2-1-2019

Quality of life and psychological distress in cancer survivors: The role of psycho-social resources for resilience

Craig A. Harms
Edith Cowan University

Lynne Cohen
Edith Cowan University

Julie Ann Pooley
Edith Cowan University

Suzanne K. Chambers
Edith Cowan University

Daniel A. Galvao
Edith Cowan University

See next page for additional authors

10.1002/pon.4934

Quality of life and psychological distress in cancer survivors: The role of psycho-social resources for resilience

Craig A. Harms [1], Lynne Cohen [3], Julie Ann Pooley [1], Suzanne K. Chambers [2,4,5], Daniel A. Galvão[2] and Robert U. Newton[2].

[1] School of Arts and Humanities, Psychology and Criminology, Edith Cowan University, Joondalup, AUSTRALIA

[2] Exercise Medicine Research Institute, Edith Cowan University, Joondalup, AUSTRALIA

[3] Faculty of Education and Arts, Edith Cowan University, Joondalup, AUSTRALIA

[4] Menzies Health Institute Queensland, Griffith University, Southport, QLD, Australia

[5] Cancer Research Centre, Cancer Council Queensland, Brisbane, QLD, Australia

.

Corresponding author:
Dr Craig Harms
Psychology and Criminology
School of Arts and Humanities,
270 Joondalup Drive, Joondalup
Perth WA 6027. AUSTRALIA
(08) 6304 5715
Email: c.harms@ecu.edu.au

Abstract:

Objective: To examine the association between scores on the Protective Factors for Resilience Scale (PFRS) scale (as a measure of a person's psycho-social resources for resilience) and quality of life as well as symptoms of psychological distress for adult cancer survivors.
Methods: In this cross-sectional study, two hundred and ninety-five cancer survivors (59% female) provided background demographic information and completed the PFRS as well as measures of quality of life and psychological distress previously validated with cancer survivors. Most of the survivors were diagnosed with breast or prostate cancer.
Results: Analysis of the data confirmed the factor structure for the PFRS for cancer survivors. While controlling for Body Mass Index and age, psycho-social resources were a unique and positive predictor for all quality of life measures as well as being a unique and negative predictor for the measures of psychological distress (depression, anxiety and somatization). There was a high degree of consistency regarding these findings for male and female survivors.
Conclusions: The PFRS is a brief and valid measure of psycho-social resources for resilience in adult cancer survivors; and scores on the PFRS proved to be a good predictor of quality of life and psychological distress of these cancer survivors. Using the PFRS to assess the psycho-social resources for resilience would be helpful when developing interventions to enhance the psychological health of adults as they adapt to a diagnosis of cancer.

Keywords: Cancer, oncology, psychological resilience, quality of life, psychological distress

1. Introduction.

The treatment of cancer adversely impacts patient's psychological distress [1,2] and quality life [3,4]. Interest in positive psychosocial factors associated with maintaining and enhancing quality of life as well as alleviating psychological distress has increased [5,6]. One such positive psychosocial construct that has attracted attention regarding cancer survivorship is resilience.

As well as focusing on processes and outcomes associated with adapting to adversity [7,8], researchers interested in resilience are also concerned with personal and environmental protective factors available to the individual that are proposed to help adaptation to adversity [9]. For example, a recently developed model of resilience and cancer survivorship by Deshields et al. [10] focused on the role of baseline factors, such as personal attributes and social factors, in coping, adapting, and adjusting to cancer diagnosis and treatment as an acute and chronic stressor. Several resilience scales have been designed to assess individual differences in key protective factors including the Brief Resilience Scale [11], the Resilience Scale (RS) [12] and the 10- [13] and 25-item [14] versions of the Connor-Davidson Resilience Scale (CD-RISC).

Some researchers have examined the association between scores on these resilience scales with quality of life for adult cancer survivors. Individual differences in resilience had (amongst a relatively large number of predictors) a unique positive effect on quality of life such as physical functioning and mental health [15-17] as well as vitality [17]. Negative associations have been observed between individual differences in resilience and symptoms of depression [17-20] and anxiety [19,20].

Several issues have been identified with the scales measuring individual differences in resilience, including doubt about the satisfactoriness of the factor structures for these scales [21-23], criticisms that majority of these scales focus on individual protective factors and do not adequately assess psycho-social protective factors [9, 21-23], and that the scales should be shorter in length [24]. Further, psychometric properties of scales such as the RS and CD-RISC have not been established in cancer survivors.

The Protective Factors for Resilience Scale (PFRS) [23] was developed to address limitations of other measures of resilience. The PFRS was designed around a definition developed by Cohen and Pooley [25] where resilience involved the "the potential to exhibit resourcefulness by using available internal and external resources in response to different contextual and developmental challenges" (p. 34); and the view that, in addition to sustaining beliefs about the self as an internal resource, beliefs about the availability of psycho-social assets from peers and family represent separate but related protective factors available to all individuals across the lifespan. The title of the PFRS emphasises that the scale assesses psycho-social resources thought to promote resourcefulness in response to contextual and developmental challenges rather than being a measure of resilience, as the concept of resilience emerged from research where resilience was inferred from outcomes such as adaptation to adversity [7,8]. Scale length was reduced by measuring key constructs using single items rather than multiple items. Initial findings, based on the responses of university students and a community sample provided initial support for the convergent and construct validity of the PFRS [23].

In summary, research with cancer survivors examining the link between protective factors thought to facilitate positive adaption and the psychological response to cancer survivorship using measures of resilience has been limited; and the research that has been conducted has used scales where psychometric and design limitations have been noted. It is theorized that the PFRS is a brief but broad measure of protective factors associated with resilience that could be used to improve what is known about the role of positive

psychosocial constructs in the psychological experience of cancer survivors. However, the convergent and construct validity of the PFRS for cancer survivors has yet to be established. Thus, the purpose of the present study was to explore, while controlling for age and Body Mass Index (BMI), the association between scores on the PFRS and measures of quality of life as well as psychological distress after testing the convergent validity of the PFRS items.

