

Surviving Childhood Cancer: Relationship between Exercise and Coping on Quality of Life

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Abstract. This research assesses Health-Related Quality of Life (HRQoL) in a Spanish sample of adolescent cancer survivors, and analyzes the relationship between HRQoL, coping styles and physical exercise. Forty-two survivors (12-19 years), who were ≥ 1 year of remission, completed standardized measures of HRQoL (CHIP-AE), coping strategies (ACS) and physical exercise (AECEF). Mean scores in all HRQoL domains were within normative values. Multiple regression analysis revealed that physical exercise and productive coping were related to higher HRQoL, whereas non-productive coping was related to lower HRQoL. This sample of survivors reported good levels of HRQoL, which are mediated by coping styles and physical exercise.

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Rates of survival in childhood cancer have increased during the last decade; nowadays more than 80% of children newly diagnosed with cancer will become 5-year survivors of their malignancy, and the majority of these patients will be completely cured of their disease (Peris-Bonet, Giner, García, Sánchez de Toledo, & Acha, 2003; Steliarova-Foucher, Stiller, & Kaatsch, 2004). With this growing population living years beyond a cancer diagnosis, survivorship has emerged as an important field of research, because living beyond cancer sometimes implied several chronic or/and late effects of the disease and its treatments (Ness & Gurney, 2007; Zebrack, 2000). Pediatric practitioners recognize that curing a child is not enough; they also had an obligation to ensure that the quality of children's lives is as important as their length. Being cancer-free does not mean being free of cancer's effects. Therefore, young adult survivors of childhood cancer are considered a high-risk vulnerable population for experiencing medical and psychosocial late effects that can adversely affect their Health-Related Quality of Life (HRQoL) across their lifespan (Eiser, Hill, & Vance, 2000; Langeveld, Stam,

Grootenhuis, & Last, 2002). For that reason, achieving an adequate level of HRQoL among childhood cancer survivors has been identified as a significant outcome in measuring the success of cancer treatment (Hudson et al., 2003; Robison et al., 2002). A different range of areas can be affected in cancer survivorship: neuro-cognitive status, endocrine, cardiac and pulmonary function (including reproduction), physical and physiologic growth, psychosocial adjustment, and health behavior or lifestyle choices. Although physical late effects have been widely explored (Bradwell, 2009; Hady, Mosher, & Reaman, 2009; Schwartz, 1999), comprehensive scientific knowledge related to the long-term psychosocial consequences of childhood cancer is less available (Eiser, Penn, Katz, & Barr, 2009; Zebrack & Chesler, 2002).

Some studies focus on understanding the underlying factors associated with a satisfactory level of HRQoL in adolescent survivors of childhood cancer (Kazak et al., 2010; Zeltzer et al., 2009). Among them, physical exercise and coping styles have been identified as two important determinants (Paxton et al., 2010; Stam, Grootenhuis, Caron, & Last, 2006). Although the literature yields some inconsistent findings, a number of clear trends can be identified.

The way of coping with a life-threatening disease such as cancer can be regarded as an important mediating factor in adaptation to the oncological experience and thus, to the survivor's long-term adjustment, as some research has demonstrated (Last & Grootenhuis, 1998; Stam, Grootenhuis, & Last, 2001). In this sense, most of the studies have shown positive relationships between productive coping or engagement and HRQoL,

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and negative relationships have been found between non-productive coping or disengagement and HRQoL (Stam et al., 2001). However, results are not conclusive, and no former studies have been found about Spanish adolescent cancer survivors in these topics.

