescents about the importance of activity and physical fitness for health and its benefits; 2) to present the ActTeens program.

This intervention component aimed to encourage the practice of PA during the day, with a focus on outside school hours. Through the use of the pedometer, the adolescent was able to monitor his/her number of daily steps and each adolescent in the intervention group received personalized goals to achieve weekly. These goals were predetermined progressively (based on the average of baseline steps) following the protocols of previous studies[16] (see supplemental Table 2), and new goals were set every two weeks.

The messages (infographics and/or videos) sent individually to adolescents and their guardians aimed to promote and encourage active behavior and healthy eating habits. The messages were sent twice a week to the adolescents and once a week to the parents.

For this study, the teacher of the intervention group and students from both schools (n = 53) were invited to complete a questionnaire about the implementation of the ActTeens intervention strategies. The adolescents in the control group answered questions only regarding the implementation of the mHealth.

The evaluation was carried out through assessment of the process based on previous evaluations of interventions in PA[14,17] similar to the current study. The evaluation of the process included questionnaires and observations from the structured sessions. The details of data collection can be seen in Table 1.

The intervention was evaluated based on the following criteria: 1) teacher participation and satisfaction with the ActTeens program (workshop, structured sessions with the material delivered; 2) reach (the number of teenagers who agreed to participate in the program); 3) retention rate (referring to the 3-month follow-up); 4) frequency (student participation in structured physical activity); 5) student satisfaction with the structured sessions ("I enjoyed participating

Table 1 – Details of data collection to evaluate the implementation of the ActTeens program.

Evaluation method	Item to be evaluated	Collection period	Respondents	Number completed	Response rate[a]
Questionnaires	Satisfaction with the intervention: structured session in the PE lesson; self-monitoring and mHealth	Post intervention	Students (intervention) and Teacher (intervention)	n = 29	93.5% of baseline adolescents 100% of the teacher
	Satisfaction with the intervention: mHealth		Students (control)	n = 22	91.6% of baseline adolescents
Observation and feedback	Fidelity to the program	In the 6th and 10th weeks of intervention	Researcher (intervention)	n =1	100%
Diary of number of steps per day	Engagement with the pedometer and adherence to the established goal	2nd to 11th weeks	Students (intervention)	n =24	77.4% of baseline adolescents
Messages sent by the researcher and received by the participants	Engagement in mHealth	During the 12 weeks of intervention	Students and parents/ guardians of both schools (Intervention and control)	n = 49 students n = 47 parents	89.1% of adolescents and 86.7% of parents

a = 55 eligible adolescents evaluated at baseline (31 in the intervention group and 24 in the control group), 53 parents/guardians participated in the intervention.

in the structured muscle strengthening and cardiorespiratory sessions" – with response options from 5 (strongly agree) to 1 (strongly disagree)[18]; 6) adolescent engagement with the pedometer (using the pedometer and meeting established goals); 7) engagement with messages - mHealth; 8) fidelity of the structured session (four observations per class), evaluated by the SAAFE checklist[15].

The percentage of reach, retention rate, participation, engagement, and adherence were classified as: low (≤50%), moderate (>50% and ≤70%), and high (>70%). The criteria used to assess student satisfaction with the intervention were grouped into three levels: disagree or low (1 - 2), neither agree nor disagree (3), and agree or high (4 - 5).

Direct observations of the structured sessions were performed by a researcher in the 6th and 10th weeks of the intervention. The questionnaire for the students was applied only once, after the end of the intervention period (November 2021).

Descriptive statistics (mean or median, standard deviation or interquartile range, and/or frequency distribution) were calculated for each criterion used in the process evaluation: participation, satisfaction, reach, retention rate, frequency, engagement, and session fidelity. All analyses were performed using the SPSS statistical package version 23.0.

Results

Of the 53 students who participated in the post-intervention assessment, 51 (29 from the IG and 22 from the CG) responded to the intervention implementation questionnaire. Overall, the reach of the ActTeens intervention was 73.3% (55/75 eligible adolescents) with a retention rate of 96.3% (53/55). The summary of the evaluation process of the ActTeens program strategies is presented in Table 2.