2. Method

2.1 Participants and Procedure

Two hundred and sixty six participants (56.3% female) diagnosed with cancer who volunteered for a community based exercise program in Perth, Western Australia, between May 2011 and June 2013 agreed to participate in the study. Participants had a histological diagnosis of cancer and had undergone surgery, radiotherapy and/or chemotherapy treatment for cancer no more than two years previously. Participants completed a series of questionnaires prior to beginning the exercise program. This protocol was approved by the University Human Research Ethics Committee (ethics project number 6192) and all participants provided written informed consent.

2.2 Measures

2.2.1 Demographic Information

Participants responded to questions about their age, marital status, highest level of education, current employment status, treatment history, and history of co-morbid health conditions. Height and weight (used to generate BMI) of the participants was assessed by accredited exercise physiologists.

2.2.2 Quality of Life

The Short Form Health Survey (SF-36, version 2) [26] is a 36-item scale designed to measure several components for quality of life. Participant responses (on Likert-scales of varying lengths) were standardised to generate scores for functioning (physical and social), limitations in role due to either physical or emotional health, bodily pain, overall mental health, personal vitality and perception of general health. Higher scores indicate more adaptive functioning (e.g., better physical functioning or fewer symptoms of pain). Previous research [27] has indicated that reliability coefficients for individual domains of the SF-36 range between 0.78 and 0.93.

2.2.3 Psychological Distress

Participants completed the Brief Symptom Inventory 18 (BSI-18) [28] by responding to 18 statements (0-4 Likert scale), where higher scores indicated greater levels of psychological distress. Responses were summed to generate scores for somatisation (6 items), depression (6 items) and anxiety (6 items). Previous research [29] has found that internal reliability for the three scales ranged from 0.69 to 0.81 for a sample of adults.

2.2.4 Protective Factors for Resilience Scale (PFRS)

The PFRS [23] is a 15-item measure (1 to 7 Likert scale). The responses of the 15 items are summed as a single score with higher scores indicating the perception that one has greater personal and psycho-social (from family and peers) protective factors available in order to be resourceful in the context of adversity. The development of the PFRS is described elsewhere [23]. Cronbach's alpha was initially reported for the overall scale as 0.93 [23].

2.4.5 Analytic Procedure and Data Preparation

Confirmatory Factor Analysis (CFA) of the PFRS was conducted (Diagonally Weighted Least Squares analysis) in LISREL 8.80 where a single higher-order factor explained the association between three lower-order factors that were specified to explain the association between the items for the three separate subscales of the PFRS. The higher-order factor loadings for the two social resources factors (peers and family) were constrained to be equal to over-identify the upper portion of the model. The model was accepted if model fit was reasonable (Root Mean-Square Error of Approximation (RMSEA) less than .08 [30]) and the first- or second-order standardised factor loadings were 0.60 or greater [31]. Descriptive data (*M, SD,* and *r*) were reported for each scale. Separate Hierarchical Multiple Regression (HMR) analyses (using SPSS 20) were conducted to investigate the association between PFRS and the measures of psychological distress as well as well-being. Age and BMI were entered (Model 1) in each HMR before psycho-social resources for resilience (Model 2) as age [32,33] and BMI have been associated with quality of life and psychological distress of cancer survivors [34,35]. Separate regression analyses [see 36] were conducted in order to determine whether the effects were moderated by gender as previous research [37-38] had examined the role of gender effects for cancer survivors. As multiple tests were conducted, alpha level was set at 0.01 for all tests. Cohen's criteria [39] were used to assess effect size.

3. Results

3.1 Participant Characteristics

The majority of participants were more than 60 years of age (62. 79 ± 11.00 years; range 31 to 92 years). On average, the male participants (67.55 ± 8.84 years) were approximately 8 years older than female participants (59.04 ± 11.11 years)**,** F (1, 264) = 45.91, $p<0.01$, d = 0.84. Other participant characteristics are described in Table 1.

3.2 Confirmatory Factor Analysis of the PFRS

The 15 item, single higher-order factor model of the PFRS was accepted as correctly specified, S-Bχ^2= 172.35, df=88, p= 0.00; RMSEA= 0.06; CFI= 0.99; SRMR= 0.07; GFI= .99. As can be seen in Table 2, lower-order and higher-order factor loadings were greater than 0.60. Cronbach's alpha for the 15-item scale for the present study was 0.93.

3.3 Descriptive Data

The descriptive data and correlation with PFRS score for all measures are presented in Table **3**. Almost all correlations between the PFRS scores and measures for quality of life as well as psychological distress ranged between (plus or minus) 0.29 and 0.47, with the exception of the association between PFRS and physical functioning which was 0.19.

3.3 Hierarchical Multiple Regression Analyses

Results of the regression analyses are presented in Table **4**. When measures of quality of life and psychological distress were regressed on the basis of age, BMI, and PFRS (Model 2s), all models explained a significant amount of variance for each measure for quality of life and psychological distress over and above variance explained by age and BMI alone. The effect sizes associated with adding PFRS into the models ranged from small (physical functioning), small to medium (role limitations due to physical or emotional problems, bodily pain, somatisation, and anxiety), and medium (general health, vitality, social functioning, mental health, and depression).

Examining the structure of Model 2s, greater scores on the PFRS were associated with better physical and social functioning, general health, and mental health; greater vitality;

fewer limitations due to physical or emotion problems; fewer problems related to bodily pain; and fewer somatic, depressive, or anxiety symptoms. Inspection of the standardised coefficients indicated that unique effects for scores on the PFRS scale were largest for symptoms of depression, vitality and general health; and smallest for physical functioning, problems related to bodily pain, and role limitations due to emotional problems.

In addition to the unique effect of PFRS in these models, greater age was associated with fewer symptoms of anxiety. Overall, the unique effect of scores of the PFRS scale in the models (with the exception of physical functioning, bodily pain and anxiety) was between 3 (mental health) and 20 (vitality) times larger than the next largest predictor in the model. For physical functioning and anxiety, the unique effects of PFRS and age were relatively similar. The unique effects of PFRS and BMI (while opposite in direction) for explaining problems related to bodily pain were relatively similar, and both measures predicted twice as much variance in bodily pain than what was explained by age.

Some differences between males and females on the models were observed (see online supplemental materials). Higher scores on the PFRS were associated with fewer problems related to bodily pain for females. Greater age was associated with better mental health as well as fewer symptoms of anxiety for males. Higher BMI was associated with worse physical functioning for females and better general health for males.