Concerning to physical exercise, previous reviews showed some promising effects of physical exercise on overall HRQoL after cancer treatment (Oldervoll, Kaasa, Hjerstad, Lund, & Loge, 2004). Particularly, improving physical functioning, body weight and composition, muscle strength and endurance, as well as immune function (Keats, Culos-Reed, Courneya, & McBride, 2006; Oldervoll et al., 2004; Schwartz, 2008). However, most of the studies reported data from adult cancer survivors, being the preventive role in health status or the fostering effect among adolescent cancer survivors less explored (Keats et al., 2006). Although some evidences suggest that physical exercise among pediatric cancer survivors is generally beneficial (Keats et al., 2006; Oldervoll et al., 2004; Schwartz, 2008), there is still a lack of knowledge about the real effects on their HRQoL, just as the optimal type of exercise, duration, frequency and timing of physical exercise in pediatric cancer survivors (Courneya & Friedenreich, 1999; Keats et al., 2006; Speed-Andrews & Courneya, 2009). Taking into account that an important goal for cancer survivors is to improve their HRQoL by maximizing functions that could be affected by the disease and its treatments, it is very important to know the effect of different exercise regimes.

The more we know about the relationship between coping styles, physical exercise and HRQoL, the better health care providers will be able to help patients to cope with the consequences of their disease.

For all these reasons, the aims of the present study were: (a) to investigate HRQoL in young Spanish cancer survivors and to compare it to normative data, controlling for age and gender, and (b) to identify the relationship between coping styles and the regular practice of physical exercise (minutes per week) with HRQoL outcomes among this population.

Method

Study procedures and measures were approved by the ethic committee of the Hospital Universitari Vall d'Hebron de Barcelona, Spain; and data were collected between March 2008 and June 2008. All survivors participated on the basis of written informed consent and all the study was structured to provide total anonymity.

Participants

Eligible adolescent cancer survivors diagnosed and treated in the Hospital Universitari Vall d'Hebron, Área

Materno-infantil, Servicio de Oncología y Hematología Pediátrica, were identified from the RNTI-SEOP (Peris-Bonet et al., 2003). The RNTI-SEOP is a hospital-based central registry for all pediatric oncology centres and geographic areas of Spain; created to collect, process, and provide data related with pediatric oncology.

Inclusion criteria for study participation required that: (a) participants had been diagnosed with cancer (all diagnosis, excluding central nervous system tumors), (b) to be 12-19 years old at the time of the study, (c) to be off-treatment for at least one year, and (d) to have a follow-up appointment at the Hospital Universitari Vall d'Hebron de Barcelona between March and June 2008. Survivors with psychopathology or mental retardation diagnosed before the first primary oncological diagnosis were excluded from the study.

Measures

Socio-demographic and illness-related data. Socio-demographic data were obtained from the patient in a semi-structured interview. That included: gender, age, current studies, nationality, and residence. Illness-related data were collected from medical records. That included: oncological diagnosis, type of treatment, bone marrow transplantation, relapse, second malignancy, duration of treatment (in months), age at the first diagnosis (in years), and time passed since first diagnosis (in years).

HRQoL measure. HRQoL was assessed with the Spanish version (Rajmil, Serra-Sutton, Alonso, Starfield, et al., 2003) of the Child Health and Illness Profile-Adolescent Edition (CHIP-AE), a generic measure of health status and subjective well-being of adolescents (12-19 years old) based on their self-report (Starfield et al., 1995). The CHIP-AE contains 183 items; the majority of them are answered on a likert scale with four or five ordered response categories. The items are divided in 20 subdomains and forming 6 domains (Rajmil, Serra-Sutton, Alonso, Herdman, et al., 2003). For the purposes of the present research only the 6 domains were considered (see Table 1).

Higher scores indicate better health (more satisfaction with health, less discomfort, more resilience, fewer risky behaviors, greater achievement and fewer disorders). To make comparisons of different adolescent populations easier, all scores have been standardized to a mean of 50 and a standard deviation (*SD*) of 10. The CHIP-AE provides normative data stratified by gender.

