The relationship between childhood adversity and personality in students: A network analysis

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Abstract

Each year, roughly one in two children between the ages of 2 and 17 experience some type of childhood adversity (CA). Multiple studies have researched the relationship between CAs and a large set of mental disorders. However, less research has been done into the relationship between CAs and personality traits, even though links between life events and personality development are well established. In the current exploratory, cross-sectional study (N = 442), using a mixed-gender (N = 442) and female (N = 354) subset, it will be examined whether there are relations between personality traits, between CAs, between personality traits and CAs, and if there are differences between a mixed-gender and a female subset network. Participants are students enrolled at Dutch educational institutions between the ages of 18 and 53. Personality traits and CAs are measured with the *Big Five Inventory-10* (BFI-10) and *Big Five Inventory*-44 (BFI-44), questionnaires adapted from the Caring Universities survey, and the *Childhood Trauma Screener* (CTQ), respectively. Subsequently, these questionnaires are analyzed using correlational and network analyses in SPSS and JASP, respectively. Overall, almost all CAs co-occur. Furthermore, higher neuroticism scores co-occurred with more sexual abuse and emotional neglect, and vice versa. In contrast, no relation was found between emotional abuse and personality traits. Finally, the association of personality traits and CAs are not stronger in the female subset network than in the mixed-gender network. Future research should use a more representative student sample, with longitudinal design, and evenly distributed gender subsets, to ensure generalizability and causality.

1. Introduction

Each year, roughly one in two children between the ages of 2 and 17 experience some type of childhood adversity (World Health Organization, 2020). Murphey and Bartlett (2019) define *childhood adversity* (CA) as "one or more stressful events or conditions that can threaten a child's sense of safety, and negatively affect the child's developing brain, physical and mental health, and behavior". These researchers include abuse (physical, emotional, and sexual) and neglect (physical and emotional), living in a dysfunctional household, bullying (physical and emotional), or being a witness of violence amongst the examples of prevalent CAs. To elaborate on this definition, living in a dysfunctional household entails witnessing parental abuse, parental association with substance abuse and/or crime, parental mental illness, and parental loss (Bruskas et al., 2013). Multiple types of CAs often co-occur (Bussemakers et al., 2019; Merrick et al., 2018).

The influence of childhood adversities on health and behavior later on in life can be traced back to the period of brain development. Research from Tottenham (2020) states that the developing brain is influenced by the environment, in which upbringing takes an important place. Adversities in childhood are associated with alternative neuronal development. As the brain develops in a hierarchical order, early negative adjustments are of influence on the further development of the brain. A common consequence named by Navalta et al. (2018) and Tottenham (2020) is the increased reactivity and sensitivity to stress due to the influence of environmental strains on the development of the amygdala. This in turn is related to increased odds for physical and mental health issues, such as internalizing (e.g. mood, anxiety, and personality) and externalizing (e.g. substance use, impulse control, and personality) disorders. Multiple studies have researched the relationship between CAs and a large set of mental disorders (e.g. Hughes et al., 2017; Kalmakis & Chandler, 2014; Nelson et al., 2020). However, much less research has been done into the relationship between CAs and personality traits, even though previous research states that life events are important in personality development (e.g. Bleidorn et al., 2018; Kandler, 2012).

Personality traits entail the description of the person in terms of relatively stable behaviors, thoughts, and emotions (Matthews et al., 2009; Parks-Leduc et al., 2015). A commonly used model to present an overview of the most important personality traits is the five factor model (Shimotsukasa et al., 2019). This model describes extraversion (dominance and excitement seeking), neuroticism (anxiety, nervousness, and moodiness), agreeableness (trusting and compliant), conscientiousness (dutiful, organizational, and achievement motivation), and openness to new experiences as the main five personality traits (O'Boyle et

al., 2014; Smith et al., 2018). Experiencing CAs in general is associated with a different development of these personality traits, such as higher neuroticism (e.g Allen & Lauterbach, 2007; Becerra-Garciá et al., 2012; Grusnick et al., 2020), openness (Allen & Lauterbach, 2007), and extraversion (Pickering et al., 2004), and lower agreeableness (Carver et al., 2014) and conscientiousness (Becerra-Garciá et al., 2012; van Dammen et al., 2019) than people who haven't experienced CAs. Contrary to research from Pickering et al., 2004, Rosenman and Rodgers (2006) found no relation with extraversion. The main reason is that Rosenman and Rodgers (2006) only looked at a dysfunctional household environment.