4. Discussion

The purpose the present study was to explore, while controlling for age and BMI, the association between scores on the PFRS [23] (as a measure psycho-social resources for resilience) and measures of quality of life as well as psychological distress for cancer survivors. In line with previous research, higher PFRS scores were associated with greater personal vitality [17], better physical functioning [15-17], and fewer symptoms of depression and anxiety [17-20]. The results of the present study extend previous research by demonstrating a link between the psycho-social protective factors assessed by the PFRS against the negative effects of adversity and other measures for quality of life such as bodily pain, general health, mental health, role limitations due to physical and emotional problems, and social functioning. The results of the present study also extend previous research by finding that greater scores on the PFRS were associated with fewer somatic symptoms associated with psychological distress.

In the present study, the strongest and more consistent impact of PFRS was as a predictor of the components of the SF-36 Mental Health Composite summary measure – vitality, social functioning, role limitations due to emotion problems, and mental health. The role of the PFRS scale as a predictor was generally weaker for several aspects (physical functioning, role limitations due to physical problems and bodily pain domains) but not all (general health domain) of the SF-36 Physical Health Composite summary measure. Regarding mental health, the association between PFRS scores and symptoms of depression was the largest effect observed in the present study.

Overall, the findings for the present study for the prediction of the participant's quality of life and symptoms of psychological distress based on scores on the PFRS were relatively consistent for both males and females. Further, participant's age and BMI made a unique contribution to a small number of the measures of quality of life and psychological distress. Greater age was associated with fewer symptoms of anxiety and better mental health for males. These findings are consistent with the results of several studies which found that cancer survivorship can be a developmentally-specific factor in the life of older men and women [32,33]. Despite previous research showing that BMI was associated with quality of life and psychological distress of cancer survivors [34,35], the unique role of BMI in findings of the present study was relatively limited, with higher BMI being associated with more

problems linked with worse physical functioning for females and better general health for males.

Regarding the PFRS, two key findings are noted. First, the results from the CFA in the present study provide good evidence of the convergent validity for the 15 items of the PFRS. Second, the nature of the associations between responses to the PFRS scale and psychological health observed in the present study, as well a general conformity of the findings between males and females also provide further evidence for the construct validity of the PFRS with cancer survivors.

4.1 Study limitations

There are several caveats regarding findings of our study. The use of a cross-sectional design in the present study meant that causal links between predictors and outcomes could not be tested (Bonanno, 2012). Whether the findings of the present study would be observed if the male and female cohorts were closer in age, the participants were not volunteers, and the survivors had been diagnosed with cancers other than breast or prostate cancer is unclear. Replicating the findings of the CFA analysis for the PFRS with larger samples will be needed.

4.2 Clinical implications

We believe that the PFRS would provide useful information to practitioners when assessing key protective factors for individuals and formulating interventions to facilitate psychological recovery in the context of diagnosis and treatment for cancer. Researchers can also use the PFRS as a measure of the personal as well as psycho-social resources linked with resilience that is much shorter in length but conceptually broader than other similar scales, and where the psychometric properties of the scale have been established based on responses of cancer survivors.

4.3 Conclusions

Overall, our findings are that the original factor structure of the PFRS [23] was confirmed. Further, the results of the present study provide good support for the internal and external validity of the PFRS based on the responses of a group of cancer survivors. With an increasing interest in resilience as a framework for studying positive adaptation to adversity such as cancer, it is important to establish the psychometric properties for all scales used in such research. We suggest that practitioners and researchers can be confident about the meaningfulness of responses by cancer survivors to the PFRS given the findings from the present study.

ACKNOWLEDGEMENTS

SKC is supported by an Australian Research Council Professorial Future Fellowship. DAG is supported by the Cancer Council Western Australia Research Fellowship. The authors declare no conflicts of interest.

References

[1] Linden W, Vodermaier A, MacKenzie R, & Greig D. Anxiety and depression after cancer diagnosis: Prevalence rates by cancer type, gender, and age. *Journal Of Affective Disorders* 2012; **141**: 343-351.

[2] Schumacher J R, Palta M, LoConte NK, Trentham-Dietz A, Witt WP, Heidrich SM, & Smith MA. Characterizing the psychological distress response before and after a cancer diagnosis. *Journal Of Behavioral Medicine*, 2013; **36**: 591-600.

[3] Ahn S, Park B, Noh D, Nam S, Lee E, Lee M, & ... Yun Y. Health-related quality of life in disease-free survivors of breast cancer with the general population. *Annals Of Oncology: Official Journal Of The European Society For Medical Oncology / ESMO* 2007; **18**: 173-182.

[4] Eton DT, & Lepore SJ. Prostate cancer and health-related quality of life: A review of the literature. *Psycho-Oncology* 2002; **11**: 307-326.

[5] Aspinwall L, & MacNamara A. Taking positive changes seriously. *Cancer* 2005; **104**: 2549-2556.

[6] Bird V, Boutillier C, Leamy M, Larsen J, Oades L, Williams J, & Slade M. Assessing the strengths of mental health consumers: A systematic review. *Psychological Assessment* 2012; **24**, 1024-1033.

[7]) Masten A. Resilience in developing systems: progress and promise as the fourth wave rises. *Development And Psychopathology* 2007; **19**: 921-930.

[8] Rutter M. Resilience, competence, and coping. *Child Abuse & Neglect* 2007; **31**: 205-209.

[9] Hjemdal O, Friborg O, Stiles TC, Rosenvinge JH, & Martinussen M. Resilience predicting psychiatric symptoms: A prospective study of protective factors and their role in adjustment to stressful life events. *Clinical Psychology and Psychotherapy* 2006; **13**: 194-201.

[10] DeShields TL, Heiland MF, Kracen AC, & Dua P. Resilience in adults with cancer. Development of a conceptual model. *Psycho-Oncology* 2016; **25**: 11-18.

[11] Smith B, Dalen J, Wiggins K, Tooley E, Christopher P, & Bernard J. The brief resilience scale: Assessing the ability to bounce back. *International Journal of Behavioral Medicine*; **15**: 194-200.

