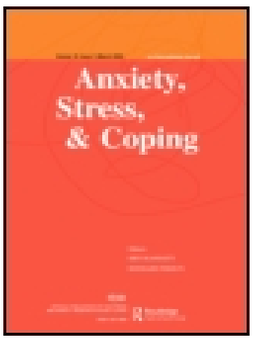

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Coping and resilience in adults: a cross-sectional network analysis

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ABSTRACT

Background and objectives: Coping and resilience, how we deal with problems and difficulties and recover from misfortune or change, are two well-known interrelated concepts within psychology. The question remains, however, to what extent the two overlap or differ.

Design: The present study investigated coping, resilience and their relationship using cross-sectional network analysis. Participants ($N = 502$), aged between 18 and 64 y old, completed an online survey including the Brief-COPE (Coping Orientation to Problems Experienced) and the SPF-24 (Scale of Protective Factors).

Results: Partial correlation networks on coping and resilience separately show strong, mostly positive associations, both within and between different cluster of coping and different higher-order resilience factors. Results for our combined partial correlation network indicate that coping and resilience are distinct, yet clearly related constructs and are likely to influence each other. Overall, the use of social support, active coping, goal efficacy and planning proved important in bridging coping and resilience.

Conclusion: The current findings are best replicated using time-series data, person-specific network models and clinical samples. Further implications for future research and clinical practice are discussed.

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Coping; resilience; network analysis; COPE; SPF

Coping and resilience, how we deal with problems and difficulties and recover from misfortune or change, are two well-known interrelated concepts within psychology. Interestingly, both concepts have often been equated with each other – to the point where some seem to use them interchangeably. The current study aims to investigate coping and resilience as well as their interrelatedness using cross-sectional network analysis.

Coping is generally defined as the "constantly changing cognitive and behavioral efforts necessary to manage to master, reduce or tolerate a troubled person-environment relationship" (Lazarus & Folkman, 1984, p. 152). In other words, coping is about how we manage or overcome problems and difficulties. Some prefer to limit the concept of coping to voluntary responses; others include automatic and involuntary responses within the coping construct (Compas et al., 2001).

Coping is a broad concept and many distinctions have been made to distinguish, categorize or group different coping responses. A recent review of the coping literature revealed more than 100 different coping categorization schemes, along with multiple scoring systems for common coping measures (Skinner et al., 2003). Two of the most commonly employed coping distinctions can be characterized as problem- versus emotion-focused coping and engagement versus disengagement coping (see detailed reviews by Compas et al., 2001; Skinner et al., 2003). When distinguishing

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between problem-focused and emotion-focused coping, Lazarus and Folkman (1984) characterized problem-focused as coping aimed at changing the situation, removing the stressor or managing the problem and emotion-focused as coping aimed at reducing or removing the negative emotions related to the problem. Strategies employed in problem-focused coping might include planning, initiation, direct action or seeking instrumental help (e.g., Felsten, 1998), whereas emotion-focused coping might include relaxation, rumination, wishful thinking, seeking emotional help or avoidance (e.g., Felsten, 1998; Tamres et al., 2002). When distinguishing between *engagement* (approach) and *disengagement* (avoidance) coping, engagement is characterized as coping that involves active attempts to manage a situation or the associated emotions that one experiences and disengagement coping as coping that involves distancing oneself from the stressor or any related feelings (Carver & Connor-Smith, 2010; Roth & Cohen, 1986). Strategies employed in engagement coping might include problem-solving, acceptance, emotional expression or rumination, whereas disengagement coping might include avoidance, denial, or distraction.

Comparing the different ways to distinguish between coping responses, it is best to recognize each distinction has its own focus of convenience and proves useful for answering different questions about one's response to stress. Furthermore, no one distinction fully represents the structure of coping as confirmatory analyses clearly support hierarchical, multidimensional models of coping (e.g., Ayers et al., 1996; Connor-Smith et al., 2000). Skinner et al. (2003) suggest the fundamental issue with identifying a model on coping may be that "coping" is not a specific behavior that can be unequivocally observed, but rather, an organizational construct used to encompass a wide range of actions individuals use to deal with stressful experiences. "Good" versus "bad" coping strategies are difficult, if not impossible, to define or distinguish from each other, as such evaluation is always context-sensitive (Lazarus & Folkman, 1984).

To measure coping, a wide variety of coping scales has been used over time (for a recent meta-analysis, see Kato, 2015). Amongst these include the Coping Orientation to Problems Experienced Inventory (COPE; Carver, 1997; Carver et al., 1989), Ways of Coping Questionnaire (WCQ; Folkman & Lazarus, 1988), Coping Strategies Questionnaire (CSQ; Rosenstiel & Keefe, 1983), Coping Inventory for Stressful Situations (CISS; Endler & Parker, 1990), and Religious-COPE (RCOPE; Pargament et al., 2000). While most coping scales, like the COPE or WCQ are so-called "broadly applicable," some coping scales, like the CSQ, are so-called "situation-specific", focusing on how we deal with particular stressors like pain or cancer. Reviewing the use of different coping scales, Kato (2015) has found the (Brief-)COPE to be the most frequently (20%) used questionnaire. Since its development, a number of studies have provided evidence to support the reliability and validity of the COPE (see Litman, 2006; Lyne & Roger, 2000 for reviews).

Resilience is typically defined as the capacity of a dynamic system to withstand or recover from significant challenges that threaten its stability, viability, or development (Masten, 2001). In other words, resilience refers to the ability to bounce back from negative emotional experiences and flexibly adapt to the changing demands of stressful experiences (Block & Kremen, 1996). It is often conceptualized as one end of a continuum with vulnerability, implying a resistance – though not total invulnerability – to psychopathology (Ingram & Price, 2010). Not to anyone's surprise, findings show that resilience positively affects mental health and well-being, as well as physical health, throughout the life span (van IJzendoorn et al., 2011; Walsh et al., 2010; Windle, 2011).

Since the concept of resilience first originated, resilience research has undergone four waves of theoretical development (Masten, 2007; Wright et al., 2013). In the early 1970s, the first wave of research aimed to identify the factors that put at risk or protect one's resiliency as well as differences in personal outcomes in the context of adversity. In a second wave, research focused on identifying the underlying process that plays a role in risk and protective factors. Concepts such as protective, assets and resources originated here. Next, the third wave of research focused on the effectiveness of interventions designed to promote resilience and the dissemination of knowledge to professionals, schools and parents. Now, the fourth wave has begun to focus on the potential neurobiological basis

of resilience as to ascertain if one's resiliency may, in fact, be semi-biologically determined (Masten, 2007; Wright et al., 2013).

A wide range of protective factors within the individual, their life and their environment have been identified that can facilitate our capacity for adaptation and ability to "bounce back" in face of adversity (Ahern et al., 2006; Beckwith et al., 2008; Connor & Davidson, 2003; Fergus & Zimmerman, 2005; Masten et al., 2009; Windle et al., 2011). These protective factors include developmental and psychosocial factors as well as genetic, epigenetic, and neurochemical factors which could contribute to the development of resilience (Wu et al., 2013). Examples of developmental and psychosocial protective factors include changes to the development of stress response systems and the central nervous system, following childhood trauma as well as cognitive processes (like cognitive reappraisal), personality traits (like optimism), and coping mechanisms (like active coping, seeking social support, humor). Examples of (epi)genetic and neurochemical protective factors include a range of human genes and polymorphisms associated with neuropeptide Y, the HPA axis, noradrenergic, dopaminergic and serotonergic systems and epigenetic changes on the regulation of the stress response and vulnerability to mental illness (Maul et al., 2020).

To measure resilience a wide variety of scales and questionnaires has been used over time (Ahern et al., 2006; Windle et al., 2011). Although a number of these have been developed with the pure intent of measuring resilience, these scales are not widely adopted and no one scale seems preferable over the others (Windle et al., 2011). Commonly used instruments include the Connor–Davidson Resilience Scale (CD-RISC; Connor & Davidson, 2003), the Resilience Scale for Adults (RSA; Friborg et al., 2003), the Brief-Resilience Scale (BRS; Smith et al., 2008) and the Resilience Scale (RS; Wagnild & Young, 1993). A methodological review by Windle et al. (2011) determined the CD-RISC, the RSA and the BRS to present with the best psychometric ratings, though none qualified as a "gold standard" instrument, while for a number of other scales the conceptual and theoretical adequacy was ruled questionable. The Scale of Protective Factors (SPF; Ponce-Garcia et al., 2015) is a more recent self-report questionnaire developed to assess protective factors shown to be important determinates of resilience. With the development of the SPF, Ponce-Garcia and colleagues aimed to create a multifactor structure model of protective factors, including a social-interpersonal factor and a cognitive-individual factor, that would aid researchers in identifying specific underlying factors that are related to overall resilience, with potential impact for prevention, intervention and treatment in mind.

