Relationships between satisfaction with life, posttraumatic growth, coping strategies, and resilience in cancer survivors: A network analysis approach

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Abstract

Objective: Cancer survivors’ satisfaction with life should be seen through the psychological factors related to a person’s capabilities to face and handle the situation. This study aimed to (1) examine the relationships of satisfaction with life, posttraumatic growth, resilience and coping strategies in a global network model, (2) find the bridge indicators between satisfaction with life and the other constructs, and (3) test for the invariance of the network structures across several moderating variables.

Methods: In a heterogeneous sample of 696 cancer survivors (69% female; mean age = 53.1 ± 15.44 years; median time from being diagnosed = 4 years; breast cancer was the most frequent type of cancer) their satisfaction with life, resilience, coping strategies and posttraumatic growth was measured. In order to account for their complexity, the relationships between the constructs were explored using a network analysis approach.

Results: The network analysis shows that satisfaction with life is strongly connected to resilience, moderately connected to coping strategies, and has a weak connection with posttraumatic growth. In the separate networks, the relationships between the psychological constructs were examined in greater detail. Besides some exceptions observed in the degree of disability, the networks were invariant across gender, age, years since being diagnosed, cancer type and treatment type.

Conclusion: The findings suggest that interventions focused on cancer survivors’ coping strategies and resilience could help increase their satisfaction with life. However, further replication of the proposed and/or modified model is needed.

KEYWORDS
bridge indicators, cancer, cancer survivors, coping strategies, network analysis, oncology survivors, posttraumatic growth, psycho-oncology, resilience, satisfaction with life
BACKGROUND

Cancer causes significant changes to a patient’s quality of life and subjectively-experienced satisfaction with life (SWL). Moreover, it affects other psychological constructs which play an important role during and after treatment and should be considered in the process of health care provision. A cancer diagnosis is likely to increase psychological distress and could consequently trigger post-traumatic reactions. However, these are not necessarily negative reactions and can result in an improvement in some areas of a survivor’s life. SWL, post-traumatic growth, resilience and coping strategies are defined as psychological constructs which have the potential for better life adjustment and even beneficial outcomes. A positive association between positive changes and life satisfaction among cancer survivors has been empirically supported. Satisfaction with life represents the cognitive-judgemental components of subjective well-being. It is often considered synonymous with quality of life or as interconnected constructs. Perceived satisfaction depends on the comparison of one’s life circumstances with what is expected to be appropriate. In other words, the more positive changes persons who face a cancer experience, the more satisfied they are with their life. Reference to positive changes in a cancer survivor’s life is often represented by post-traumatic growth (PTG). PTG means development in various areas of life such as relating to others, new possibilities, personal strength, spirituality and appreciation of life and has been widely studied among cancer patients and cancer survivors. Moreover, those with high PTG generally display higher psychological well-being.

While PTG leads to positive psychological changes following the struggle with a traumatic event and involves moving beyond pre-trauma levels of adaptation, resilience of an individual has a protective potential and assumes the ability to bounce back and move forward with life after adversity. The level of resilience also plays an important role in the process of managing a cancer situation. Resilience is defined as the ability to withstand difficult circumstances and a positive relationship has been documented between resilience and quality of life. The level of resilience is also related to the coping strategies that a person uses to deal with a difficult situation. The use of active coping strategies is important in the process of resilience development. These are also known as solution-oriented strategies or cognitive coping strategies (e.g., acceptance, attempt to reformulate the situation or a humorous approach) and can also result in increased SWL. Conversely, the use of avoidant coping strategies is not only associated with lower PTG, but also with a lower quality of life. It can be assumed that these constructs form an interconnected network of relationships. However, the constructs as well as the relationships between them could vary in cancer survivors due to several moderating factors. For example, a significant predictor of PTG is the time since the diagnosis. This might be because a certain distress period is needed for PTG to develop, if it ever does. A longer time since diagnosis is associated with the well-being of survivors, with higher PTG levels and more effective coping with stress. In addition to the level of distress, age and gender also correlate with PTG in cancer patients. Regarding the demographic factors, gender, age and education are related to the resilience of cancer survivors. Among the illness-related factors, resilience has been associated with time since diagnosis and presence of physical symptoms. In addition, the coping strategies of cancer patients were associated with demographic and illness-related factors such as age, gender and stage of cancer.