The majority of adolescents in the intervention group classified the structured PA sessions as enjoyable (Table 3). The structured PA sessions were implemented as planned (score 9/10). The teacher/staff gave students the opportunity to choose the activities they would like to undertake (autonomy), provided a session in which students remained active and in which everyone had the ability/opportunity to participate (fair activity), reflecting the SDT constructs and SAAFE principle. Of the 35 eligible adolescents from the intervention school, 88.5% agreed to participate in the structured sessions and the retention rate was 93.5% (29/31 students). During the 12 weeks of intervention, of the 24 planned

Table 2 – Summary of the process assessment

1. Implementation of PA sessions at school	
Sessions planned and delivered for the adolescents, % (n)[a]	89.5 (21)
2. Participation	
Student participation in PA sessions, % (n)	93.8 (27)
3. Engagement with the pedometer	
Users, n	24
Daily use of the pedometer, % [b]	57.9 %
Goals set weekly, % [c]	20.9%
4. Engagement with mHealth	
Users, n	50
Adolescents who received the 12 messages, %	94.3%
Parents/guardians who received the messages, %	86.7%
5. Student satisfaction with the different components of the ActTeens intervention	
Structured PA session[1]	
Overall satisfaction, median (IQ)[d]	5.0 (4.0 – 5.0)
Role of the teacher/staff in the ActTeens program, median (IQ)[d]	5.0 (4.0 – 5.0)
Relationship with teacher/staff, median (IQ)[e]	5.0 (4.0 – 5.0)
Knowledge of the teacher/staff, median (IQ)[e]	5.0 (4.0 – 5.0)
Methodology of structured PA sessions, median (IQ)[e]	5.0 (4.0 – 5.0)
Enjoyable structure of PA sessions, median (IQ)[e]	4.0 (4.0 – 5.0)
Useful information for a healthy lifestyle, median (IQ)[e]	5.0 (4.0 – 5.0)
Self-monitoring[1]	
Pedometer motivated/helped me to be more active, median (IQ)[e]	4.0 (3.0 – 4.0)
Use of the pedometer helped to change behavior, median (IQ)[e]	4.0 (3.0 – 4.5)
Goals set/achieved, median (IQ)[e]	3.0 (3.0 – 4.0)
Graphics motivated me to increase the number of steps/day, median (IQ)[e]	4.0 (3.0 – 4.0)
mHealth[2]	
Check the WhatsApp group, median (IQ)[f]	4.0 (3.0 – 4.0)
Messages sent in the WhatsApp group reminded me about adopting a healthy lifestyle, median (IQ)[e]	3.0 (2.0 – 4.0)
Use of the WhatsApp group to exchange information and strategies on how to become more active, median (IQ)[e]	3.0 (1.0 – 3.0)
Use of WhatsApp group to achieve daily steps goals, median (IQ)[e]	3.0 (2.0 – 4.0)
6. Fidelity of the Intervention	
Use of resources, %	100
Overall session score, mean (0 - 10)	9
Warm-up	
Adapted games with specific physical fitness movement, mean, %	100
Structured activies	
Specific structured session for muscular fitness, mean, %	75
High-intensity structured session including PA and cardiorespiratory, mean, %	25

Continue…

Continuation of **Table 2 –** Summary of the process assessment

Calm down	
Reinforcement of behavioral messages, mean, %	100
Reinforcement of the physical fitness components involved in the session, mean,%	50
7. Adherence to the SAAFE principle	
Support, median (IQ)[g]	4.0 (4.0 – 5.0)
Active, median (IQ) [g]	5.0 (4.0 – 5.0)
Autonomy, median (IQ) [g]	5.0 (3.0 – 5.0)
Fair, median (IQ) [g]	4.5 (3.0 – 5.0)
Enjoyable, median (IQ) [g]	4.5 (3.0 – 5.0)

PA = physical activity; SD = standard deviation; IQ_= interquartile range; Percentage (%); number of participants (n); 1components evaluated only by adolescents in the intervention group; 2component evaluated by both groups. a = Of the total number of sessions offered (n = 24). b = Adolescents who used the pedometer for at least 7 weeks. c = Adolescents who achieved 6 of the 9 goals set weekly. d = 5-point Likert scale ranging from very poor (1) to excellent (5). e = 5-point Likert scale ranging from strongly disagree (1) to strongly agree (5). f = 4-point Likert scale ranging from never (1) to often (4). g = 5-point Likert scale ranging from not very true (1) to very true (5).

structured sessions, 89.5% were implemented, with a participation frequency of 93.7% per class.