Interestingly, coping and resilience have often been equated with each other – to the point where some seem to use both concepts interchangeably. Some scholars have argued resilience should be conceptualized as a constellation, i.e., a fit between individual resources, social conditions and the developmental challenge or problem (Greve & Staudinger, 2006), whereas coping should be conceptualized as a process (as opposed to a trait or a competence) by which individuals manage the challenging or threatening demands placed upon them (Lazarus & Folkman, 1984). Others have argued coping strategies are mediators of the link between positive emotions and resilience (Gloria & Steinhardt, 2016) or have proposed resilience should be considered a conceptual bridge between coping and the development of coping abilities (Leipold & Greve, 2009). Despite the differences in conceptualization, current consensus is that it is useful to distinguish between coping and resilience as psychological concepts (Rice & Liu, 2016a, 2016b). For instance, research investigating coping and resilience within the same population does not tend to provide support for the (false) theoretical assertion that resilient individual will automatically demonstrate "better" coping skills as compared to individuals who are less resilient (e.g., Davey et al., 2003). The question remains, however, to what extent these two interrelated concepts overlap and which commonalities to be acknowledged.

Psychological network analysis, a new theoretical and statistical approach to the field of psychology, may prove an important tool to shed light on this long-standing issue. Network analysis allows one to estimate (and visualize) associations between variables without assuming an underlying dimensional structure (Borsboom, 2008; Borsboom et al., 2011; Cramer et al., 2010). Recently, psychological network modeling has been applied successfully within the field of depression, PTSD and suicidality (Armour et al., 2017; De Beurs et al., 2019; Fried, 2017; Fritz et al., 2018). Since long, regardless

of whether psychopathology is viewed through a categorical or dimensional lens, consensus has been that symptoms are reflective indicators of an underlying latent variable. As such, symptoms are thought of as interchangeable and equally reflective of the latent variable they represent. Recently, however, research has shown that for a range of psychological disorders, symptoms (1) vary in their comorbidity with alternative disorders, (2) relate differently to quality of life, and (3) can display differential responses to treatment (Armour et al., 2017; Dell'Osso & Pini, 2012). As an alternative to latent-variable modeling, rather than assuming a latent entity gives rise to observable behaviors or symptoms, network analysis assumes that a particular network of behaviors or symptoms can be understood as the psychological construct itself. As such, symptoms are not conceptualized as interchangeable indicators of an underlying latent variable nor reflective of an underlying disorder; instead, the associations among symptoms constitute the disorder itself (Beard et al., 2016; Fried, 2015; Fried & Cramer, 2017).

In network analysis, each network consists of nodes (items) and the pairwise relations between the nodes (edges) which take into account all other pairwise interactions within the network (so-called partial correlation). A penalized maximum likelihood estimation (i.e., LASSO) is often applied, minimizing all non-relevant spurious partial correlations, resulting in a network of direct nonspurious relations between nodes (Tibshirani, 1996). Based on the pairwise relations between the nodes, the role of each individual node within a network is expressed via network parameters, like node strength, node closeness, node betweenness or bridge centrality (for more detailed information, see Epskamp, 2017).

Network analysis, in contrast to other variable classification techniques, has several unique benefits for the study of psychological phenomena. First, network analysis allows one to unravel complex psychological phenomena through a bottom-up analysis of the different symptoms or behaviors and their associations with each other (Borsboom, 2008; Cramer et al., 2010). As such, network analysis creates a shift in focus (and information gathering) from phenomena or large constructs to individual symptoms or behaviors and their associations. Secondly, network analysis allows for a better understanding of covariance or comorbidity as it allows for associations between *all* symptoms or behaviors, unhindered by any presuppositions, and allows for visualizing specific associations between substructures (Cramer et al., 2010). Finally, by investigating network parameter like node strength, network analysis can identify the relationship between each given node and other nodes in the network and highlight influential (bridge) symptoms or behaviors which could form the basis for guiding therapeutic interventions (Opsahl et al., 2010). To date, the relationship between coping and resilience has not yet been investigated using network analysis.

The present study aims to investigate coping, resilience and their relation using cross-sectional network analysis. First, we will estimate two simple networks, one on coping and one on resilience separately. Next, we will estimate a complex network on coping and resilience as combined in order to (1) investigate differences in network structure compared to the simple networks and (2) identify the (bridge) centrality indices of each node within the network. Finally, our analyses are evaluated regarding network accuracy and network stability.

Methods

Participants

The study included 502 English or Dutch-speaking participants ($N_{♂} = 165$, $N_{♀} = 333$, $N_{o} = 4$), aged 18–84 years old. Age was measured as a categorical variable; 18–24 (64%), 25–34 (17%), 35–44 (4%), 45–54 (9%), 55–64 (5%), 65–74 (1%), 75–84 (<1%). Participants indicated whether they were single (44%) or in a committed relationship (56%) and whether they identified as religious (19%), spiritual (10%), neither (69%) or both (2%). Participants were screened for mental and/or physical chronical illness prior to participation. Participants suffering from a chronic illness were excluded from participation.

Procedure

All study protocols were in accordance with the ethical standards of the institutional ethical committee, EC-DPECS, of the Erasmus University of Rotterdam, Netherlands. Individual informed consents were obtained prior to participation. Participant recruitment was set up through the university's recruitment facility as well as through distribution of the survey via social media. All participants completed the Brief-COPE (Carver, 1997; Carver et al., 1989) and the SPF-24 (Ponce-Garcia et al., 2015) in addition to completing the beforementioned socio-demographic questions. No compensation was provided. Data was collected using a self-administered, online survey available in both English and Dutch.

Assessment

Brief-COPE

The Brief-COPE is an abbreviated version of the COPE (Carver, 1997; Carver et al., 1989) Inventory, a self-report questionnaire developed to assess a broad range of coping responses. The Brief-COPE includes 14 two-item subscales: Use of Emotional Support, Use of Instrumental Support, Venting, Religion, Active Coping, Planning, Self-Distraction, Denial, Substance Use, Behavioral Disengagement, Self-Blame, Positive Reframing, Humor, and Acceptance. Each item is rated on a 4-point scale, ranging from 1, "*I haven't been doing this at all*", to 4, "*I've been doing this a lot*". The structure of the Brief-COPE has been explored using principal component factor analysis, identifying a 4-factor structure accounting for 45% of the total variance (6–17% per factor) (Baumstarck et al., 2017). These four factors were labeled according to their constitutive items as follows: (1) Social support (Use of Emotional Support, Use of Instrumental Support, Venting and Religion; 8 items), (2) Problem solving (Active Coping and Planning; 4 items), (3) Avoidance (Self-Distraction, Denial, Substance Use, Behavioral Disengagement and Self-Blame; 10 items), and (4) Positive thinking (Positive Reframing, Humor and Acceptance; 6 items). The Brief-COPE is characterized by acceptable to good internal consistency (Cronbach's alpha ranging from .64 to .82; Baumstarck et al., 2017), good internal validity and good test-retest reliability (Cooper et al., 2008; Garcia et al., 2018). For convenience, the Brief-COPE will be referred to as "COPE" throughout the Results section.

SPF-24

The SPF-24 is an abbreviated version of the SPF (Ponce-Garcia et al., 2015), a self-report questionnaire developed to assess protective factors shown to be important determinates of resilience. The SPF-24 includes four six-item subscales: Social Support, Social Skills, Prioritizing/Planning Behavior and Goal Efficacy. The four factors of the SPF-24 can fall under two, higher order, latent variables, namely (a) Social-Interpersonal resilience, which includes Social Support and Social Skills and (b) Cognitive-Individual (or Intrapersonal) resilience, which includes Prioritizing/Planning Behavior and Goal Efficacy. Each individual item is rated on a 5-point Likert scale, ranging from 1, "*Disagree*", to 5, "*Agree*". The SPF-24 is characterized by good to excellent internal and good internal validity (Cronbach's alpha ranging from .86 to .92; Ponce-Garcia et al., 2015). For convenience, the SPF-24 will be referred to as "SPF" throughout the Results section.

Data analysis

All analyses were run in R 3.5.2 using the *R*-packages *qgraph*, *bootnet*, and *networktools* (Epskamp, 2017; Epskamp et al., 2018a; Fruchterman & Reingold, 1991; Jones et al., 2019; Opsahl et al., 2010). Data and analytic code for this manuscript are available upon request. More details on network estimation, centrality indices, network accuracy and network stability, including how-to-tutorials, are available elsewhere (Epskamp, 2017).

Network estimation and visualization

To investigate the structure of coping as measured by the brief-COPE and resilience as measured by the SPF-24, we estimated two partial correlation networks: a brief-COPE network, to include 14 nodes (i.e., 14 subscales of the Brief-COPE) and 91 possible pairwise association and a SPF-24 network, to include 4 nodes (i.e., 4 subscales of the SPF-24) and 6 possible pairwise associations. To investigate the relationship between coping as measured by the Brief-COPE and resilience as measured by the SPF-24, we estimated a combined, partial correlation network on coping and resilience, to include 18 nodes and 153 possible pairwise associations. For all three partial correlation networks, the nodes represent either a coping style or a resilience factor, while the edges represent the connection between two nodes after controlling for all other edges in the network. As such, all edges can be interpreted as polychoric partial correlations (ranging from −1 to 1). All networks were estimated using Gaussian Markov random field estimation using graphical LASSO, where the optimal regularization parameter is selected using the extended Bayesian information criterion (EBIC).

