ORIGINAL ARTICLE

A Network Analysis Approach to Understanding the Relationship Between Childhood Trauma and Wellbeing Later in Life

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Abstract
Though childhood maltreatment negatively affects later in life functioning, current interventions do little to mitigate this impact. This ineffectiveness may be exacerbated by deficit-focused models which focus primarily on mental illness, ignoring other indicators of healthy functioning. This paper presents two studies that examine the relationships between childhood maltreatment and later in life functioning, including indicators of mental illness and mental health. In Study 1, network analysis was used as an exploratory tool to examine how childhood maltreatment relates to later in life wellbeing. Study 2 used a different sample of adults to provide a confirmatory test of the network obtained in Study 1 given remaining concerns about the replicability of networks from network analysis. Study 1 included a subset of participants from the Midlife Development in the United States Study 2 (MIDUS 2) Biomarker Project 4, 2004–2009. Study 2 included individuals from the MIDUS Refresher Biomarker Project 4, 2012–2016. Network comparison tests demonstrated that the networks generally replicated as they did not significantly vary in structure, global strength, or measures of strength centrality. In both studies, emotional forms of maltreatment (i.e., emotional abuse, emotional neglect) emerged as particularly influential in the networks. Childhood maltreatment impacts the ability to thrive in adulthood, beyond its impact on diagnosable mental illness, and also affects positive functioning. A stronger focus on emotional abuse and emotional neglect is warranted within maltreatment intervention and education initiatives, as is an emphasis on the impact of maltreatment on positive functioning in adulthood.

Introduction

Maltreatment during childhood is a common experience for many children. Maltreatment can include abuse (emotional, physical, and sexual) and neglect (emotional and physical) [1]. The extant literature demonstrates that experiencing maltreatment often results in multiple negative outcomes later in life, such as mental illness and poorer physical health [2–4]. Unfortunately, our current interventions are often ineffective at mitigating negative later in life outcomes related to abuse and neglect [5, 6]. These interventions rarely highlight targets that disrupt the system, indicating that we lack a clear understanding of the intricacies of the relationship system.

Given the complexities of assessing childhood maltreatment, including its multiple dimensions, and understanding its impact on functioning, which can also be represented in a variety of manners, researchers are increasingly turning towards alternative analytic strategies, such as network analysis (NA), that can explore these multiple relationships. Like linear regression and latent variable models (e.g., structural equation models [SEM]), NA can examine the directionality and strength of relationships within a model, but within NA, these relationships are not bound by predetermined predictor and criterion variables or by latent versus manifest variables. Instead, analysts can examine all possible pairwise relationships between variables and constructs simultaneously to determine their independent associations. Further, NA has several indices that quantify the importance of particular variables within the network as the variable relates to others of its kind (i.e., same construct) and/or of different kinds (i.e., different construct) that can help identify potential points for intervention. Lastly, NA provides a visual representation

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of all of the relationships that emerge and can be useful in exploring structures between variables and constructs that may not be easily identified in the raw data [7, 8].

Network analyses have recently begun to be used in psychological research [9–11], but few have been conducted in the realm of childhood abuse. In fact, to our knowledge, only one Network Analysis on childhood maltreatment has been published. Breuer and colleagues focused on the relationship between adverse childhood experiences and DSM-IV diagnoses, finding that in the presence of multiple adverse childhood experiences, only childhood sexual abuse was related to mental health disorders in adulthood [5]. While this is a worthwhile exploration, a sole focus on diagnosable mental illnesses as an outcome is limiting for multiple reasons. An individual not meeting criteria for a DSM diagnosis does not indicate that they are thriving [12, 13]. This narrow, deficit-based model, while commonly utilized in the literature, entirely ignores indicators of positive functioning, such as gratitude, positive affect, and satisfaction with life, that form the basis for mental health.

Furthermore, this sole focus on mental illness likely contributes to the ineffectiveness of current interventions by limiting our understanding of functioning in adult childhood maltreatment survivors. One model, the theory of wellbeing, integrates both mental illness (depression, anxiety) and mental health (positive affect, gratitude, and satisfaction with life) [12, 13]. A model which incorporates these two separate, albeit often highly correlated, continuums (mental health and mental illness) captures functioning in a way that up until this point has been largely ignored. With a clearer understanding of how different forms of maltreatment affect the ability to thrive in adulthood, potential targets for disrupting said relationships will likely emerge, allowing for the creation of more effective interventions.

The present paper is comprised of two studies, each of which uses Network Analysis to examine relationships between experiences of different forms of childhood maltreatment (i.e., emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect) and wellbeing (depression symptoms, anxiety symptoms, satisfaction with life, positive affect, and gratitude) in middle adulthood in a large sample of United States adults. Study 1 is exploratory in nature, while Study 2 is used as a confirmatory measure of Study 1's findings, addressing concerns about replicability of networks within psychological science [14, 15]. Because of the exploratory nature of Study 1, we made no specific hypotheses about the nature of the relationships within the network analysis, or about which nodes (i.e., variables) would emerge as most central or most influential, though we expected that childhood maltreatment would generally be associated with worse wellbeing (i.e., greater mental illness, lower mental health).

Study 1: Exploratory Analysis Methods

Participants

Participants were from the Midlife Development in the United States Study 2 (MIDUS 2) Biomarker Project 4, 2004–2009 (ICPSR 29282), a subsample of the main MIDUS 2 study. The MIDUS 2 study is a longitudinal study of health and aging in the U.S., while the Biomarker Project within it collected data on a series of biological and psychosocial markers [16]. Study 1 participants included 1239 English-speaking adults with a mean age of 54.55 ($SD = 11.73$) years, of whom 56.5% were female. For more details on recruitment, consent/assent and data collection methods see the following: http://www.midus.wisc.edu/scopeofstudy.php#History.

Measures and Procedures

Wellbeing Measures

Wellbeing was measured cross-sectionally at baseline via self-report and focused on indicators of mental illness and of mental health. All indicators of wellbeing were assessed by having participants rate each question based on their experiences over the previous week.