The strategies used in the self-monitoring component promoted a significant increase of 3,203 steps per day. Figure 1 show the individual behavior of the adolescents who used the pedometer. Adolescent engagement with this strategy was 82.7% (5 of the 29 participants did not use the device). To assess adherence, only adolescents who engaged in the self-monitoring strategy, that is, who used the equipment, were considered. An adherence of 57.8% (14/24 adolescents) was observed for the use of the pedometer and of 20.9% for the fulfillment of the established goals (Table 2). Regarding the feedback graphics, 15 of the 24 adolescents highlighted that the graphs stimulated them to increase their PA practice. In addition, adolescents reported these actions as stimulators for an active lifestyle (increasing the number of steps), which can be seen in Table 3.

The adolescents' engagement with the mHealth component was 94.3%, with 28 and 22 students from the intervention and control schools, respectively, receiving the 12 messages. The 53 adolescents were asked about this strategy, in which 50.9% stated that they frequently checked the messages sent, 37.8% reported that the messages helped them to adopt healthy habits, and 20.7% used the WhatsApp group as peer support (colleagues) to be more physically active (Figure 2). Regarding the engagement of parents with the messages, 86.7% (47/53 parents or guardians) received the 12 messages sent.

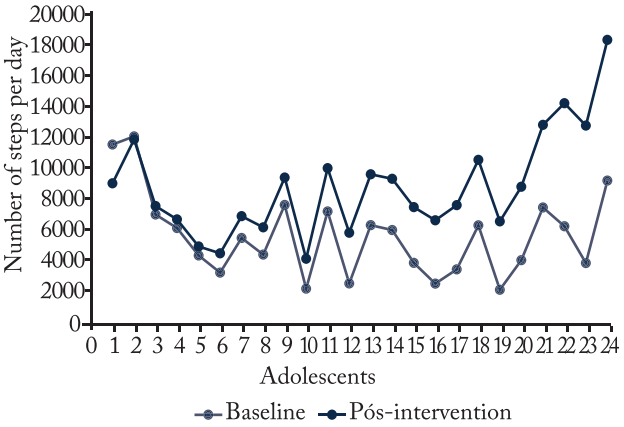

Figure 1 – Individual comparison of the number of steps per day between baseline and post-intervention.

Table 3 – Assessment of the adolescents in relation to satisfaction with the structured session and self-monitoring.

	Strongly disagree/ Disagree % (n)	Neither agree nor disagree % (n)	Strongly agree/Agree % (n)
Structured PA sessions			
a) I enjoyed/liked the ActTeens practical sessions	6.9% (2/29)	13.8% (4/29)	79.3% (23/29)
b) I liked the methodology in which the teacher/staff conducted sessions during the class	0% (0/29)	10.3% (3/29)	89.7% (26/29)
c) I found the relationship with my teacher/staff easy	3.4% (1/29)	6.9% (2/29)	89.7% (26/29)
Teacher-led seminar			
d) I noticed that my teacher/STAFF is knowledgeable about health and physical fitness	0% (0/0)	0% (0/0)	100% (29/29)
e) The seminar provided useful information on living a healthy lifestyle	0% (0/0)	6.9% (2/29)	93.1% (27/29)
Pedometer			
f) It motivated/helped me to be more active	8.3% (2/24)	12.5% (3/24)	79.2% (19/24)
g) It helped me to change my PA behavior	16.6% (4/24)	20.8% (5/24)	62.5% (15/24)
Setting goals			
h) The goals were easy to achieve	16.7% (4/24)	37.5% (9/24)	45.9% (11/24)
i) The graphs sent helped me to increase my number of steps/day.	12.5% (3/24)	25.0% (6/24)	62.5% (15/24)

PA = physical activity; Percentage (%); number of participants (n).