(Bridge) centrality indices

Given the size of the SPF network and to reduce repetition, centrality analyses were only conducted for the combined estimated network. To investigate the centrality of the nodes within the combined network, i.e., what the role is of each node within the network, three common centrality measures were estimated using the *R*-package *qgraph* (Epskamp et al., 2018a; Opsahl et al., 2010). (1) Node *strength*, which is the direct connection of a node to the network, calculated as the sum of absolute weights of all edges of a given node with all others, (2) c*loseness*, which is the indirect connection of a node to the network, calculated as the sum of the inverse of all shortest path lengths between one node and all others, and (3) *betweenness*, which is the indirect connection of a node to the network, calculated as the number of times a node lies on the shortest path connecting two other nodes in a network. Overall, more central nodes have higher centrality values.

To investigate the bridge centrality of the nodes within a combined network, i.e., to what extent a node plays a role in bridging or connecting two or more subnetworks, three common bridge centrality measures were estimated (1) *Bridge strength*, which is the sum of absolute values of edges between one node and all other nodes in a second cluster, (2) *bridge expected influence (1-step)*, which is the sum of all edges between one node and all other nodes of a second cluster, and (3) *bridge expected influence (2-step)*, which is the same as 1-step, but also includes the indirect influence of the node through other nodes. Overall, nodes that have more *bridging* influence have higher bridge centrality values.

Accuracy and stability

To reduce repetition, accuracy and stability were only evaluated for the combined estimated network. To investigate the accuracy of the combined estimated network, the accuracy of the edge weights was assessed by bootstrapping (1000 iterations) 95% confidence intervals (CIs) around the edge weights. Smaller CIs indicate greater accuracy. To investigate the stability (or replicability) of the combined estimated network, the stability of the node centrality and bridge centrality indices were evaluated using a case-dropping subset bootstrap (1000 iterations; Epskamp et al., 2018a). In a case-dropping subset bootstrap, the correlation between the original centrality indices and the centrality indices as obtained from smaller subsets, with up to 75% of participants dropped, is assessed. To quantify the stability of centrality indices using case-dropping subset bootstrap, where possible, correlation stability coefficients or CS-coefficients, were calculated. A CS-coefficient quantifies the maximum proportion of cases that can be dropped to retain, with 95% certainty, a correlation with the original centrality indices of 0.70 or higher. Ideally, a CS-coefficient is at least 0.25 for the centrality to be considered stable, though preferably above 0.50 (Epskamp et al., 2018a).

Results

Network estimation and visualization

To investigate the structure of coping as measured by the COPE and resilience as measured by the SPF two individual partial correlation networks were estimated. Visualizations of both estimated partial correlation networks are shown in Figure 1.

For coping, the COPE network shows coping styles are positively associated with each other with 14 nodes connected by 14 associations. Positive associations emerged within so-called coping clusters (cf. 4-factor structure as discussed by Baumstarck et al., 2017), namely between A1-A2 (.56; Use of Emotional Support with Use of Instrumental Support), A1-A3 (.37; Use of Emotional Support with Venting), A2-A3 (.28; Use of Instrumental Support with Venting), B1-B2 (.39; Active Coping with Planning), C1-C5 (.19; Self-Distraction with Self-Blame), C2-C4 (.27; Denial with Behavioral Disengagement), C3-C4 (.17; Substance Use with Behavioral Disengagement), D1-D2 (.24; Positive Reframing with Humor), D1-D3 (.18; Positive Reframing with Acceptance), D2-D3 (.17; Humor with Acceptance), as well as between so-called cluster, namely between A1-C1 (.11; Use of Emotional Support with Self-Distraction), A4-D1 (.17; Religion with Positive Reframing), and B2-D1 (.20; Planning with Positive Reframing), while a negative association emerged between B1-C4 (−.22; Active Coping with Behavioral Disengagement).

For resilience, the SPF network shows strong, positive associations with four nodes connected by five associations. Strong connections emerged between E1-E2 (.26; Social Support with Social Skills), the two social-interpersonal resilience factors, and E3-E4 (.34; Planning with Goal Efficacy), the two intrapersonal resilience factors. In addition to that, interconnections between the two higher-order factors emerged, with a positive association between E1-E3 (.18; Social Support with Planning), E1-E4 (.09; Social Support with Goal Efficacy) and E2-E4 (.28; Social Skills with Goal Efficacy). The only association to be absent from the network, though the association between E1-E4 is only weak, is an association between E2-E3 (Social Skills with Planning).

To investigate the relationship between coping as measured by the COPE and resilience as measured by the SPF a combined partial correlation network was estimated. A visualization of the combined partial correlation network is shown in Figure 2. Overall, the combined network shows clear associations both within and between coping and resilience, with 18 nodes connected by 17 pairwise associations. Zooming in on nodes related to coping, strong associations emerged between A1-A2 (.54; Use of Emotional Support with Use of Instrumental Support), A1-A3 (.36; Use of Emotional Support with Venting), A2-A3 (.28; Use of Instrumental Support with Venting), and B1-B2 (.36; Active Coping with Planning). In addition to that, positive associations emerged between C2-C4 (.26; Denial and Behavioral Disengagement), D1-D2 (.22; Positive Reframing with Humor) and D1-D3 (.18; Positive Reframing and Acceptance). Last but not least, a positive association emerged between D1-B2 (.20; Positive Reframing with Planning), while a negative association emerged between B1-C4 (−.17; Active Coping with Behavioral Disengagement). A4 (Religion), C1 (Self-Distraction), C3 (Substance Use) and C5 (Self-Blame) were no longer associated with other nodes on coping. Of the 14 associations present within the network on coping only, 9 remained present in the current network, though exact partial correlations differ. Zooming in on nodes related to resilience, an interconnected network emerged, with positive associations within the higher-order clusters, with E1-E2 (.20; Social Support with Social Skills) and E3-E4 (.25; Planning with Goal Efficacy) and between the higher-order cluster, with E1-E3 (.17; Social Support with Planning) and E2-E4 (.23; Social Skills with Goal Efficacy). Of the 5 associations present within the network on resilience, 4 remained present in the current network, though exact partial correlations differ. Zooming in on edges connecting coping and resilience within our network, interesting associations between the two emerged. First off, a positive association emerged between A1-E1 (.18; Use of Emotional Support with Social Support), B1-E4 (Active Coping with Goal Efficacy) and B2-E3 (.18; Planning with Planning). Secondly, a negative association emerged between C5-E4 (−.24; Self-Blame with Goal Efficacy).

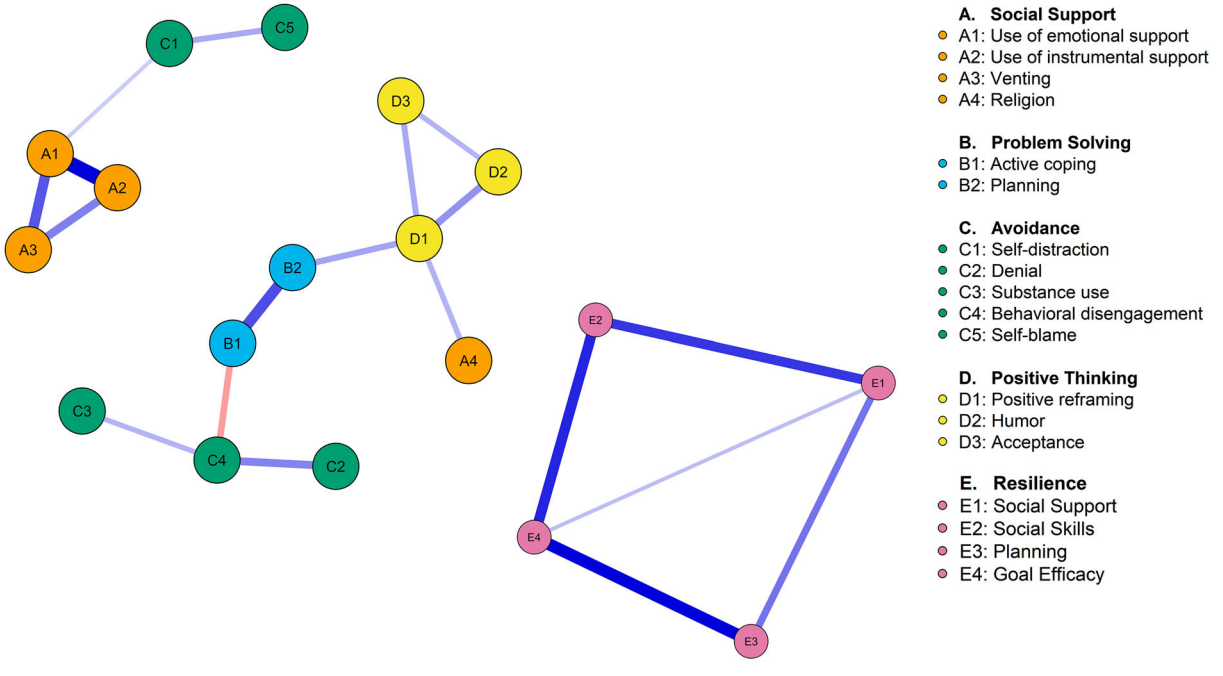

Figure 1. Estimated partial correlation networks of coping as measured by the Brief-COPE (A1 – D3, left panel) and resilience as measured by the SPF-24 (E1-E4, right panel). Blue lines represent positive associations, red lines represent negative associations and the thickness and brightness of an edge indicates the association strength. Absence of edges between nodes implies statistically independence or insufficient power to detect an association between these nodes (colour online).