Most studies in psycho-oncology have either focused on the bivariate relationships between SWL, PTG, coping strategies and resilience or tested mediation models. Indeed, there has been little attention paid to the interconnection of these variables. Despite all four constructs repeatedly occurring in cancer studies, the outcome of our systematic review (see osf link: osf.io/tm49j/) has revealed that research examining the mutual relationships among them is missing. This has led the authors of the current study to investigate the mutual relationships between SWL, PTG, coping strategies and resilience in detail as well as to explore their structure in a sample of cancer survivors.

The aim of this study is to (1) explore and describe in detail the interconnection between these constructs (at the level of items/factors of the individual constructs), (2) identify which variables (bridge indicators) play the most important role in interconnecting these constructs, and (3) examine how the relationships between the constructs are moderated by variables such as gender, age, length since diagnosis of disease, degree of disability, type of cancer and method of treatment.

1.1 | Network analysis and bridge indicators

The network approach to psychological constructs has become widely popular in recent years, especially in the field of psychopathology. In this approach, a psychological construct is not conceptualised as a latent variable causing the observable behaviour. Rather, the indicators of the construct are viewed as independent but mutually interacting entities and the construct emerges because of these indicators. The network approach thus allows one to study a selected construct in its complexity and reveal its structure and dynamics. As such, it shows what the relationships between the indicators are (conditional on all other indicators in the network), which indicators of the constructs are central/peripheral, as well as how well an indicator connects the other indicators in the network. In the network analysis, several constructs can be modelled within one network (of course, as in all other statistical models, the inference is only valid if the model involves all causally relevant variables). If a network involves several constructs, it might be of interest to study how these constructs are connected and see which indicators of the constructs are either (1) overlapping or (2) non-overlapping but still play an important part in connecting the constructs. In psychopathology, such indicators are called bridge symptoms. In this paper, the term “bridge indicators” will be used as the research focuses on constructs that do not represent psychopathology. In a
similar way to the established centrality/connectivity measures, the methods have been developed to examine how well an indicator connects two constructs within a network. Given the aims of this study, (1) a global network comprising SWL, PTG, coping strategies, and resilience will be estimated, (2) the networks of SWL and one of the other constructs will be estimated and the bridge indicators between SWL and the other construct examined in detail, and (3) the invariance of the estimated networks will be tested across several moderators.

2 | METHODS

2.1 | Participants and data collection procedure

Data from 696 cancer survivors (67% women; mean age = 53.1 ± 15.4 years) was collected throughout 2019 and 2020. Based on a recent systematic review, cancer survivorship is defined in this paper as a process that starts with a cancer diagnosis and continues throughout one’s life. As such, the following inclusion criteria were applied: being 18 or older, having been diagnosed with cancer, not having a severe mental health or physical condition and not being terminally ill. Detailed information about the participants is available in Table 1. The participants were recruited in cooperation with the Slovak National Oncological Centre (NOU), oncological clinics and from cancer support groups. The ethical permissions were granted by the Ethical Committee at Trnava University (resolution no. 1/2018) and the National Cancer Institute (no. 13012020) and were subsequently approved by the management of each hospital. All participants provided written informed consent prior to participation. The research was carried out according to the Declaration of Helsinki.

2.2 | Measures

The participants were administered the following psychological measures: Satisfaction with life (SWL) was measured using the Satisfaction with Life Scale (SWLS). Posttraumatic growth (PTG) was measured by the Posttraumatic Growth Inventory (PTGI). Coping strategies (COP) were measured by the Mini-Mental Adjustment to Cancer Scale (Mini-MAC); and Resilience (RES) was measured using the Brief Resilience Scale (BRS). Each of the measures has been used in previous studies with cancer survivors. The measures were adapted to and administered in the Slovak language. In order to make the study easier to read, abbreviations are used when referring to items (lower case) or factors (upper case) of the corresponding constructs. More information about the measures is available at OSF link (https://osf.io/m3hzy/).

