

## Exergames and implications on quality of life in pediatric oncology patients: A preliminary qualitative study

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### Abstract:

The purpose of the study was to investigate the effect of exergames on the quality of life of three pediatric oncology patients and their attitudes towards participation in physical activity after the end of the program. In the present study volunteered three pediatric oncology patients, aged from five to six years old, who had been diagnosed with cancer and were staying at the hostel of the Association of Friends of Children with Cancer "Storgi" of Thessaloniki in Greece. A 12-week exercise program was implemented. Frequency of attendance was 3 times a week, while duration was thirty minutes per training session. The exergames «Kinect sports», «Kinect sports-season 2» and «Kinect Adventures» were used. Data were collected via observations and individual interviews with the cancer patients, with one of their parents and a staff member of the hostel. Our findings indicate that exercise through digital interactive games improved the childrens' overall quality of life regarding the parameters physical functioning, psychological functioning and social relations in the hostel. Moreover, through their participation in this program they had the intention to continue exercising with exergames and to participate in exercise programs in a realistic environment after their cancer treatment. In conclusion, exergaming is an adjunct treatment for achieving a better quality of life, which gives motivation to the patients to participate in regular physical activity and do not follow a sedentary lifestyle during the phase of cancer treatment.

**Key Words:** *Exercise, childhood cancer, children, digital interactive games*

### Introduction

Pediatric cancer is a chronic disease with many undesirable psychosomatic disorders both for the patient and for the family environment (Klassen et al., 2008). The painful clinical interventions which experienced by pediatric oncology patients are important factors which associated with low quality of life during the phase of therapy (Eiser, Eiser, & Stride, 2005). However, it has been reported that if the treatment of the child is associated with an enjoyable activity, it contributes positively to the improvement of mental health, increases self-esteem, reduces fatigue symptoms and improves the overall quality of life (Garipey & Howe, 2003; Juan, Wolin, & Lucia, 2011).

According to international literature, painful clinical treatment methods such as surgery, chemotherapy and stay in the hospital environment contribute decisively to the deterioration of the patients' quality of life during the phase of cancer treatment. More specifically, clinical setting is a traumatic experience as the child feels insecure, anxiety, fear and at the same time suffers from a variety of unpleasant symptoms such as fatigue (Perdikaris, Merkouris, Patiraki, Papadatou, Vasilatou, Kosmidis, & Matziou, 2008; Perdikaris, Merkouris, Patiraki, Tsoumakas, Vasilatou-Kosmidis, & Matziou, 2009), organ sub-operation, decreased self-esteem, depression, lack of autonomy (Langeveld, Stam, Grootenhuis, & Last, 2002) and pain (Matziou et al., 2016).

In the past, many researchers have studied the impact of interventional exercise programs in oncology patients, arguing that their participation in regular physical activity is a beneficial intervention strategy for this population, both during and after treatment (Courneya, 2001), which increases the life expectancy of individuals and at the same time improves their quality of life (Blanchard, Stein, & Courneya, 2010; Courneya, 2005; Cramp, James, & Lambert, 2010; Orsini, Mantzoros, & Wolk, 2008).

It has been found that the involvement of oncology populations in exercise programs contributes positively to the improvement of muscle strength, bone density (Singh, Newton, Galvão, Spry, & Baker, 2013; Uth et al., 2014) and cardiovascular capacity (Huang & Ness, 2011). Similarly, Speck, Courneya, Mâse, Duval and Schmitz (2010) argued that engaging in physical activity enhances aerobic capacity, muscle strength and quality of life, and at the same time reduces stress. In addition, the secretion of endorphins during the exercise increases the positive emotions, while decreases the feeling of anxiety or intense anger, and as a result leads to a

feeling of euphoria and happiness (Mustian et al., 2009). Based on the above findings, the participation of oncology patients in exercise programs plays an important role for the enhancement of both physical (Blanchard, Stein, & Courneya, 2010) and psychological parameters (Courneya, Stevinson, & Vallance, 2007; Courneya, 2001; McClellan, 2013), which significantly contribute to the reduction of fatigue and the improvement of the overall quality of life (Courneya, 2005; Cramp, James, & Lambert, 2010; Juan, Wolin, & Lucía, 2011).

Regarding physical activity recommendations for pediatric oncology patients during the phase of treatment, it seems to be in line with the recommended guidelines for healthy children (Astruc, 2016). In particular, pediatric oncology patients should participate in low to moderate intensity exercise, at least 30 minutes per training session, with duration three days a week or more. In addition, regarding the type of exercise, pediatric oncology patients should participate in pleasant aerobic and recreational familiar activities (Astruc, 2016).