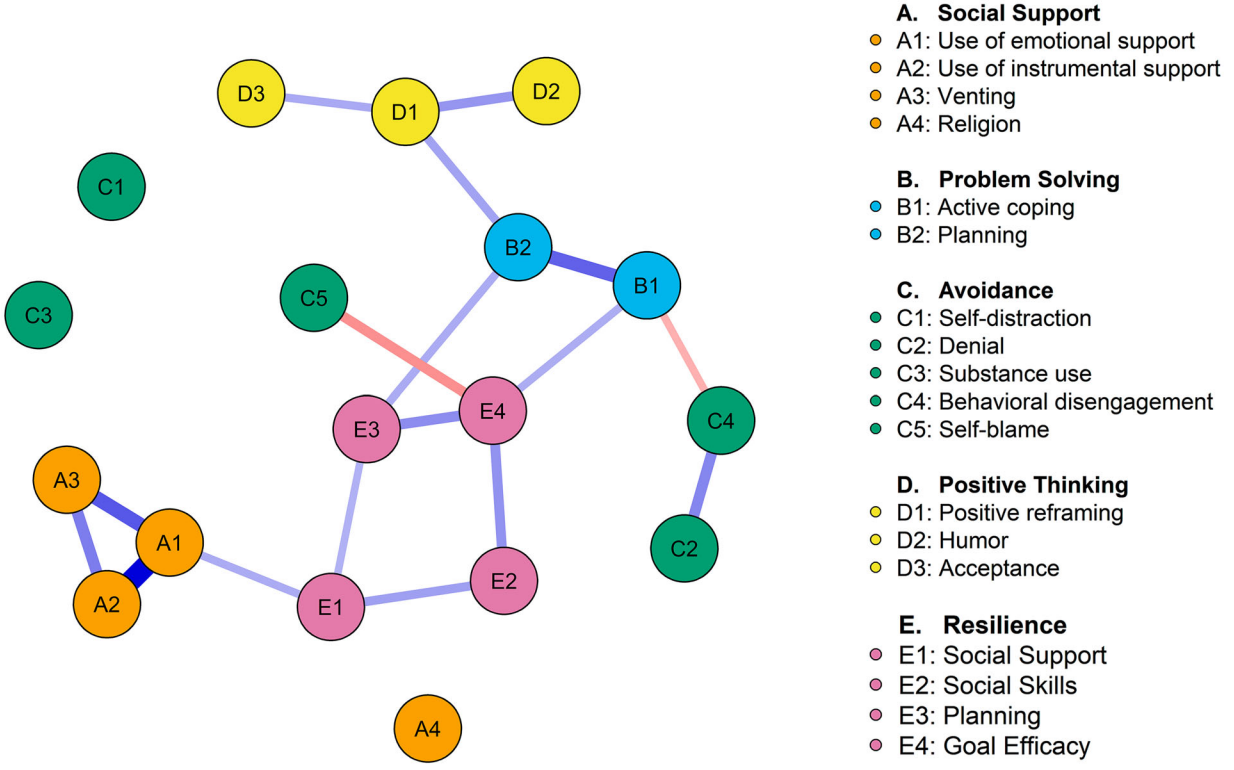

Figure 2. Estimated partial correlation network of coping as measured by the Brief-COPE (A1 – D3) and resilience as measured by the SPF-24 (E1-E4) as combined within one network. Blue lines represent positive associations, red lines represent negative associations and the thickness and brightness of an edge indicates the association strength. Absence of edges between nodes implies statistically independence or insufficient power to detect an association between these nodes (colour online).

(Bridge) centrality indices

To investigate the centrality of each node within the combined network node strength, node closeness and node betweenness were estimated. Visualizations of these three standardized centrality indices for the combined, estimated partial correlation network, are shown in Figure 3. Regarding node strength, the nodes with the highest node strength were A1 (Use of Emotional Support), A2 (Use of Instrumental Support) and E4 (Goal Efficacy), while node strength was lowest for A4 (Religion), C1 (Self-Distraction) and C3 (Substance Use). Nodes with high node strength are likely to interact with other nodes in the network, either because they (1) predict other nodes in the network, (2) are predicted by other nodes in the network or (3) predict and are predicted by other nodes in the network (Bringmann et al., 2019). Regarding node closeness, the nodes with the highest node closeness were E3 and B2 (Planning), B1 (Active Coping) and E4 (Goal Efficacy). Regarding node betweenness, the three nodes with the highest betweenness were B2 (Planning), B1 (Active Coping) and A1 (Use of Emotional Support). To investigate the bridge centrality of each nodes within the combined network, bridge strength, bridge expected influence 1-step, and bridge expected influence 2-step, were estimated. Visualizations of these three bridge centrality indices for the combined, estimated partial correlation network, are shown in Figure 4. Note, the underlying data is exactly the same as in the previous analysis, the only difference is that for an analysis on bridge centrality, the estimation process takes into account that certain nodes belong to one "community" whereas other nodes belong to a different "community", say coping and resilience. Across all indices, A1 (Use of Emotional Support), B1 (Active Coping), B2 (Planning) and C5 (Self-Blame) had the highest values of all nodes on coping, thus exerting the most *bridging* influence on resilience, whereas E1 (Social Support), E3 (Planning) and E4 (Goal Efficacy) had the highest values of all resilience nodes, thus exerting the most *bridging* influence on coping. Taken together, this would suggest that Use of Emotional Support, Social Support, Active Coping, Planning (B2 & E3), Self-Blame and Goal Efficacy are important in tackling coping and resilience, either directly or indirectly.

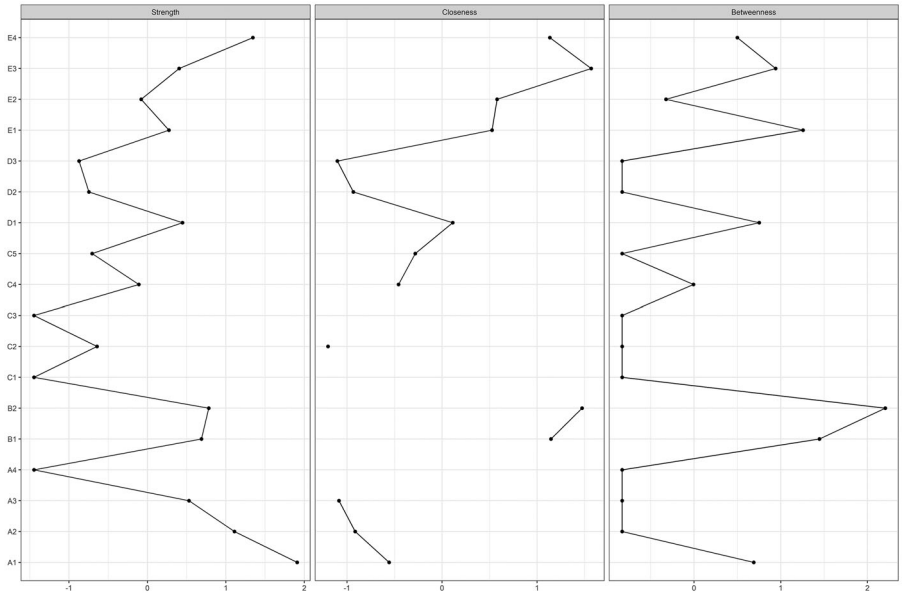

Figure 3. Centrality indices of node strength, closeness and betweenness of the estimated network. All indices are shown as standardized z-scores. See Figure 1 for the descriptions of the short codes.