Mental Illness Anxiety symptoms were measured using the 11-item "general distress due to anxious symptoms" subscale of the Mood and Symptoms Questionnaire (MASQ-A) [17, 18]. Reliability for this subscale was acceptable ($\alpha = 0.81$). Depression symptoms were measured using an overall composite score of the 20-item Center for Epidemiological Studies Depression Inventory (CESD) [19–21]. Reliability for this subscale was also acceptable ($\alpha = 0.89$).

Mental Health Other indicators of wellbeing beyond mental health disorders included positive affect, satisfaction with life and gratitude. Positive affect was assessed via a 14-item subscale of the MASQ [17, 18]. Reliability for this subscale was acceptable ($\alpha = 0.93$). Subscales of the Subjective-Wellbeing Scale (SWS) were used to measure satisfaction with life (5-items), and gratitude (2-items) [22]. Reliability for each subscale was acceptable ($\alpha = 0.88$, $\rho = 0.72$, respectively).

Childhood Maltreatment Measures

History of childhood maltreatment was measured retrospectively and cross-sectionally at baseline via self-report using the Childhood Trauma Questionnaire (CTQ) [23].

Participants were asked 25 questions to assess various forms of negative childhood experiences (ages 0–17), including emotional abuse, physical abuse, sexual abuse, emotional neglect, and physical neglect. For example, participants responded to items such as: "I didn't have enough to eat," "I was punished with a belt, a board, a cord, or some other hard object," or "Someone tried to make me do sexual things or watch sexual things." Participants rated each item on a Likert-type scale ranging from 1 "never true" to 5 "very often true." The five items assessing each form of childhood maltreatment were then summed and presented as a composite score in which higher scores represent greater severity of each form of maltreatment. Participants received composite scores for each type of maltreatment. Reliability for each subscale was acceptable, though lowest for the physical neglect subscale ($\alpha = 0.88$, 0.80, 0.94, 0.70, respectively).

Data Analytic Procedure

Glasso Networks

A network was modeled that included all measures of wellbeing and childhood maltreatment. The network was analyzed in R (Version 3.6.3) using the *glasso* function in the *qgraph* package, which relied on a partial Pearson correlation matrix to estimate the relationships between each variable included in the model. A least absolute shrinkage and selection operation (LASSO) was used to retain the most parsimonious network by reducing all weak partial correlations between measures to an absolute zero, thus reducing the number of "false positive" edges [8]. The suggested tuning parameter of 0.25 was used to achieve the most parsimonious model [8].

Within network models, each node represents an individual variable. "Edge weights" depict the strength and directionality (i.e., positive or negative) of the relationship between pairs of nodes, while statistically controlling for all other associations within the network. Using the *centralityPlot* function in the *qgraph* package [24] "node centrality," an indicator of a particular variable's (node) relative importance within the network, was calculated. Node "strength," or how strongly a node is <u>directly</u> connected to other nodes based on the sum of the weighted number and magnitude of direct connections, was used to assess centrality [25]. Although other measures of centrality exist (i.e., closeness, betweenness), we examined only node strength, as recent literature has questioned the utility and emphasis of these other centrality measures in psychological networks, identifying that they may not be as beneficial to psychological networks as their social network counterparts [7, 26].

Bridge Nodes

Bridge nodes are nodes that serve as potential links between broader communities of nodes. Given the nature of the constructs in the present network model, we conceptualized two communities of nodes a priori: (1) childhood maltreatment and (2) wellbeing. The *bridge* function of the *networktools* package [27], was used to calculate bridge strength and identify potential bridge nodes. Bridge strength is defined as the sum of the absolute value of all edges that exist between a node and all nodes that are not in the same community or construct.

Stability

Network stability represents the robustness of estimates yielded in the model and should be examined prior to interpreting the network. As recommended by Epskamp and colleagues, a non-parametric bootstrapping approach using observations in the dataset to create a series of new plausible datasets was used to assess "edge-weight accuracy" [8]. "Centrality stability" is calculated from a correlation stability (CS) coefficient for the centrality index (e.g., strength) and indicates the maximum number of cases that could be dropped to assure 95% probability that the correlation between original centrality indices and centrality of networks based on subsets of the data is 0.50 or higher. As suggested by Epskamp and colleagues, a CS should be at least above 0.25 and preferably above 0.50 in order to interpret the measure of centrality [8]. Edge-weight accuracy and centrality stability were tested using R package *bootnet* case dropping function [8].

Difference Tests

To calculate significant differences between individual edge weights and centrality measure (i.e., strength) within the network, the *differenceTest* function was used in the R package *bootnet* [8]. This test incorporates bootstrapped 95% confidence intervals (CI) around the calculated difference scores [8]. Those CIs that do not include zero are considered to be significantly different from others in the network [28]. A plot of these significance values can be found in Figs. 3 and 4.

Study 1 Results

Descriptive and Bivariate Analyses

For detailed descriptive information on the sample, see Table 1. Bivariate correlations between wellbeing and childhood maltreatment are included in Table 2. In Study 1, the percentage of individuals who endorsed any type of

childhood maltreatment were as follows: 61.2% for emotional abuse, 59.9% for physical abuse, 23.7% for sexual abuse, 78.0% for emotional neglect and 51.7% for physical neglect. Overall, higher levels of reported childhood maltreatment were related to poorer wellbeing in adulthood.

Stability Analysis

With a tuning parameter of 0.50, there were 32 (71.1%) non-zero edges in the network. Edge-weight accuracy graphs (Supplemental Figure 1a) contained mostly small confidence intervals. The CS coefficient for network strength (CS = 0.75) was stable in this network, and therefore interpretable.