One study that shows that the big five personality traits along with the CAs as defined by Murphey and Bartlett (2019) have strong interrelationships, with emotional abuse being most ubiquitously related to all big five personality traits, is research from Hengartner et al. (2015). The researchers examined 20 to 41 year olds from the general population in a cross-sectional study. The big five personality traits were investigated with the Big Five Inventory Short form (BFI-S), and the CAs were investigated with the Childhood Trauma Questionnaire (CTQ). Furthermore, the researchers found that neuroticism appeared to be positively associated with emotional, physical, and sexual abuse, and emotional and physical neglect. Openness also showed a positive association with emotional abuse. Extraversion, conscientiousness, and agreeableness on the other hand appeared to be negatively associated with emotional neglect and abuse. Research from Grusnick et al. (2020) matches these results, and adds that neuroticism is also positively correlated with household dysfunction. However, a drawback from these studies is that they use research designs with which you can only examine one-to-one associations, while it has been proven that personality traits are interrelated (Wechsler et al., 2018), and often multiple types of CAs coincide (Hodgdon et al., 2019).

Research from Schouw et al. (2020) is the first to show multifaceted associations between CAs and personality traits. Schouw et al. (2020) examined male alcohol dependent patients and healthy controls, with the use of the Traumatic Events in Childhood (ITEC) questionnaire and the Parental Acceptance and Rejection Questionnaire (PARQ), and the Temperament and Character Inventory (TCI) for CAs and personality traits subsequently. Furthermore, the researchers used network analysis, making it possible to map the interconnectedness of the different types of CAs and personality traits. Within network analysis the relations between all the variables can be estimated in a network model using 'edge weights' (the partial correlations between the variables). Next, it can be visualized using 'nodes' (the variables) and edges. Thicker edges represent a stronger relation between the

nodes (Hevey, 2018). Using this method, Schouw et al. (2020) found that physical and emotional abuse, and maternal rejection showed the strongest association to personality traits, indicating that these CAs may be influential in personality forming. In contrast to findings from Hengartner et al. (2015), sexual abuse was not associated with any personality trait. In line with research from Hodgdon et al. (2019) and Wechsler et al. (2018), Schouw et al. (2020) found interrelations between personality traits, and positive associations between the different types of CAs. At the same time, no evidence was found of the co-occurrence of sexual abuse with any of the other CAs. A possible cause stated by the researchers is the use of a male-only population. Previous research from Abajobir et al. (2017) states a possible explanation in that childhood sexual abuse is more prevalent in females than males.

In addition to Abajobir et al. (2017), multiple studies found a difference between men and women in the type of CAs they experienced (e.g. Haahr-Pedersen et al., 2020; Mhamdi et al., 2017). Women tend to experience more sexual abuse, physical abuse, and emotional neglect in childhood than men (Haahr-Pedersen et al., 2020; Mhamdi et al.,2017; Schilling et al., 2007; Soares et al., 2016). Women who experienced childhood sexual abuse are also more likely to have experienced other types of CAs than women who have not (Haahr-Pedersen et al., 2020; Kennedy et al., 2021). Contrastingly, prevalence of physical neglect, household dysfunction, and bullying in childhood is the same for men and women (Lucas et al., 2016; Mhamdi et al., 2017). In addition to this, there is a difference between men and women when looking at personality traits (Hengartner et al., 2015; Schmitt et al., 2008; Weisberg et al., 2011). Women score higher than men regarding the personality traits neuroticism, agreeableness, extraversion, and conscientiousness.

1.1 Relevance

Through the years a variety of research has been done into personality traits and CAs. Additionally, multiple articles investigated network models of CAs in association with a variety of psychiatric disorders (e.g. Isvoranu et al., 2016; Kratzer et al., 2021). However, research into the relationship between CAs and personality traits through network analysis is fairly new, with research from Schouw et al. (2020) being the first to publish about this subject. This group's network analysis about CAs and personality provides a greater understanding of the interaction between CAs and personality traits from a multifaceted perspective. Yet, results from Schouw et al. (2020) are limited, because they use a male-only population, although men and women differ in the types of CAs they have experienced, and the personality traits that are present.

The main aim of the current study is to follow-up on research from Schouw et al. (2020) by identifying the relationship between the various types of CAs and personality traits through network analysis, first in a mixed-gender student population, and second in a subset that is only female. Due to a low number of male participants in the current study, a separate analysis of the male subset is not feasible, as the power of this analysis would be too low. In combination with the findings of Schouw et al. (2020), the results from this study will present a more holistic view of the interactions between CAs and personality traits in a network.

1.2 Hypothesis and research questions

Overall, we formulated the following six hypotheses: 1) regarding both the mixed-gender population and the female subset network analyses, there are some interrelationships between the various types of CAs (Hodgdon et al., 2019; Schouw et al., 2020); 2) in contrast with research from Schouw et al. (2020), there is a relation between sexual abuse and the other CAs, due to the presence of a large female subset (Haahr-Pedersen et al., 2020); 3) there are some interrelationships between the different personality traits (Schouw et al., 2020; Wechsler et al., 2018); 4) neuroticism will be associated to all forms of CAs, in the mixed-gender population as well as in the female subset (Allen & Lauterbach, 2007; Grusnick et al., 2020; Hengartner et al., 2015); 5) physical and emotional abuse will be associated to all personality traits (Hengartner et al., 2020; Schouw et al., 2020); and 6) concerning differences between genders, there are stronger associations of neuroticism, agreeableness, extraversion, and conscientiousness with all forms of CAs in the female subset than in the mixed-gender population network (Mhamdi et al., 2017; Schilling et al., 2007; Schmitt et al., 2008; Soares et al., 2016; Weisberg et al., 2011).