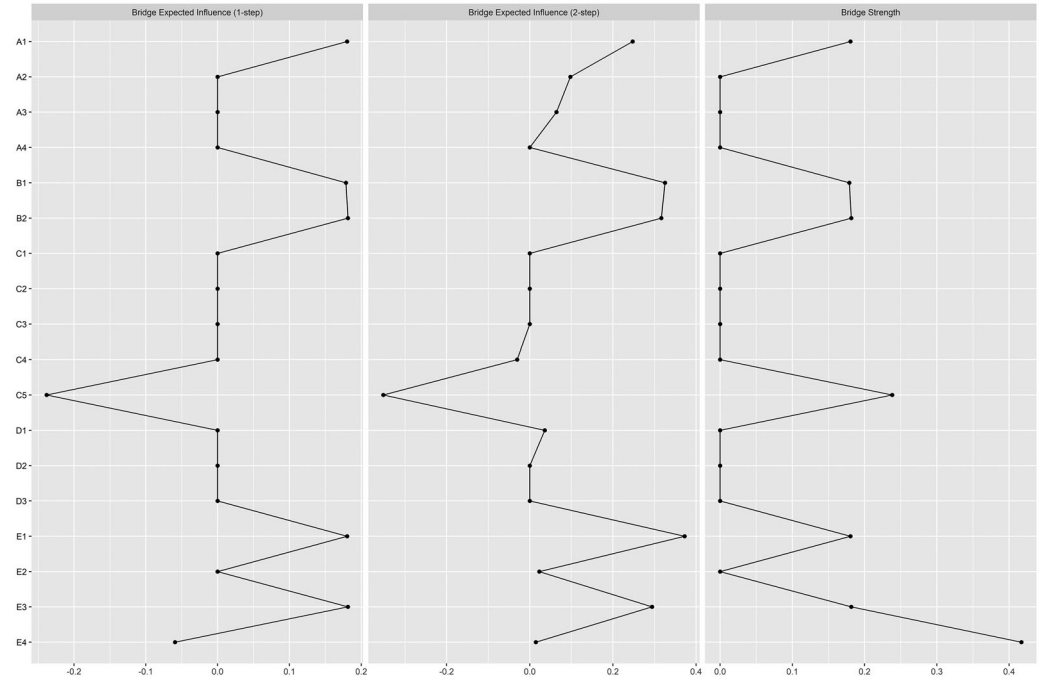

Figure 4. Bridge centrality indices of bridge expected influence (1-step), bridge expected influence (2-step) and bridge strength of the estimated network. All indices are shown as standardized z-scores. See Figure 1 for the descriptions of the short codes.

Network accuracy and stability

To investigate the accuracy of the combined estimated network, an edge weight bootstrap procedure was run on the 95% CIs around the edge weights. A visualization of the edge weight bootstrap procedure for network accuracy is shown in Figure 5 (top panel). Results show reasonably small bootstrapped CIs around most estimated edge-weights, indicative of high accuracy. The larger bootstrapped CI's imply that interpreting the order of those edges in the network should be done with care. To investigate the stability of the combined estimated network, a case-dropping subset bootstrap procedure was run in order to estimate the network model based on subsets of the data. A visualization of the case-dropping bootstrap procedure for node strength is shown in Figure 5 (bottom left panel). A visualization of the case-dropping bootstrap procedure for bridge strength and bridge expected influence is shown in Figure 5 (bottom right panel). Quantifying the network stability by evaluating the CS-coefficients, results of the case-dropping bootstrap suggest that node strength is the most stable centrality measure ($CS_{(cor = 0.7)} = 0.516$).

Discussion

Coping and resilience, how we deal with problems and difficulties and recover from misfortune or change, are two well-known, interrelated concepts within psychology. The present study investigated coping, resilience and their relationship using cross-sectional network analysis. First, the structure of coping, the structure of resilience and the relationship between coping and resilience were evaluated by estimating three partial correlation networks. Subsequently, the node and bridge centrality of each node within the combined network were evaluated. Finally, the accuracy and stability of the combined network were evaluated. Overall, results indicate clear associations both within and between coping and resilience, with 18 nodes connected by 17 (i.e., 15 positive and 2 negative) pairwise associations, suggesting coping and resilience are distinct, yet clearly related constructs. The Use

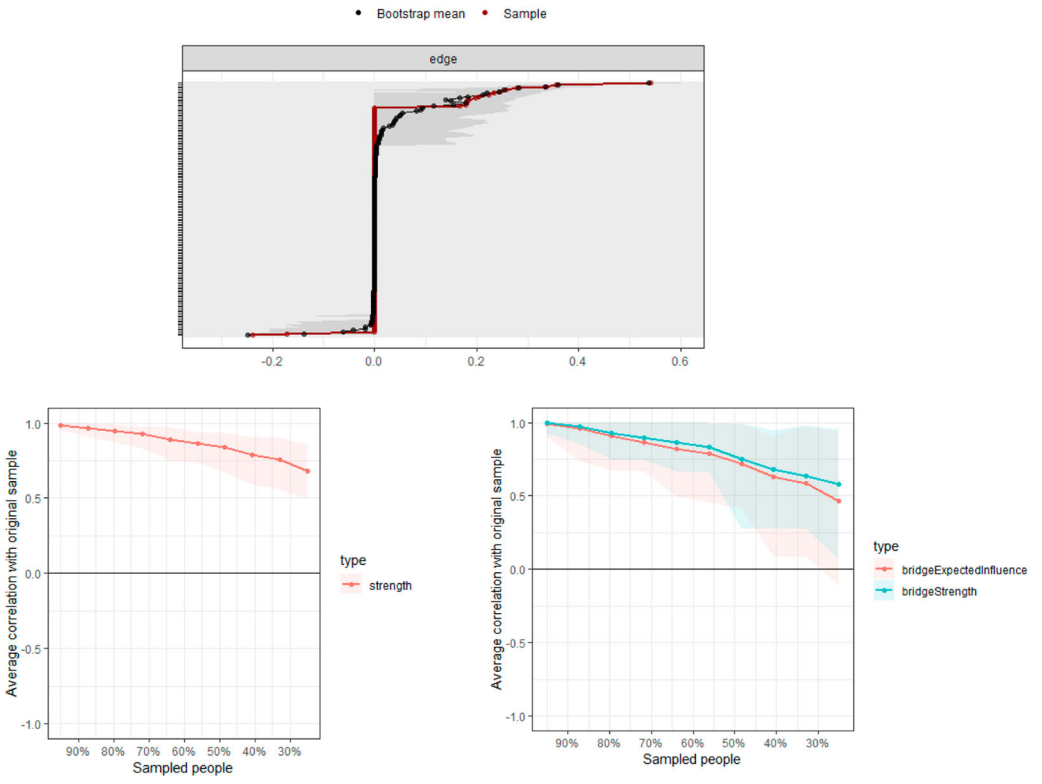

Figure 5. Bootstrapped confidence intervals of estimated edge-weights (top panel). Case-dropping bootstrap procedure for node strength (left panel) and bridge strength and bridge expected influence (right panel). Full line indicates the mean correlation while the colored area indicates the 2.5th quantile to the 97.5th quantile range (colour online).

of Emotional Support, Social Support, Active Coping, Planning, Self-Blame and Goal Efficacy proved important in affecting coping and resilience as combined within one network, either directly or indirectly.

Each their own

For the individual networks on coping and resilience, results showed (mostly) positive pairwise associations. In addition, results revealed interesting data patterns suggestive of the fact that, indeed, not all symptoms or aspects measured in these questionnaires are equally reflective of the latent construct that they aim to represent.

Regarding coping, network analysis revealed most coping styles are positively associated with each other, except for one negative association between Active Coping and Behavioral Disengagement (B1-C4). The Use of Emotional Support (A1), Use of Instrumental support (A2), Active Coping (B1) and Positive Reframing (D1) proved important in shaping the network. The four-factor structure as identified by Baumstarck et al. (2017), distinguishing between Social Support, Problem Solving, Avoidance and Positive Thinking, seemed to hold ground within the current network. Moreover, most nodes on Social Support, Problems Solving, Avoidance and Positive Thinking proved nicely clustered together, though Avoidance did present itself as two subclusters (C1-C5 vs C2-C3-C4) rather than one. So far, consensus regarding the number of main factors one needs for the Brief-COPE (as obtained through factor analysis) is lacking (e.g., Fillion et al., 2002; Litman, 2006; Litman & Lunsford, 2009; McLoughlin, 2019). Here, network analysis allows for a shift in focus from phenomena or large clusters to the individual coping styles and their associations. Religion (A4), hypothesized to be

part of the Social Support cluster (Baumstarck et al., 2017), found itself without any association to Social Support coping styles. Previous research has suggested that religion does not belong within a Social Support cluster, but that it represents such a valuable coping resource that it requires a separate assessment (e.g., RCOPE; Pargament et al., 2000). The reasoning behind RCOPE and other similar attempts is that the multifunctional nature of religion is often obscured in the coping literature as, when included in general coping measures, religion/spirituality is typically assessed by only one or two items (Lazarus & Folkman, 1984; Litman, 2006; Rosenstiel & Keefe, 1983) and its unique contribution is masked when embedded in broader factor-analytically derived dimensions (Pargament et al., 2000).

With regard to resilience, network analysis revealed resilience factors to be strongly positively associated with each other. Interestingly, nodes of the same cluster, i.e., associations within the interpersonal versus intrapersonal cluster (e.g., E1-E2 and E3-E4) were only as strong as associations between nodes of opposite clusters, i.e., associations between both clusters (e.g., E1-E3 and E2-E4). Factor analyses on the SPF-24 in the past have mostly been supportive of the 2×2 hierarchical design of the measure (Madewell & Ponce-Garcia, 2016; Ponce-Garcia et al., 2015). As such, it is easy to predict strong associations between one's social skills and their level of social support, as well as to what extent one is able to plan and (thus) demonstrate goal efficacy. It is less intuitive to predict strong associations between one's social skills and one's goal efficacy (Talkers make things "happen"?) or one's planning ability and level of social support (With a good network, a bad planner can still succeed?). Again, if this finding were to generalize to other samples, it could suggest that other higher-order clusters are called for or all four resilience factors are to stand on their own.

