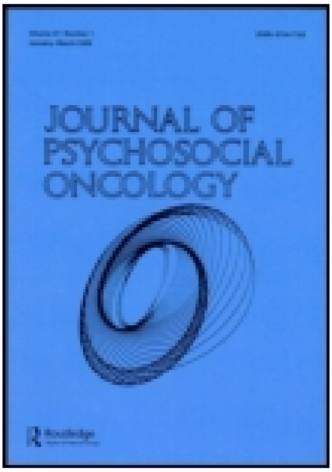

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Development and Validation of the Cancer Exercise Stereotypes Scale

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The objective of this study was to develop and validate a French-language questionnaire measuring stereotypes related to exercise in cancer patients: The Cancer Exercise Stereotypes Scale (CESS). Four successive steps were carried out with 806 participants. First, a preliminary version was developed on the basis of the relevant literature and qualitative interviews. A test of clarity then led to the reformulation of six of the 30 items. Second, based on the modification indices of the first confirmatory factorial analysis, 11 of the 30 initial items were deleted. A new factorial structure analysis showed a good fit and validated a 19-item instrument with five subscales. Third, the stability of the instrument was tested over time. Last, tests of construct validity were conducted to examine convergent validity and discriminant validity. The French-language CESS appears to have good

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psychometric qualities and can be used to test theoretical tenets and inform intervention strategies on ways to foster exercise in cancer patients.

KEYWORDS *cancer, exercise, stereotypes, validation, scale*

INTRODUCTION

The benefits of physical activity for cancer patients (i.e., individuals currently in treatment) have been well documented in the scientific literature. Several meta-analyses and reviews have shown that moderate-intensity physical activity may confer numerous physical and mental health benefits related to improved physiology, body composition, physical functioning, emotional well-being, and quality of life in this population (e.g., Cramp & Daniel, 2008; Ferrer, Huedo-Medina, Johnson, Ryan, & Pescatello, 2011; Fong et al., 2012). Furthermore, Ibrahim and Al-Homaidh (2011) observed that postdiagnosis physical activity reduced cancer deaths by 34% and disease recurrence by 24%. Despite the well-documented effects, cancer patients are often not sufficiently physically active to gain health benefits (Blanchard, Courneya, & Stein, 2008; Loh, Chew, & Lee, 2011). The low rates of physical activity suggest that little is known about how to change in physical activity behavior (Pinto & Ciccolo, 2011; Pinto, Eakin, & Maruyama, 2000).

Several types of exercise barriers have been first identified in exploratory studies of cancer patients' lack of involvement in physical activity (Cooper, 1995; Schwartz, 1998). These barriers are (1) physical (e.g., fatigue, pain, nausea, treatment side effects), (2) psychological (e.g., fear of injury, social anxiety, poorly perceived physical appearance), and (3) social and environmental (e.g., lack of time, family constraints, lack of social support). Based on the theory of planned behavior (Bandura, 1986) or the transtheoretical model (Prochaska & DiClemente, 1983), more recent studies have shown that the most frequent barriers are the lack of time and treatment side effects (Clark et al., 2008; Courneya et al., 2005; Courneya, Friedenreich, Sela, Quinney, & Rhodes, 2002). Furthermore, Rogers, Courneya, Shah, Dunnington, and Hopkins-Price (2007) indicated that lack of self-discipline, the low priority of exercise, and procrastination are the main psychological barriers affecting exercise intention in breast cancer patients. Although many barriers have been identified, there is little evidence of psychometrically supported measures developed to test exercise barriers in cancer patients and link the barriers to exercise beliefs and behaviors.

Nonetheless, some measures have been used to examine exercise barriers in these patients. Rogers et al. (2007) adapted an existing barriers questionnaire (Lewis et al.,1992) by amending items to include additional barriers identified by three focus groups with cancer. Participants were asked to rate how often 30 barriers (e.g., lack of self-discipline, fatigue, lack of enjoyment) interfered with exercise on a 5-point Likert-type scale. Although this questionnaire was useful to study how exercise barriers are related to various constructs like self-efficacy, its psychometric properties were not reported. Furthermore, psychological barriers were only considered as motivation, with little regard to other perceptions or beliefs. Another barriers-type scale is the 23-item Fear of Physical Activity/Exercise Scale (Sander, Eliot, Newsome, Roach, & Tasche, 2011) that addresses fear as a barrier to physical activity in breast cancer survivors. The items are organized into seven subscales: (1) side effects/symptoms, (2) overall health, (3) pain/injury, (4) lymphedema, (5) body image, (6) recurrence, and (7) lack of knowledge/misinformation, and they tap only into the fear that physical activity might cause physical damage and worsen health. Despite the usefulness of the information obtained through these questionnaires, no valid tool is currently available to measure a wider range of psychological barriers to exercise.