Coping Strategies measure. Coping strategies were assessed with the Spanish version (Pereña & Seisdedos, 1996) of the Adolescent Coping Scale (ACS) generic version. The ACS is a self-report checklist inventory

Table 1. Concepts included in the CHIP-AE domains

DOMAINS (Number of items)	Summary of content
SATISFACTION (12)	Perceived level of health and well-being.
DISCOMFORT (45)	Specific physical and emotional feelings/interfere with comfort.
RESILIENCE (32)	States and behaviors known to protect individuals from illness or injury.
RISKS (38)	States and behaviors known to heighten the likelihood of illness or injury.
ACHIEVEMENT (11)	Meeting expectations for developmentally appropriate role performance.
DISORDERS (45)	Diagnostic entities including conditions/injuries/impairments.

that consists in 79 items scored on a 5-point likert scale which assesses 18 possible coping strategies used by adolescents and young adults (12-19 years old) in dealing with stress (Frydenberg & Lewis, 1993). The items asks for frequency of use of different coping

strategies ranging from 1 (*doesn't apply or don't do it*), to 5 (*used a great deal*) with higher scores indicating higher use of these coping strategies. Strategies are associated with three styles of coping: productive coping, coping in reference to others, and non-productive coping (see Table 2). The ACS provides normative data stratified by gender.

Physical Exercise measure. Weekly practice of physical exercise (total of minutes per week) was assessed with the AECEF, a Spanish adaptation (Capdevila, 2005) based on the "Sample Physical Activity Questionnaire to Determine State of Change" (United States Department of Health and Human Services [USDHHS], 1999). Respondents were asked to answer "yes" or "no" to a serie of five questions related to their current exercise behavior and future intentions to exercise. If they were currently practicing regular physical exercise (at least three times per week a minimum of thirty minutes), three additional questions were answered to assess its specific frequency, timing and the years of uninterrupted practice. Versions of this measure have been found to be both reliable and valid in previous studies (Marcus & Simkin, 1993; Reed, Velicer, Prochaska, Rossi, & Markus, 1997).

Table 2. Concepts included in the ACS. Coping styles and related strategies

COPING STYLE Related strategy	Summary of content
SOLVING-PROBLEM COPING	
Solving the problem	Tackling my problem systematically by thinking about it and taking other points of view into account.
Physical recreation	Playing sport and keeping fit.
Seek relaxing diversions	Taking my mind off the problem by finding ways to relax such as reading a book, watching television, going out and having a good time.
Work hard to achieve	Being conscientious about my (school) work; working hard and achieving high standards.
Focus on positive	Looking on the bright side of things, reminding myself that there are others who are worse off, trying to stay cheerful.
REFERENCE TO OTHERS	
Seek social support	Share the problem with others. To enlist their support, encouragement and advice.
Social action	Enlisting support by organizing group action to deal with my concerns, attending meetings and rallies.
Seek spiritual support	Praying for help and guidance. Reading a holy book.
Seek professional help	Discussing my problem with a professionally qualified person.
Invest in close friends	Spending time being with close friends and making new friendships.
Seek to belong	Being concern with what others think, and doing things to gain their approval.
NON-PRODUCTIVE COPING	
Wishful thinking	Hoping for the best that things will sort themselves out or that a miracle will happen.
Worry	Worrying about the future in general and my personal happiness in particular.
Keep to self	Keeping my concerns and feelings to myself, avoiding other people.
Tension reduction	Making myself feel better by letting off the steam. Taking my frustration out on others. Crying, screaming, and taking alcohol, cigarettes or drugs.
Self-blame	Being hard on myself. Seeing myself as being responsible for the problem.
Ignore the problem	Consciously blocking out the problem. Pretending it doesn't exist.
Not coping	Not doing anything about my problem. Giving up. Feeling ill.

Procedure

Eligible survivors were contacted by telephone. In this first contact, they were informed about the purpose of the study and asked for participation. If they agree to collaborate, an assessment appointment was scheduled.

The assessment was conducted by the main researcher of this study (CC) in a hospital office in a 45-minute session. Parents were requested to attend in the waiting room while the patient completed the questionnaires. Patients fulfilled the *CHIP-AE* questionnaire and the *ACS-generic version*, and finally they answered the *AECEF*. In the case of severe visual impairment, assistance was offered to read the items.