Bridging coping and resilience

Regarding the relationship between coping and resilience, network analysis reveals coping and resilience to be distinct, yet clearly related constructs. Visual inspection of the combined network shows that, while the subnetworks remain largely intact when combined, resilience is positioned at the heart of the coping network, with strong associations between the two. While it may seem obvious that the individual "subnetworks" would hold their shape, this is not to be expected per se, as the estimation procedure for generating the combined network does not take into account that certain nodes belong to distinct communities and any combination of two sets of data could yield large shifts within their original partial correlation matrix. Overall, the (Use of) Social Support (A1/E1), Active Coping (B1), Planning (B2/E3) and Goal Efficacy (E4) proved important bridge nodes, i.e., to hold great potential in affecting both coping and resilience, either directly or indirectly. Identification of such bridge nodes is an important strength of network analysis, as bridge nodes are hypothesized to drive co-morbidity between disorders or co-occurrence of psychological phenomena (Cramer et al., 2010), with activation of one network to spread to another network through these edges (without making any causal interferences or assumptions). Here, four interesting associations emerged: a positive association between the Use of Emotional Support and Social Support (A1-E1), between Active Coping and Goal Efficacy (B1-E4) and between the two nodes on Planning (B2-E3), and a negative association between Self-Blame and Goal Efficacy (C5-E4).

The association between the Use of Emotional Support (A1) as measured by the Brief-COPE and Social Support (E1) as measured by the SPF-24 may illustrate an important commonality between the two constructs. While causally indeterminate, the fact that seeking support from family or friends creates developmental opportunities that both serve to increase effective coping as well as strengthen the building blocks of one's resiliency, may hold interesting implications for clinical practice. The association between Active Coping (B1) as measured by the Brief-COPE and Goal Efficacy (E4) as measured by the SPF-24 might demonstrate that our (conscious or unconscious) choice to deal with things in an active manner is intertwined with our self-confidence and belief in the ability to perform certain tasks. In essence, self-efficacy is about our ability to do or to perform

and *not* about outcome expectancies (Bandura, 1982), i.e., those who belief they *can*, may feel confident enough to attempt active coping, regardless of any outcome expectancy. The more obvious association between Planning (B2) as measured by the Brief-COPE and Planning (E3) as measured by the SPF-24 is interesting enough as well. Important to note, it is not the case that both subscales measure the *same* thing. Planning (B2) as measured by the Brief-COPE is about what we do when we encounter difficulties and to what extent we plan our actions when in the midst of things (e.g., "I try to come up with a strategy about what to do."), whereas Planning (E3) as measured by the SPF-24 is about a general tendency to plan ahead and be self-organized (e.g., "I organize my time well"; "I set priorities before I start"). Thinking about implications for clinical practice, this association suggests that interventions aimed at planning and self-organization could create developmental opportunities which have positive implications for one's ability to cope as well as one's level of resiliency. Finally, the negative association between Self-Blame (C5) as measured by the Brief-COPE and Goal Efficacy (E4) as measured by the SPF-24 might suggest an internal attribution style for negative events (i.e., to self-blame when things go awry) to be negatively related to one's confidence or belief in one's ability (i.e., self- or goal-efficacy), and/or the other way around. This is in line with previous literature that suggests a self-serving attribution bias, i.e., internal attribution for positive events and external attribution for negative effects, is positively related to (over)confidence (Moosa & Ramiah, 2017). As such, interventions aimed at reducing self-blame and/or boosting self-confidence may have more than one positive consequence.

Taken together, the (Use of) Social Support (A1/E1), Active Coping (B1), Planning (B2/E3) and Goal Efficacy (E4) may prove important for future interventions as these aspects may hold great potential in affecting both coping and resilience, either directly or indirectly.

Implications and limitations

The current study has important implications for both researchers and clinicians. By investigating the structure of coping, resilience and their relationship and by identifying important bridge nodes, current findings allow for new insights into the structure of both constructs and their relationship. (Use of) Social Support (A1/E1), Active Coping (B1), Planning (B2/E3), Positive Reframing (D1) and Goal Efficacy (E4) proved important bridge nodes between the two subnetworks. As such, one could argue these nodes hold great potential with regard to new research as well as future intervention studies aiming to tackle coping and/or resilience in clients, as mentioned hereabove. However, three important remarks need to be considered.

First, network studies based on cross-sectional data instead of time-series data, like the current study, are exploratory in nature. By estimating partial correlation networks and calculating centrality indices, cross-sectional networks may generate important insights into the concepts of investigation and generate hypotheses about directed, causal or predictive relationships between different nodes (Epskamp et al., 2018b). For nodes like the (Use of) Social Support (A1/E1), Active Coping (B1), Planning (B2/E3), and Goal Efficacy (E4) one could hypothesize that intervening directly onto them could speed up intervention/recovery by partially breaking down or improving interaction within the network. As such, these nodes may hold great potential with regard to future intervention. However, actual time-series data research is needed in order to investigate and/or detect the actual direction of any causal relationship or distinguish between direct and indirect influence. It is possible that these bridge nodes identified in relation to coping and resilience, constitute ideal targets for intervention. However, it is also possible that these nodes simply *appear* to be key, not because they have high predicting power, but because they are predicted by many other nodes in the network or that feedback loops within the network lead to (re-)activation of central nodes as soon as they have been targeted in therapy (Fried et al., 2018).

Secondly, network studies based on cross-sectional data tend to result in networks of aggregated data rather than person-specific network models. While working with a large data set and using aggregated data to estimate a network is considered good practice in terms of increasing stability

and replicability of the estimated network, information on potential important individual differences can get lost in the process. Recent developments in the field have highlighted to the usefulness of person-specific network models, as some nodes could show potential causal influence in an aggregated data network, but in individualized network prove to have no predictive influence over any other node (or associations), rendering generic intervention ineffective (for an example, see Fisher et al., 2017). While many individuals coping and/or resilience networks may exist, cross-sectional group-level analysis cannot reveal that potential heterogeneity (Fried & Cramer, 2017).

Thirdly, the current study assessed coping and resilience in a typically developing, non-clinical sample using a self-administered, online questionnaire. As a result, the current sample and corresponding estimated networks, may not be representative of coping and resilience for a population with (sub)clinical psychopathology and/or capture less of the heterogeneity than what may surface with a more heterogeneous sample, as it is possible that at times of great distress, illness or pathology, networks of coping styles or resilience may behave quite differently, with different (bridge) centrality nodes at the foreground. Ideally, current estimations are repeated in the future with the inclusion of (longitudinal data) on one or more clinical samples.

In sum, while network analysis based on cross-sectional, non-clinical data is an imperative first step, it is important to replicate the current findings and to follow-up on these findings using time-series data, person-specific network models and clinical samples to investigate potential causal relationships within the network and improve the applicability of these findings for future intervention studies.

Conclusion

The current study investigated coping as measured by the Brief-COPE, resilience as measured by the SPF-24, and the relationship between coping and resilience using cross-sectional network analysis. First, results for coping and resilience separately, show strong, mostly positive associations, both within and between different cluster of coping and different higher-order resilience factors. Secondly, results for our combined network indicate that coping and resilience are distinct, yet clearly related constructs and are likely to influence each other. Overall, the Use of Social Support, Active Coping, Planning and Goal Efficacy were identified as important nodes in bridging coping and resilience. For future research, it is important to replicate the current findings and to follow-up on this line of investigation using time-series data, person-specific network models and clinical samples.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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References

Ahern, N. R., Kiehl, E. M., Sole, M. L., & Byers, J. (2006). A review of instruments measuring resilience. *Issues in Comprehensive Pediatric Nursing*, *29*(2), 103–125. https://doi.org/10.1080/01460860600677643

Armour, C., Fried, E. I., Deserno, M. K., Tsai, J., & Pietrzak, R. H. (2017). A network analysis of DSM-5 posttraumatic stress disorder symptoms and correlates in U.S. military veterans. *Journal of Anxiety Disorders*, *45*, 49–59. https://doi.org/10.1016/j.janxdis.2016.11.008

Ayers, T. S., Sandler, I. N., West, S. G., & Roosa, M. W. (1996). A dispositional and situational assessment of children's coping: Testing alternative models of coping. *Journal of Personality*, *64*(4), 923–958. https://doi.org/10.1111/j.1467-6494.1996.tb00949.x

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist*, *37*(2), 122–147. https://doi.org/10.1037/0003-066X.37.2.122

Baumstarck, K., Alessandrini, M., Hamidou, Z., Auquier, P., Leroy, T., & Boyer, L. (2017). Assessment. *Health and Quality of Life Outcomes*, *15*, 8. https://doi.org/10.1186/s12955-016-0581-9