## Study Childhood Maltreatment & Wellbeing Network Model 1

The largest edge-weight across the constructs of childhood maltreatment and wellbeing was between emotional neglect and gratitude (edge-weight = − 0.15). Difference tests identified that this edge-weight was significantly different from all other edge weights across the constructs, except the edge-weight between emotional neglect and positive affect (edge-weight = − 0.10; edge-weight difference CI = − 0.02, 0.12). Among the childhood maltreatment nodes, the largest edge-weight was between emotional abuse and physical abuse (edge-weight = 0.41). Difference tests demonstrated that this edge weight was significantly different than all other edges between

childhood maltreatment nodes, other than emotional abuse and emotional neglect (edge-weight = 0.42; edge-weight difference CI = − 0.11, 0.07) and emotional neglect and physical neglect (edge-weight = 0.38; edge-weight difference CI = − 0.13, 0.01). Among the wellbeing nodes, depression symptoms and general distress due to anxious symptoms (edge-weight = 0.51) and positive affect and depression symptoms (edge-weight = − 0.45) had the largest edge-weights, and were significantly different from all others. For more details on edge weights see Fig. 1 and for difference tests see Fig. 2.

The nodes with the greatest strength in the model were emotional abuse (strength = 1.51) and depression symptoms (strength = 1.26) (Fig. 3). Although these nodes were not significantly different in strength from each other (strength difference CI = − 0.20, 0.11), they were significantly different from all other nodes (see Fig. 4). This demonstrates that depression symptoms and emotional abuse were most central and directly connected to the other nodes in the network.

Emotional neglect (bridge strength = 0.35) and emotional abuse (bridge strength = 0.34; bridge strength difference CI = − 0.15, 0.12) emerged as the nodes with the highest bridge strength in the network; their bridge strengths were not significantly different from each other, but were significantly different from all other nodes' in the model. Based on these indicators, emotional neglect and emotional abuse were identified as potentially important links between the communities of childhood maltreatment and wellbeing. For more details on bridge strength see Fig. 3 and for difference tests see Fig. 4.
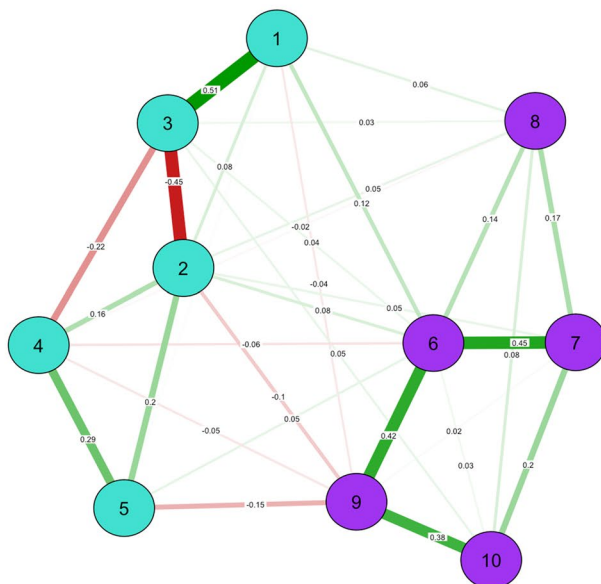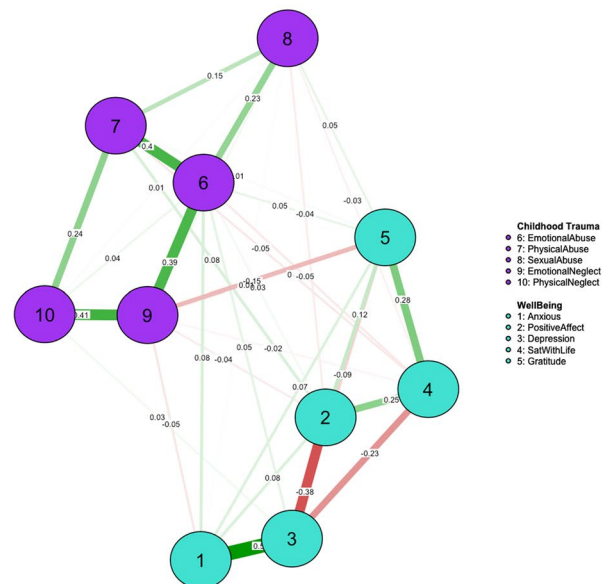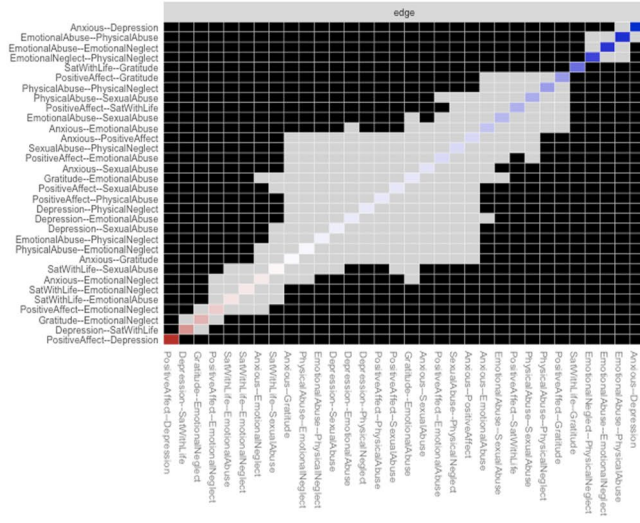

Fig. 1 Study 1 and study 2 networks. Wellbeing indices are in turquoise and childhood maltreatment indices in purple. Thicker lines between nodes represent stronger relationships
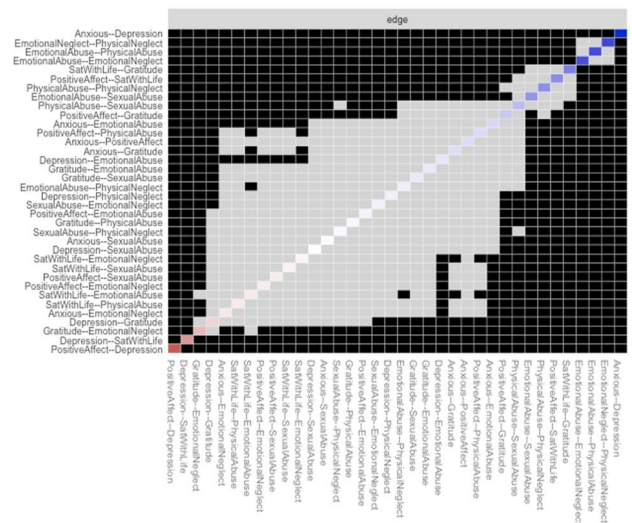
Fig. 2 Edge-weight difference test plots. The diagonal represents the direction and magnitude of the associations. Grey boxes represent non-significant differences while black boxes represent significant differences