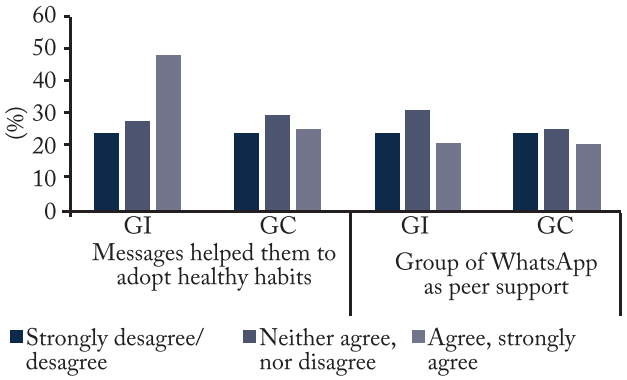

Figure 2 – Evaluation of messages sent to adolescents, separated by group.
IG = intervention group; CG = control group.

Discussion

The results of the current study provide a detailed assessment of the ActTeens Program implementation process. Overall, we observed that the ActTeens intervention had a reach of 73.3% with high a retention rate of participants (96.3%), and satisfaction reported by adolescents of the IG with the components of the intervention, structured session and self-monitoring were high (score 5), while for the mHealth strategy, 48.2% of the adolescents in the IG and 25% of the control group reported that the messages received helped them to adopt a healthy behavior.

Overall, the reach of the current intervention for students in both groups was 73.3% (82.8% and 60% of the intervention and control groups, respectively). Detecting the level of reach of a program is essential to direct how much this program needs to improve to maximize the number of individuals reached[11]. In addition to the reach domain, the characteristic of the participants must be considered, to describe the representativeness of the population and, thus, the ability to generalize the results found[11].

Regarding the implementation of the component in the school environment during Physical Education lessons, the results indicated high rates of retention (93.5%), reach (88.5%), participation (93.7%), and satisfaction with the sessions of PA, which suggest that the type of activity and the method implemented during the classes were well accepted by the participants and resulted in continuous involvement. The strategies used in the structured PA session were guided by the theory of self-determination, adopting the principle of satisfying the adolescents' basic psychological needs, namely: autonomy, competence, and relationship; which are basic principles for motivation (specifically intrinsic motivation)[12]. A study carried out by Jong et al.[3] resulted in a low reach, approximately 37.9% of the participants of the intervention schools received the GoActive sessions. This finding was due to the high variability in the fidelity of the intervention, such as the irregularity of the sessions to the students.

The importance of providing (delivering) structured PA sessions in the school environment has been proven in previously developed programs[14,17]. In the present study, PA sessions were delivered in more than 89% of classes, with high session fidelity. Corroborating these findings, Kennedy et al.[14] also found in their clinical trial an average frequency of more than 80% delivery of PA sessions. More than 79.3% of the students in the intervention group reported that they enjoyed in participating in the structured PA sessions and more than 89% liked the methodology used during classes, mainly because adolescents had the opportunity to choose which activities they would like to perform. This is consistent with the available literature, suggesting that autonomy in the choice of activity is fundamental to promote motivation and engagement in PA[17,19].

Regarding the strategies used in self-monitoring, an engagement of 82.7% was verified with the strategy of the number of steps per day, however, when analyzing the adherence to the daily use of the pedometer, only 14 of the 24 adolescents used this motion sensor every day with the aim of increasing the number of daily steps. A possible explanation for this moderate adherence was discussed by Suchert et al[20], who reported that after a period of time using the device, the adolescents began to feel inconvenienced/uncomfortable and in certain activities the use of the device was not feasible (sports/water activities and cycling)[20]. Along the same lines, research has shown that the design and aesthetics of wearable devices are determining factors, as they can promote engagement and adherence to the daily use of these devices[21,22]. Thus, device comfort is an important factor to be considered in PA interventions that use this type of strategy[23]. A possible solution to this problem would be to replace the pedometer with a smartband.