Based on the above findings, a new, alternative and at the same time entertaining kind of physical activity is the digital interactive exercise games or the well-known "exergames". The term "exergaming" consists of a combination of words, exercise and game and is used to describe video games that promote physical activity (Lieberman, 2006) in both healthy and clinical populations in every age category (Apostolakis, & Antoniou, 2010; Patsi, Antoniou, Batsiou, Bebetos, & Lagiou, 2012; Vernadakis, Gioftsidou, Antoniou, Ioannidis, Giannousi, 2012; Vernadakis, Kouli, Tsitskari, Gioftsidou, Antoniou, 2014).

Given that exercise is beneficial for the quality of life in pediatric oncology patients and that exergames is a more pleasant way of training this study sought to determine whether this form of physical activity, could improve the quality of life in a six-year patient who had been diagnosed with acute myeloid leukemia. To the best of our knowledge this is the first worldwide qualitative study which examined the effect of exergames with the use of Xbox 360 kinect console on a patient with acute myeloid leukemia. It was hypothesized that a 12-week program with the use of Xbox 360 kinect console, with three 30-minute sessions a week would result in a significant improvement in quality of life of the participant.

## Material & methods

### Participants

A bilateral agreement dealing with ethical procedures between the researchers and the President of the Association of Friends of Children with Cancer "Storgi" was signed. Approval was obtained from the Ethics Committee (EC) of Democritus University of Thrace (DUTH). The selection of the participant in this qualitative case study was purposeful (Creswell, 2007). In the present study volunteered three pediatric oncology patients, aged from five to six years old, who had been diagnosed with cancer and were staying at the hostel of the Association of Friends of Children with Cancer "Storgi" of Thessaloniki in Greece. Participants' characteristics are analytically presented in Table 1.

**Table 1.** Characteristics of the participants

Sex	Age	Type of cancer
Female	6	Acute Myeloid Leukemia
Female	6	Acute Myeloid Leukemia
Male	5	Retinoblastoma

### Measure

#### Observations

During the 12-week period the main instrument was the researcher herself (1st author), as she was observing and keeping detailed notes in a field diary about the intervention program, events, discussions and attendance of the participant in exercise (Hammersley, & Atkinson, 1995).

#### Individual interviews

In order to examine the effect of the 12-week interventional program through exergames on the quality of life of the participants, interviews were conducted with the children (N=3), with one of the parents of each child (N=3) and a staff member of the hostel for a total of 30-40 minutes with the principle purpose of the study on whether this kind of exercise can be beneficial for the improvement of the quality of life during the phase of cancer treatment regarding the physical, psychological and social parameters. The interviews were conducted twice, in the middle (after the 6th week) and after the end of the interventional exercise program through exergames. The interviewer (1st author) asked each respondent the same series of open-ended questions, which were created prior to the interview. At the end of each interview, a copy of the written text of the interview was given to each participant to read it carefully and sign it except from the child in purpose to enhance the trustworthiness of the interviews. Finally, it is necessary to add that all field notes of the observations which contained some informal discussions with participants outside of the program with exergames and discussions with the staff of the hostel, clarified the researchers' worries about the honesty of the participants' answers, enhancing with this way the reliability of our findings.

### Procedure

Permission was asked and granted from the Association of Friends of Children with Cancer "Storgi" of Thessaloniki in Greece. The permission allowed only one of the researchers to enter the facilities of the hostel. The data were collected from October 2017 to January of 2018. Before the children's participation, the parents

were informed about the aim and the design of the study and they signed a written informed consent. All measurements were performed at the hostel of the Association of Friends of Children with Cancer "Storgi" of Thessaloniki in Greece.

Prior to the intervention program with exergames medical history was completed in order to collect information about the patients and their family. The program lasted a total of 12 weeks. Prior to training program with exergames, the participants received an introductory tutorial on how to use the Xbox 360 Kinect console and its peripheral devices. Frequency of attendance was 3 times a week, while exercise was thirty minutes. The exergames «Kinect sports», «Kinect sports-season 2» and «Kinect Adventures» were used. The participants had their own Mii character (virtual self), which had created according to the appearance that they would like to have. They played darts, golf, boxing, tennis, ping pong, baseball, bowling, track and field games, ski and more others. The children didn't refer any prior participation in physical activity before the exercise program.

#### *Data collection and analysis*

In the social sciences, triangulation is often used to indicate that two or more methods are used in a study in order to check the results of one same subject (Denzin, 1970). So based on the above, in order to strengthen the validity of our findings, we tried to collect data through interviews (children, parents, member staff of the hostel) and observations (before, during and after the exercise program), with the purpose to obtain the same results from each research technique, so we could become sure that the data are valid.

