Exergames on Line for Childhood Obesity: Using a Web Platform as an Ambulatory Program to Increase the Acceptance and Adherence to Physical Activity (PA)

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Abstract. Many initiatives exist to promote physical activity (PA) in children but dropouts are a very common outcome. Information and Communication Technologies (ICTs) are considered as useful tools to promote adherence in PA. This study analyzes the acceptance and adherence of an Internet-based exergame (MOVE-IT) to promote PA compared to a non-technological ambulatory intervention (NTI). The role of clinicians support is also analyzed. Thirty one obese children (9–15 aged) were asked to do an exercise routine (3 times/week along 3 months), using a pamphlet (NTI) or MOVE-IT web. In addition, MOVE-IT participants were divided into two groups, with and without (S-EBW/NS-EBW) weekly support. Results showed no differences in adherence between conditions, but differences were found for acceptability and usability. MOVE-IT was considered more attractive and entertaining. Furthermore, S-EBW participants felt more comfortable and confident in the management of the program and informed greater intention to use it.

Keywords: Physical activity · Exergames · Adherence · Acceptance · Children · Obesity

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1 Introduction

According to the World Health Organization [1], childhood obesity is a serious and global public health problem and it is increasingly affecting many low and middle-income countries, especially in urban areas. In recent years the prevalence has increased at an alarming rate. As "The global strategy on diet, physical activity and health" [1] points out 42 million children were overweight worldwide. Evidence shows that obese and overweight children tend to remain obese in adulthood and they are more likely to develop at an earlier age, noncommunicable diseases such as diabetes and cardiovascular disease [2]. However, overweight, obesity and related diseases are largely preventable. Therefore, prevention of childhood obesity should be a priority.

Currently, overweight and obesity are more determined by environmental factors than by genetics ones [3] and physical inactivity and sedentary lifestyles are considered as crucial risks factors. For this reason, the promotion of physical activity (PA) among young people is considered as a priority for public health [4]. Many initiatives have been undertaken in order to promote PA in adults, children and adolescents. However, dropouts and failure of the proposed programs are a very common outcome [5]. Approximately 50% of individuals who start an exercise program abandon it in the first 6 months [6]. Therefore, the study of the variables that influence the acquisition and maintenance of PA becomes increasingly more relevant, especially in the adolescent stage where if achieved PA tends to keep to adulthood with health benefits [7]. Is needed to incorporate new ways to prescribe PA and Information and Communication Technologies (ICTs) are considered as useful tools to study the variables involved in the practice of PA and promote adhesion to these types of interventions and prescriptions.

Most interventions to promote PA have been applied in schools, especially for preventive purposes. However, interventions in this context are not able to respond specifically to the needs and peculiarities of overweight and obese children. Interventions implemented at hospital and clinical settings can be more easily adapted to the characteristics of these children providing a much more intensive and focused treatment. However, these interventions neither are exempt from difficulties such as cost and adherences. Lison et al. [8] compared the effect of a PA intervention for the treatment of childhood obesity in two contexts: hospital (face-to-face 3 times a week in sessions of 60 min) and ambulatory settings (pamphlet with PA instructions to be performed at home). Results of this study showed that both hospital and ambulatory interventions were effective and a reduction of BMI Z and waist circumference after 6 months. However, the ambulatory intervention was less expensive, allowed participant´s greater flexibility, more privacy, more resources and involved parents and siblings.

In order to make more attractive the set of exercises, promote their availability at home, increase acceptance, adherence and expand the number of users who may receive the intervention, our group has designed an Internet-based exergame website (MOVE-IT) which replicates the exercise routine which has been shown to be effective [8]. The aim of this study is to analyze the acceptance and adherence of this Internet-based exergame (MOVE-IT) to promote PA in a sample of obese children, compared to a non-technological ambulatory intervention (NTI, a pamphlet). In addition, the role of clinicians support in acceptance and adherence of MOVE-IT is also explored and two

groups with and without (S-EBW/NS-EBW) support of professionals are compared. It is expected to find higher scores in adherence and acceptance in those participants using MOVE-IT than those in NTI condition. Also, the participants in the supported exergame-based website (S-EBW) will obtain higher scores in adherence and acceptance compared to a non- supported web condition (NS-EBW).