2. Methods

2.1 Design

Data for the current cross-sectional exploratory study were gathered from the first Measurement point of the WARN-D study, an ongoing 5-year research project.

2.2 Participants

Participants were Dutch and international students between 18 to 53 years old, enrolled at various Dutch educational institutions (n = 449, M age = 22.66). Of the participant population, 80.4% identified as female, 15.8% as male, and 3.6% as other. Approximately

half of the participants were Dutch (50.6%). The participants' highest level of completed education varied between a secondary school diploma (39%), vocation school degree (4.7%), Applied University Bachelor's degree or equivalent (4.5%), Applied University Master's degree or equivalent (.2%), University Bachelor's degree or equivalent (39.9%), University Master's degree or equivalent (9.8%), Doctoral degree (.2%), or unknown (1.8%).

2.3 Measures

2.3.1 Personality. Extraversion, agreeableness, conscientiousness, and openness were measured using the corresponding 8 of the 10 items from the *Big Five Inventory 10* (BFI-10; Rammstedt & John, 2007). The BFI-10 consists of ten statements looking at extraversion (e.g. 'I see myself as someone who is outgoing, sociable'), agreeableness (e.g. 'I see myself as someone who is generally trusting'), conscientiousness (e.g. 'I see myself as someone who does a thorough job'), openness to experience (e.g. 'I see myself as someone who has an active imagination'), and neuroticism (see below). The statements could be answered on a scale (Likert-type) ranging from 0 ('Disagree strongly') to 4 ('Agree strongly'). Each personality trait was measured with two statements, and half of the statements were reverse-scored. The test-retest reliability of the BFI-10 is good (r = .75), and there is a strong part-whole correlation between scales of the BFI-10 and the BFI-44 (r =.83). Neuroticism was more extensively measured using the *Big Five Inventory,* because of its strong relation with depression in the WARN-D dataset (BFI-44; John & Srivastava, 1999). The BFI-44 consists of 44 statements of which eight measuring neuroticism (e.g. 'I see myself as someone who can be tense'). The statements could be answered on a scale (Likert-type) ranging from 0 ('Disagree strongly') to 4 ('Agree strongly'). Half of the statements were reverse-scored. The test-retest reliability of the BFI-44 is strong (r = .84) (Rammstedt & John, 2007), and the internal validity for the current study is high (α = .83).

2.3.2 Childhood adversity. Childhood adversity was measured using the definition of Murphey and Bartlett (2019) mentioned earlier. Dysfunctional household environment and bullying were measured using questionnaires adapted from the Caring Universities survey (CUS; https://caring-universities.com/). The dysfunctional household questionnaire consists of five statements about experiences in the household environment (e.g. 'One of your parents (or the people who raised you) was involved in criminal activities'). The bullying questionnaire consists of one question ('How often were you bullied as a child or teenager?'). Answer possibilities ranged from 0 ('never') to 4 ('very often'). Abuse and neglect were measured using the *Childhood Trauma Screener* (CTS; Grabe et al., 2012). The CTS includes

five statements assessing emotional abuse ('When I was growing up someone in my family hated me'), emotional neglect ('When I was growing up I felt loved'), physical abuse ('When I was growing up people in my family hit me so hard that it left me with bruises or marks'), physical neglect ('When I was growing up there was someone to take me to the doctor if I needed it'), and sexual abuse ('When I was growing up someone molested me (took advantage of me sexually)'). Answer options varied from 0 ('never true') to 4 ('very often true'). Some statements were reverse-scored. The internal validity of the CTS is good (α = .76), and the correlation between the CTS and the CTQ is high (r = .88) (Grabe et al., 2012).

2.4 Procedure

Participants were recruited through online and offline methods (e.g. flyers, social media, e-mail, and word-of-mouth). When interested, people filled out an online form with their e-mail and gave informed consent. Subsequently, they filled out a short screener assessing eligibility.

2.4.1. Inclusion criteria. Participants could be included if they were at least 18 years old, studying at a Dutch higher educational institution, and were fluent in either Dutch or English. They also needed to own a smartphone with android or iOS operating system, and have a European bank account with an IBAN.

2.4.2. Exclusion criteria. Participants were excluded if there were ethical concerns, being the presence of 1) schizophrenia, psychosis, or thought disorder, 2) major depressive disorder, 3) (hypo)mania or bipolar disorder, 4) primary substance use disorder, and/or 5) moderate or severe suicidal ideation. Because participants were initially recruited for the WARN-D research, participants would also be excluded if they expressed it to be stressful seeing a 'daily calories burnt' estimate, visible on the smart watch needed during the WARN-D study.