2.3 | Statistical analysis

The missing data related to the scales (about 1%) were imputed using a regression-based imputation method and the reliabilities of the measured scales and subscales were then calculated. As all the reliabilities were sufficiently high, sum scores were computed for the factors of the PTGI and Mini-MAC. This reduced the number of nodes in the network substantially while capturing the relevant aspects of the constructs, making the networks easier to interpret. As part of the descriptive process, the observed scores were compared with the scores obtained from different studies in the general Slovak population that had used the same measures. In order to answer the research questions, the following network models were estimated: a global network combining the items of the SWLS (5 nodes), the factors of the PTGI (5 nodes), the items of the BRS (6 nodes) and the

| Variable                                | Percentage or mean ± SD or median |
|-----------------------------------------|----------------------------------|
| Gender (female)                         | 66.5%                            |
| Age                                     | 53.1 ± 15.44                     |
| Partner status (married or in a relationship) | 69.5%                           |
| Education - high school                 | 51.8%                            |
| Education - university degree           | 31.6%                            |
| Employed                                | 29.9%                            |
| Disablement pension                     | 26%                              |
| Retired                                 | 32.2%                            |
| Years since diagnosis                   | 4                                |
| Most frequent diagnosis - breast cancer | 30.3%                            |
| Time since finishing treatment (years)  | 2.95 ± 4.98                      |
| Experienced a relapse                   | 19.3%                            |
| Undergone a combination of 3 or more types of medical treatment | 35.9%                           |
| Attended cancer support groups          | 39.3%                            |
factors of the Mini-MAC (5 nodes). For a deeper understanding of which indicators are important in bridging SWL with each of the other constructs, the following were subsequently estimated: a) a network including the items of the SWLS and the items of PTGI; b) a network including the items of the SWLS and the items of BRS; and c) a network including the items of SWLS and the items of Mini-MAC. To examine exactly how the constructs are interconnected, the average weight of all the edges was calculated (in their absolute values) connecting the two constructs. Additionally, a latent network model and a structural model, in which the correlations between the latent factors were allowed, were computed. The networks were estimated using the EBICglasso estimator. In order to reduce the possibility of finding spurious correlations, the tuning parameters were set to 0.50 to produce sparse networks. Given the aims of the research, the focus was specifically on the bridge variables and their centrality, following the method of Jones et al.\(^2\) Networks estimation performance and stability of the parameters was assessed. To examine how the networks differ across the subgroups (based on gender, age, time since being diagnosed, type of cancer, type of treatment and degree of disability), the networks for the subgroups were compared (a median split was used for the continual variables) using a Network comparison test.\(^3\) The analyses were performed in R, using bootnet,\(^25\) NetworkComparisonTest,\(^32\) and networktools\(^26\) packages.

3 | RESULTS

The descriptive characteristics of the scales including their reliability and comparison of the scores with the general Slovak population (the data were obtained from\(^33\)), is available in Table 2. A bivariate as well as a partial correlation matrix of the items/scales can be found in the supplementary materials at https://osf.io/hfmaz/.

|       | M       | SD      | Potential range | Skewness | Kurtosis | \(\omega_{total}\) | Comparison with general population (Hedges’ g) |
|-------|---------|---------|-----------------|----------|----------|-------------------|---------------------------------------------|
| SWL   | 4.46    | 1.34    | 1–7             | -0.44    | -0.42    | 0.90              | 0.22                                        |
| RES   | 3.12    | 0.77    | 1–5             | -0.10    | -0.27    | 0.85              | 0.01                                        |
| COP1  | 3.01    | 0.82    | 1–4             | -0.81    | -0.18    | 0.95              | -                                           |
| COP2  | 2.69    | 0.74    | 1–4             | -0.18    | -0.61    | 0.90              | -                                           |
| COP3  | 2.95    | 0.72    | 1–4             | -0.72    | 0.11     | 0.80              | -                                           |
| COP4  | 2.91    | 0.72    | 1–4             | -0.55    | 0.03     | 0.81              | -                                           |
| COP5  | 2.93    | 0.66    | 1–4             | -0.62    | 0.09     | 0.78              | -                                           |
| PTG1  | 3.07    | 1.25    | 0–5             | -0.61    | -0.36    | 0.92              | 0.70                                        |
| PTG2  | 2.56    | 1.29    | 0–5             | -0.09    | 0.83     | 0.88              | 0.29                                        |
| PTG3  | 2.97    | 1.29    | 0–5             | -0.45    | -0.52    | 0.87              | 0.51                                        |
| PTG4  | 2.53    | 1.71    | 0–5             | -0.14    | -1.26    | 0.89              | 0.48                                        |
| PTG5  | 3.56    | 1.28    | 0–5             | -0.95    | 0.30     | 0.86              | 0.81                                        |