Drawing from existing studies on barriers to exercise, Falzon et al. (2012) identified four categories of beliefs that were psychological barriers to exercise in cancer patients, including beliefs related to (1) the lack of interest in exercise, (2) the lack of physical abilities, (3) side effects of treatment, and (4) risks of exercise, as well as a fifth category related to benefits of exercise. This study suggested the negative beliefs may reflect stereotype internalization about weakness and physical decline in cancer patients, similar to the stereotypes about the elderly (Levy & Myers, 2004). According to Leyens, Yzerbyt, and Schadron (1996), *stereotypes* can be defined as shared beliefs about the personal characteristics, generally personality traits but also behaviors, of a group of persons. Based on studies conducted in older people, Levy (2009) proposed the stereotype embodiment theory, which suggests that stereotypes are embodied when their assimilation from the surrounding culture leads to self-definitions that, in turn, influence functioning and health. In line with this model, researchers have suggested that internalizing stereotypes about the low capacities of vulnerable populations, like older adults, may hamper engagement in physical activity (Emile, Chalabaev, Stephan, Corrion, & d'Arripe-Longueville, 2014; Sánchez Palacios, Torres, & Blanca Mena, 2009). Based on this theoretical framework, cancer patients' beliefs about physical activity might be the expression of cancer stereotype internalization, which may explain the low levels of exercise in this group. Given the theoretical and conceptual link between stereotypes and behaviors related to physical activity, there is a need to measure stereotypes that impede or encourage regular exercise in cancer patients. The purpose of the present study was to develop and validate the Cancer Exercise Stereotypes Scale (CESS). This scale could then be used (1) in research to test theoretical tenets and conceptual links to beliefs and behaviors and (2) in practice by health and exercise professionals to develop intervention strategies to modify these stereotypes and enact positive behavior change.

OVERVIEW OF THIS RESEARCH

The development and validation of the CESS was carried out according to Vallerand's procedure (1989), which consists of (1) developing a preliminary version and evaluating the clarity of the items, (2) examining and confirming the factorial structure of the instrument, (3) evaluating the stability of the tool over time, and (4) demonstrating some evidence of construct validity by testing the convergent validity and discriminant validity of the scale.

A total of 694 voluntary French speaking cancer patients and 112 voluntary French speaking healthy individuals were necessary to achieve the successive steps in developing and validating the scale in four studies. Cancer patients were recruited from three cancer support organizations and healthy individuals were recruited through an announcement in a local newspaper. Cancer patients represented breast ($n = 367$), prostate ($n = 129$), colon ($n = 121$), and other such as lung or ovaries ($n = 77$) diagnosis sites, and all were currently undergoing systemic treatment (i.e., chemotherapy or radiotherapy). Ethical approval was obtained for these studies along with the participants' informed written consent.

STUDY 1: PRELIMINARY VERSION AND CONTENT CLARITY

The purpose of the first study was to develop a preliminary version of the CESS.

Method

An ad hoc committee including four researchers specialized in the field of health psychology and five cancer patients formulated a series of items based on (1) secondary analyses of semistructured interviews focused on exercise beliefs in cancer patients (Falzon et al., 2012) and (2) a scale that measures different dimensions of aging stereotypes in the exercise domain (Chalabaev et al., 2013). Formulation of the items was based on established guidelines for wording literacy and comprehension (Streiner & Norman, 2008). Each of the stereotype categories contained many items based on anticipation that some would be deleted as part of the refinement process (Morey, 2003). The number of initial items was determined by the principles of qualitative saturation, which was considered to be reached when no new meaningful item emerged (Strauss & Corbin, 1998). Item selection was then performed using the Delphi method (Whitman, 1990). The list of items was submitted as often as necessary to obtain a consensus of at least 80% among the raters. Following the initial expert panel iterations, cancer patients ($n = 10$, $M_{age} = 51.40$, $SD = 3.5$) were asked to complete an evaluation of the exploratory version of the instrument by responding on the clarity of each item on a 6-point

Likert-type scale ranging from 1 (*not at all clear*) to 6 (*completely clear*). Qualitative interviews were conducted with each participant to discuss each item, including possible modifications, endorsement, and relevance. Specifically, participants were encouraged to provide feedback on items rated as being low in quality (Morey, 2003). A second sample of cancer patients (n = 10, M_{age} = 52.20, SD = 4.26) was recruited to evaluate the modified version of the instrument in a method analogous to the first evaluation protocol.