In the present study for the assessment of the qualitative data, interviews were transcribed verbatim and analyzed using thematic analysis (Braun & Clarke, 2006). Data analysis was conducted as collaborative negotiations between the first two researchers. The researchers had competence in conducting qualitative studies in athletic psychology, exercise and social sciences. In the beginning, all researchers read the transcripts and the text of observations in order to get an overall impression. In second phase, they identified and coded units of meaning representing participants' perceived experiences of interventional program with exergames. Then, they grouped all the coded data under greater categories, and compared them with the original. After this, they summarized the contents of each group to generalize the descriptions regarding the participants' exergaming experience. Finally, all authors discussed the coded data and agreed on the themes (Braun & Clarke, 2006).

## **Results**

From the qualitative data analysis four major themes were conducted from the two first authors of the present study. The following is a description of the themes which identified (Table 3). Regarding the responses of our sample it seems that participation of the children in the 12-week program with exergames improved the patients' overall quality of life regarding the parameters a) physical functioning, b) psychological functioning, c) social relations in the hostel, d) Intention to participate in exercise after the end of the program (Fig. 1).

**Table 3.** The effect of exergames on quality of life of the children

1 <sup>st</sup> Theme-Physical Functioning	
Children	"I feel my body healthy. I felt better....., I do not feel tired, Look, how much powerful my hands are, I have more power than your own player, look at my arm! (during boxing game)"
Parents	"She/he is stronger and more active....., She/he is full of energy, It is better to participate in this program, because she/he increases her/his physical activity levels (during her/his stay in the hostel) ....., How else to spend her/his time here during the day (during her/his stay in the hostel)?....., This is better (exergames) she/he moves (her/his body) a little bit more"
Staff member	"She/he was not tired (smiling)....., She/he wanted to play longer....., I would like to have this (the exercise program) not only three days per week but even more days, more playing with these games. It was very important and very meaningful (the program with digital interactive games), (The games) pushed the child to be active, to pass and forget all the negative symptoms that her/his body receives during the cancer treatment, she/he walks more, It is a lively program (in comparison with the other sedentary activities) that covers the need of the child to move, gives her/him the sense of exercising, gives her/him another dynamic in her/his functionality, (I believe) that is good for her/him to participate in the exergames program because it boosts her/him to decrease her/his tension, the child is standing up, not lying all day on a bed as usual ....., The fact that she/he was going to another place (except from her/his room) in the hostel, .... and exercise through these games (exergames), was for us (Association of Friends of Children with Cancer "Storgi") the initiative goal that we want to achieve....., exergames is a structured exercise program which in my opinion covered the need of the child to express herself/himself, through playing that she/he loves so much
2 <sup>nd</sup> Theme-Psychological Functioning	
Children	"I feel happier....., You are happy when you get married, I got married with the games, (The games) are funny, I love the games, I am happy when I come here, I have fun....., I prefer to be here, I would like to play every day, I'm happy with the games when was coming downstairs (in the room where the Xbox console was located)"
Parents	"Super!, She/he is very happy, She/he comes (at the room) and tells me ..... let me tell you what

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I did today (what games she/he had played)"

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Staff member	“She/he is enthusiastic, happy, excited (smiling), she/he is very satisfied”
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3<sup>rd</sup> Theme-Social Functioning

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Children	“....., I am friend with the girls, With ..... (relatives and other patients who stayed at the hostel)”
Parents	“She/he is happy to talk with everyone. She/he doesn’t have any problem (to communicate with others)”
Staff member	“..... is a child who thinks individually....., has a limited social life....., she/he tries to attract the attention of the others....., (she/he wants) everybody to turn the eyes on her/his....., she/he doesn’t have a positive and communicative friendship (with the others), a mutual friendship, The games helped her/his on this point, (After the exercise program) she/he plays with the other kids, she/he stays in the same place (with them)....., she/he shares, she/he learnt that she/he have to share things (with other persons who are staying in the hostel), exergames helped her/him very much to be more social, to build a proper communication....., in particularly, it was something (the exercise program) that helped her/him.....”

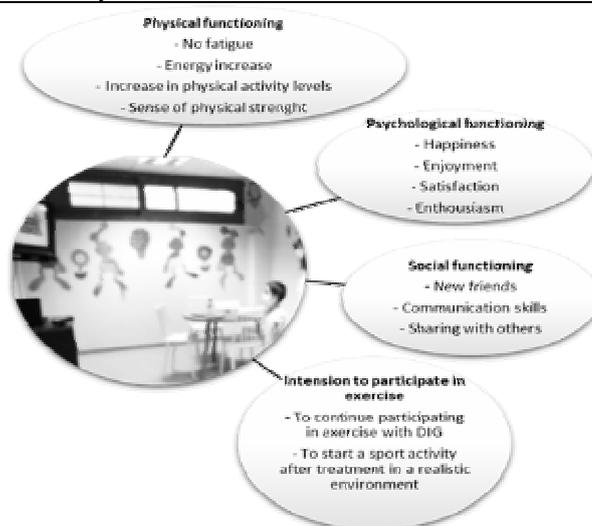
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4<sup>th</sup> Theme-Intention to participate in exercise after the end of the program