Abbreviations: COP1−COP5, factors of coping; PTG1−PTG5, factors of posttraumatic growth; RES, resilience; SWL, satisfaction with life.

Given the complexity of the network approach, it is only the main findings that will be highlighted. Please note that the networks have had very good stability and accuracy. All the data, code and additional outputs are available in the supplementary materials at https://osf.io/9dsve/.

The first aim of the study was to explore and describe in detail the relationship between four psychological constructs. The network analyses revealed the following patterns: a global network comprising SWL, PTG, RES and COP has shown that the indicators of satisfaction with life are most strongly connected to the indicators of resilience, whereas there is virtually no connection between the indicators of PTG and satisfaction with life (see Figure 1). These results have been conceptually confirmed by the latent network model, in which the correlations between SWL, RES, COP, and PTG were 0.42, 0.27, and 0.12, respectively. In this global network, satisfaction with life (swl3), quick recovery after a difficult situation (res1), difficulty to cope with stressful situations (res2) and anxious preoccupation (COP4) served as the bridge indicators. The second aim of the study was to identify which variables (bridge indicators) play the most important role in bridging the four psychological constructs. When a closer look was taken at how SWL was connected with each of the other three constructs (in separate networks; see Figure 1A,B,C), the following results were observed: SWL and PTG were linked through life acceptance (swl3), quick recovery after a difficult situation (res1), difficulty to cope with stressful situations (res2) and anxious preoccupation (COP4) served as the bridge indicators. The second aim of the study was to identify how the relationships between the constructs are moderated by selected variables (e.g., gender, age, invalidity percentage, etc.). When the network invariance was tested across the moderating variables, it was found (with some exceptions in degree of disability), that the networks were invariant across gender, age, years since being diagnosed with
cancer, degree of disability, cancer type and treatment type number. The exact results can be seen in Table 3.

4 | DISCUSSION

This study has examined the mutual interactions and structures of four supportive/protective psychological constructs (SWL, PTG, RES and COP) among cancer survivors. The results of the network analyses have confirmed the expected relationships between the variables with the exception of the PTG and SWL connections. It was found that there were three items and one factor, satisfaction with life (swl3), quick recovery after a difficult situation (res1), difficulty to cope with stressful situations (res2) and anxious preoccupation (COP4), which were important in connecting the global network.

A significant relationship between SWL and RES has also been confirmed in other studies although this has been in different populations or using a different measure. In this context, RES has been found to promote a long-term positive attitude towards one's life. This is especially important because life satisfaction is affected by negative events and traumas throughout life which can be jeopardised if individuals have low resilience. SWL can also be used to assess whether individuals have bounced back from or shown permanent declines in their well-being after experiencing adversity. The global network of the constructs implies the significant relationships of SWL and RES through items res1 and res2 which represent positively and negatively worded items. There is still a debate about the unitary factor structure of the BRS.

Based on the presented results, destructive coping strategies appear to have a negative relationship with SWL. More specifically, SWL and COP strategies were linked by life acceptance (swl5) and anxious preoccupation (COP4). This finding is in line with the previous study in which anxious preoccupation was significantly negatively correlated with quality of life. Constructive coping strategies increased the quality of life (QoL), which is related to SWL. However, they were not associated with SWL in the present study. Kershaw et al. have stated that avoidant strategies, such as behavioural disengagement and denial, may interfere with patients' and family caregivers’ ability to problem-solve in the face of advanced cancer. Bussel and Naus have found that a positive
cognitive-type of coping may be adaptive for cancer survivors. This result may hold implications for clinical practice as either decreasing destructive or increasing constructive coping strategies could be expected to have a positive effect on one’s life satisfaction.