[12] Wagnild GM, & Young HM. Development and psychometric evaluation of the Resilience Scale. *Journal of Nursing Measurement* 1993; **1**:165-178.

[13] Campbell-Sills L, & Stein MB. Psychometric analysis and refinement of the Connor-Davidson resilience scale (CD-RISC): Validation of a 10-item measure of resilience. *Journal of Traumatic Stress* 2007; **20**: 1019-1028.

[14] Connor CM, & Davidson JRT. Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). *Depression and Anxiety* 2003; **18**: 76-82.

[15] Manne SL, Myers-Virtue S, Kashy D, Ozga M, Kissane D, Heckman C, Rubin SC, & Rosenblum N. Resilience, positive coping, and quality of life among women newly diagnosed with gynaecological cancers. *Cancer Nursing* 2015; **38**: 375-382.

[16] Rosenberg AR, Syrjala KL, Martin PJ, Flowers ME, Carpenter PA, Salit RB, Baker KS, & Lee SJ. Resilience, health, and quality of life among long-term survivors of hematopoietic cell transplantation. *Cancer* 2015; **121**: 4250-4257.

[17] Gotay C, Ransom S, & Pagano I. Quality of life in survivors of multiple primary cancers compared with cancer survivor controls. *Cancer* 2007; **110**: 2101-2109.

[18] Sharpley CF, Christie DRH, Bitsika V, & Andronicos NM. Does psychological resilience buffer against the link between 5-HTTLPR polymorphism and depression following stress. *Physiology & Behavior* 2017;180: 53-59.

[19] Pascoe EC, & Edvardsson E. Psychological characteristics and traits of finding benefit from prostate cancer. *Cancer Nursing* 2016; **39**: 446-454.
[20] Kamen C, Jabson JM, Mustian KM, & Boehmer U. Minority stress, psychological resources and psychological distress among sexual minority breast cancer patients. *Health Psychology* 2017; **36**: 529-537.
[21] Burns RA, & Anstey KJ. The Connor–Davidson Resilience Scale (CD-RISC): Testing the invariance of a uni-dimensional resilience measure that is independent of positive and negative affect. *Personality and Individual Differences* 2010; **48**: 527 – 531.
[22] Windle G, Markland DA, & Woods RT. Examination of a theoretical model of psychological resilience in older age. *Aging & Mental Health* 2008; **12**: 285-292.
[23] Harms, C, Pooley, J A, & Cohen, L. The protective factors for resilience scale (PFRS): Development of the scale. *Cogent Psychology* 2017; **4***:* 1400415.
[24] Windle G, Bennett K, & Noyes J. A methodological review of resilience measurement scales. *Health and Quality of Life Outcomes* 2011; **9**: 1-18.
[25] Cohen L & Pooley J. Resilience: A definition in context. *The Australian Community Psychologist* 2010; **22**: 30-37.
[26] Ware JE. & Sherbourne CD. The MOS-36-item short form survey (SF-36). *Medical Care* 1992; **30**: 473-483.
[27] McHorney CA, Ware JE, Rogers W, Raczek AE, & Lu J. The validity and relative precision of MOS short- and long-form health status scales and Dartmouth COOP Charts: Results from the medical outcomes study. *Medical Care* 1992; **30**: 253-265.
[28] Derogatis LR. *Brief Symptom Inventory (BSI)-18. Administration, scoring and procedures manual.* Minneapolis: NCS Pearson, Inc, 2001.
[29] Petkus AJ, Gum AM, King-Kallimanis B, & Wetherell J. Trauma history is associated with psychological distress and somatic symptoms in homebound older adults. *The American Journal Of Geriatric Psychiatry* 2009; **17**: 810-818.
[30] Hu L, & Bentler PM. Cut off criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modelling* 1999; **6**: 1-55.
[31] Marsh HW, & Hau KT. Confirmatory factor analysis: Strategies for small sample sizes. In R. H. Hoyle (ed.), *Statistical Strategies for Small Sample Size*. Thousand Oaks, CA: Sage, 1999; 251-306.
[32] Gannon K, Guerro-Blanco M, Patel A, & Abel P. Re-constructing masculinity following radical prostatectomy for prostate cancer. *The Aging Male: The Official Journal Of The International Society For The Study Of The Aging Male* 2010; **13**: 258-264.
[33] Loerzel V, & Aroian K. "A bump in the road": Older women's views on surviving breast cancer. *Journal Of Psychosocial Oncology* 2013; **31**: 65-82.
[34] Goldney RD, Dunn KI, Air TM, Dal Grande E, & Taylor AW. Relationships between body mass index, mental health, and suicidal ideation: Population perspective using two methods. *Australian And New Zealand Journal Of Psychiatry* 2009; **43**: 652-658.
[35] Xu Q, Anderson D, & Courtney M. A longitudinal study of the relationship between lifestyle and mental health among midlife and older women in Australia: Findings from the Healthy Aging of Women Study. *Health Care For Women International* 2010; **31**: 1082-1096.
[36] Paternoster R, Brame R, Mazerolle P, & Piquero A. Using the correct statistical test for the equality of regression coefficients. *Criminology;* **36**: 859-866.
[37] Matthews B. Role and gender differences in cancer-related distress: a comparison of survivor and caregiver self-reports. *Oncology Nursing Forum* 2003; **30**: 493-499.

[38] Phipps E, Braitman L, Stites S, & Leighton J. Quality of life and symptom attribution in long-term colon cancer survivors. *Journal Of Evaluation In Clinical Practice* 2008; **14**: 254-258.
[39] Cohen J. A power primer. *Psychological Bulletin* 1992; **112**: 155-159.
[40] Bonanno G. Uses and abuses of the resilience construct: Loss, trauma, and health-related adversities. *Social Science and Medicine* 2012; **74:** 753-756.

Table 1. Summary of the background variables for the participants.