Results

The ad hoc committee initially generated ten items for each of the five belief categories identified by Falzon et al. (2012): (1) stereotypes related to the lack of interest in exercise (LI), (2) stereotypes related to the lack of physical abilities (LPA), (3) stereotypes related to side effects of treatment (SET), (4) stereotypes related to risks of exercise (RE), and (5) stereotypes related to benefits of exercise (BE). Following the Delphi method, the committee retained six items for each of the five subscales. The analysis of the 30 items from a first panel of cancer patients revealed some low scores for clarity across all 30 items (M = 3.38, SD = 1.32). The comments made during the process evaluation interviews prompted modifications to six of the 30 initial items (e.g., “physical exercise increases the chances of a cancer being cured” was changed to “physical exercise improves the chance of recovery in cancer patients”). The subsequent evaluation of item clarity with the second sample of cancer patients yielded higher mean clarity scores across all 30 items (M = 4.41, SD = .65) and discussions prompted no further modifications to the items (see Table 1). Study 1 yielded the initial 30-item CESS that required psychometric testing. Items will be rated on a 6-point Likert-type scale to emphasize the discrimination and reliability, and reduce the risks that might be happened from the deviation of personal decision making (Chomeya, 2010).

STUDY 2: FACTORIAL STRUCTURE ANALYSES

The purpose of Study 2 was to test the factorial structure of the scale to examine whether the 30 items represented the underlying stereotype categories related to (1) the lack of interest in exercise, (2) the lack of physical abilities, (3) side effects of treatment, (4) risks of exercise, and (5) benefits of exercise.

Participants

According to Hair, Anderson, Tatham, and Black (1998), a sample of 5 times the number of questionnaire items is considered the minimum for factor

TABLE 1 Items and Clarity Scores for the Preliminary Version of the Cancer Exercise Stereotypes Scale

Dimensions	Items	Clarity Scores (*M*)
Stereotypes related to the lack of interest	1. Les patients atteints de cancer ne trouvent aucun intérêt à faire de l'exercice physique[a]	4.1
	Cancer patients have no interest in exercising	
	6. Les patients atteints de cancer ne font pas d'exercice physique car ils manquent de motivation[b]	4.5
	Cancer patients do not exercise because they lack motivation	
	11. Les patients atteints de cancer ne font pas d'exercice car ils trouvent cela trop ennuyeux[a]	3.6
	Cancer patients do not exercise because they find it too boring	
	16. L'exercice physique n'est pas une priorité pour les patients atteints de cancer[a]	3.8
	Physical exercise in not a priority for cancer patients	
	21. Les patients atteints de cancer n'ont pas envie de consacrer une partie de leur temps à l'exercice physique[b]	5.2
	Cancer patients do not feel like devoting any time to exercise	
	26. Les patients atteints de cancer n'ont pas suffisamment de volonté pour faire de l'exercice physique[b]	4.1
	Cancer patients do not have enough will to exercise	
Stereotypes related to the lack of physical abilities	2. Les patients atteints de cancer n'ont pas les compétences pour faire de l'exercice physique[b]	4.0
	Cancer patients do not have the abilities to exercise	
	7. Les patients atteints de cancer sont incapables de faire de l'exercice physique[b]	5.7
	Cancer patients are not able to exercise	
	12. Les patients atteints de cancer n'ont pas les ressources physiques pour faire de l'exercice[b]	5.1
	Cancer patients do not have enough physical resources to exercise	
	17. Les patients atteints de cancer ne sont pas capables de faire de l'exercice physique[b]	4.1
	Cancer patients are not physically capable of exercising	
	22. Les patients atteints de cancer ne font pas d'exercice physique car ils ne se sentent pas à l'aise avec leur apparence physique[b]	4.7
	Cancer patients do not exercise because they do not feel at ease with their physical appearance	
	27. Les patients atteints de cancer ne font pas d'exercice physique car ils n'assument pas leur image corporelle[a]	3.7
	Cancer patients do not exercise because they are not at ease with their physical appearance	
Stereotypes related to side effects of treatment	3. Les douleurs musculaires et articulaires causées par les traitements empêchent les patients atteints de cancer de faire de l'exercice physique[b]	5.2
	Muscle and joint pain caused by treatments prevent cancer patients to exercise	

(Continued on next page)

TABLE 1 Items and Clarity Scores for the Preliminary Version of the Cancer Exercise Stereotypes Scale *(Continued)*