Study 1 Discussion

Study 1 was an exploratory examination of the relationships between childhood maltreatment and later in life wellbeing using network analysis. Given the exploratory approach, no hypotheses were made about which nodes would emerge as most influential or central in the network. However, it was expected that childhood maltreatment would be negatively associated with wellbeing in later adulthood, demonstrating positive associations with indicators of mental illness (i.e., anxiety symptoms, depression symptoms) and negative associations with indicators of mental health (i.e., positive affect, satisfaction with life, gratitude). Bivariate relationships bore this hypothesis out, as did individual edge-weights (i.e., partial correlations) within the network.

In terms of key nodes within the model, emotional forms of childhood maltreatment (i.e., emotional neglect, emotional abuse) emerged as particularly important via multiple indicators of centrality, bridge strength, and based on edge-weights within the network. For example, controlling for all other relationships within the network, the strongest associations between a form of childhood maltreatment and wellbeing in adulthood were between: (1) emotional neglect and gratitude and (2) emotional neglect and positive affect. Although these relationships have not been explored previously via network analysis, links between emotional neglect and impaired positive functioning in adulthood have been found. For example, the association between emotional neglect in childhood and lower levels of gratitude in adulthood has been previously demonstrated [29].

Taken together, these findings from the network analysis indicate that the more 'emotionally' based forms of maltreatment may be especially relevant to understanding wellbeing in adulthood, particularly when wellbeing incorporates the presence of mental health, rather than solely the absence of diagnosable mental illness, the latter of which predominates in the literature. Unfortunately, emotional forms of maltreatment are less often explored in research than their physical and sexual counterparts. Consistently including emotional abuse and neglect within the scientific study of childhood trauma and incorporating mental health in addition to mental distress and illness may not only better elucidate the far-reaching impact of childhood maltreatment on adult functioning but may also lead to new avenues for more robust and effective intervention to mitigate this impact.

Study 2: Confirmatory Analysis

The second study aimed to confirm the results from Study 1's network analysis exploring the relationships between childhood maltreatment and later in life wellbeing in a different sample of midlife U.S. adults. Network analysis is a data-driven approach that has received some criticism given concerns about the replicability of networks and the limited examples of replication studies of networks within psychological science [14, 15]. Therefore, in addition to establishing the network model in a separate sample, the resulting network in Study 2 was analytically compared to the network from Study 1. Given the findings from Study 1,