Variable		*N*	%
Gender	Female	149	57
	Male	117	39
Current marital status	Single, separated, widowed or divorced	61	23
	Married / defacto	199	75
	Non-response/unknown	6	2
Highest education level	Primary or secondary	81	30.5
	Trade, certificate or diploma, or other	113	42
	Bachelor or higher degree	62	23.5
	Non-response/unknown	10	4
Current employment status	Retired	139	52
	Unemployed	19	7
	Employed: Casual or part-time	52	20
	Employed: Full time	28	11
	Volunteer	8	3
	Sick leave	9	3
	Non-response/unknown	11	4
Cancer site	Breast	85	32
	Prostate	79	30
	Bowel and Colon	29	11
	Non-Hodgkin's Lymphoma	10	4
	Other	63	24
Treatment history	Surgery	167	63
	Chemotherapy	144	54
	Radiation	115	43
	Hormone therapy	115	42
Comorbid conditions	Hypertension or high blood pressure	117	44
	High cholesterol	109	41
	Cardiovascular or heart disease	32	12
	Diabetes	27	10
	Osteoporosis	27	10
Diagnosed with a secondary cancer (Yes)		40	15

Note: % = percentage of total sample.

Table 2. Factor loadings associated for the second-order-factor model for the Protective Factors for Resilience Scale (PFRS).

	PR	SR P	SR F
1. I can deal with whatever challenges come my way.	.89		
2. I achieve what I set out to do.	.84		
5. I believe in myself.	.85		
6. I follow through on plans to achieve my goals.	.84		
13. When I think about my future, I feel positive.	.76		
3. I feel that that I belong with my friends.		.77	
7. My friends treat me fairly.		.90	
9. My friends look after me.		.78	
11. My friends are a great source of support.		.95	
14. I can rely on my friends for help if I needed it.		.94	
4. My family are a source of strength for me.			.92
8. I feel accepted by my family.			.94
10. I know that my family would help me if I needed help.			.91
12. I feel comfortable around my family.			.96
15. I feel safe within my family.			.96

Note: PR = Personal Resources; SR-P = Social Resources – Peers; and SR-F = Social Resources – Family. Second-order factor loadings: PR= .70, SR-P= .81, and SR-F= .86.

Table 3. Correlations between and descriptive data for the PFRS as well as measures of quality of life and psychological distress.

	PFRS	*M*	*SD*	Range
Physical functioning [a]	0.19*	46.64	8.25	0-100
RL: Physical [a]	0.29*	43.06	10.84	0-100
Bodily pain [a]	0.29*	48.57	10.42	0-100
General health [a]	0.40*	46.66	10.12	0-100
Vitality [a]	0.44*	49.06	10.32	0-100
Social functioning	0.39*	39.76	8.34	0-100
RL: Emotional [a]	0.32*	38.86	8.90	0-100
Mental health [a]	0.40*	50.32	9.24	0-100
Somatisation [b]	-0.31*	2.62	2.88	0-24
Depression [b]	-0.47*	2.43	3.45	0-24
Anxiety [b]	-0.31*	2.59	1.85	0-24
BMI	-0.03	27.38	4.65	18-51
Age	0.19*	62.79	11.00	31-92
M	87.46			
SD	13.74			
Range	7-105			

Note: *Correlation was significant at the 0.01 level. *M* = Mean; *SD* = Standard Deviation; BMI = Body Mass Index. [a] = subscale of the SF-36, data presented as norm based score; and [b] = subscale of the BSI. PFRS = Protective Factors for Resilience scale. RL = Role Limitations

Table 4. Results from the hierarchical regression analyses.

	Model 1			Model 2									
	R^2	*F for R^2	p	R^2	*F for ΔR^2	p	$f^2\Delta$		B	SE	p	β	B CI	Gender**
Physical functioning	0.02	2.04	0.13	0.06	13.11	<0.01	0.05	Age	-0.11	0.05	0.01	-0.15	-0.20 / -0.02	β for BMI: ♀= -0.22 & ♂= 0.14.
								BMI	-0.07	0.11	0.51	-0.04	-0.28 / 0.14	
								PFRS	**0.13**	**0.04**	**<0.01**	**0.22**	**0.06 / 0.21**	
RL: Physical	0.00	0.41	0.67	0.07	19.90	<0.01	0.08	Age	0.00	0.06	0.96	0.00	-0.12 / 0.12	
								BMI	0.07	0.14	0.62	0.03	-0.21 / 0.34	
								PFRS	**0.26**	**0.06**	**<0.01**	**0.27**	**0.14 / 0.37**	
Bodily pain	0.04	5.82	<0.01	0.10	19.75	<0.01	0.07	Age	0.11	0.06	0.05	0.12	0.00 / 0.22	β for PRRS: ♀= 0.34 & ♂= 0.13.
								BMI	-0.27	0.13	0.04	-0.12	-0.52 / -0.01	
								PFRS	**0.20**	**0.05**	**<0.01**	**0.26**	**0.11 / 0.29**	
General health	0.00	0.00	0.99	0.16	53.06	<0.01	0.18	Age	-0.07	0.05	0.17	-0.08	-0.18 /0.11	β for BMI: ♀= -0.12 & ♂= 0.25
								BMI	0.05	0.12	0.69	0.02	-0.19 / 0.29	
								PFRS	**0.31**	**0.04**	**<0.01**	**0.42**	**0.23 / 0.39**	
Vitality	0.01	0.87	0.42	0.19	60.21	<0.01	0.22	Age	0.00	0.05	0.98	0.00	-0.11 /0.10	
								BMI	0.04	0.12	0.74	0.02	-0.20 / 0.28	
								PFRS	**0.33**	**0.04**	**<0.01**	**0.44**	**0.25 / 0.41**	
Social functioning	0.03	3.66	0.03	0.16	42.78	<0.01	0.15	Age	0.07	0.04	0.11	0.09	-0.02 /0.16	
								BMI	0.02	0.10	0.87	0.01	-0.18 / 0.22	
								PFRS	**0.23**	**0.04**	**<0.01**	**0.38**	**0.16 / 0.30**	