Dimensions	Items	Clarity Scores (*M*)
	8. Les nausées et vomissements causés par les traitements empêchent les patients atteints de cancer de faire de l'exercice physique[a] *Nausea and vomiting caused by treatments prevent cancer patients to exercise*	3.9
	13. Les patients atteints de cancer ne font pas d'exercice physique car ils sont trop fatigués par les traitements[b] *Cancer patients do not exercise because they are too tired from the treatments*	4.5
	18. Les patients atteints de cancer ont des capacités physiques trop limitées pour faire de l'exercice physique à cause des traitements[b] *Physical abilities of cancer patients are too limited to exercise because of the treatments*	4.3
	23. Les patients atteints de cancer n'ont plus assez d'énergie pour faire de l'exercice physique à cause de traitements[b] *Cancer patients no longer have the energy to exercise because of the treatments*	4.7
	28. La perte de sensibilité causée par les traitements empêche les patients atteints de cancer de faire de l'exercice physique[a] *The loss of sensitivity caused by treatments prevent cancer patients to exercise*	3.4
Stereotypes related to risks of exercise	4. L'exercice physique doit être évité par les patients atteints de cancer car il provoque des blessures[b] *Physical exercise should be avoided by cancer patients because it causes injuries*	5.2
	9. L'exercice physique est dangereux pour les patients atteints de cancer car il entraîne trop d'essoufflements[b] *Physical exercise is dangerous for cancer patients because it involves too much breathlessness*	4.8
	14. L'exercice physique est dangereux pour les patients atteints de cancer car il entraîne une perte de poids[a] *Physical exercise is dangerous for cancer patients because it involves a weight loss*	3.8
	19. L'exercice physique entraîne trop de fatigue chez les patients atteints de cancer[b] *Physical exercise induces too much fatigue in cancer patients*	5.6
	24. L'exercice physique augmente les effets secondaires des traitements chez les patients atteints de cancer[a] *Physical exercise increases the side effects of treatment in cancer patients*	4.2
	29. L'exercice physique provoque des nausées chez les patients atteints de cancer[a] *Physical exercise causes nausea in cancer patients*	3.6

(Continued on next page)

TABLE 1 Items and Clarity Scores for the Preliminary Version of the Cancer Exercise Stereotypes Scale *(Continued)*

Dimensions	Items	Clarity Scores (*M*)
Stereotypes related to benefits of exercise	5. L'exercice physique améliore le moral des patients atteints de cancer[b]	3.8
	Physical exercise improves the morale of cancer patients	
	10. L'exercice physique améliore la forme physique des patients atteints de cancer[a]	4.0
	Physical exercise improves the physical condition of cancer patients	
	15. L'exercice physique améliore le bien-être des patients atteints de cancer[b]	4.5
	Physical exercise improves the well-being of cancer patients	
	20. L'exercice physique permet aux patients atteints de cancer de se sentir mieux physiquement[b]	5.3
	Physical exercise allows cancer patients to feel better physically	
	25. L'exercice physique diminue le risque de récidive chez les patients atteints de cancer[a]	3.7
	Physical exercise decreases the risk of reccurence in cancer patients	
	30. L'exercice physique améliore les chances de guérison chez les patients atteints de cancer[b]	5.1
	Physical exercise improves the chance of recovery in cancer patients	

Notes. English translations are in italics. For each item, the participant had to answer on a 6-point Likert-type scale from 1 (*do not agree at all*) to 6 (*totally agree*). M = Mean clarity scores.
a. Deleted items following the first CFA.
b. Retained items in the final model.

analysis. Given that the scale contained 30 items, a minimum of 150 patients was required to test the scale's factorial structure. Cancer patients ($n = 211$, $M_{age} = 51.81$, $SD = 11.68$) were asked to complete the scale. A second sample of cancer patients ($n = 282$, $M_{age} = 50.25$, $SD = 12.32$) was recruited to complete a modified version of the scale.

Method

A maximum likelihood estimation confirmatory factorial analysis (CFA) was conducted in AMOS v7.0 to test the factor structure of the items that were developed to assess the five exercise stereotype categories. Each item was identified as an indicator of a single underlying stereotype category, and no items were specified to cross-load. Assessment of adequate model fit was based on multiple indicators (Hu & Bentler, 1999; MacCallum, Browne, & Sugawara, 1996; Vandenberg & Lance, 2000): chi square (χ^2; significant values), the Comparative Fit Index (CFI; values above 0.90), the Tucker-Lewis Index (TLI; values above 0.90), the root mean square error of approximation (RMSEA; values below 0.08), and the 90% confidence interval (CI) of the RMSEA (RMSEA 90% CI; values ranging from 0−0.08). Modification indices were examined to identify sources of poor fit (Bowen & Guo, 2011). Additionally, Cronbach's alphas (1951) were estimated to examine the internal consistency of each subscale, with convention suggesting values greater than 0.70.