With respect to the achievement of goals, only 20.8% of the adolescents reached the predetermined goals, however, when analyzing adherence to goals by subgroups (according to the values of the number of steps from the baseline), it was verified that the less active adolescents (less than 5,000 steps per day) had a higher adherence compared to the more active adoles-

cents (54.5% and 21.4% respectively). Lubans et al.[24] and Kantanista et al.[25] highlighted that self-monitoring using a pedometer combined with goal setting is a more effective strategy to promote PA among individuals with low PA levels.

On the other hand, a strategy that can increase the adherence of adolescents with a higher level of PA would be to associate the establishment of goals with competition, since studies[20,26] have emphasized that including competition with friends is a mechanism that helps participants achieve PA scores/goals. Despite the low adherence found in the current intervention, feedback, self-monitoring, and establishing goals are acceptable strategies to increase PA in adolescents[26]. In addition, in a qualitative analysis in the study by Suchert et al.[20], the importance of individual goal setting was verified, as students reported increased focus on PA.

The majority of participants reported that pedometer use motivated them to be more active. According to Koorts et al.[23], the use of a device that promotes feedback has the impact of motivating adolescents to be more active, increasing awareness of PA practice and the likelihood of users becoming active on their own in a short period of time. Another study carried out in the United Kingdom with adolescents aged between 13 and 14 years also observed increases in motivation for PA in response to the use of a watch that performs PA tracking. (FitBit)[27].

Interventions using digital strategies (eHealth and mHealth) have shown great potential to help change adolescents' PA behavior in the short term, particularly when integrated into multicomponent interventions[28,29]. The actions of the present research regarding this component (mHealth) included the sending of messages weekly with guidelines on the importance and benefits of adopting a healthy lifestyle for adolescents. Messages were also delivered to parents via WhatsApp® in order to inform them about the importance of family support in the behavior change of adolescents.

Twelve different messages were sent, 6 of which were specifically about PA (benefits and practical tips) and 6 about a healthy lifestyle (PA associated with healthy eating and sleep quality), and the engagement of adolescents with this strategy was considered good (94.3%). However, 48.2% of the adolescents in the intervention group and only 25% in the control group reported that the messages received helped them to adopt a healthy behavior. This low percentage in the CG may be due to the mHealth component being the only strategy applied in this group, since researchers have observed a greater effectiveness of this strategy when associated with other components of an intervention program[28,29].

According to Bandeira et al.[30], 42% of the students participating in a multicomponent intervention program stated that the messages delivered through pamphlets were able to positively change their lifestyle, this percentage being similar to that found in the present study (48.2%). Although this text message strategy is apparently simple, it can be incorporated into PA programs to help overcome barriers and promote stimuli for the individual to engage in PA[31], since not all individuals respond positively to messages that provide feedback, especially those that highlight a "weakness" (for example: decrease cell phone usage time, increase the number of steps). This fact may also help to explain why most adolescents reported the irrelevance of messages in relation to encouraging the adoption of a more active and healthy lifestyle[32].

Another strategy included in the mHealth component was parental involvement in the intervention, since research[33] has emphasized the role of family support in the level of PA and in the adoption of healthy behavior by adolescents, being considered as important contributors to the success of interventions[7]. In the current research, the satisfaction and opinion of parents regarding the information received was not evaluated, but processes of evaluation of previous interventions observed that the direct involvement of parents (example: educational meetings) showed more beneficial results in the PA of adolescents than indirect involvement[30,34].

The main strength of this study is the focus on the evaluation process of the different components of the ActTeens program, including collecting data on reach, recruitment, retention, satisfaction, and fidelity, providing detailed information about the implementation of the intervention. In addition, the evaluation process was carried out by an independent evaluator, who did not act directly in any of the program's strategies or as an outcome evaluator. However, the present research has some limitations, such as the absence of a qualitative evaluation of the implementation, which could help to answer complex questions that cannot be answered only by the quantitative approach. In addition, in the evaluation of the mHealth component, the satisfaction of parents/guardians was not carried out in

relation to the messages received, which did not allow deeper evaluation of this strategy.