Table 4 Continues

	Model 1							Model 2						
	R^2	F for R^2	p	R^2	F for ΔR^2	p	$f^2\Delta$		B	SE	p	β	B CI	Gender**
RL: Emotional	0.01	0.93	0.40	0.10	27.04	<0.01	0.10	Age	0.02	0.05	0.67	0.03	-0.08 / 0.12	
								BMI	0.01	0.11	0.91	0.01	-0.21 / 0.23	
								PFRS	**0.20**	**0.04**	**<0.01**	**0.31**	**0.13 / 0.28**	
Mental health	0.04	4.89	0.01	0.18	44.89	<0.01	0.17	Age	0.10	0.05	0.04	0.12	0.00 / 0.19	β for Age: ♀= -0.03 & ♂= 0.32.
								BMI	0.02	0.11	0.87	0.01	-0.20 /0.24	
								PFRS	**0.26**	**0.04**	**<0.01**	**0.38**	**0.18 / 0.33**	
Somatisation	0.01	0.71	0.49	0.10	27.41	<0.01	0.11	Age	0.00	0.02	0.88	0.01	-0.03 / 0.03	
								BMI	-0.04	0.04	0.28	-0.06	-0.11 / 0.03	
								PFRS	**-0.07**	**0.01**	**<0.01**	**-0.31**	**-0.09 / -0.04**	
Depression	0.02	3.24	0.04	0.23	68.31	<0.01	0.27	Age	-0.02	0.02	0.27	-0.06	-0.05 / 0.02	
								BMI	0.03	0.04	0.49	0.04	-0.05 / 0.11	
								PFRS	**-0.12**	**0.01**	**<0.01**	**-0.46**	**-0.14 / -0.09**	
Anxiety	0.06	8.03	<0.01	0.13	21.60	<0.01	0.08	Age	**-0.04**	**0.01**	**<0.01**	**-0.19**	**-0.07 / -0.02**	β for Age: ♀= -0.05 & ♂= -0.39
								BMI	-0.01	0.03	0.80	-0.02	-0.07 / 0.06	
								PFRS	**-0.05**	**0.01**	**<0.01**	**-0.27**	**-0.07 / -0.03**	

Notes. B = unstandardised coefficient, SE = standard error, β = standardised coefficient; CI = 95% Confidence Interval for B. The value for $f^2\Delta$ (size of the effect due to the addition of PFRS value) was calculated using the on-line calculator at https://www.danielsoper.com/statcalc/calculator.aspx?id=13. RL = Role Limitations. Results for the regression analyses in bold indicates the p value <0.01 for the predictor in the model. * Δ df=1. ** for results of a z-test comparing the regression coefficients for males and females was < 0.01; or model fit was significantly different (using R values and Fisher's Z test, p < .01) between the males and females.

Supplemental Appendix 1. Regression coefficients of the first step (Model 1) for each hierarchical regression analyses.

	R^2*	*F* for ΔR^2**	*p*		*B*	*SE*	*p*	*β*	*B* CI
Physical functioning	0.02	2.04	0.13	Age	-0.08	0.05	0.08	-0.11	-0.17 / 0.01
				BMI	-0.09	0.11	0.42	-0.05	-0.30 / 0.13
RL: Physical	0.00	0.41	0.67	Age	0.05	0.06	0.40	0.05	-0.07 / 0.17
				BMI	0.04	0.14	0.80	0.02	-0.25 / 0.32
Bodily pain	0.04	5.82	<0.01	Age	**0.16**	**0.06**	**<0.01**	**0.17**	**0.05 / 0.27**
				BMI	-0.29	0.14	0.03	-0.13	-0.56 / -0.03
General health	0.00	0.00	0.99	Age	0.00	0.06	0.99	0.00	-0.11 / 0.11
				BMI	0.01	0.13	0.96	0.00	-0.26 / 0.27
Vitality	0.01	0.87	0.42	Age	0.08	0.06	0.19	0.08	-0.04 / 0.19
				BMI	0.00	0.14	0.98	0.00	-0.03 / 0.27
Social functioning	0.03	3.66	0.03	Age	**0.13**	**0.05**	**<0.01**	**0.17**	**0.03 / 0.22**
				BMI	-0.01	0.11	0.90	-0.01	-0.23 / 0.20
RL: Emotional	0.07	0.93	0.40	Age	0.07	0.05	0.17	0.08	-0.30 / 0.17
				BMI	-0.02	0.12	0.90	-0.01	-0.25 / 0.22
Mental health	0.04	4.89	0.01	Age	**0.16**	**0.05**	**<0.01**	**0.19**	**0.06 / 0.26**
				BMI	-0.02	0.12	0.90	-0.01	-0.25 / 0.22
Somatisation	0.01	0.71	0.49	Age	-0.01	0.02	0.41	0.01	-0.05 / 0.02
				BMI	-0.03	0.04	0.42	-0.05	-0.10 / 0.04
Depression	0.02	3.24	0.04	Age	-0.05	0.02	0.02	-0.15	-0.08 / -0.01
				BMI	0.04	0.05	0.34	0.06	-0.05 / 0.13
Anxiety	0.06	8.03	<0.01	Age	**-0.06**	**0.01**	**<0.01**	**-0.24**	**-0.08 / -0.03**
				BMI	0.00	0.03	0.97	0.00	-0.07 / 0.07

Notes. *B* = unstandardised coefficient, *SE* = standard error, *β* = standardised coefficient; CI = 95% Confidence Interval. RL = Role Limitations. Results for the regression analyses in bold indicates the *p* value <0.01 for the predictor in the model. **df*=2.** Δ*df*=1.

Supplemental Appendix 2. Results of the separate hierarchical regression analyses for males and females.