2.5 Ethics

For the current study, approval from the Leiden University Psychology Research Ethics Committee (CEP) has been obtained on the 6th of September 2021. The corresponding CEP number is 2021-09-06-E.I.Fried-V2-3406. Approval from the METC wasn't necessary.

2.6 Statistical analyses

Statistical analyses will be executed using *Jeffrey's Amazing Statistics Program* version 0.16 (JASP) and SPSS version 24 (IBM Corp, 2016; JASP Team, 2021). Before estimating the network, a pearson's correlational analyses was performed to investigate whether the five statements about household experiences could be combined into one variable, dysfunctional household environment. Due to the low power of the variable 'caretaker(s) involved in criminal activities', this variable has been omitted in the combining of the variable, dysfunctional household environment. The correlation table can be seen in Appendix A.

2.6.1 Network estimation and accuracy. To obtain a *sparse* (conservative and interpretable) network, a 'Least Absolute Shrinkage and Selection Operator' (LASSO; Tibshirani, 1996) will be used. The LASSO diminishes the number of false-positive edges by excluding spurious correlations. Thus, only the most relevant relations between the nodes will be shown (Hevey, 2018). To ensure a network wherein spurious correlations are minimal and true correlations are maximal, a tuning parameter has to be set. This tuning parameter can be set by minimizing the Extended Bayesian Information Criterion (EBIC; Epskamp et al., 2017). Based on research from Foygel and Drton (2010) a tuning parameter of 0.5 will be used, as it is a good compromise between removing spurious edges, and removing some non-spurious correlations. In JASP the combined version of the EBIC and LASSO will be used, the EBICglasso. Lastly, to determine the accuracy of edge weights (node centrality and edge strengths) the confidence intervals (95%CI) will be calculated. This will be done using non-parametric bootstrapping, a method that repeats estimation of the model to get more consistent results (Hevey, 2018). In the current study 1000 bootstrap samples will be run.

2.6.2 Network analysis. A network analysis will be executed where the twelve previously mentioned variables (items of the BFI-10, BFI-44, CUS, and the CTS) are displayed as 'nodes'. As all the variables are continuous, a Gaussian Graphical Model (GGM) will be used, which is a network model for continuous data. The 'edges' that appear in the GGM display partial correlations between the nodes. The network is undirected weighted, which conveys that there is no direction of effects between the nodes, and the edges vary in thickness depending on the strength of the relation between the nodes (Hevey, 2018). Thicker edges represent a stronger relation between the nodes. Positive relations between nodes are illustrated with blue edges, and negative relations with red edges. Participants with missing values will be removed using pairwise deletion. Whether a node is placed central in the network, and thus of importance, depends on the strength of the connections with other nodes.

This strength will be inspected using three measures: degree centrality (the amount of edges connected to a node), betweenness (the shortest path length between any two nodes), and closeness (the sum of shortest paths between one node and the other nodes) (Bringmann et al., 2019).

Lastly, using the same variables and procedures as above, a female subset network analysis will be executed by splitting the network by gender. Additionally, comparing both networks may yield insights into the female, as well as male subset in the mixed-gender analysis, despite the small male dataset present.

3. Results

An overview on the scores on the personality traits and CAs is shown in Table 1. Seven participants were excluded due to missing data, making the final total of participants 442. Of the mixed-gender population, 93.5% scored on 1 or more childhood adversities. Within the female subset, the mean score was highest for a dysfunctional household environment (M = 1.67). The mean score for the male subset was highest for bullying (M = 1.51). Regarding personality traits, the female subset had a higher average score than the male subset on every personality trait, except agreeableness. However, no significant difference between men and women was observed in the scores on the CA and personality trait variables. In the following paragraphs, the results will be discussed with respect to the hypotheses in the current study.

3.1 Relations between different CAs

Mixed-gender network. Figure 1 visualizes the network structure of the mixed-gender population. There were more positive relations within the network than negative. Out of 66 possible edge weights, 26 (39.4%) were non-zero. As observed in Figure 1, multiple associations between the CAs are represented in the network. Also observed is that sexual abuse was positively associated to all other CAs, with the strongest associations between sexual abuse and bullying (.203), and sexual abuse and physical abuse (.188). There was no relation between bullying and physical neglect. Furthermore, there were no negative relations. The strongest three edges were between emotional neglect and physical neglect (.324), emotional abuse and physical neglect (.297), and emotional abuse and physical abuse (.217). The weakest edge was between dysfunctional household environment and bullying (.011).