Results

The results of the first CFA did not show a good fit, that is, $\chi^2(367, N = 211) = 1045.59$, CFI = .76, TLI = .73, RMSEA = .09, 90% CI [.10, .00]. According to Guttman (1954), retained items should saturate with a weight greater than .55. Therefore, 11 of the 30 initial items were deleted (i.e., 3 items on the LI subscale, 1 item on the LPA subscale, 2 items on the SET subscale, 3 items on the RE subscale, and 2 items on the BE subscale). A second CFA (using data from the same sample) was conducted with the 19-item scale, that is,, $\chi^2(142, N = 211) = 328.58$, CFI = .90, TLI = .88, RMSEA = .07, 90%CI [.06, .09] (see Figure 1). This model was tested with a second sample of cancer patients ($n = 282$) and showed a better fit, that is,, $\chi^2(142, N = 282) = 298.69$, CFI = .93, TLI = .91, RMSEA = .06, 90% CI [.05, .07]. Cronbach's alphas ranged between .73 and .86 for all five factors.

Study 2 provide support for the factorial structure of a five-factor model of the CESS instrument representing cancer exercise stereotype categories related to (1) the lack of interest in exercise, (2) the lack of physical abilities, (3) side effects of treatment, (4) risks of exercise, and (5) benefits of exercise.

STUDY 3: TEMPORAL STABILITY

The aim of Study 3 was to test the reliability of the scale. One important measure of reliability for psychometric instruments is that of temporal stability, often known as "test–retest" (Yu, 2005). For an instrument to be useful, it is important for it to have a reasonable level of temporal stability that can be related to the defining measures of the constructs.

Participants

According to Altman (1991), a minimum sample size of 50 is recommended for assessment of test–retest reliability. In this study, 67 cancer patients ($M_{age} = 52.35$, $SD = 13.89$) were recruited to test the temporal stability of the tool.

Method

The 19-item questionnaire was administered to participants twice over a 4-week period. According to Marx, Menezes, Horovitz, Jones, and Warren

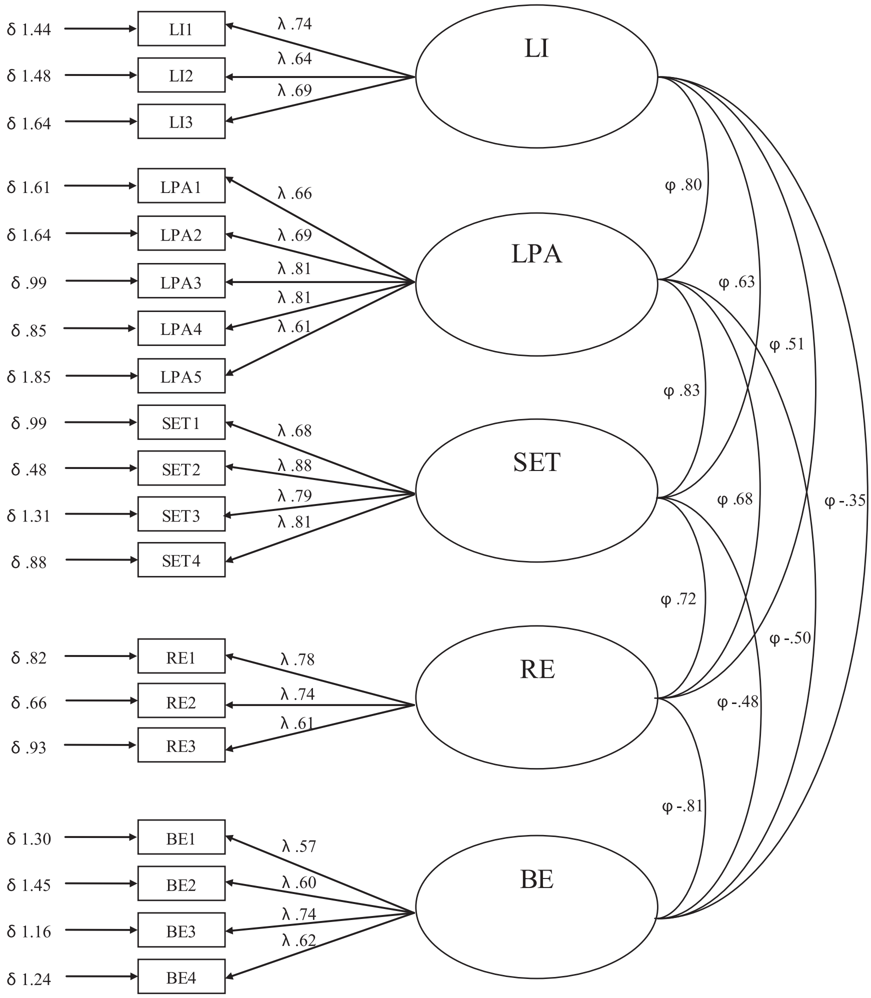

FIGURE 1 Coefficients of estimation and standard errors of measurement of the Cancer Exercise Stereotypes Scale.