Beard, C., Millner, A. J., Forgeard, M. J. C., Fried, E. I., Hsu, K. J., Treadway, M. T., Leonard, C. V., Kertz, S. J., & Björgvinsson, T. (2016). Network analysis of depression and anxiety symptom relationships in a psychiatric sample. *Psychological Medicine*, *46*(16), 3359–3369. https://doi.org/10.1017/S0033291716002300

Beckwith, S., Dickinson, A., & Kendall, S. (2008). The "con" of concept analysis A discussion paper which explores and critiques the ontological focus, reliability and antecedents of concept analysis frameworks. *International Journal of Nursing Studies*, *45*(12), 1831–1841. https://doi.org/10.1016/j.ijnurstu.2008.06.011

Block, J., & Kremen, A. M. (1996). IQ and ego-resiliency: Conceptual and empirical connections and separateness. *Journal of Personality and Social Psychology*, *70*(2), 349–361. https://doi.org/10.1037/0022-3514.70.2.349

Borsboom, D. (2008). Psychometric perspectives on diagnostic systems. *Journal of Clinical Psychology*, *64*(9), 1089–1108. https://doi.org/10.1002/jclp.20503

Borsboom, D., Cramer, A. O. J., Schmittmann, V. D., Epskamp, S., & Waldorp, L. J. (2011). The small world of psychopathology. *PloS One*, *6*(11), e27407. https://doi.org/10.1371/journal.pone.0027407

Bringmann, L. F., Elmer, T., Epskamp, S., Krause, R. W., Schoch, D., Wichers, M., Wigman, J. T. W., & Snippe, E. (2019). What do centrality measures measure in psychological networks? *Journal of Abnormal Psychology*, *128*(8), 892–903. https://doi.org/10.1037/abn0000446

Carver, C. S. (1997). You want to measure coping but your protocol's too long: Consider the brief COPE. *International Journal of Behavioral Medicine*, *4*(1), 92–100. https://doi.org/10.1207/s15327558ijbm0401_6

Carver, C. S., & Connor-Smith, J. K. (2010). Personality and coping. *Annual Review of Psychology*, *61*(1), 679–704. https://doi.org/10.1146/annurev.psych.093008.100352

Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology*, *56*(2), 267–283. https://doi.org/10.1037//0022-3514.56.2.267

Compas, B. E., Connor-Smith, J. K., Saltzman, H., Thomsen, A. H., & Wadsworth, M. E. (2001). Coping with stress during childhood and adolescence: Problems, progress, and potential in theory and research. *Psychological Bulletin*, *127*(1), 87–127. https://doi-org.eur.idm.oclc.org/10.1037/0033-2909.127.1.87

Connor-Smith, J. K., Compas, B. E., Wadsworth, M. E., Thomsen, A. H., & Saltzman, H. (2000). Responses to stress in adolescence: Measurement of coping and involuntary stress responses. *Journal of Consulting and Clinical Psychology*, *68*(6), 976–992. https://doi-org.eur.idm.oclc.org/10.1037/0033-2909.127.1.87

Connor, K. M., & Davidson, J. R. T. (2003). Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). *Depression and Anxiety*, *18*(2), 76–82. https://doi.org/10.1002/da.10113

Cooper, C., Katona, C., & Livingston, G. (2008). Validity and reliability of the brief COPE in carers of people with dementia: The LASER-AD Study. *The Journal of Nervous and Mental Disease*, *196*(11), 838–843. https://doi.org/10.1097/NMD.0b013e31818b504c

Cramer, A. O. J., Waldorp, L. J., van der Maas, H. L. J., & Borsboom, D. (2010). Comorbidity: A network perspective. *Behavioral and Brain Sciences*, *33*(2–3), 137–150. https://doi.org/10.1017/S0140525X09991567

Davey, M., Eaker, D. G., & Walters, L. H. (2003). Resilience processes in adolescents: Personality profiles, self-worth, and coping. *Journal of Adolescent Research*, *18*(4), 347–362. https://doi.org/10.1177/0743558403018004002

De Beurs, D., Fried, E. I., Wetherall, K., Cleare, S., Connor, O', B, D., Ferguson, E., O'Carroll, R. E., & O' Connor, R. C. (2019). Exploring the psychology of suicidal ideation: A theory driven network analysis. *Behaviour Research and Therapy*, *120*, 103419. https://doi.org/10.1016/j.brat.2019.103419

Dell'Osso, L., & Pini, S. (2012). What did we learn from research on comorbidity in psychiatry? Advantages and Limitations in the Forthcoming DSM-V Era. *Clinical Practice and Epidemiology in Mental Health : CP & EMH*, *8*, 180–184. https://doi.org/10.2174/1745017901208010180

Endler, N. S., & Parker, J. D. A. (1990). *Coping inventory for stressful situations (CISS): Manual*. Multi-Health Systems.

Epskamp, S. (2017). *Network psychometrics*. https://dare.uva.nl/search?identifier=a76273c6-6abc-4cc7-a2e9-3b5f1ae3c29e.

Epskamp, S., Borsboom, D., & Fried, E. I. (2018a). Estimating psychological networks and their accuracy: A tutorial paper. *Behavior Research Methods*, *50*(1), 195–212. https://doi.org/10.3758/s13428-017-0862-1

Epskamp, S., Waldorp, L. J., Mõttus, R., & Borsboom, D. (2018b). The Gaussian graphical model in cross-sectional and time-series data. *Multivariate Behavioral Research*, *53*(4), 453–480. https://doi.org/10.1080/00273171.2018.1454823

Felsten, G. (1998). Gender and coping: Use of distinct strategies and associations with stress and depression. *Anxiety, Stress, & Coping*, *11*(4), 289–309. https://doi.org/10.1080/10615809808248316

Fergus, S., & Zimmerman, M. A. (2005). Adolescent resilience: A framework for understanding healthy development in the face of risk. *Annual Review of Public Health*, *26*, 399–419. https://doi.org/10.1146/annurev.publhealth.26.021304.144357

Fillion, L., Kovacs, A. H., Gagnon, P., & Endler, N. S. (2002). Validation of the shortened cope for use with breast cancer patients undergoing radiation therapy. *Current Psychology*, *21*(1), 17–34. https://doi.org/10.1007/BF02903157

Fisher, A. J., Reeves, J. W., Lawyer, G., Medaglia, J. D., & Rubel, J. A. (2017). Exploring the idiographic dynamics of mood and anxiety via network analysis. *Journal of Abnormal Psychology*, *126*(8), 1044–1056. https://doi.org/10.1037/abn0000311

Folkman, S., & Lazarus, R. S. (1988). *Manual for the ways of coping questionnaire*. Consulting Psychologists Press.

Friborg, O., Hjemdal, O., Rosenvinge, J. H., & Martinussen, M. (2003). A new rating scale for adult resilience: What are the central protective resources behind healthy adjustment? *International Journal of Methods in Psychiatric Research*, *12*(2), 65–76. https://doi.org/10.1002/mpr.143

Fried, E. I. (2015). Problematic assumptions have slowed down depression research: Why symptoms, not syndromes are the way forward. *Frontiers in Psychology*, *6*, 309. https://doi.org/10.3389/fpsyg.2015.00309

Fried, E. I. (2017). The 52 symptoms of major depression: Lack of content overlap among seven common depression scales. *Journal of Affective Disorders*, *208*, 191–197. https://doi.org/10.1016/j.jad.2016.10.019

Fried, E. I., & Cramer, A. O. J. (2017). Moving forward: Challenges and directions for psychopathological network theory and methodology. *Perspectives on Psychological Science: A Journal of the Association for Psychological Science*, *12*(6), 999–1020. https://doi.org/10.1177/1745691617705892

Fried, E. I., Eidhof, M. B., Palic, S., Costantini, G., Huisman-van Dijk, H. M., Bockting, C. L. H., Engelhard, I., Armour, C., Nielsen, A. B. S., & Karstoft, K.-I. (2018). Replicability and generalizability of posttraumatic stress disorder (PTSD) networks: A cross-cultural multisite study of PTSD symptoms in four trauma patient samples. *Clinical Psychological Science*, *6*(3), 335–351. https://doi.org/10.1177/2167702617745092

Fritz, J., Fried, E. I., Goodyer, I. M., Wilkinson, P. O., & van Harmelen, A.-L. (2018). A network model of resilience factors for adolescents with and without exposure to childhood adversity. *Scientific Reports*, *8*(1), 15774. https://doi.org/10.1038/s41598-018-34130-2

Fruchterman, T. M. J., & Reingold, E. M. (1991). Graph drawing by force-directed placement. *Software: Practice and Experience*, *21*(11), 1129–1164. https://doi.org/10.1002/spe.4380211102

Garcia, F. E., Barraza-Pena, C. G., Wlodarczyk, A., Alvear-Carrasco, M., & Reyes-Reyes, A. (2018). Psychometric properties of the Brief-COPE for the evaluation of coping strategies in the Chilean population. *Psicologia, Reflexao e Critica : Revista Semestral Do Departamento de Psicologia Da UFRGS*, *31*(1), 22. https://doi.org/10.1186/s41155-018-0102-3

Gloria, C. T., & Steinhardt, M. A. (2016). Relationships among positive emotions, coping, resilience and mental health. *Stress and Health*, *32*(2), 145–156. https://doi.org/10.1002/smi.2589

Greve, W., & Staudinger, U. M. (2006). Resilience in later adulthood and old age: Resources and potentials for successful aging. In D. Cichetti & D. J. Cohen (Eds.), *Developmental psychopathology: Risk, disorder, and adaptation* (pp. 796–840). John Wiley & Sons Inc.