2 Materials and Methods

2.1 Participants

Participants were recruited from the Unit Pediatric of the General Hospital of Valencia. The final sample was composed by 31 children (67.7% boys and 32.3% girls; 9–15 aged) with BMIz scores of the 2.12 (SD = 0, 41) in overweight and obesity treatment. Participants were randomly assigned in three conditions: 9 participants in NTI group, 10 participants in S-EBW group and 12 participants in NS-EBW group.

2.2 Instruments

The following questionnaires were designed ad hoc for this study:

(a) *Questionnaire about video games and physical activity:* It evaluates the use of video games (frequency, platform type, active video games, etc.) and sports habits (frequency, type and time of practice)
(b) *Questionnaire about acceptance and satisfaction with the intervention:* It was adapted to each of the 3 experimental conditions. It is composed by 11 questions evaluated by a Likert scale of 5 possible answers. The internal consistency was 0.812.
(c) *Questionnaire about usability of the intervention:* it was developed and adapted to each of the 3 experimental conditions. It was composed by 9 questions evaluated by a Likert scale of 5 possible answer. The internal consistency was 0.419.
(d) *Registration of use of "MOVE-IT":* Frequency of days and hours using the platform.
(e) *Physical activity intervention and "MOVE-IT":* It consists in a sheet which appears the days of the week and weekends of the intervention and participants note whether they have practiced exercise routine.

2.3 Procedure

Parent consent and child assent were obtained before data collection and intervention. After that, participants were assigned to each of the 3 experimental condition (NTI, S-EBW, NS-EBW) with 2 moments of assessment (pre and post intervention). The intervention lasted 3 months.

In all conditions participants were asked to make the set exercises at least 3 times a week. Similarly, the set of exercises increased the level of difficulty gradually and

included resistance training and an aerobic activity. In the NTI condition participants received a pamphlet (paper with instructions and explanatory drawings). At the end, participants received a pencil-and- paper self-report and the date of the next session in 3 months. In both MOVE-IT conditions, participants had login and password to a web page "MOVE-IT" (http://moveit-etiobe.com/) which is self-administered and they had to repeat a set of exercises that avatar performed. In addition, participants received a CD with an explanation of the program and a demonstration of each exercise. Participants were asked to access "MOVE-IT" at least 3 times a week. In addition, the S-EBW condition (but not in the NS-EBW), participants received weekly emails with reminder and encouraging messages.

3 Results

3.1 Adherence to the Program

Regarding the adherence to the intervention 2 variables (frequency and regularity in the use of the program) were considered:

(a) *Comparison of MOVE-IT (S-EBW/NS-EBW) and (NTI).* Regarding the frequency of use of the program, one way ANOVA was conducted between the 2 conditions, and no differences were found between both conditions, $F(1,26) = 0.001 = 0.981$. In the NTI condition (M = 20.13, SD = 20.23) and in the S- EBW/NS-EBW (M = 19.9, SD = 23). As for the regularity in the use of the program, Chi square test was used and no differences were found between conditions X^2 (1) = 4, 178, p = 0, 056

(b) *Comparison of offering weekly support (S-EBW) or not (NS-EBW).* Regarding the frequency of use one way was conducted and no differences were found, $F(1,18) = 0.191 = 0.667$, between both conditions. As for the regularity in the use of the program, Chi square test was used and no differences were found between both conditions X^2 (1) = 0.069 $p > 0.05$.

3.2 Acceptability and Usability

(a) A.*Comparison of MOVE-IT (S-EBW/NS-EBW) and NTI.* One way ANOVA was conducted between the 2 conditions and significant differences were found in usability, acceptance and satisfaction, $F(1,28) = 4.375$, $p = .045$; $n = 0.125$. Participants in the MOVE-IT condition found it more entertaining than participants in the NTI condition (see Tables 1 and 2) Regarding the opinion of children on learning through intervention the participants in the MOVE-IT condition found it easier to learn the use of program than participants in NTI condition, $F(1,28) = 6.049$ p = 0.020; n = 0.168.