Notes: LI: Stereotypes related to the lack of interest; LPA: Stereotypes related to the lack of physical abilities; SET: Stereotypes related to side effects of treatment; RE: Stereotypes related to risks of exercise; BE: Stereotypes related to benefits of exercise; λ: Standardized factor loadings; φ: Correlations between latent factors; δ: Standard errors of measurement of latent factor indicators. The standardized estimate coefficients are all significant at $p < .01$.

(2003), this interval was deemed to be a reasonable compromise between an attempt to reduce recall bias and assess reliability unrelated to important clinical change. Data analyses involved the calculation of intraclass correlation coefficients (ICCs) and the 95% CI of the ICCs (ICC 95% CI), and paired/dependent sample t tests were conducted to examine significant change in subscale scores from Time 1 to Time 2. The internal consistency of the scale was examined as Cronbach's alphas calculated at both timepoints.

Results

The results of the ICC and *t* tests are presented in Table 2. The ICCs for each subscale ranged from .55 to .86. In addition, there were no significant differences in the scores from Time 1 to Time 2. Cronbach's alpha coefficients for all five factors were between .69 and .85 at Time 1 and between .71 and .87 at Time 2.

Based on these findings, the CESS is stable over a 4-week period. Internal reliability was consistently demonstrated.

STUDY 4: CONVERGENT VALIDITY AND DISCRIMINANT VALIDITY

The aim of Study 4 was to test the construct validity of the CESS by examining convergent validity and discriminant validity. *Construct validity* refers to the degree to which inferences can legitimately be made from the operationalizations in a study to the theoretical constructs on which those operationalizations were based. When convergent and discriminant validities are satisfied, construct validity is said to be satisfied (Agarwal, 2011).

Participants

For the purpose of testing validity, a significant correlation of 0.3 is desired between the scale and other theoretically appropriate measures (Machin, Campbell, Tan, & Tan, 2008). Using an alpha of 0.05 and a 1-beta of 0.2, 85 participants were needed to obtain a significant correlation of 0.3 or more. In this study, 114 cancer patients ($M_{\text{age}} = 48.60$, $SD = 11.12$ years) were recruited to test convergent validity. The discriminant validity of the scale was assessed using the same sample of 114 cancer patients and a sample of healthy adults ($n = 112$, $M_{\text{age}} = 50.97$, $SD = 6.56$ years).

TABLE 2 Descriptive Statistics for the Questionnaire Structure in Study 3

	Time 1		Time 2				
	M (*SD*)	α	*M* (*SD*)	α	*t* Tests	ICC	ICC 95% CI
LI	2.94(1.17)	.69	2.78(.92)	.79	$t(132) = 1.72, p = .09$	.55*	[.26, .72]
LPA	3.77(.95)	.75	3.70(.96)	.81	$t(132) = .77, p = .44$	.86**	[.77, .91]
SET	3.55(1.16)	.82	3.59(1.13)	.88	$t(132) = -.45, p = .65$	.76**	[.62, .85]
RE	2.36(.90)	.85	2.38(.85)	.75	$t(132) = -.27, p = .78$	.79**	[.66, .87]
BE	4.95(.93)	.80	4.94(1.02)	.85	$t(132) = .02, p = .98$	.80**	[.67, .87]

Notes: ICC: Intraclass Correlation Coefficient; ICC 95% CI: Intraclass Correlation Coefficient 95% Confidence Interval; LI: Stereotypes related to the lack of interest; LPA: Stereotypes related to the lack of physical abilities; SET: Stereotypes related to side effects of treatment; RE: Stereotypes related to risks of exercise; BE: Stereotypes related to benefits of exercise; *t*-tests: Student's *t* test.
$^{*}p < .05$. $^{**}p < .01$.

Method

Based on research on exercise stereotypes in the elderly (Chalabaev et al., 2013), convergent validity of the scale was tested by examining the relationships between the five subscales of the CESS and two subscales related to physical self-worth and sport competence of the French version of the Physical Self-Perception Profile questionnaire (Fox & Corbin, 1989; Ninot, Delignières, & Fortes, 2000). The subscale related to physical self-worth consists of general feelings of happiness, satisfaction, pride, respect, and confidence in the physical self, whereas the subscale related to sport competence refers to perceptions of sport and athletic ability, ability to learn sport skills, and confidence in the sport environment. Participants answered on a 7-point Likert-type scale ranging from 1 (*completely disagree*) to 7 (*completely agree*). The association between variables was measured using Pearson correlation coefficients. Cronbach's alphas were examined as internal consistency coefficients.