Although this study has not confirmed a direct relationship between PTG and SWL, other studies have shown a positive relationship between these constructs in cancer patients. Other studies have shown a relationship between a similar construct (QoL) and PTG in patients with cancer. Other studies have pointed to the ambiguity of results or dependence on the stage of the disease or time since being diagnosed with cancer. The variation within the research sample (type and stage of cancer, time from being diagnosed, etc.) seems to play a role and could affect the results. Based on the global network, PTG and SWL were indirectly linked through the level of resilience and coping strategies that the patient uses. Resilience may serve as a protective factor related to the use of active coping strategies and mediate its relationship with QoL. However, the role of resilience and coping strategies in the relationships between these variables requires further investigation.

In terms of a separate network, SWL and PTG were bridged by personal strength (PTG3) and life acceptance (swl5) indicating that the presence of self-reliance and personal strength is associated with the acceptance of life despite difficult life situations.

The observed relationships between the constructs were invariant across the entire spectrum of potentially moderating variables except for the degree of disability. Joshy et al. have provided evidence that QoL decreases with an increase in limitations to physical functioning. Previously mentioned study showed that physical disability is a key determinant of psychological distress and deteriorating QoL. The current findings support this claim as the degree of disability was found to be a significant moderator in the relationship between life satisfaction and coping strategies among cancer survivors. The potential differences in the observed relationships may stem from the cancer stage. However, such data was not available at our discretion.

4.1 Study limitations

The study has several caveats. (1) The present network analysis is of an exploratory nature and thus the results are needed to be replicated on other samples of cancer survivors. (2) The study has a cross-sectional design and, as such, does not capture the intrapersonal dynamic of the relationships over time. (3) Given the heterogeneity of the sample, it is likely that the findings could be further shaped by certain factors which were not able to be controlled or were not focused on in the survey (e.g., the stage of cancer). However, the invariance testing indicates that the observed
relationships were invariant across different moderating variables. Nonetheless, there is a dearth of studies on moderators of these relationships, and further research is welcome before an in-depth discussion or conclusions can be offered. (4) The SWLS assesses the most general level of life satisfaction. For more precise inferences, it would be helpful to focus on the specific domains of quality of life. (5) The retrospective evaluation of PTG could be biased by social desirability or participants’ motivation to perceive growth. The participants could thus report growth although this might not necessarily reflect the truth (reality/objective circumstances).

4.2 | Clinical implications

Based on the observed relationships, there are several clinical implications for psycho-oncological practice:

1. In general, knowing which nodes are central to a proposed network enables clinicians to tailor more effective intervention strategies (e.g.,

2. Both SWL and PTG could be fostered by interventions that focus on the coping strategies adopted by cancer survivors. In particular, the interventions should aim to develop more constructive coping strategies, support a positive adjustment to the situation and reinforce the internal sources of coping.

3. Since RES serves as a protective factor for mental health (especially in stressful circumstances and at times of personal crisis), systematic training of it could also help to increase SWL and PTG.

The QoL of cancer survivors could greatly benefit from having sufficient psychological therapy from psycho-oncologists as well as from supportive survivor groups. For higher efficiency, psycho-oncological support should ideally include the survivor’s closest family and friends as well. Furthermore, psycho-social support should continue even after the medical treatment is finished, although this is often absent in practice.

5 | CONCLUSION

The present study offers a unique view of the structure and relationships between four psychological constructs - satisfaction with life, post-traumatic growth, coping and resilience - that are highly relevant for understanding how cancer survivors fare in their
situation. The results of the network analyses (both the global network as well as the separate networks) suggest that psychological interventions aimed at increasing the satisfaction with life of cancer survivors could benefit from focusing on the development of constructive coping strategies and reinforcement of resilience. Given the exploratory nature of this study, both further replications and studies with repeated-measures designs are needed. Moreover, it would be beneficial to add other psychological constructs into the network analysis to deepen the understanding of the relationship complexity between them.

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CONFLICT OF INTEREST
None.