Table 1

Descriptives of the childhood adversity and personality measures

	Mixed-gender population* (n = 442)		Female subset (n = 354)		Male subset (n = 71)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Childhood adversities						
Dysfunctional household environment (DHE)	1.63	2.32	1.67	2.40	1.38	1.81
Bullying (B)	1.41	1.12	1.36	1.14	1.51	1.03
Emotional neglect (EN)	1.01	1.00	1.00	1.00	1.00	1.04
Emotional abuse (EA)	.52	.97	.56	.98	.35	.85
Physical neglect (PN)	.31	.70	.31	.70	.31	.65
Physical abuse (PA)	.32	.78	.32	.76	.31	.86
Sexual abuse (SA)	.23	.72	.23	.71	.13	.51
Big-5 Personality						
Agreeableness (A)	5.21	1.62	5.21	1.66	5.29	1.49
Conscientiousness (C)	5.23	1.69	5.24	1.67	5.13	1.76
Extraversion (E)	4.46	1.86	4.46	1.82	4.32	2.10
Openness to experience (O)	5.17	1.88	5.19	1.88	4.85	1.86
Neuroticism (N)	16.77	6.22	17.38	5.96	13.46	6.37

Notes: * no separate subset was made for respondents who noted their gender as 'other', due to the low response; Score ranges are as follows: DHE (0 – 16), B/EN/EA/PN/PA/SA (0 – 4), A/C/E/O (0 – 8), and N (0 – 32)

Female subset network. Figure 2 visualizes the network structure of the female subset. As well as in the previous network, there were more positive relations within the network than negative. Out of 66 possible edge weights, 29 (43.9%) were non-zero. As was the case in the first network, emotional abuse, emotional neglect, physical abuse, and physical neglect were all associated to each other in this network. Almost all CAs were related to each other, except for bullying and physical neglect, and bullying and dysfunctional household environment. Sexual abuse was positively correlated to all other CAs. The three strongest edges were between emotional neglect and physical neglect (.342), emotional abuse and physical neglect

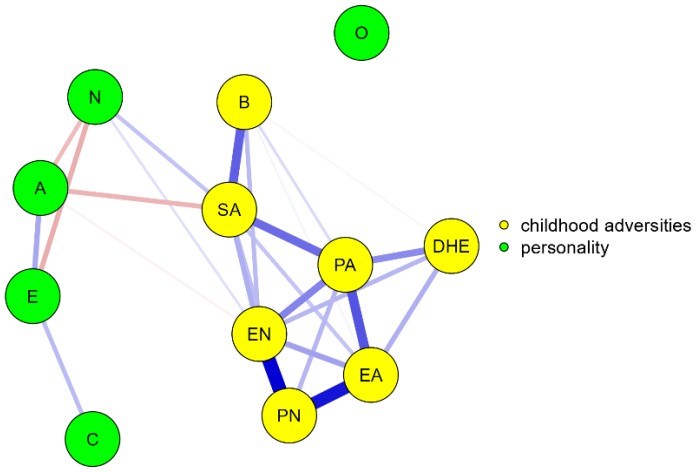

Figure 1. Network of the mixed-gender population containing the 7 CAs and big-5 personality traits (DHE = dysfunctional household environment, B = bullying, EN = emotional neglect, EA = emotional abuse, PN = physical neglect, PA = physical abuse, SA = sexual abuse, A = agreeableness, C = conscientiousness, E = extraversion, O = openness to experience, and N = neuroticism). Blue lines illustrate positive relations, red lines illustrate negative ones. The thickness of a line illustrates the strength of the relation.

(.254), and sexual abuse and bullying (.196). The weakest edge was between dysfunctional household environment and sexual abuse (.003).

3.2 Relations between different personality traits

Mixed-gender network. The different personality traits are lined up in the network in Figure 1, with openness outside of the network. There were four edges present, two of which were negative and two positive. The strongest three edges were between extraversion and agreeableness (.111), extraversion and neuroticism (-.103), and extraversion and conscientiousness (.086). The weakest edge present was between neuroticism and agreeableness (-.085).

Female subset network. When assessing the network structure in Figure 2, four edges can be seen between the different personality traits. As well as in network 1, there were two negative relations and two positive. Even so, openness did not relate to any other personality trait. The strongest three edges were between extraversion and neuroticism (-.108), agreeableness and neuroticism (-.097), and extraversion and agreeableness (.084). The weakest edge was between extraversion and conscientiousness (.029).