To examine discriminant validity, mean differences on the CESS were examined for people with cancer and a sample of people without cancer. Specifically, significant differences were tested using univariate analyses of covariance (ANCOVAs) while controlling for the level of physical activity, age, and gender. Kazak et al. (2010) previously showed that people with cancer had fewer positive health beliefs than healthy individuals. Based on this result, the two groups were expected to differ in terms of exercise stereotypes. To assess physical activity, all participants completed the Physical Activity Score of Dijon (Robert et al., 2004). The internal consistency of the items scores was examined using Cronbach's alpha coefficients.

Results

Convergent validity. The negative cancer exercise stereotypes (i.e., stereotypes related to the lack of interest in exercise, the lack of physical abilities, side effects of treatment, and risks of exercise) were inversely related to physical self-worth and sport competence. The positive cancer exercise stereotypes (i.e., stereotypes related to benefits of exercise) were positively related to physical self-worth and sport competence (see Table 3). Cronbach's alphas were between .67 and .86 in healthy individuals and between .73 and .87 in cancer patients.

Discriminant validity. Based on the ANCOVA analyses, significant differences were noted between the two groups for all CESS subscales. Specifically, healthy individuals had (1) lower scores for negative cancer exercise stereotypes (i.e., stereotypes related to the lack of interest in exercise, the lack of physical abilities, side effects of treatment, and risks of exercise) and (2) higher scores for positive cancer exercise stereotypes (i.e., stereotypes related to benefits of exercise), compared with cancer patients, with physical activity level controlled for (see Table 4).

TABLE 3 Matrix of Pearson's *r* Correlations in Study 4

	LI	LPA	SET	RE	BE	PSW	SC
LI	—						
LPA	.66*	—					
SET	.54*	.53*	—				
RE	.47*	.45*	.67*	—			
BE	−.30*	−.27*	−.42*	−.56*	—		
PSW	−.21*	−.19*	−.39*	−.26*	.28*	—	
SC	−.35*	−.33*	−.46*	−.32*	.32*	.75*	—

Notes:. LI: Stereotypes related to the lack of interest; LPA: Stereotypes related to the lack of physical abilities; SET: Stereotypes related to side effects of treatment; RE: Stereotypes related to risks of exercise; BE: Stereotypes related to benefits of exercise; PSW: Physical self-worth; SC: Sport competence.
$^{*}p < .05$.

Based on the construct validity assessments for convergent and discriminant validity, the CESS was significantly related to physical self constructs in the expected directions and the expected differences between cancer patients and healthy individuals were demonstrated.

DISCUSSION

The objective of this study was to develop and validate a French-language scale to measure cancer exercise stereotypes. Although several studies have identified some of the psychological barriers related to exercise in cancer patients, exercise stereotypes have rarely been studied. Based on the related work of Falzon and colleagues (2012), a 19-item, five-subscale measure called the Cancer Exercise Stereotypes Scale (CESS) was developed and assessed on dimensions of internal consistency, test–retest reliability, and content and construct validity.

The items describing stereotypes related to the lack of interest in exercise were focused on assessing cancer patients' motivation for exercise

TABLE 4 Mean (SD) Differences Between Cancer Patients and Healthy Individuals in Study 4

	Cancer patients (n = 114)	Healthy individuals (n = 112)	Between-Group Difference
LI	3.08 (1.43)	2.65(.87)	$F(1, 221) = 9.88, \eta^2 = .03, p < .01$
LPA	3.67 (1.17)	3.07(1.01)	$F(1, 221) = 19.29, \eta^2 = .08, p < .001$
SET	4.23 (1.30)	3.50(1.08)	$F(1, 221) = 21.09, \eta^2 = .09, p < .001$
RE	2.74 (1.05)	1.72(.74)	$F(1, 221) = 99.93, \eta^2 = .31, p < .001$
BE	4.93 (1.01)	5.37(.83)	$F(1, 221) = 10.24, \eta^2 = .04, p < .01$

Notes: LI: Stereotypes related to the lack of interest; LPA: Stereotypes related to the lack of physical abilities; SET: Stereotypes related to side effects of treatment; RE: Stereotypes related to risks of exercise; BE: Stereotypes related to benefits of exercise.

(e.g., "cancer patients do not exercise because they lack motivation"). The importance of assessing stereotypes pertaining to lack of interest confirms previous findings that the most frequent barriers are psychological and linked to a lack of interest (Rogers et al., 2007). This stereotype belief may be associated with perceptions of competence and autonomy, and it may also be important for predicting the initiation and adherence to future physical activity (Deci & Ryan, 2000; Wilson, Blanchard, Nehl, & Baker, 2006). Future research is needed to examine the long-term impact of these stereotypes on health beliefs and behaviors.