The findings of the present study suggest that the ActTeens intervention had good reach and engagement among adolescents. Adherence (participation in Physical Education classes) of students to activities in the school environment was considered high, however, adherence with the self-monitoring component presented a median percentage for the pedometer and low for the goals.

The offer of structured sessions of non-traditional physical activities within the school environment was considered a satisfactory strategy, especially with regard to student satisfaction. The insertion of the SAAFE principle in the methodology of the proposed activities seems to be important for the development of more active classes and greater participation of adolescents. In addition, self-monitoring proved to be a promising strategy, especially for less physically active adolescents, since the feedback provided by the device motivated these adolescents to become more active, which could be an important action aimed at promoting PA throughout the day, especially outside the school context. Regarding the mHealth strategy (guidance via WhatsApp messages), additional investigations are necessary, since most adolescents reported that the messages received were irrelevant to encourage the adoption of a healthy lifestyle.

The present study resulted in important findings regarding the reach, engagement, and adherence of the ActTeens program components. The results suggest that the structured PA sessions during PE lessons and the use of the pedometer were well accepted by the adolescents, being relevant strategies to promote an active lifestyle. However, the mHealth component, when used as a single strategy, did not help in the adoption of a more physically active lifestyle. Future research is needed to explore the feasibility of different strategies to increase adolescent adherence to interventions using wearable technology (motion sensors) and approaches to maximize adolescent integration with smartphone apps as a way to improve PA intervention strategies that aim to change behavior in adolescents.

Conflict of interest

The authors declare no conflict of interest.

Funding

The Géssika Castilho dos Santos author would like to acknowledge support by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brazil (CAPES) – Grant number [88887.500360/2020-00- Educational Scholarship – Ph.D. student].

Authors contributions

Santos GC, participated in the conception of the manuscript, and data analysis and interpretation. Silva JM, participated in the conception of the manuscript and data collection. Correa RC, participated of the intervention. Barbosa RO, participated of the intervention. Pinzon G, participated in the data collection. Francisquini MCJ, participated in the data collection. Silva TM, participated in the data collection. Stabelini Neto A, conducted the manuscript writing and critical review of its content.

Acknowledgments

The authors thank the schools (Casucha and ELO) for their involvement in this study.

Reference

1. WHO. WHO guidelines on physical activity and sedentary behaviour. In: Organization WH, editor. Geneva 2020.
2. Guthold R, Stevens GA, Riley LM, Bull FC. Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1· 6 million participants. The Lancet Child & Adolescent Health. 2020;4(1):23-35.
3. Jong ST, Croxson CH, Foubister C, Brown HE, Guell C, Lawlor ER, et al. Reach, recruitment, dose, and intervention fidelity of the GoActive School-Based Physical Activity Intervention in the UK: A mixed-methods process evaluation. Children. 2020;7(11):231.
4. Love R, Adams J, van Sluijs EM. Are school-based physical activity interventions effective and equitable? A meta-analysis of cluster randomized controlled trials with accelerometer-assessed activity. Obes Rev. 2019;20(6):859-70.
5. Silva JAd, Gonçalves ECA, Silva DAS, Silva KS. Programas de intervenção para atividade física nas escolas brasileiras: revisão com base no modelo RE-AIM. Cienc Saúde Colet. 2019;24:3443-56.
6. Grant A, Treweek S, Dreischulte T, Foy R, Guthrie B. Process evaluations for cluster-randomised trials of complex interventions: a proposed framework for design and reporting. Trials. 2013;14(1):1-10.
7. Naylor P-J, Nettlefold L, Race D, Hoy C, Ashe MC, Higgins JW, et al. Implementation of school based physical activity interventions: a systematic review. Prev Med. 2015;72:95-115.
8. Gorely T, Harrington DM, Bodicoat DH, Davies MJ, Khunti K, Sherar LB, et al. Process evaluation of the school-based Girls Active programme. BMC Public Health. 2019;19(1):1-16.
9. Durlak JA, DuPre EP. Implementation matters: A review of research on the influence of implementation on program outcomes and the factors affecting implementation. Am. J. Community Psychol. 2008;41(3):327-50.
10. Saunders RP. Implementation monitoring and process evaluation: Sage Open; 2015.