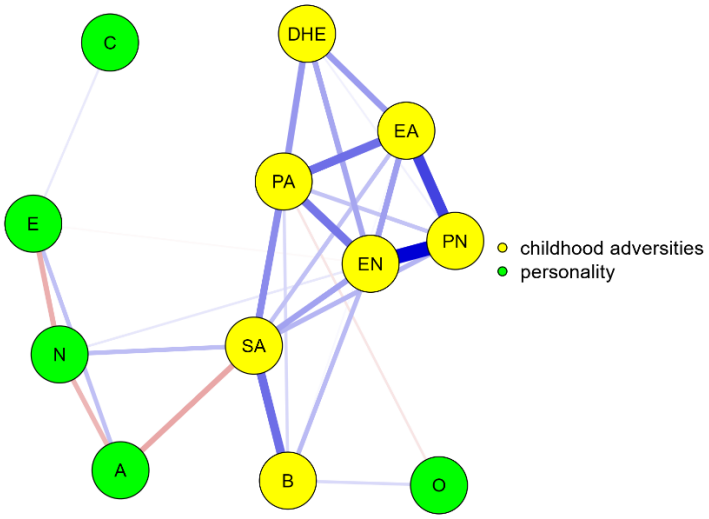

Figure 2. Network of the female subset containing the 7 CAs and big-5 personality traits (DHE = dysfunctional household environment, B = bullying, EN = emotional neglect, EA = emotional abuse, PN = physical neglect, PA = physical abuse, SA = sexual abuse, A = agreeableness, C = conscientiousness, E = extraversion, O = openness to experience, and N = neuroticism). Blue lines illustrate positive relations, red lines illustrate negative ones. The thickness of a line illustrates the strength of the relation.

3.3 Relations between CAs and personality traits

Mixed-gender network. When assessing the network structure in Figure 1, four edges can be perceived between different CAs and personality traits. No relations were found between openness and any other CA or personality trait. Agreeableness was negatively related to sexual abuse (-.095) and emotional neglect (-.018). Neuroticism was positively related to sexual abuse (.077) and emotional neglect (.039). Regarding the association between Neuroticism and the other CAs, no other associations were found. The same goes for the relation between physical and emotional abuse, and the personality traits. See Appendix B for the weights matrix of the network in Figure 1.

Female subset network. In the female subset network in Figure 2, a total of six edges were observed between CAs and personality traits, with a very weak negative edge between extraversion and emotional neglect (-.008). Other weak edges were between neuroticism and emotional neglect (.032), and openness and physical abuse (-.035). The three strongest edges were between agreeableness and sexual abuse (-.118), neuroticism and sexual abuse (.088), and openness and bullying (.051). Regarding the association between Neuroticism and the

other CAs, no other associations were found. The same goes for the relation between physical and emotional abuse, and the personality traits. See Appendix C for the weights matrix of the network in Figure 2.

3.4 Comparison of the networks

There were positive edges in both networks between neuroticism and emotional neglect, and neuroticism and sexual abuse, with the former being .007 stronger in de mixed-gender network and the latter being stronger by .011 in the female subset network. Additionally, there was a negative edge between agreeableness and sexual abuse in both networks, where the edge in the female subset network was stronger by .023. Furthermore, a negative edge was found between agreeableness and emotional neglect in the mixed-gender population, while none was found in the female subset. On the contrary, a positive edge between openness and bullying, and negative edges between extraversion and emotional neglect, and openness and physical abuse were solely found in the female subset. See Table 2 for the differences in edge weights between the two networks.

Table 2

Differences in edge weights between the mixed-gender and female subset networks for relations between CAs and personality traits.

	Mixed-gender	Female subset	Difference
A – SA	-.095	-.118	.023
A – EN	-.018	-	.018
N – SA	.077	.088	.011
N – EN	.039	.032	.007
E – EN	-	-.008	.008
O – PA	-	-.035	.035
O – B	-	.051	.051

Notes: A = agreeableness, N = neuroticism, E = extraversion, O = openness, SA = sexual abuse, EN = emotional neglect, PA = physical abuse, B = bullying

To assess the similarity, the two networks were compared using a correlation of the edge weights of both networks. The spearman correlation was .92 ($p < .001$), signifying a strong similarity between the two networks. A line chart with all the similarities and differences between the edge weights of the two networks is shown in Appendix D.

Centrality estimation. Appendix E shows the centrality plot with the expected influence estimates (EI) for the mixed-gender population, which gives an overview of the interconnectedness of all the nodes in the network. Emotional neglect (EI = 1.31), physical abuse (EI = 1.17), and emotional abuse (EI = 1.10) served as the core features in this network. The three least central nodes in the network were openness (EI = -1.02), neuroticism (EI = -1.20), and agreeableness (EI = -1.24). Appendix F shows the centrality plot with the expected influence estimates (EI) for the female subset. Emotional neglect (EI = 1.53), emotional abuse (EI = 1.01), and physical neglect (EI = .99) served as the core features in this network. The three least central nodes in the network were extraversion (EI = -.95), neuroticism (EI = -1.15), and agreeableness (EI = -1.27).

4. Discussion

The current cross-sectional exploratory study is the first study to investigate the relationship between personality traits and CAs in a network structure between men and women. Specifically, we examined whether there are relations within personality traits, within CAs, between personality traits and CAs, and differences between a mixed-gender and a female subset network. The results can be summarized as follows.