The items describing stereotypes related to the lack of physical abilities were linked to cancer patients' perceptions of low energy and physical strength, as well as low confidence in their exercise capacity (e.g., "cancer patients do not have the abilities to exercise"). The moderate-level endorsement of this type of stereotype is consistent with findings among older adults (Chalabaev et al., 2013), whereby a stereotype pertaining to loss of physical capabilities was also reported. These exercise stereotypes could be related to perceptions of competence and self-efficacy, which have been shown to be significant predictors of exercise habits in cancer patients (Rogers et al., 2006). Further research is needed to support this hypothesis.

The items regarding stereotypes related to side effects of treatment suggest that cancer patients perceive that side effects cause considerable physical discomfort and do not seem compatible with exercise (e.g., "the muscular and joint pain that is caused by cancer treatments prevents cancer patients from exercising"). These stereotypes may reflect the long-term beliefs that cancer treatments are barriers to exercise. For example, Knobf (1990) pointed out that symptoms associated with the toxicity of anticancer therapeutics (e.g., fatigue, pain, vomiting) are a major barrier to physical exercise. Mock et al. (1997) also described treatment side effects as key factors in limiting exercise. More recently, Perna, Craft, Carver, and Antoni (2008) reported that cancer treatments were inversely associated with exercise frequency in early-stage breast cancer patients. And historically, a "limit exercise" philosophy has long been endorsed by medical practitioners, and this may only recently have started to wane (Demark-Wahnefried, Aziz, Rowland, & Pinto, 2005). Nonetheless, exercise guidelines for cancer patients have been offered, suggesting that exercise is safe, feasible, and efficacious throughout the cancer survivorship trajectory (Schmitz et al., 2010). Given these stereotypes, it is important that researchers and practitioners work together to help foster manageable exercise strategies during and after cancer treatment.

The items describing stereotypes related to risks of exercise express the idea that physical exercise can aggravate the cancer patient's illness (e.g., "physical exercise should be avoided by cancer patients because it causes injuries"). Based on the items identified in this subscale, the decision not to exercise is likely prompted by the fear of worsening one's health status. In a sample of breast cancer survivors, Sander et al. (2011) found that the fear of exercise aggravating the disease was a major barrier to regular exercise.

Moreover, a lack of information about the harmlessness of physical exercise can be an additional barrier to commitment to adapted physical activity programs (Camerini, Schulz, & Nakamoto, 2012) and can thus maintain negative cancer exercise stereotypes. Specific communications focusing on the absence of exercise risks should thus be used in cancer patients so that they can improve their knowledge about exercise and overcome barriers such as fear.

Last, the items describing stereotypes about benefits of exercise concern the positive effects of physical exercise for cancer patients (i.e., "physical exercise improves the well-being of cancer patients"). This subscale was the most highly endorsed on the CESS. The association of these stereotypes with stereotypes related to exercise risks is a paradox that has been noted in other research (e.g., Courneya et al., 2002; Falzon et al., 2012), suggesting that cancer patients are often aware of exercise benefits but do not automatically translate this belief into intention or behavior. Brawley, Culos-Reed, Angove, and Hoffman-Goetz (2002) showed that even when cancer patients know that physical exercise can attenuate some of the treatment symptoms, these same symptoms may discourage and prevent them from becoming involved in a physical activity program. This paradoxical situation becomes a vicious circle, reinforcing less active lifestyles. Further research would thus be needed to examine the relationships between stereotypes related to risks and benefits of exercise and physical activity level in cancer patients over time.

The CESS is a reliable and valid measure to assess cancer exercise stereotypes and offers a new outlook on the assessment of psychological barriers to exercise in cancer patients. However, some limitations must be acknowledged. One of these limitations is that the scale measures the stereotypes related to exercise in patients treated for different types of cancer and does not specifically assess the stereotypes related to unique treatments, cancer site diagnosis, or cancer recurrences and secondary cancers. Therefore, the generalizability of scale use may be limited to global assessments of stereotypes. There is also a need to conduct cross-sectional studies to strengthen the convergent validity of the instrument and identify the correlates (e.g., personality traits, perceived health status, knowledge) of internalization of cancer exercise stereotypes. Furthermore, longitudinal studies would be warranted to examine the relationships between cancer exercise stereotypes and physical activity level in cancer patients over time. Last, the CESS needs to be validated in other languages so that it can be used across countries.

Clinical Implications

The French-language CESS appears to have good psychometric qualities and can be used to test theoretical tenets and inform intervention strategies on ways to foster exercise among cancer patients. Specifically, identifying and measuring stereotypes is the first step in potentially modifying them so that physical activity can be more convincingly promoted among cancer patients. This is an important outcome given the well-documented benefits of exercise and the few cancer patients who are actually active enough to reap the benefits. Changing stereotypes may increase the number of patients who are able to improve their physical and mental health one step, jump, or stroke at a time.

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