11. Glasgow RE, Harden SM, Gaglio B, Rabin B, Smith ML, Porter GC, et al. RE-AIM planning and evaluation framework: adapting to new science and practice with a 20-year review. Front. Public Health2019;7:64.

12. Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. Am Psychol. 2000;55(1):68.

13. Bandura A. Social foundation of thought and action: A social cognitive theory Prentice Hall. 1986.

14. Kennedy SG, Smith JJ, Morgan PJ, Peralta LR, Hilland TA, Eather N, et al. Implementing resistance training in secondary schools: a cluster randomized controlled trial. Med Sci Sports Exerc. 2018;50(1):62-72.

15. Lubans DR, Lonsdale C, Cohen K, Eather N, Beauchamp MR, Morgan PJ, et al. Framework for the design and delivery of organized physical activity sessions for children and adolescents: rationale and description of the 'SAAFE'teaching principles. Int J Behav Nutr Phys Act 2017;14(1):1-11.

16. Kantanista A, Bronikowski M, Laudańska-Krzemińska I, Król-Zielińska M, Osiński W. Positive effect of pedometer-based walking intervention on body image and physical activity enjoyment in adolescent girls. Biomed. Hum. Kinet. 2017;9(1):34-42.

17. Lubans DR, Smith JJ, Peralta LR, Plotnikoff RC, Okely AD, Salmon J, et al. A school-based intervention incorporating smartphone technology to improve health-related fitness among adolescents: rationale and study protocol for the NEAT and ATLAS 2. 0 cluster randomised controlled trial and dissemination study. BMJ open. 2016;6(6):e010448.

18. Costigan SA, Eather N, Plotnikoff RC, Taaffe DR, Pollock E, Kennedy SG, et al. Preliminary efficacy and feasibility of embedding high intensity interval training into the school day: a pilot randomized controlled trial. Prev Med Rep. 2015;2:973-9.

19. Sparks C, Dimmock J, Lonsdale C, Jackson B. Modeling indicators and outcomes of students' perceived teacher relatedness support in high school physical education. Psychol. Sport Exerc. 2016;26:71-82.

20. Suchert V, Steinvoord K, Schwarz J, Isensee B, Krieger C. Motivational aspects and critical issues of a pedometer intervention in adolescents. Health Promot. Pract. 2018;19(1):60-7.

21. Ridgers ND, McNarry MA, Mackintosh KA. Feasibility and effectiveness of using wearable activity trackers in youth: a systematic review. JMIR Mhealth Uhealth. 2016;4(4):e6540.

22. Schaefer SE, Ching CC, Breen H, German JB. Wearing, thinking, and moving: testing the feasibility of fitness tracking with urban youth. Am. J. Health Educ. 2016;47(1):8-16.

23. Koorts H, Salmon J, Timperio A, Ball K, Macfarlane S, Lai SK, et al. Translatability of a wearable technology intervention to increase adolescent physical activity: Mixed methods implementation evaluation. J Med Internet Res 2020;22(8):e13573.

24. Lubans DR, Morgan PJ, Callister R, Collins CE. Effects of integrating pedometers, parental materials, and E-mail support within an extracurricular school sport intervention. JJ Adolesc Health. 2009;44(2):176-83.

25. Kantanista A, Bronikowski M, Laudanska-Krzeminska I, Osinski W. Effects of pedometer-based walking intervention on psychological and biological variables in adolescent girls: does achieving goals make a difference. Med Sport. 2014;67:261-72.

26. Creaser AV, Clemes SA, Costa S, Hall J, Ridgers ND, Barber SE, et al. The acceptability, feasibility, and effectiveness of wearable activity trackers for increasing physical activity in children and adolescents: a systematic review. Int. J. Environ. Res. Public Health. 2021;18(12):6211.

27. Kerner C, Goodyear VA. The motivational impact of wearable healthy lifestyle technologies: a self-determination perspective on Fitbits with adolescents. Am. J. Health Educ. 2017.