DATA AVAILABILITY STATEMENT
The data that support the findings of this study are openly available in Open Science Framework at https://osf.io/9dsve/.

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REFERENCES
1. Fallowfield L, Jenkins V, Farewell V, Saul J, Duffy A., Eves R. Efficacy of a Cancer Research UK communication skills training model for oncologists: a randomised controlled trial. Lancet. 2002;359(9307): 650-656. https://doi.org/10.1016/s0140-6736(02)07810-8
2. Zabora J, BrintzenhofeSzoc K, Curbow B, Hooker C, Plantadit S. The prevalence of psychological distress by cancer site. Psycho Oncol. 2001;10(1):19-28. https://doi.org/10.1002/1099-1611(200101/02)10:1<19:aid-pon501>3.0.co;2-6
3. Jim HSL, Jacobsen PB. Posttraumatic stress and posttraumatic growth in cancer survivorship: a review. Cancer J. 2008;14(6): 414-419. https://doi.org/10.1097/poo.0b013e31818d8963
4. Tedeschi RG, Calhoun LG. Posttraumatic growth: conceptual foundations and empirical evidence. Psychol Inq. 2004;15(1):1-18. https://doi.org/10.1037/1532-7766.15.1.1
5. Kou W-J, Wang X-Q, Li Y, et al. Research trends of posttraumatic growth from 1996 to 2020: a bibliometric analysis based on Web of Science and CiteSpace. J Affect Disord Rep. 2021;3:100052. https://doi.org/10.1016/j.jadrep.2020.100052
6. McKay S, Skues JL, Williams BJ. Does the Brief Resilience Scale actually measure resilience and succumbing? Comparing artefactual and substantive models. Adv Ment Health. 2021;19(2):192-201. https://doi.org/10.1080/18387357.2019.1688667
7. Tamura S, Suzuki K, Ito Y, Fukawa A. Factors related to the resilience and mental health of adult cancer patients: a systematic review. Support Care Cancer. 2021;29(7):3471-3486. https://doi.org/10.1007/s00520-020-05943-7
8. Silva SM, Crespo C, Canavarro MC. Pathways for psychological adjustment in breast cancer: a longitudinal study on coping strategies and posttraumatic growth. Psychol Health. 2012;27(11): 1323-1341. https://doi.org/10.1080/08870446.2012.676644
9. Seitz DCM, Hagmann D, Besier T, et al. Life satisfaction in adult survivors of cancer during adolescence: what contributes to the latter satisfaction with life? Qual Life Res. 2011;20(2):225-236. https://doi.org/10.1007/s11136-010-9739-9
10. Polanksi J, Chabowski M, Jankowska-Pola B, Mazur G. Can life satisfaction be considered a predictor of quality of life in patients with lung cancer? Eur Rev Med Pharmacol Sci;24(11):11128-11138.
11. Mostarac I, Brajković L. Life after facing cancer: posttraumatic growth, meaning in life and life satisfaction [Internet]. J Clin Psychol Med Settings. 2021. [cited 2021 Dec 13] https://link.springer.com/10.1007/s10880-021-09786-0
12. Diener E, Emmons RA, Larsen RJ, Griffin S. The satisfaction with life scale. J Pers Assess. 1985;49(1):71-75. https://doi.org/10.1207/s15327752ja4901_13
13. Tomich PL, Helgeson VS. Posttraumatic growth following cancer: links to quality of life: posttraumatic growth. J Trauma Stress. 2012;25(5):567-573. https://doi.org/10.1002/jts.21738
14. Ruini C, Vescovelli F, Albieri E. Post-traumatic growth in breast cancer survivors: new insights into its relationships with well-being and distress. J Clin Psychol Med Settings. 2013;20(3):383-391. https://doi.org/10.1002/jps.20940-1
15. Popa-Velea O, Diaconescu L, Jidveian Popescu M, Trușescu C. Resilience and active coping style: effects on the self-reported quality of life in cancer patients. Int J Psychiatr Med. 2017;52(2): 124-136. https://doi.org/10.1080/00207594.2017.1370253
16. Shand LK, Brooker JE, Burney S, Fletcher J, Ricciardelli LA. Psychosocial factors associated with posttraumatic stress and growth in Australian women with ovarian cancer. J Psychosoc Oncol. 2018;36(4): 470-483. https://doi.org/10.1080/10533506.2018.1461728
17. Casellas-Grau A, Ochoa C, Ruini C. Psychological and clinical correlates of posttraumatic growth in cancer: a systematic and critical review. Psycho Oncol. 2017;26(12):2007-2018. https://doi.org/10.1002/pon.4426
18. Shand LK, Cowlishaw S, Brooker JE, Burney S, Ricciardelli LA. Correlates of post-traumatic stress symptoms and growth in cancer patients: a systematic review and meta-analysis: correlates of PTSS and PTG. Psycho Oncol. 2015;24(6):624-634. https://doi.org/10.1002/pon.3719
19. Grassi L, Buda P, Cavana L, Annunziata MA, Torta R, Varetto A. Styles of coping with cancer: the Italian version of the mini-mental adjustment to cancer (Mini-MAC) scale. Psycho Oncol. 2005;14(2):115-124. https://doi.org/10.1002/pon.826
20. Romeo A, Di Tella M, Ghigia A, Tesio V, Torta R, Castelli L. Post-traumatic growth in breast cancer survivors: are depressive symptoms really negative predictors? Psychol Trauma Theory Res Pract Policy. 2020;13(3):244-250. https://doi.org/10.1037/tra0000508
21. Borsboom D. A network theory of mental disorders. World Psychiatr. 2017;16(1):5-13. https://doi.org/10.1002/wps.20375
22. Borsboom D, Cramer AOJ. Network analysis: an integrative approach to the structure of psychopathology. Annu Rev Clin Psychol. 2013;9(1): 91-121. https://doi.org/10.1146/annurev-clinpsy-050212-185608
23. Castro D, Ferreira F, de Castro I, et al. The differential role of central and bridge symptoms in deactivating psychopathological networks. Front Psychol. 2019;10:2448. https://doi.org/10.3389/fpsyg.2019.02448
24. Levinson CA, Zerwas S, Calebs B, et al. The core symptoms of bulimia nervosa, anxiety, and depression: a network analysis. J Abnorm Psychol. 2017;126(3):340-354. https://doi.org/10.1037/abn0000254
25. Ep skamp S, Borsboom D, Fried EI. Estimating psychological networks and their accuracy: a tutorial paper. Behav Res Methods. 2018;50(1):195-212. https://doi.org/10.3758/s13428-017-0862-1
26. Jones PJ, Ma R, McNally RJ. Bridge centrality: a network approach to understanding comorbidity. *Multivariate Behav Res.* 2021;56(2):353-367. https://doi.org/10.1080/00273171.2019.1614898