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Children	“I want to play with them (with exergames)....., (I would like to play) boxing and darts (in a realistic environment), But I like all the sports, But now (I can’t, because I) have the Hickman (catheter)....., I still cannot (to participate in an realistic environment), But I would also like to play golf (after the end of therapy)”
Parents	“(She/he wants to continue) very much, It would be good for her/his (this program) to be continued, She/he loves them (the program with exergames), Every time she/he was waiting to start (playing with exergames), I think she/he will want to start something when the (cancer) treatment will be over, to participate in sports”
Staff member	Now at the end of the program she/he asks (me): When will I play again.....?, She/he wants it (to participate in the exercise program) so much, I think that after treatment she/he will start a sport activity....., When she/he will be fine”

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**Fig. 1** Analytically presentation of the four major themes which conducted from qualitative data analysis.

**Discussion**

In the present study individual interviews and observations were conducted by the first researcher in order to evaluate the effect of a 12-week exercise program of three 30-minute sessions a week on the participants’ quality of life and their attitudes towards participation in physical activity. Our findings indicate that the interventional program with exergames improved the childrens’ overall quality of life regarding the parameters a) physical functioning, b) psychological functioning and c) social relations in the hostel. Also, now through their participation in this program d) they have a positive attitude to continue participating both in digital interactive games and exercise programs in a realistic environment after their cancer therapy.

Regarding the parameter physical functioning the responders’ answers showed that the children during the 12-week exercise program with exergames didn’t refer any related symptoms with cancer therapy like organ sub-operation, fatigue and lack of autonomy. Our results showed that the patients through their participation in this exercise program increased their physical activity levels, were more active, full of energy and they improved their physical strength. Similarly, previous studies suggest that engaging in physical activity and digital

interactive exercise games leads to increase of physical strength and energy levels, and as a result reduces the cancer patients' related fatigue (da Silva Alves et al., 2017; Mustian, Peppone, Darling, Palesh, Heckler, & Morrow, 2009). In this point it is necessary to note that the patients before their involvement in exergames didn't participate in any form of physical activity during their stay in the hostel. Moreover, during the day they spent their free time in their room with their family and most of the mornings they were at the hospital for receiving their medication.

Regarding the parameters psychological and social functioning, it was observed that the patients had a plethora of positive emotions such as happiness, enjoyment during every training session, satisfaction, enthusiasm to share their interactive adventures, their achievements, their highest scores and records on the console, they were more communicative, they started to make new friends and learnt the value of sharing things and maintaining a positive interaction with others. This psychological and social enhancement was observed both by the family environment and the staff of the hostel from the first one week of the childrens' involvement in the exercise program. Also, in similar studies which evaluated the effect of physical activity through digital interactive games on the participants' psychosocial aspects of their lives, results indicated that this form of exercise has the potential to increase enthusiasm, enjoyment, positive emotions and improve social relations with others in both healthy and clinical populations (Patsi, Antoniou, Batsiou, Bebetos, & Lagiou, 2012; Patsi, Yfantidou, Antoniou, Gkoraki, & Lagiou, 2016).

Finally, the results of the present study revealed that children had a positive attitude towards exercise to continue participating in exergames and they also had the intension to participate in physical activity in a realistic environment, and more specifically as they referred, they want after their cancer therapy to start playing golf. Similarly, relative studies have revealed that exergames are an enjoyable form of physical activity, which connects exercise with electronic games and as result it encourages individuals to increase their physical activity levels in everyday life. What is more, the participants' involvement in exergames likely leads in increased motivation for participating in exercise in realistic environment settings (Patsi, Antoniou, Batsiou, Bebetos, & Lymnioudis, 2011).

### Conclusions

To the best of our knowledge this is the first worldwide qualitative study which examined the effect of exergames with the use of Xbox 360 kinect console on pediatric oncology patients. Nevertheless, it is necessary to note that our small sample and lack of prior studies on this topic could be the limitations of the present study. Moreover it is necessary to note that these results are part of a doctoral thesis. Though, participation in exergames seems to have positively contributed to improving the childrens' overall quality of life, enabling the children to participate in their favorite sports in a controlled and safe environment and spend their free time creatively during their stay in the hostel. Finally, our results suggest that exergames has to be incorporated as a therapeutic form of treatment into the pediatric oncology organizations and as a result to help the pediatric oncology patients to adapt in the new conditions of their life and maintain their quality of life on a stable condition during their therapy.

**Conflicts of interest** The authors have no conflict of interest to declare.

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