Data analysis

Multiple linear regression analyses (Stepwise entry) were performed to investigate the explanatory value of coping styles and physical exercise in relation to HRQoL scores. All analyses were corrected for (a) demographics (i.e. age and gender), and (b) medical selected variables (diagnosis, type and length of treatment, age at first diagnosis, bone marrow transplantation, relapse and second malignancy). For these purposes, non-parametric Mann-Whitney U-Tests and Pearson correlations were performed to determine which among these variables should be included in the regression analyses. Finally, we limited the regression analyses to the 6 summary scales of the *CHIP-AE* (*satisfaction, discomfort, resilience, risks, achievement and disorders*), the 3 basic coping styles (*productive coping, coping in reference to others and non-productive coping*), and the *weekly practice of physical exercise* in order to minimize the number of statistical tests. The variable "age at the first diagnosis" was also included in these analyses. All tests were two-sided with 5% significance level.

Results

Participant's characteristics

A total of 61 Spanish adolescent cancer survivors were asked to take part in the cross-sectional study, 33 males (54.1%) and 28 females (45.9%). Among them, 19 survivors did not participate for several reasons (response rate 68.85%). Most of the non-participants just did not show to the assessment appointment ($n = 12$), and some of them reported that they did not have enough time ($n = 3$) or did not want to be confronted again with cancer ($n = 4$). Finally, data from 42 survivors could be used for the analyses: 26 males (61.9%) and 16 females (38.1%). Their mean age was 15.64 years old ($SD = 1.9$; range = 12-19) and the median age was 16 (see Table 3). The demographic information as well as

Table 3. Demographic and medical characteristics of the survivors group ($n = 42$)

	<i>M</i>	<i>SD</i>	<i>Range</i>
Age at the study (years)	15.64	1.9	12–19
Age at the first diagnosis (years)	6.55	5.1	1–16
Time since first diagnosis (years)	9.95	4.2	2–19
	<i>N</i>	<i>%</i>	
Gender			
Male	26	61.9	
Female	16	38.1	
Educational level (at the moment of the study)			
Not going to school	1	2.4	
Primary school	2	4.8	
Secondary school	21	50	
High school	11	26.2	
Superior grade/formative course	7	16.6	
Diagnosis			
Leukemia	26	62	
Lymphoma	5	12	
Solid tumors	11	26	
Bone Marrow Transplantation			
Yes	4	9.5	
No	38	90.5	
Relapse			
Yes	1	2.4	
No	41	97.6	
Second malignancy			
Yes	1	2.4	
No	41	97.6	
Duration of treatment (in months)			
≤ 6 months	12	28.6	
7 – 12 months	9	21.4	
> 12 – 24 months	21	50	
> 24 months	0	0	

the medical data, was all scrutinized by the primary investigator (CC) from medical records. This information is also summarized in Table 3.

Patient characteristics between participants and non-participants did not differ significantly with regard to demographical (age, gender, educational level) or medical data (diagnosis, type and duration of treatment, bone marrow transplantation, relapse, second malignancy, age at the first diagnosis and time passed since first diagnosis).

HRQoL scores. The mean score for each HRQoL dimension was examined for comparability with standardized scores from the *CHIP-AE* reference values (Rajmil, Serra-Sutton, Alonso, Starfield et al., 2003).

Reported standardized mean score of Spanish cancer survivors for the dimension *satisfaction* of HRQoL was 50 ($SD = 10$), for *discomfort* 50 ($SD = 9.9$), for *resilience* 50 ($SD = 10$), for *risks* 50 ($SD = 9.9$), for *disorders* 49.99 ($SD = 9.9$), and finally, for *achievement* 55.77 ($SD = 8.8$).

No significant differences were found with regard to gender for any HRQoL dimension. The same occurred with regard to the medical variables (diagnosis, type and length of treatment, age at first diagnosis, bone marrow transplantation, relapse and second malignancy). However, age at first diagnosis was negatively related with the *risks* dimension of HRQoL ($r = -.451$, $p = .003$).

Coping styles scores. The most used coping style among survivors was *productive coping* ($M = 71.83$, $SD = 11.92$, range = 40.8 – 100), followed by *copied in reference to others* ($M = 56.32$, $SD = 9.26$, range = 40 – 80.67). Finally, the less preferred style among survivors was *non-productive coping* ($M = 48.82$, $SD = 7.78$, range = 31 – 61.57). No differences were found between males and females survivors in the use of any of the coping styles assessed. Medical variables and age at the assessment appointment were neither related.