Fig. 3 Study 1 and study 2 centrality and bridge strength plots. 1 = anxiousness, 2 = positive affect, 3 = depression, 4 = satisfaction with life, 5 = gratitude, 6 = emotional abuse, 7 = physical abuse, 8 = sexual abuse, 9 = emotional neglect, 10 = physical neglect
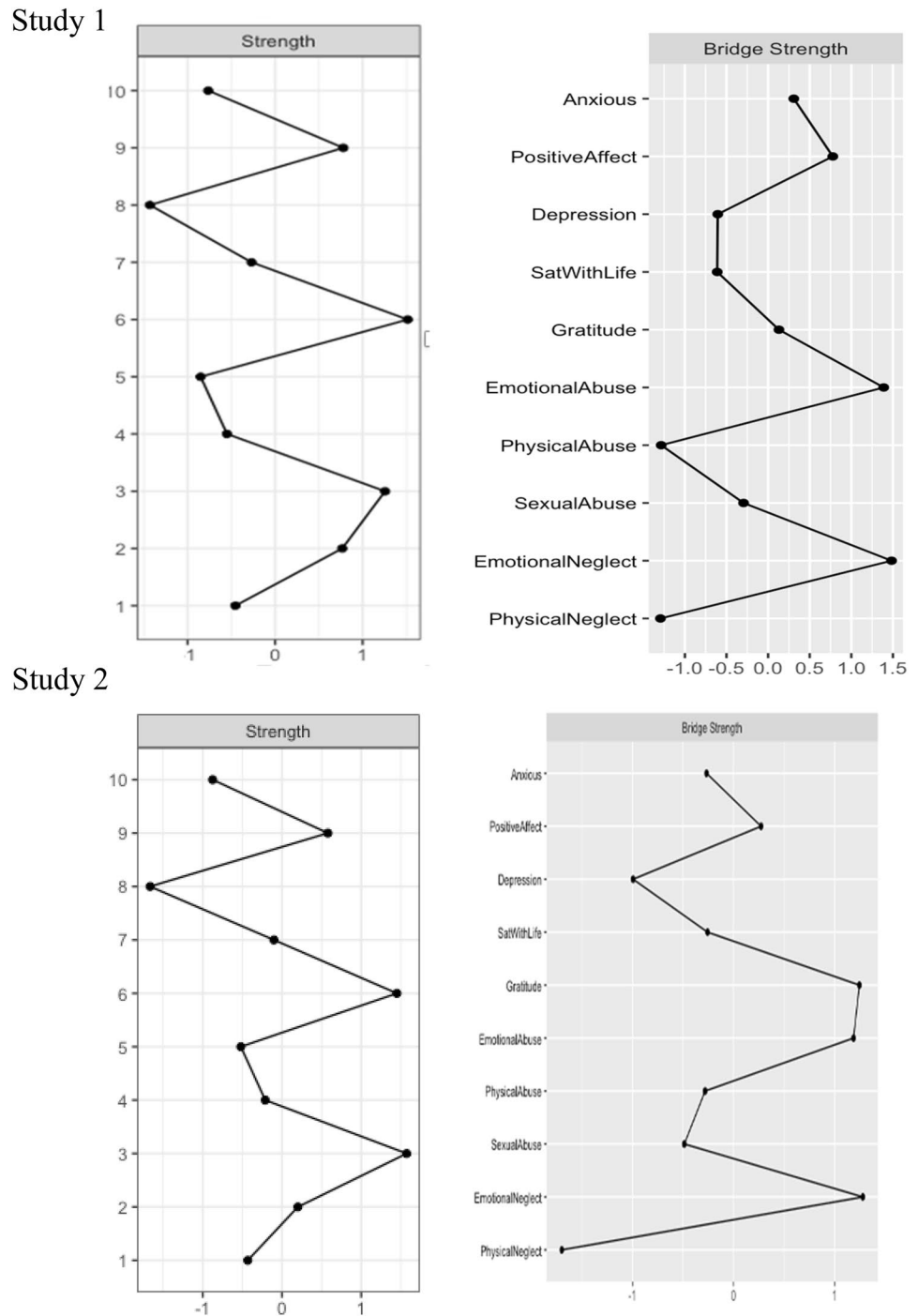
it was hypothesized that emotional forms of maltreatment (i.e., emotional abuse and emotional neglect) would emerge as the most central and influential nodes within the network. Considering specific relationships between childhood maltreatment and wellbeing in adulthood, results from Study 1 found that the most robust relationship between these constructs was between emotional neglect and gratitude. Given previous findings that support this relationship [29], we also hypothesized that this link would replicate in Study 2's network.
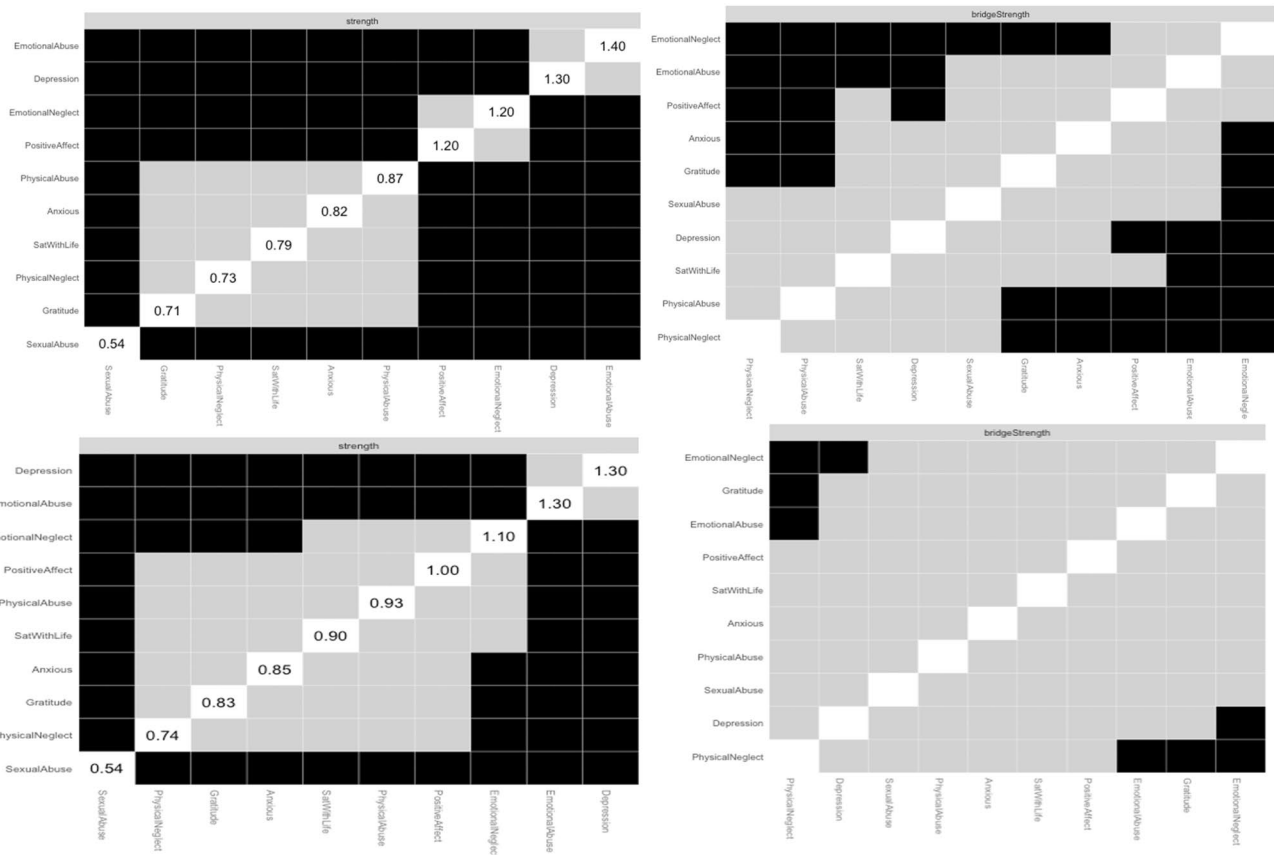
Fig. 4 Study 1 (top) and study 2 (bottom) centrality and bridge strength difference test plots. The diagonal represents the coefficients. Grey boxes represent non-significant differences while black boxes represent significant differences

Study 2 Methods

Participants

Participants for Study 2 were a subsample of the MIDUS Refresher Biomarker Project 4, 2012–2016 (ICPSR 36901), that replenished the original MIDUS 2 study. All data collected paralleled that of Study 1 [30]. Study 2 participants included 855 English-speaking adults with a mean age of 50.79 (SD = 13.41), of whom 52.20% female. For more details on recruitment, consent/assent and data collection methods see the following: http://www.midus.wisc.edu/scopeofstudy.php#History

Measures and Procedures

All measures and procedures in Study 2 were replicated from Study 1. Study 2 reliability scores were acceptable for all measures of wellbeing, including anxiety symptoms (MASQ-A; $\alpha = 0.81$), depression symptoms (CESD; $\alpha = 0.88$), positive affect (MASQ-PA; $\alpha = 0.93$), satisfaction with life (SWS; $\alpha = 0.89$), and gratitude (SWS; $\rho = 0.72$). Reliability was also acceptable for each of the childhood maltreatment scores from the CTQ, including emotional abuse ($\alpha = 0.86$), physical abuse ($\alpha = 0.80$), sexual abuse ($\alpha = 0.95$), emotional neglect ($\alpha = 0.90$), and physical neglect ($\alpha = 0.70$).