(b) *Comparison of offering weekly support (S-EBW) or not (NS-EBW).* One way ANOVA was conducted and significant differences were found in usability and acceptability. The participants in the S-EBW condition showed higher scores in usability and acceptability of the intervention (see Tables 3 and 4). Significant

Table 1. Descriptive statistics: Acceptance

	MOVE-IT	NTI
	M (SD)	M (SD)
Do you like to do it?	3,13 (1,16)	2,50 (0,84)
Do you prefer it?	2,83 (1,29)	2,00 (1,15)
Would you recommend it your friends?	3,22 (0,75)	3,20 (1,23)
Does it facilitate you to do PA?	3,09 (1,23)	3,20 (0,91)
Does it seem you entertaining?	3, 22 (1,11)	2,40 (0,84)
Does it seem you funny?	3,27 (1,12)	2,40 (1,07)
Does it hooked you?	2,31 (1,28)	2,20 (1,22)
Does it seem you difficult to use?	1,31 (0,77)	1,70 (0,82)
If you could continue to use it. Would you do it?	2,81 (1,18)	2,70 (1,16)
Do you think you have improved your fitness after using it?	2,77 (1,34)	2,60 (0,52)
Does it help you to be more physically active?	3,22 (1,23)	3,20 (1,13)

Table 2. Descriptive statistics: Usability

	MOVE-IT	NTI
	M (SD)	M (SD)
Did it take you a lot of time to learn how to use it?	1,54 (0,80)	1,70 (0,82)
Did it you seem difficult?	2,27 (1,48)	2,22 (0,83)
Did you like the design?	3,23 (1,19)	3,30 (1,49)
Did it seem complicated to use?	1,13 (0,64)	1,40 (0,96)
Would you like to use it more often?	2,90 (1,02)	3,00 (1,24)
Do you think other children quickly learn to use it?	3,90 (1,02)	2,90 (1,20)
Did you feel comfortable and confident with the management of the program?	3,40 (1,81)	3,20 (1,22)
Would you use it every day?	3,14 (1,06)	2,80 (1,03)
Did it seem you helpful?	3,75 (0,91)	3,50 (0,85)

differences between 2 conditions were found in comfort and confidence in the use of the program [F (1, 19) = 4, 104 p = 0, 0178; n = 0, 238], intention of everyday use of the program [F (1,18) = 15, 474 p = 0,001 n = 0,462] and the belief of improving their fitness after the intervention [F (1, 19) = 4,125 p = 0,056; n = 0,179]. The participants in the S-EBW condition showed higher scores in comfort and confidence in the use of the program, in the intention of everyday use it and the belief of improving their fitness. In addition, the weekly support was evaluated by participants as a good communication means, easy to use and very useful to achieve the objectives of the intervention.

Table 3. Descriptive statistics: Acceptance

	NS-EBW	S-EBW
	M (SD)	M (SD)
Do you like to do it?	3,00 (1,18)	3,30 (1,19)
Do you prefer it?	2,60 (1,26)	3,12 (1,35)
Would you recommend it your friends?	3,27 (0,78)	3,18 (0,75)
Does it facilitate you to do PA?	3,09 (1,13)	3,09 (1,37)
Does it seem you entertaining?	3,45 (1,03)	3,00 (1,18)
Does it seem you funny?	3,45 (1,12)	3,00 (1,09)
Does it hooked you?	2,36 (1,36)	2,27 (1,27)
Does it seem you difficult to use?	1,18 (0,60)	1,45 (0,93)
If you could continue to use it. Would you do it?	3,00 (0,90)	2,63 (1,43)
Do you think you have improved your fitness after using it?	2,27 (0,90)	3,27 (1,56)
Does it help you to be more physically active?	3,18 (1,16)	3,27 (1,35)