First, almost all of the CAs are connected to each other in both network models. This confirms research from Bussemakers et al. (2019) and Merrick et al. (2018) that CAs often co-occur, and experiencing more types of CAs is likely when children already experienced one type of CA. Second, sexual abuse is positively associated to all the other CAs in the mixed-gender population network, as well as in the female subset network, indicating that sexual abuse often coincides with other forms of childhood adversity. Third, we examined interrelations between the different personality traits, and have found that there are some present in both networks. Extraversion appears to be the most connected to the other personality traits. Fourth, we have found few relations between personality traits and CAs in both networks. Agreeableness and neuroticism show the most connections to CAs, especially to sexual abuse and emotional neglect. Lastly, we didn't find a stronger association between personality traits and CAs in the female subset network than in the mixed-gender network.

In the next paragraphs, we will elaborate on these results in more detail, discuss strengths and limitations of the current study, and give recommendations for future research.

4.1 Childhood adversities

Regarding hypothesis 1, it is unsurprising that emotional and physical neglect, and emotional abuse and physical neglect have the strongest association, indicating that these CAs often occur together. Concerning the latter relation, research from Maguire et al. (2015) mentions the following: "emotional abuse entails persistent disregard of a child's emotional and psychological needs", and often overlaps with neglect. More interestingly, the results in the current study show no association between bullying victimization and physical neglect. These results correspond with earlier research from O'Hara (2020), but conflict with research from Yoon et al. (2021), where a positive relation was found between bullying victimization and physical neglect. O'Hara (2020) only examined victims of physical bullying, while Yoon et al. (2021) examined both emotional and physical bullying victimization, and bullying perpetration. Nonetheless, research from Hsieh et al. (2020) also examined the relationship between bullying and physical neglect, and concluded physical neglect was only related to bullying perpetration, and not victimization. This could also be a possible explanation for the absence of a relation in the current study, since only bullying victimization was examined. As shown above, there is no agreement on the relationship between bullying victimization and physical neglect in the most recent literature. Future research into physical and emotional bullying victimization, as well as bullying perpetration is needed to create more consensus on the subject.

Concerning hypothesis 2, an interesting finding is that sexual abuse has the strongest relation with bullying, which is in line with previous findings from Haahr-Pedersen et al. (2020) and Kennedy et al. (2021), but in contrast with previous research from Schouw et al. (2020). A likely cause for these differing results is that Schouw et al. (2020) used a male sample, as previous research has shown that women experience more sexual abuse than men (Haahr-Pedersen et al., 2020; Mhamdi et al.,2017; Schilling et al., 2007; Soares et al., 2016). However, no notable differences regarding sexual abuse were observed between the two network models. This is likely due to the large subset of women in the current study.

4.2 Personality traits

With respect to hypothesis 3, it is of no surprise that there are positive relations between extraversion and agreeableness, and extraversion and conscientiousness, as this confirms prior work from Costa and McCrae (1995). The findings indicate that higher scores on extraversion are accompanied by higher scores on agreeableness and conscientiousness, Costa and McCrae (1995) state that agreeableness and conscientiousness both have overlapping characteristics

with extraversion, thus making it likely that these personality traits are associated. Perhaps also unsurprising, are the negative relations of neuroticism with extraversion and agreeableness found in the current study. This indicates that higher levels of neuroticism often go along with lower levels of extraversion and agreeableness, and vice versa, confirming prior work (Campbell & Reynolds ,1982; Roberts et al., 2008; Sarubin et al., 2015; Steiner et al.,2012; Verduyn & Brans, 2012). Previous research into the relation between neuroticism and extraversion points out that both personality traits include an affective component, with extraversion leaning towards a positive affective style, and neuroticism toward a negative affective style (Sarubin et al., 2015; Verduyn & Brans, 2012). With respect to the relation between neuroticism and agreeableness, Roberts et al. (2008) state that these personality traits are associated due to their influence in social functioning. Higher scores on agreeableness, together with lower scores on neuroticism enhance social contact. Interestingly, there are no relations between openness and any other personality trait. This contrasts with research from Aluja et al. (2003) and García et al. (2005), who found that extraversion and openness were highly correlated. However, Aluja et al. (2003) and García et al. (2005) used the NEO-PI-R to measure relationships between extraversion and openness, while the current study uses the BFI-10. Future research should look into the distinction between measurement instruments as a possible influence for different outcomes.

4.3 Childhood adversities and personality traits

Regarding hypothesis 4, we expected that neuroticism was associated to all CAs. However, we have found that neuroticism is only related to sexual abuse and emotional neglect, in both networks, contrasting with prior work (Grusnick et al.,2020; Hengartner et al.,2015). As for hypothesis 5, we expected that physical and emotional abuse were associated to all personality traits. Surprisingly, no associations between emotional abuse and the personality traits are found in both networks, and only a small negative association between physical abuse and openness is found in the female subset network, contrasting with previous research (Hengartner et al., 2015; Schouw et al., 2020). Differences may arise from using different measures of CAs (Grusnick et al. used the ACE Study Questionnaire and Schouw et al. used the the ITEC, PARQ, and TCI for measuring CAs and personality traits subsequently); different sample characteristics (unlike other studies based on general population samples, we had a young student sample); sampling variability and power (our sample was considerably smaller, reducing power to estimate parameters reliably); and statistical models (in contrast to prior work, we used partial correlation models). Finally, it

has to be mentioned that there are other associations present in the current study that do match research from Hengartner et al. (2015). Emotional neglect is negatively associated to agreeableness in the mixed-gender population network, and negatively associated to extraversion in the female subset network.