28. Champion KE, Parmenter B, McGowan C, Spring B, Wafford QE, Gardner LA, et al. Effectiveness of school-based eHealth interventions to prevent multiple lifestyle risk behaviours among adolescents: a systematic review and meta-analysis. The Lancet Digital Health. 2019;1(5):e206-e21.

29. Shin Y, Kim SK, Lee M. Mobile phone interventions to improve adolescents' physical health: A systematic review and meta-analysis. Public Health Nurs. 2019;36(6):787-99.

30. Bandeira AS, Pizani J, Sousa ACFC, Silva JA, Minatto G, Barbosa Filho VC, et al. Implementation of a school-based physical activity intervention for Brazilian adolescents: a mixed-methods evaluation. Health Promot. Int. 2022;37(2):daab091.

31. Vajravelu ME, Arslanian S. Mobile health and telehealth interventions to increase physical activity in adolescents with obesity: a promising approach to engaging a hard-to-reach population. Curr. Obes. Rep. . 2021:1-9.

32. Kangovi S, Asch DA. Behavioral phenotyping in health promotion: embracing or avoiding failure. JAMA. 2018;319(20):2075-6.

33. Cheng LA, Mendonça G, Lucena J, Rech CR, Farias Júnior JC. Is the association between sociodemographic variables and physical activity levels in adolescents mediated by social support and self-efficacy? J. Pediatr. 2020;96:46-52.

34. Verjans-Janssen SR, van de Kolk I, Van Kann DH, Kremers SP, Gerards SM. Effectiveness of school-based physical activity and nutrition interventions with direct parental involvement on children's BMI and energy balance-related behaviors–A systematic review. PloS one. 2018;13(9):e0204560.

Received: 14/072022
Approved: 01/08/2023

Quote this article as:

Santos GC, Silva JM, Correa RC, Barbosa RO, Pinzon G, Francisquini MCJ, Silva TMS, Stabelini Neto A. Implementation of different strategies of the "ActTeens" intervention for adolescents: a process evaluation. Rev Bras Ativ Fís Saúde. 2023;28:e0306. DOI: 10.12820/rbafs.28e0306

Supplemental Table 1 – Description of the components of the ActTeens Intervention

	Components of the Intervention	Strategies/Actions	Description
School environment	Structured PA session	- Workshop for the teacher; - Support material; - STAFF; - Observation sessions and feedback.	The structured session included muscle strengthening and aerobic resistance exercises, in addition to high-intensity challenges. Each exercise session lasted a maximum of 20 minutes and was performed during PE classes twice a week. Students are required to select a variety of exercises from those pre-determined by the teacher/staff, with both aerobic and muscle strengthening activities. Suggestions about behavior change (being physically active, limiting time spent in SB, healthy eating) were reinforced at the end of the session.
Outside school hours	Self-monitoring	- Pedometer; - Setting weekly goals	Each participant in the IG received a Yamax SW700 pedometer for PA self-monitoring, and every two weeks the goal to be achieved was changed. The goals were elaborated based on the number of steps measured at baseline. The adolescent received messages twice a week via WhatsApp® reminding them to use the pedometer and reinforcing the goal to be achieved. This strategy aimed to propose a realistic goal to increase the number of steps of the adolescent.
Guidance on Healthy Lifestyle and Social Support	mHealth	- Weekly message sending	Adolescents and their parents/guardians from both groups received weekly messages about the benefits of PA and healthy eating via WhatsApp® with the aim of promoting and supporting behavior change in the home context.

PA = physical activity; MVPA = moderate to vigorous physical activity; SB = sedentary behavior; PE = Physical Education IG = intervention group; PAL = physical activity level; RT = resistance training.

Supplemental Table 2 – Goal setting

WEEKS	GOALS
1st and 2nd	B+10% or minimum of 10,000 steps/day
3rd and 4th	B+15% or minimum of 10,000 steps/day
5th and 6th	B+20% or minimum of 10,000 steps/day
7th and 8th	B+25% or minimum of 10,000 steps/day
9th and 10th	B+30% or minimum of 10,000 steps/day

B = Average steps at baseline.