Data Analytic Procedure

All analytic procedures in Study 2 mirror those from Study 1.

Network Comparison Test

To test network replicability in Study 2, a set of network comparison tests were conducted to examine similarities and differences between the network from Study 1 and the network obtained in Study 2 [31]. Differences in four

aspects of the networks were assessed across networks in Study 1 and Study 2: (1) network structure, (2) individual edge strength between nodes, (3) global strength within the network, and (4) centrality measures. All network comparison tests (NCT) were conducted with the Network-ComparisonTest package in R [32].

Study 2 Results

Descriptive and Bivariate Analyses

For detailed descriptive information on the sample, see Table 1. Bivariate correlations between wellbeing and childhood maltreatment are included in Table 2. In Study 2 the percentage of individuals who reported each type of childhood maltreatment were as follows: 63% for emotional abuse, 56.6% for physical abuse, 23.6% for sexual abuse, 78.8% for emotional neglect and 51.7% for physical neglect. Overall, higher levels of reported childhood maltreatment were related to poorer wellbeing.

Stability Analysis

With a tuning parameter of 0.50, there were 36 (80.0%) non-zero edges for Study 2's network. Edge-weight accuracy graphs (Supplemental Fig. 1b) contained mostly small confidence intervals. The CS coefficient for network strength ($CS = 0.75$) was above threshold, and therefore interpretable.

Study 2 Childhood Maltreatment & Wellbeing Network Model

The largest edge-weight between the constructs of childhood maltreatment and wellbeing was between emotional neglect and gratitude (edge-weight $= -0.15$). Results from differences tests demonstrated that this edge-weight was significantly different from all other edge-weights across constructs, except the one between emotional abuse and satisfaction with life (edge-weight $= -0.05$; edge-weight difference CI $= -0.004, 0.18$). Among the childhood maltreatment nodes, emotional neglect and physical neglect had the strongest edge-weight (edge-weight $= 0.41$), though it was not significantly different from the edge-weights between emotional abuse and physical abuse (edge-weight $= 0.40$; edge-weight difference CI $= -0.01, 0.13$) or emotional abuse and emotional neglect (edge-wight $= 0.39$; edge-weight difference CI $= -0.05, 0.12$). Among the wellbeing nodes, depression symptoms and general distress due to anxious symptoms had the highest edge-weight (edge-weight $= 0.56$),

which was significantly different from all other edge weights. For more details on study 2 edge weights, see Fig. 1 and for difference tests, see Fig. 2.

The nodes with the highest strength in the model were depression symptoms (strength $= 1.57$) and emotional abuse (strength $= 1.45$). While the strength of these two nodes were not significantly different from each other (strength difference CI $= -0.13, 0.23$), they were significantly different from all other nodes. For more details on strength see Fig. 3 and for difference tests see Fig. 4. This demonstrates that depression symptoms and emotional abuse were most central and directly connected to the other nodes in the network.

In Study 2's network, emotional neglect (bridge strength $= 0.26$) and emotional abuse (bridge strength $= 0.26$) emerged as the nodes with the highest bridge strength. However, few nodes' bridge strengths were statistically significantly different from each other within the network. For more details on bridge strength see Fig. 3 and for difference tests see Fig. 4.

Study 1 and Study 2 Network Model Comparison of Childhood Maltreatment & Wellbeing

Network structure invariance ($p = 0.66$) and global strength ($p = 0.94$) invariance tests indicated that the networks did not significantly vary across studies. Edge strength invariance tests demonstrated that only 3 (7.6%) edge weights significantly varied between the networks. Strength centrality invariance tests were interpreted, and results demonstrated invariance across the studies' networks. Results indicate that the networks did not significantly vary in structure, global strength, or measures of strength centrality, suggesting that these networks were largely replicated across studies.

Study 2 Discussion

Study 2 served as a confirmatory study for Study 1 given that there has been much debate over the replicability of networks, especially across samples [14, 15]. Therefore, the network from Study 1 was compared to the network from Study 2. It was hypothesized that, consistent with Study 1, emotional forms of maltreatment (i.e., emotional abuse, emotional neglect) would emerge as the most influential nodes within the network in Study 2. Across the two studies, the networks were replicated based on almost all indicators of invariance (i.e., network structure invariance, global strength invariance, and centrality invariance test). Edge weight invariance tests did show differences on 3 edge weights across models, though this represented only 8% of edge weights. The fact that these models largely replicated across studies allows for further confidence in the key

associations found and offers an additional piece of support for using this analytical approach.

It was hypothesized that emotional forms of maltreatment would be most influential and central in the network. This hypothesis was partially supported. Controlling for all other relationships within the network, emotional neglect and emotional abuse demonstrated the strongest relationships with measures of wellbeing (gratitude and satisfaction with life, respectively). Emotional abuse was also the most central node within the model based on strength. However, two aspects of the network temper full support for emotional forms of maltreatment as most important within this network. First, depression symptoms demonstrated similar strength to emotional abuse, highlighting its similar importance to the model. Second, while emotional neglect and emotional abuse had the highest bridge strength values within the model, indicating that they may represent an important link between maltreatment and wellbeing, these bridge strength values were not significantly different from many others within the network, reducing the ability to rely on them as the "best" representations of bridge nodes.