Practice of physical exercise outcomes. In our sample, males reported a significantly higher mean score than females (minutes per week) in the practice of physical exercise ($t(36.848) = 2.522$, $p = .016$, $d = .733$) ($M = 318.46$, $M = 148.75$, means for males and females, respectively). Medical variables and age at the assessment appointment showed no significant relationship with regard to physical exercise outcomes.

Multiple linear regression analyses. Four significant models by multiple linear regression analyses (stepwise entry) were obtained.

For *satisfaction* dimension, analyses revealed a positive association with productive coping and a negative association with non-productive coping. Both coping styles explained a high variance of *satisfaction* $F(2, 39) = 15.435$, $p < .001$, $R^2 = .442$. The second model for *discomfort* dimension showed that greater practice of physical exercise was associated with greater comfort, contrary to what happened with the use of non-productive coping $F(2, 39) = 8.664$, $p = .001$, $R^2 = .308$. For *disorders* $F(2, 39) = 6.682$, $p = .003$, $R^2 = .255$ it was observed that a better health status was positively associated with the practice of physical exercise and negatively associated with non-productive coping. In the case of

resilience dimension of HRQoL $F(1, 40) = 9.730$, $p < .003$, $R^2 = .196$ it was only obtained a model of one component including productive coping.

Discussion

Results of the present research show that in this sample of survivors, HRQoL scores are within normative average values, and that these scores are mediated by coping styles and the practice of regular physical exercise.

As we said before, in this sample of Spanish adolescent cancer survivors all HRQoL scores were within standardized values for the instrument (for reference values see Rajmil, Serra-Sutton, Alonso, Starfield, et al., 2003). Therefore, their perceived health status was satisfactory and similar to Spanish adolescents without history of cancer. These findings, agree with recent papers (Castellano et al., 2009; Eiser et al., 2009; Langeveld et al., 2002; Zebrack & Chesler, 2002), confirm the good adjustment in this growing population of childhood cancer survivors. It could be explained as a result of the improvements in medical treatments and understanding of cancer, as well as a result of the process of response shift, which has been described in adults who have suffered from cancer (Sprangers & Schwartz, 1999). Response shift states that the cancer experience might modify the internal standards of survivors, resulting in changes in the meaning of their self-evaluation and hence in a possibly different experience of problems, conceiving the experience as a potential transforming event (Stam et al., 2006). In this sense, the good adjustment of these cancer survivors could be explained as a result of a benefit finding, produced by the experience of positive consequences, and/or even some sort of personal growth (Mattsson, Ringnér, Ljungman, & von Essen, 2007; Sundberg, Lampic, Björk, Arvidson, & Wettergren, 2009; Yi & Zebrack, 2010; Zebrack et al., 2010).

In addition to this, the availability of social supports systems, as well as an adequate coping with the stresses of long-term consequences of childhood cancer can

Table 4. Multiple Linear Regression Analyses

Independent variables	Dependent variables											
	Model 1 Satisfaction			Model 2 Discomfort			Model 3 Disorders			Model 4 Resilience		
	β	p	R^2	β	p	R^2	β	p	R^2	β	p	R^2
Productive coping	.583***	<.001	.442			.308			.255	.442**	.003	.196
Non-productive coping	-.522***	<.001		-.378*	.007		-.284*	.046				
Physical exercise				.402*	.005		.414*	.005				

Note. * $p < .05$, ** $p < .005$, *** $p < .001$

contribute to adjustment in survivorship (Stam et al., 2001). In our study, the pattern of coping styles used by cancer survivors was similar to that observed in the general population (Frydenberg & Lewis, 1993), being the productive coping style the most used by all adolescents. However, among our sample of cancer survivors, differences between boys and girls disappear, contrary to what happens with the normative group where a preferential pattern of coping strategies between boys and girls exists (Frydenberg & Lewis, 1993). It is possible that the oncological experience might have blended the pattern of some coping strategies among survivors, erasing in some degree the differences between sexes expected for their developmental stage (Mullis & Chapman, 2000; Williams & McGillicuddy, 1999). Although every individual experience with cancer is unique, some studies support that regardless of the type of cancer, the treatment or other medical variables, all people diagnosed with cancer experience similar distress (Erickson & Steiner, 2000; Langeveld, Grootenhuis, Voute, & de Haan, 2004; Meeske, Ruccione, Globe, & Stuber, 2001). Hence, it could be argued that this has an effect on the pattern of coping styles.