Table 4. Descriptive statistics: Usability

	MOVE-IT	NTI
	M (SD)	M(SD)
Did it take you a lot of time to learn how to use it?	1,63 (0,92)	1,40 (0,69)
Did it you seem difficult?	2,18 (1,54)	2,40 (1,50)
Did you like the design?	3,73 (0,65)	2,70 (1,42)
Did it seem complicated to use?	1,27 (0,90)	1,00 (0,00)
Would you like to use it more often?	2,82 (0,98)	3,00 (1,10)
Do you think other children quickly learn to use it?	3,54 (0,93)	4,20 (1,01)
Did you feel comfortable and confident with the management of the program?	2,90 (1,04)	3,90 (1,14)
Would you use it every day?	2,50 (0,71)	3,73 (1,10)
Did it seem you helpful?	3,90 (0,74)	3,67 (0,88)
Did ICTs seem you helpful for PA?	2,8 (1,23)	3,7 (1,25)
Did MOVE-IT seem you easy to start?	2,5 (1,84)	4,30 (0,82)

4 Conclusions

The aim of this study was to analyze the acceptance and adherence to an Internet-based exergame (MOVE-IT) to promote PA in a sample of obese children and compared to a non-technological intervention. In addition, the role of the support on acceptance and adherence of Internet-based exergame was also explored and two groups with and without support (S-EBW/NS-EBW) were compared.

In relation to the adherence with the intervention the results did not support the hypothesis, as no significant differences between MOVE-IT and NTI were found. These results are in the line with those found in other study [9], which observed that

children who used pencil and paper self-report showed more adherence in the intervention that children that used technological self-report. Participants in the pencil and paper condition filled out more records than participants in technological condition. However, when the complete records were taken into account, these differences disappeared because in the technological condition the records were more complete. Authors argued that in pencil and paper condition, participants could modify the information and in fact children reported that completed the self-report just before delivering. Therefore, the lack of differences could be due to a problem of reliability.

Regarding to the analyses of the acceptability and usability of the program, the results supported the hypothesis. The participants in MOVE-IT condition had higher scores than those in NTI condition. These results suggest that the web platform is more attractive and more entertaining than traditional interventions [9]. In this sense, the web platform could help to combat the major difficulties that professionals have encountered in the interventions such as lack of motivation, dropouts and failure. If children considerer the intervention more attractive and more entertaining is more likely that they continue the intervention.

Regarding the role of support in adherence with the intervention the results did not support the hypothesis, as no significant differences between both conditions (S-EBW/NS-EBW) were found. These results suggest that the weekly email support was not effective to promote adherence in the intervention and would be interesting to use other ways of support.

As for the acceptability and usability of the program comparing S-EBW/NS-EBW conditions, the results supported the hypothesis. The participants in the S-EBW condition felt more comfortable and confident in the management of the program than the participants in the NS-EBW condition. In addition, they informed greater intention to make daily use of the program and they expressed that their fitness improved. The weekly support was evaluated by participants as a good communication means, easy to use and very useful to achieve the objectives of the intervention. Therefore, although the weekly email support was not effective to promote adherence, was considered more acceptable and usable. These results suggest that the support provided in this intervention was assessed positively but it was insufficient and other ways of support should be explored.

Some limitations of the current study should be noted. The first one is the small sample size (N = 31). Another limitation was the absence of a control group treatment. For this reason, it is not possible to discriminate between the effects caused by PA program and other factors (regression to the mean, the natural evolution, etc.) Finally, the third limitation was the variables used to measure adherence to the program. In MOVE-IT condition the data was extracted directly from the web while in the NTI condition the data was extracted from the paper self-register with limitations of reliability and validity.

Despite of limitations, this study represents one of the first initiatives that assess an Internet-based exergame as a tool for ambulatory intervention in the field of childhood obesity. Our study found as the platform is more attractive and easier to use that the traditional pamphlet and it allows the collection of more reliable and valid data that the traditional self-register. With respect to the support, it has a positive impact in the acceptability and usability of the platform. However, we did not found significant

influence in the adherence to the program, although it increased the scores in acceptability and usability.

For future implementation, the web platform is being introduced as a tool for the treatment of obesity and overweight in children. In fact, the MOVE-IT has been inserted into the ETIOBE system [10], a treatment program for childhood obesity in order to strengthen the specific component of PA in treatment program. Is necessary the development of this programs to give more importance to the PA in the control of body weight.

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