In consideration of the cross-construct relationships between childhood maltreatment and wellbeing in adulthood, it was hypothesized that the association between emotional neglect and gratitude would again emerge as the strongest link in Study 2, replicating this finding from Study 1. This hypothesis received mixed support, as the absolute magnitude of this association was larger than all other cross-construct relationships; however, this edge-weight was not significantly larger than the edge-weight linking emotional abuse to satisfaction with life. Taken together, the findings from Study 2 provide additional support for the role of emotional maltreatment in understanding psychological functioning in later life. The results also highlight the relevance of examining positive indicators of functioning when exploring the impact of childhood maltreatment, rather than solely relying on negative outcomes, as the strongest cross-construct relationships that emerged were focused on mental health, rather than mental illness.

General Discussion

High rates of maltreatment were identified in our two samples of adults (emotional abuse: 61.2–63%, physical abuse: 56.6–59.9%, sexual abuse: 23.6–23.7%, emotional neglect: 78–78.8%, physical neglect: 51.7%). Respondents reported maltreatment with a higher frequency than previously estimated [33]. This discrepancy could be explained by sampling methodology, such as age in which the data was collected and national representation of previous samples. The purpose of this study was to gain a more comprehensive view of how childhood maltreatment relates to later

functioning. In the past, studies examining this relationship have primarily used a deficit-focused model which ignores indicators of healthy functioning. This gap has likely contributed to ineffectual and inadequate intervention strategies [5, 6]. With the extant literature in mind, we used network analysis to parse out these correlated relationships more clearly and highlight targets for intervention via an exploratory (Study 1) and a confirmatory (Study 2) study.

General trends in both network models indicated that the more childhood maltreatment an individual experienced the poorer wellbeing they reported in adulthood (i.e., higher anxiety and depression symptoms, lower positive affect, gratitude, and satisfaction with life). This demonstrates that in a dose–response manner, childhood maltreatment reduces the ability to thrive in adulthood. In both studies, two forms of maltreatment stood out as particularly impactful: emotional neglect and emotional abuse. This finding diverges from Breuer and colleagues who demonstrated in their network analysis that sexual abuse was the sole form of maltreatment related to mental illness, as measured by DSM-IV diagnoses in adulthood [5]. The inclusion of healthy functioning (positive emotions, gratitude, and satisfaction with life) in the present studies was an important addition to the current literature. Our differing findings from those of Breuer and colleagues highlight the value of integrating a comprehensive model of mental illness and mental health within networks. We found that maltreatment may not only impact incidences of mental illness but may also significantly affect positive functioning as well. Consistent with other researchers, we reiterate that the impact of childhood maltreatment on adult functioning likely extends to important constructs that are not clinically recognized, including elements of mental health that represent optimal functioning [34].

In our model, those who experienced emotional neglect, or the failure on the part of a caregiver to provide for their needs in childhood (love, a sense of belonging, nurturance, and support), reported especially low wellbeing in adulthood. This finding corroborates previous research demonstrating the link between childhood emotional neglect and later in life wellbeing [35]. While there are various reasons emotional neglect may stand out as a particularly impactful form of maltreatment, we suspect that this form of abuse limits children's emotion processing capabilities [36, 37]. Difficulties with emotion regulation and processing are heavily linked to many facets of wellbeing. In particular, we found a connection between emotional neglect and gratitude, or the emotional tendency to appreciate other people and events [38, 39] that was consistent in both studies. Other researchers have found, more generally, that adverse childhood experiences, broadly, impair gratitude in adulthood [29, 40, 41], however we found a unique link between emotional neglect and gratitude. Individuals low in gratitude are

less likely to appreciate what they gain and receive, and as a result may be more likely to focus on the negative aspects of life, likely affecting their day to day health and wellbeing [29].

Emotional abuse, or verbal assaults on a child's self-worth, was also a key node within both studies, though the specific nature of its importance (e.g., strength, bridge node) was not identical across studies. Notably, in Study 2, emotional abuse demonstrated a key relationship with satisfaction with life, otherwise known as the cognitive component of wellbeing [42]. Life satisfaction predicts health outcomes such as longevity of life [43, 44]. Rose and Abramson's developmental theory may provide one possible explanation for why this close relationship emerged [45]. Rose and Abramson theorize that children seek to explain the cause of adverse experiences, such as caregivers treating them poorly [45]. When maltreatment is recurring, the causal explanation for the abuse shifts towards internal, stable, and global attributes. In the case of emotional abuse in particular, the caregiver readily labels reasons why the child is experiencing maltreatment, via name calling and humiliation. This may promote a negative cognitive style in which survivors of emotional abuse are more likely to attribute negative life events to stable causes which persists over time and permeates their appraisal of their own lives [45].

In the public domain, emotional trauma is often viewed as a 'less serious' form of maltreatment (as opposed to physical abuse or sexual abuse, for example). In fact, many child protective services departments across the United States do not investigate claims of maltreatment based solely on emotional neglect, mandating that there must be some other form of maltreatment present as well [46]. However, our results indicate that emotional neglect and emotional abuse may uniquely affect children well into adulthood. Not only do they relate to higher severity of mental illness, but also to reduced healthy functioning, indicators of which (i.e., gratitude) may serve a protective function against other negative outcomes [47]. This is not to say that the public's and child protective services' focus on other forms of maltreatment is not warranted, as it certainly is. Instead, we suggest a heavier focus on intervention and more broadly, an increase in maltreatment education initiatives which include a focus on the impacts of emotional forms of maltreatment.

Limitations and Future Directions

It should be noted that limitations to these studies exist. First, both samples are racially homogenous and are focused on adults in middle age, rather than during other parts of life. Given that differences in life experiences are related to our constructs of interest [26, 48], this limited sample restricts our ability to make generalizations about the broader population. Future work should examine the relationships between child maltreatment and wellbeing in more diverse and representative samples and should consider the impact and nature of these relationships over the life course. Second, we examined symptoms of mental illness as opposed to mental illness diagnoses in an effort to more thoroughly capture inter-individual experiences beyond DSM criteria. However, we were limited to solely anxiety and depressive symptoms. Future work should continue to explore symptom level experiences (emotion dysregulation, impulsivity, etc.).