	Model 1			Model 2				Model 1					Model 2				
	R^2	F for R^2	p	R^2	F for ΔR^2	p/ f^2 Δ		B	SE	p	β	B CI	B	SE	p	β	B CI
Physical functioning																	
Females	0.11	9.11	<0.01	0.16	7.47	0.01/ 0.06	Age	-0.15	0.06	0.01	-0.20	-0.26 / -0.03	**-0.18**	**0.06**	**<0.01**	-0.24	-0.29 / -0.07
							BMI	**-0.42**	**0.13**	**<0.01**	**-0.25**	**-0.68 / -0.16**	**-0.36***	**0.13**	**<0.01**	**-0.22**	-0.62 / -0.10
							PFRS						**0.12**	**0.04**	**<0.01**	**0.22**	0.04 / 0.21
Males	0.07	4.32	0.02	0.09	0.73	0.39/ 0.02	Age	-0.18	0.08	0.03	-0.20	-0.34 / -0.02	-0.19	0.08	0.02	-0.21	-0.36 / -0.03
							BMI	0.29	0.17	0.08	0.16	-0.04 / 0.62	0.26	0.17	0.12	0.14	-0.07 / 0.60
							PFRS						0.09	0.06	0.15	0.13	-0.03 / 0.20
RL: Physical																	
Females	0.02	1.50	0.23	0.13	21.17	<0.01/ 0.13	Age	0.04	0.08	0.64	0.04	-0.12 / 0.19	-0.03	0.08	0.68	-0.03	-0.18 / 0.16
							BMI	-0.30	0.18	0.09		-0.65 / 0.05	-0.18	0.18	0.28	-0.09	-0.51 / 0.15
							PFRS						**0.24**	**0.06**	**<0.01**	**0.35**	**0.13 / 0.35**
Males	0.03	1.96	0.15	0.06	1.15	0.29 / 0.03	Age	-0.05	0.12	0.68	-0.04	-0.28 / 0.19	-0.07	0.18	0.55	-0.06	-0.30 / 0.16
							BMI	0.45	0.24	0.06	0.18	-0.02 / 0.93	0.40	0.24	0.10	0.16	-0.07 / 0.90
							PFRS						0.15	0.09	0.08	0.16	-0.02 / 0.32

Supplemental Appendix 2 Continues

	Model 1			Model 2				Model 1					Model 2				
	R^2	F for R^2	p	R^2	F for ΔR^2	p/ f^2 Δ		B	SE	p	β	B CI	B	SE	p	β	B CI
Bodily pain																	
Females	0.05	4.02	0.02	0.16	19.43	<0.01/ 0.14	Age	0.07	0.08	0.34	0.08	-0.07 / 0.22	0.01	0.07	0.92	0.01	-0.14 / 0.15
							BMI	**-0.47**	**0.17**	**<0.01**	**-0.22**	**-0.82 / -0.13**	-0.36	0.17	0.03	-0.17	-0.68 / -0.03
							PFRS						**0.24***	**0.06**	**<0.01**	**0.34**	**0.13 / 0.35**
Males	0.01	0.82	0.44	0.03	0.59	0.45/ 0.02	Age	0.11	0.11	0.28	0.10	-0.09 / 0.32	0.10	0.10	0.35	0.09	-0.11 / 0.31
							BMI	-0.13	0.21	0.55	-0.06	-0.55 / 0.30	-0.16	0.21	0.45	-0.07	-0.59 / 0.26
							PFRS						0.10	0.08	0.18	0.13	-0.05 / 0.25
General health																	
Females	0.04	3.14	0.05	0.21	26.42	<0.01/ 0.22	Age	-0.06	0.08	0.46	-0.06	-0.21 / 0.09	-0.14	0.07	0.06	-0.15	-0.28 / 0.00
							BMI	-0.41	0.18	0.02	-0.19	-0.75 / -0.06	-0.26	0.16	0.11	-0.12	-0.58 / 0.06
							PFRS						**0.30**	**0.05**	**<0.01**	**0.42**	**0.19 / 0.40**
Males	0.09	5.89	<0.01	0.22	13.61	<0.01/ 0.17	Age	0.12	0.10	0.22	0.11	-0.07 / 0.32	0.08	0.19	0.38	0.08	-0.10 / 0.27
							BMI	**0.66**	**0.20**	**<0.01**	**0.29**	**0.26 / 1.06**	**0.56***	**0.19**	**<0.01**	**0.25**	**0.19 / 0.94**
							PFRS						**0.28**	**0.07**	**<0.01**	**0.35**	**0.15 / 0.42**

Supplemental Appendix 2 Continues

	Model 1			Model 2				Model 1					Model 2				
	R^2	F for R^2	p	R^2	F for ΔR^2	p/ f^2 Δ		B	SE	p	β	B CI	B	SE	p	β	B CI
Vitality																	
Females	0.02	1.65	0.20	0.18	26.49	<0.01/ 0.20	Age	-0.13	0.07	0.86	-0.01	-0.16 / 0.13	-0.09	0.70	0.21	-0.10	-0.22 / 0.05
							BMI	-0.30	0.17	0.08	-0.15	-0.64 / 0.33	-0.17	0.16	0.29	-0.08	-0.48 / 0.15
							PFRS						**0.28**	**0.05**	**<0.01**	**0.41**	**0.17 / 0.38**
Males	0.03	1.85	0.16	0.23	21.05	<0.01/ 0.26	Age	0.10	0.11	0.35	0.09	-0.11 / 0.32	0.05	0.10	0.64	0.04	-0.15 / 0.24
							BMI	0.39	0.22	0.08	0.16	-0.05 / 0.83	0.25	0.20	0.21	0.11	-0.14 / 0.65
							PFRS						**0.39**	**0.07**	**<0.01**	**0.46**	**0.25 / 0.53**
Social functioning																	
Females	0.04	2.62	0.08	0.19	27.61	<0.01/ 0.19	Age	0.07	0.06	0.28	0.09	-0.06 / 0.20	0.00	0.06	0.95	0.01	-0.12 / 0.12
							BMI	-0.31	0.15	0.04	-0.17	-0.60 / -0.02	-0.19	0.14	0.16	-0.10	-0.46 / 0.08
							PFRS						**0.24**	**0.05**	**<0.01**	**0.41**	**0.15 / 0.33**
Males	0.10	6.52	<0.01	0.17	7.26	<0.01/ 0.08	Age	0.19	0.08	0.01	0.22	0.42 / 0.35	0.17	0.08	0.03	0.20	0.02 / 0.32
							BMI	**0.43**	**0.16**	**<0.01**	**0.25**	**0.13 / 0.74**	0.38	0.15	0.02	0.21	0.08 / 0.68
							PFRS						**0.17**	**0.05**	**<0.01**	**0.27**	**0.06 / 0.27**