It is not surprising the fact that the practice of physical exercise among survivors showed the same pattern of that observed in the normative group, being the boys those who practice more physical exercise. Indeed, recent findings in survivorship literature point this way (Heath, Ramzy, & Donath, 2010). Thus, it seems that adolescent cancer survivors do not differ from healthy adolescents in this issue.

Our findings showed that coping styles and physical exercise were related with HRQoL, explaining a high percentage of the total variance, and resulting good explanatory factors of some medical and psychosocial dimensions of HRQoL. Significant effects were found between coping styles (productive and non-productive coping) and the dimensions of satisfaction, discomfort, disorders and resilience. The same occurred with the practice of physical exercise what was significantly related with discomfort and disorders. These findings are consistent with prior studies (Last & Grootenhuis, 1998; Oldervoll et al., 2004; Paxton et al., 2010; Stam et al., 2001; Stam et al., 2006), but to our knowledge, this is the first study that examines both variables at the same time in pediatric population. The results are very promising, because they show the relevance of current coping and lifestyle choices on HRQoL, providing evidences that could be useful for clinical practice.

Some limitations of the present study should be addressed. First, the small number of survivors and the heterogeneity of oncological diagnosis, limits the generalization of our results. Second, it is conceivable that some of the non-participating survivors (those who refused to collaborate directly, and those who did

not come to the appointment) experienced a different quality of life. For example, patients who feel good might disregard the importance of the study and, otherwise, it is also possible that some survivors could have refused to collaborate to avoid being confronted again with their disease and their memories, which might suggest concerns or persistent distress, or even worse coping strategies and poorer quality of life. Third, it could be said that the quality of life of the survivors was only partially explained by the factors that were investigated in the present study. Other explanatory factors, such as social support, personality traits, as well as biomedical factors such as time since diagnosis and incidence and long-term side-effects following surgery, radiotherapy and/or chemotherapy, may also be of importance. We suggest for future studies to have this in consideration. There is a need for methodological studies that measure HRQoL among survivors of childhood cancer more precisely by taking into account the effects of the severity of the cancer and the long-term impact of different treatments (Hady et al., 2009). Since not many institutions have a sufficient number of patients to control for the numerous patient-specific and therapy-specific variables involved, multi-institutional collaboration is recommended. Fourth, the results might be influenced by the choice of a general health-related quality of life questionnaire. A non-specific questionnaire may not identify potential problematic issues, specifically associated with this population. Unfortunately, there are not too many valid questionnaires available for this purpose in our country. And fifth, many of the studies reported to date are based on Anglo-Saxon samples, however, there are many cultural differences between countries, and this raises questions about the functioning of childhood cancer survivors in other countries. It is well known that there are many differences in adjusting to cancer across cultures (Die Trill, 1998; Marshall, 1999; Mitchell, 1998). The cultural distinctions between and within national boundaries provide a unique opportunity to examine differences in the meaning of survivorship, as well as values and behaviors in different groups.

Future research efforts should also be directed at the intermediate factors of HRQoL that have received relatively less attention in previous studies, including the role of coping and adaptation, social relationships and family variables.

Despite these limitations, our data suggest that Spanish adolescent cancer survivors report a good quality of life which is related with coping styles and the practice of physical exercise. Although more studies are needed to clarify this outcomes, it can be suggested that enhancing physical exercise and specific coping styles (increasing productive coping and reducing the use of non-productive coping) could be beneficial to

foster adaptation among adolescent cancer survivors in their functioning in later life.

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