Third, the retrospective nature of the Childhood Trauma Questionnaire (CTQ) also serves as a limitation. While it would be ideal to have data collected during childhood, the present data preclude this. However, many researchers have found moderately strong correlations between prospective and retrospective data regarding abuse [49, 50]. This provides some confidence in using retrospective reports, though it should be noted that there is not perfect concordance between the two methods, meaning that other information (i.e., personality factors, recall) could be captured in our measures, the amount of which may vary by form of maltreatment. For example, Nivison and colleagues recently examined prospective and retrospective scores of emotional availability of caregivers and found weak convergence between the two [51]. Notably, prospective data collection is not without fault; it typically relies on the reports of caregivers and professionals which also runs the risk of inaccurate assessments [52]. As such, we maintain cautious confidence in our results given their replication across studies while maintaining that more research is clearly needed to understand how assessment type and timeframe affect the reporting of childhood maltreatment experiences.

Fourth, relationships were fairly small across the constructs of childhood maltreatment and wellbeing within the networks and this should be noted when considering the impact of our findings. This may reflect the true strength of independent associations between these constructs given that mental illness and mental health are determined by a myriad of factors, and/or it may be related to the timeframe of sampling. Both samples were conducted with people in middle age and in reference to a recent period (e.g., depression symptoms over the past week), which may have attenuated the association between maltreatment in childhood and current functioning. It may be the case that some associations would have differed in magnitude if assessed during different periods of life and/or time.

Finally, our analysis examines the independent associations between different forms of childhood maltreatment and wellbeing. Although many participants did experience multiple forms of maltreatment in their childhoods and each experience is included within the network, the interpretation of nodes' importance within the model is

based on their individual impact and associations, that is, while controlling for all other relationships within the network [8]. As a result, our findings are not well-suited to explore the joint impact of multiple forms of maltreatment or how particular patterns of maltreatment experiences relate to functioning later in life. Future work that compares network results to those obtained from a person-centered approach that can identify patterns of maltreatment, such as latent class analysis, may supplement our studies' findings.

Summary

Our results confirm that childhood maltreatment is related to wellbeing throughout life, including in middle adulthood. Emotional abuse and emotional neglect stand out as particularly common and relevant forms of maltreatment for understanding adult functioning, which should include

exploration of negative experiences such as mental illness along with positive experiences such as mental health (e.g., satisfaction with life). Our findings suggest that beyond their relationship to mental illness symptoms, emotional forms of maltreatment affect people's orientation to the world, including their ability to view and appreciate positive experiences, their affect, and their overall satisfaction with their lives. As such, education and interventions on the lasting impact of childhood maltreatment would benefit from consistent inclusion of emotional forms of trauma and indicators of healthy functioning. Finally, network analysis may offer a valuable tool for exploring the multiple relationships between childhood maltreatment and functioning in adulthood.

Appendix

See Tables 1 and 2.

Table 1 Sample descriptive statistics

Variable name	Study 1 (n = 1239)	Study 2 (n = 855)
Demographics		
Age, M (SD)	54.55 (11.73)	50.79 (13.41)
Female % (n)	56.5 (700)	52.20 (446)
Variable name	Mean (SD)	Mean (SD)
Childhood maltreatment		
Emotional abuse	8.05 (4.33)	8.23 (4.16)
Physical abuse	6.99 (3.07)	7.13 (3.28)
Sexual abuse	6.61 (3.99)	6.68 (4.16)
Emotional neglect	9.78 (4.57)	9.94 (4.59)
Physical neglect	6.91 (2.77)	6.86 (2.73)
Wellbeing		
Subjective wellbeing: satisfaction with life scale	4.78 (1.31)	4.69 (1.34)
Subjective wellbeing: gratitude scale	6.26 (0.84)	6.18 (0.90)
MASQ: general distress-anxious symptoms	16.67 (4.80)	16.71 (4.88)
MASQ: high positive affect	44.53 (10.19)	44.34 (10.49)
CESD: depression scale	8.59 (8.15)	9.28 (7.92)

Table 2 Bivariate correlations for study 1 and study 2

	Emotional abuse	Physical abuse	Sexual abuse	Emotional neglect	Physical neglect	Satisfaction with life	Gratitude	General distress-anxious symptoms	High positive affect	Depression symptoms
Emotional abuse	1	0.687**	0.440**	0.678**	0.532**	− 0.295**	− 0.169**	0.337**	− 0.139**	0.330**
Physical abuse	0.646**	1	0.430**	0.517**	0.513**	− 0.202**	− 0.135*	0.208**	− 0.067*	0.201**
Sexual abuse	0.478**	0.416**	1	0.319**	0.336**	− 0.172**	− 0.085**	0.232**	− 0.051	0.214**
Emotional neglect	0.647**	0.464**	0.346**	1	0.629**	− 0.354**	− 0.343**	0.227**	− 0.304**	0.336**
Physical neglect	0.519**	0.517**	0.304**	0.628**	1	− 0.221**	− 0.196**	0.213**	− 0.189**	0.288**
Satisfaction with life	− 0.279**	− 0.204**	− 0.181**	− 0.283**	− 0.206**	1	0.492**	− 0.320**	0.504**	− 0.537**
Gratitude	− 0.130**	− 0.076*	− 0.043	− 0.272**	− 0.174**	0.470**	1	− 0.174**	0.447**	− 0.358**
General distress-anxious symptoms	0.252**	0.136**	0.149**	0.126**	0.136**	− 0.309**	− 0.128**	1	− 0.300**	0.636**
High POSITIVE AFFECT	− 0.139**	− 0.043	− 0.130**	− 0.207**	− 0.124**	0.535**	0.386**	− 0.287**	1	− 0.636**
Depression symptoms	0.295**	0.174**	0.180**	0.247**	0.218**	− 0.560**	− 0.361**	0.647**	− 0.596**	1

*Correlation is significant at the 0.05 level; Study 1 correlations are above the diagonal in the table and Study 2 are below the diagonal in the table

**Correlation is significant at the 0.01 level

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participation were in accordance with the ethical standards of the institutional and/or national research committee and with their 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in this study.

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