Supplemental Appendix 2 Continues

	Model 1			Model 2				Model 1					Model 2				
	R^2	F for R^2	p	R^2	F for ΔR^2	p/ f^2 Δ		B	SE	p	β	B CI	B	SE	p	β	B CI
RL: Emotional																	
Females	0.00	0.21	0.81	0.15	24.12	<0.01/ 0.17	Age	0.01	0.07	0.85	0.02	-0.12 / 0.15	-0.05	.07	0.41	-0.07	-0.18 / 0.08
							BMI	-0.10	0.16	0.52	-0.05	-0.42 / 0.21	0.02	0.15	0.89	0.10	-0.27 / 0.31
							PFRS						**0.25**	**0.05**	**<0.01**	**0.40**	**0.15 / 0.35**
Males	0.01	0.35	0.71	0.03	1.63	0.20/ 0.02	Age	0.07	0.09	0.46	0.07	-0.11 / 0.24	0.05	0.09	0.56	0.06	-0.12 / 0.22
							BMI	0.07	0.18	0.69	0.04	-0.28 / 0.42	0.03	0.18	0.86	0.02	-0.32 / 0.38
							PFRS						0.11	0.06	0.08	0.16	-0.01 / 0.24
Mental health																	
Females	0.00	0.24	0.79	0.19	28.15	<0.01/ 0.23	Age	0.05	0.07	0.49	0.06	-0.09 / 0.18	-0.03	0.06	0.65	-0.03	-0.15 / 0.10
							BMI	0.01	0.16	0.96	0.00	-0.30 / 0.32	0.14	0.14	0.32	0.08	-0.14 / 0.43
							PFRS						**0.28**	**0.05**	**<0.01**	**0.45**	**0.18 / 0.37**
Males	0.12	7.44	<0.01	0.22	11.78	<0.01/ 0.14	Age	**0.36**	**0.09**	**<0.01**	**0.34**	**0.17 / 0.54**	**0.32***	**0.09**	**<0.01**	**0.31**	**0.15 / 0.50**
							BMI	0.00	0.19	1.00	0.00	-0.37 / 0.37	-0.09	0.18	0.63	-0.04	-0.44 / 0.27
							PFRS						**0.25**	**0.06**	**<0.01**	**0.33**	**0.13 / 0.38**

Supplemental Appendix 2 Continues

		Model 1			Model 2			Model 1					Model 2				
	R^2	F for R^2	p	R^2	F for ΔR^2	p/ f^2 Δ		B	SE	p	β	B CI	B	SE	p	β	B CI
Somatisation																	
Females	0.00	0.13	0.87	0.10	17.01	<0.01/ 0.10	Age	-0.01	0.02	0.76	-0.03	-0.05 / 0.04	0.01	0.02	0.62	0.04	-0.03 / 0.05
							BMI	0.02	0.05	0.66	0.04	-0.01 / 0.12	-0.01	0.05	0.86	-0.01	-0.11 / 0.09
							PFRS						**-0.06**	**0.02**	**<0.01**	**-0.32**	**-0.10 / -0.03**
Males	0.03	1.48	0.23	0.10	8.09	<0.01/ 0.08	Age	-0.01	0.03	0.73	-0.03	-0.07 / 0.05	0.00	0.03	0.97	0.00	-0.06 / 0.06
							BMI	-0.10	0.06	0.09	-0.16	-0.22 / 0.02	-0.08	0.06	0.17	-0.12	-0.20 / 0.04
							PFRS						**-0.06**	**0.02**	**<0.01**	**-0.28**	**-0.10 / -0.02**
Depression																	
Females	0.01	0.82	0.44	0.28	43.27	<0.01/ 0.37	Age	-0.02	0.03	0.41	-0.07	-0.08 / 0.03	0.01	0.03	0.58	0.04	-0.04 / 0.06
							BMI	0.07	0.07	0.30	0.09	-0.06 / 0.20	0.01	0.06	0.98	0.00	-0.11 / 0.11
							PFRS						**-0.14**	**0.02**	**<0.01**	**-0.53**	**-0.17 / -0.10**
Males	0.06	3.85	0.02	0.18	13.75	0.12/ 0.14	Age	**-0.09**	**0.03**	**<0.01**	**-0.25**	**-0.15 / -0.02**	-0.07	0.03	0.01	-0.22	-0.13 / -0.02
							BMI	0.00	0.06	0.98	0.00	-0.13 / 0.12	0.03	0.06	0.65	0.04	-0.09 / 0.14
							PFRS						**-0.08**	**0.02**	**<0.01**	**-0.34**	**-0.12 / -0.04**

Supplemental Appendix 2 Continues

	Model 1			Model 2				Model 1					Model 2				
	R^2	F for R^2	p	R^2	F for ΔR^2	p/ $f^2\,\Delta$		B	SE	p	β	B CI	B	SE	p	β	B CI
Anxiety																	
Females	0.01	0.96	0.39	0.12	15.64	<0.01/ 0.12	Age	-0.03	0.02	0.17	-0.11	-0.07 / 0.01	-0.01	0.02	0.58	-0.05	-0.05 / 0.03
							BMI	0.00	0.05	0.94	0.01	-0.09 / 0.09	-0.03	0.04	0.55	-0.05	-0.11 / 0.06
							PFRS						**-0.06**	**0.02**	**<0.01**	**-0.34**	**-0.10 / -0.03**
Males	0.16	11.11	<0.01	0.20	5.60	0.02/ 0.05	Age	**-0.11**	**0.02**	**<0.01**	**-0.41**	**-0.16 / 0.07**	**-0.11***	**0.02**	**<0.01**	**-0.39**	**-0.15 / -0.06**
							BMI	-0.03	0.05	0.60	-0.05	-0.12 / 0.07	-0.01	0.05	0.80	-0.02	-0.11 / 0.08
							PFRS						-0.04	0.02	0.02	-0.20	-0.07 / -0.01

Notes. B = unstandardised coefficient, SE = standard error, β = standardised coefficient; CI = 95% Confidence Interval. RL = Role Limitations. Results for the regression analyses in bold indicates the p value <0.01 for the predictor in the model. * indicates p value for the z-test comparing the regression coefficients for males and females was < 0.01. $f^2\,\Delta$ = effect size attributable to the addition of the variables at Model 2. The value for $f^2\Delta$ (size of the effect due to the addition of PFRS value) was calculated using the on-line calculator at https://www.danielsoper.com/statcalc/calculator.aspx?id=13.