27. Marzorati C, Riva S, Pravettoni G. Who is a cancer survivor? A systematic review of published definitions. *J Cancer Educ.* 2017;32(2):228-237. https://doi.org/10.1007/s13187-016-0997-2

28. Tedeschi RG, Calhoun LG. The posttraumatic growth inventory: measuring the positive legacy of trauma. *J Trauma Stress.* 1996;9(3):455-471. https://doi.org/10.1080/09209121.1996.9990305

29. Smith BW, Dalen J, Wiggins K, Tooley E, Christopher P, Bernard J. The brief resilience scale: assessing the ability to bounce back. *Int J Behav Med.* 2008;15(3):194-200. https://doi.org/10.1007/s107050080222972

30. Romeo A, Di Tella M, Ghiggia A, et al. The traumatic experience of breast cancer: which factors can relate to the post-traumatic outcomes? *Front Psychol.* 2019;10:891. https://doi.org/10.3389/fpsyg.2019.00891

31. Kavak F, Özdemir A, Dural G. The Relation between spiritual well-being and psychological resilience among patients diagnosed with advanced gastrointestinal cancer. *Curr Psychol.* 2021;40(4):1788-1794. https://doi.org/10.1080/12144-018-0116-0

32. Koczvara B, Kascakova N, Adamkovi M, et al. Comparing Network Structures on Three Aspects: A Permutation Test. *Manuscr Submitt Publ.* 2017.