Ingram, R. E., & Price, J. M. (2010). Understanding psychopathology: The role of vulnerability. In R. E. Ingram & J. M. Price (Eds.), *Vulnerability to psychopathology: Risk across the lifespan* (pp. 3–17). Guilford Press.

Jones, P., Ma, R., & McNally, R. (2019). Bridge centrality: A network approach to understanding comorbidity. *Multivariate Behavioral Research*, 1–15. https://doi.org/10.1080/00273171.2019.1614898

Kato, T. (2015). Frequently used coping scales: A meta-analysis. *Stress and Health: Journal of the International Society for the Investigation of Stress*, *31*(4), 315–323. https://doi.org/10.1002/smi.2557

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer Publishing Company.

Leipold, B., & Greve, W. (2009). Resilience. *European Psychologist*, *14*(1), 40–50. https://doi.org/10.1027/1016-9040.14.1.40

Litman, J. A. (2006). The COPE inventory: Dimensionality and relationships with approach- and avoidance-motives and positive and negative traits. *Personality and Individual Differences*, *41*(2), 273–284. https://doi.org/10.1016/j.paid.2005.11.032

Litman, J. A., & Lunsford, G. D. (2009). Frequency of use and impact of coping strategies assessed by the COPE Inventory and their relationships to post-event health and well-being. *Journal of Health Psychology*, *14*(7), 982–991. https://doi.org/10.1177/1359105309341207

Lyne, K., & Roger, D. (2000). A psychometric re-assessment of the COPE questionnaire. *Personality and Individual Differences*, *29*(2), 321–335. https://doi.org/10.1016/S0191-8869(99)00196-8

Madewell, A. N., & Ponce-Garcia, E. (2016). Assessing resilience in emerging adulthood: The Resilience Scale (RS), Connor–Davidson Resilience Scale (CD-RISC), and Scale of Protective Factors (SPF). *Personality and Individual Differences*, *97*, 249–255. https://doi.org/10.1016/j.paid.2016.03.036

Masten, A. S. (2001). Ordinary magic: Resilience processes in development. *American Psychologist*, *56*(3), 227–238. https://doi.org/10.1037/0003-066X.56.3.227

Masten, A. S. (2007). Resilience in developing systems: Progress and promise as the fourth wave rises. *Development and Psychopathology*, *19*(3), 921–930. https://doi.org/10.1017/S0954579407000442

Masten, A. S., Cutuli, J. J., Herbers, J. E., & Reed, M.–G. J. (2009). Resilience in development. In *Oxford handbook of positive psychology* (2nd ed., pp. 117–131). Oxford University Press.

Maul, S., Giegling, I., Fabbri, C., Corponi, F., Serretti, A., & Rujescu, D. (2020). Genetics of resilience: Implications from genome-wide association studies and candidate genes of the stress response system in posttraumatic stress disorder and depression. *American Journal of Medical Genetics Part B: Neuropsychiatric Genetics*, *183*(2), 77–94. https://doi.org/10.1002/ajmg.b.32763

McLoughlin, L. T. (2019). Understanding and measuring coping with cyberbullying in adolescents: Exploratory factor analysis of the brief coping orientation to problems experienced inventory. *Current Psychology*. https://doi.org/10.1007/s12144-019-00378-8

Moosa, I. A., & Ramiah, V. (2017). Overconfidence and self-serving bias. In I. A. Moosa, & V. Ramiah (Eds.), *The Financial consequences of behavioural biases: An analysis of bias in corporate finance and financial planning* (pp. 45–69). Springer International Publishing. https://doi.org/10.1007/978-3-319-69389-7_3

Opsahl, T., Agneessens, F., & Skvoretz, J. (2010). Node centrality in weighted networks: Generalizing degree and shortest paths. *Social Networks*, *32*(3), 245–251. https://doi.org/10.1016/j.socnet.2010.03.006

Pargament, K. I., Koenig, H. G., & Perez, L. M. (2000). The many methods of religious coping: Development and initial validation of the RCOPE. *Journal of Clinical Psychology*, *56*(4), 519–543. https://doi.org/10.1002/(sici)1097-4679(200004)56:4<519::aid-jclp6>3.0.co;2-1

Ponce-Garcia, E., Madewell, A. N., & Kennison, S. M. (2015). The development of the scale of protective factors: Resilience in a violent trauma sample. *Violence and Victims*, *30*(5), 735–755. https://doi.org/10.1891/0886-6708.VV-D-14-00163

Rice, V., & Liu, B. (2016a). Personal resilience and coping with implications for work. Part I: A review. *Work (Reading, MA)*, *54*(2), 325–333. https://doi.org/10.3233/WOR-162300

Rice, V., & Liu, B. (2016b). Personal resilience and coping part II: Identifying resilience and coping among U.S. Military service members and veterans with implications for work. *Work (Reading, MA)*, *54*(2), 335–350. https://doi.org/10.3233/WOR-162301

Rosenstiel, A. K., & Keefe, F. J. (1983). The use of coping strategies in chronic low back pain patients: Relationship to patient characteristics and current adjustment. *Pain*, *17*(1), 33–44. https://doi.org/10.1016/0304-3959(83)90125-2

Roth, S., & Cohen, L. J. (1986). Approach, avoidance, and coping with stress. *American Psychologist*, *41*(7), 813–819. https://doi.org/10.1037/0003-066X.41.7.813

Skinner, E. A., Edge, K., Altman, J., & Sherwood, H. (2003). Searching for the structure of coping: A review and critique of category systems for classifying ways of coping. *Psychological Bulletin*, *129*(2), 216–269. https://doi.org/10.1037/0033-2909.129.2.216

Smith, B. W., Dalen, J., Wiggins, K., Tooley, E., Christopher, P., & Bernard, J. (2008). The brief resilience scale: Assessing the ability to bounce back. *International Journal of Behavioral Medicine*, *15*(3), 194–200. https://doi.org/10.1080/10705500802222972

Tamres, L. K., Janicki, D., & Helgeson, V. S. (2002). Sex differences in coping behavior: A meta-analytic review and an examination of relative coping. *Personality and Social Psychology Review*, *6*(1), 2–30. https://doi.org/10.1207/S15327957PSPR0601_1

Tibshirani, R. (1996). Regression shrinkage and selection via the lasso. *Journal of the Royal Statistical Society: Series B (Methodological)*, *58*(1), 267–288. https://doi.org/10.1111/j.2517-6161.1996.tb02080.x

van IJzendoorn, M. H., Palacios, J., Sonuga-Barke, E. J. S., Gunnar, M. R., Vorria, P., McCall, R. B., LeMare, L., Bakermans-Kranenburg, M. J., Dobrova-Krol, N. A., & Juffer, F. (2011). Children in institutional care: Delayed development and resilience. *Monographs of the Society for Research in Child Development*, *76*(4), 8–30. https://doi.org/10.1111/j.1540-5834.2011.00626.x

Wagnild, G. M., & Young, H. M. (1993). Development and psychometric evaluation of the resilience Scale. *Journal of Nursing Measurement*, *1*(2), 165–178. Scopus.

Walsh, W. A., Dawson, J., & Mattingly, M. J. (2010). How are we measuring resilience following childhood maltreatment? Is the research adequate and consistent? What is the impact on research, practice, and policy? *Trauma, Violence & Abuse*, *11*(1), 27–41. https://doi.org/10.1177/1524838009358892

Windle, G. (2011). What is resilience? A review and concept analysis. *Reviews in Clinical Gerontology*, *21*(2), 152–169. https://doi.org/10.1017/S0959259810000420

Windle, G., Bennett, K. M., & Noyes, J. (2011). A methodological review of resilience measurement scales. *Health and Quality of Life Outcomes*, *9*(1), 8. https://doi.org/10.1186/1477-7525-9-8

Wright, M. O., Masten, A. S., & Narayan, A. J. (2013). Resilience processes in development: Four waves of research on positive adaptation in the context of adversity. In S. Goldstein & R. B. Brooks (Eds.), *Handbook of resilience in children* (pp. 15–37). Springer Science + Business Media. https://doi-org.eur.idm.oclc.org/10.1007/978-1-4614-3661-4_2

Wu, G., Feder, A., Cohen, H., Kim, J. J., Calderon, S., Charney, D. S., & Mathé, A. A. (2013). Understanding resilience. *Frontiers in Behavioral Neuroscience*, *7*, 10. https://doi.org/10.3389/fnbeh.2013.00010