33. Romeo A, Di Tella M, Ghiggia A, et al. The traumatic experience of breast cancer: which factors can relate to the post-traumatic outcomes? *Front Psychol.* 2019;10:891. https://doi.org/10.3389/fpsyg.2019.00891

34. Alarcón R, Cerezo MV, Hevilla S, Blanca MJ. Psychometric properties of the Connor-Davidson Resilience Scale in women with breast cancer. *Int J Clin Health Psychol.* 2020;20(1):81-89. https://doi.org/10.1016/j.ijchp.2019.11.001

35. O'Connor M, Guilfoyle A, Breen L, Mukhardt F, Fisher C. Relationships between quality of life, spiritual well-being, and psychological adjustment styles for people living with leukemia: an exploratory study. *Ment Health Relig Cult.* 2007;10(6):631-647. https://doi.org/10.1080/13674670601078221

36. Russell VA, Naus MJ. A longitudinal investigation of coping and posttraumatic growth in breast cancer survivors. *Psychosoc Oncol.* 2010;28(1):61-78. https://doi.org/10.1007/07347330903438958

37. Osłoniaewska E, Misiąg W, Chabowski M, Jankowska-Polańska B. Coping strategies, pain, and quality of life in patients with breast cancer. *J Clin Med.* 2021;10(19):4469. https://doi.org/10.3390/jcm10194469

38. Kershaw T, Northouse L, Kritipracha C, Schafanacker A, Mood D. Coping strategies and quality of life in women with advanced breast cancer and their family caregivers. *Psychol Health.* 2004;19(2):139-155. https://doi.org/10.1080/088704003001652687

39. Rzeszutek M, Oniszczenko W, Gruszczyńska E. Satisfaction with life, big-five personality traits and posttraumatic growth among people living with HIV. *J Happiness Stud.* 2019;20:35-50. https://doi.org/10.1007/s10902-017-9925-3

40. Zettler T, Maercker A. Posttraumatic growth in clinical psychology – A critical review and introduction of a two component model. *Clin Psychol Rev.* 2006;26(5):626–53.

41. Helgeson VS, Reynolds KA, Tomich PL. A meta - analytic review of benefit finding and growth. *J Consult Clin Psychol.* 2006;74(5):797–816.

42. Helgeson VS, Reynolds KA, Tomich PL. A meta - analytic review of benefit finding and growth. *J Consult Clin Psychol.* 2006;74(5):797–816.

43. Joshy G, Thandrayen J, Koczwara B, Butow P, Laidsaar - Powell R, Rankin N, et al. Disability, psychological distress and quality of life in relation to cancer diagnosis and cancer type: population - based Australian study of 22,505 cancer survivors and 244,000 people without cancer. *BMC Med.* 2020;18(1):372.

44. Davis EB, Van Tongeren DR, McElroy-Heltzel SE, Davis DE, Rice KG, Hook JN, et al. Perceived and actual posttraumatic growth in religiously and spiritually following disasters. *J Pers.* 2021;89(1):68–83.

45. Zoellner T, Maercker A. Posttraumatic growth in clinical psychology — A critical review and introduction of a two component model. *Clin Psychol Rev.* 2006;26(5):626–53.

46. Loprinzi C, Prasad K, Schroeder D, Sood A. Stress management and resilience training (SMART) program to decrease stress and enhance resilience among breast cancer survivors: A pilot randomized clinical trial. *Clin Breast Cancer.* 2011;11:364–8.

47. Luo Y, Xia W, He XL, Zhang J, Li HCW. Psychological interventions for enhancing resilience in parents of children with cancer: a systematic review and meta-analysis. *Support Care Cancer.* 2021;29(11):7101-10.

48. Luo YH, Li WHC, Cheung AT, Ho LLK, Xia W, He XL, et al. Relationships between resilience and quality of life in parents of children with cancer. *J Health Psychol.* 2022;27(5):1048-56.

49. Kounarianou A, Symeonidou AE, Kattamis A, Linardatou K, Chrourouos GP, Darviri C. A review of psychosocial interventions targeting families of children with cancer. *Palliat Support Care.* 2020;07/02. 2021;19(1):103-18.

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