With respect to the 6th and final hypothesis, we expected stronger associations of neuroticism, agreeableness, extraversion, and conscientiousness with all forms of CAs in the female subset than in the mixed-gender population network. Unfortunately, both networks present little associations between neuroticism, agreeableness, extraversion, and conscientiousness and CAs, making interpretations very difficult. What is visible, is that the associations present are mainly higher in the female subset than in the mixed-gender subset, which indicate that the presence of a male subset has some, although very small, influence on the presence or absence of certain associations. However, no hard conclusions that associations between the above mentioned personality traits and CAs are stronger in the female subset than in the mixed-gender population can be made. Thus, the current study didn't replicate findings from Schmitt et al. (2008) and Weisberg et al. (2011). This can be explained partly in that we analyzed the relations between personality traits and CAs in two network structures with a high degree of similarity. Another very plausible explanation is that there were overall low scores on the CAs in the current study, making it hard to inspect associations.

4.4 Limitations and Implications

Several limitations have to be mentioned. First, male and female networks could not be compared, as the male subset was very small. Second, a small sample size ascertains that the analysis has less power and only strong associations are visual. Additionally, weaker associations are not detected. Third, the highest completed education of most participants was either a secondary school diploma or University Bachelor's degree or equivalent. This results in the lack of a representative sample of the student population, because students from Applied Universities and vocation schools are underrepresented. As a consequence, the results cannot be generalized to all students (currently) residing in the Netherlands. In future research, the use of a more evenly distributed sample in gender as well as degree-type should help realize generalizability. The use of a similar amount of men and women, with similar education, ensures that evident conclusions can be made based on the findings. Fourth, the use of a cross-sectional design and an undirected network can be seen as a limitation. Since there is no direction of effects between the nodes in the network models, no conclusions about

causality can be made. Even though life events are important in personality development, the results in the present study cannot be interpreted as such (Bleidorn et al., 2018; Kandler, 2012). Future research should use a longitudinal design, where they assess personality traits at a young age and later in life when CAs possibly have occurred. As previous research found that other influences (such as the social, family, and economic environment, school and work, and spirituality and health amongst others) are also important in personality forming, these have to be taken into account as well before assessing personality trait change due to CAs (Bleidorn et al., 2018; de Vries et al., 2021). Longitudinal research is also a solution to the possibility of recall-bias in the current study, due to the cross-sectional design. Additionally, future studies should also include the age when CAs occurred, as CAs are of influence on brain development (Navalta et al., 2018; Tottenham, 2020). Finally, as the retrieved data is part of a bigger study into the mental health of students no extensive information was collected about personality traits and CAs. Future research should focus more deeply on personality questionnaires and getting a broad perspective of the occurrence of CAs. With the purpose of getting a more holistic view of the relationship between CAs and personality, is would also be advised that future research focuses on a broader population instead of a student-only sample.

4.5 Conclusion

In sum, as expected almost all CAs are related to each other, indicating that experiencing more types of CAs is likely when children already have experienced one type of CA. Second, sexual abuse is related to all other CAs. Third, neuroticism is positively related to sexual abuse and emotional neglect. In contrast, unexpectedly no relation is present between emotional abuse and personality traits, and only a small relation is present between physical abuse and openness. Finally, the association of neuroticism, agreeableness, extraversion, and conscientiousness with all forms of CAs is not stronger in the female subset network than in the mixed-gender population network. We hope that, by reading this article, we have provided enough handles for further research into the relationship between childhood adversities and personality traits will be executed.

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Appendix

Appendix A

Pearson's correlations dysfunctional household environment

	1	2	3	4
1 Caretaker(s) emotional/mental health problems	-			
2 Caretaker(s) drug or alcohol problems	.43*	-		
3 Caretaker(s) attempted suicide/died by suicide	.20*	.37*	-	
4 Caretakers violent to each other	.33*	.27*	.27*	-

Note: * p<.001 (two-tailed), due to low power the variable 'caretaker(s) involved in criminal activities' has been omitted

Appendix B

Weights matrix mixed-gender population

	Network											
	EN	PA	EA	SA	PN	B	DHE	E	A	O	C	N
EN	-											
PA	.157	-										
EA	.119	.217	-									
SA	.103	.188	.075	-								
PN	.324	.092	.297	.083	-							
B	.086	.045	.014	.203	.000	-						
DHE	.092	.147	.102	.000	.000	.011	-					
E	.000	.000	.000	.000	.000	.000	.000	-				
A	-.018	.000	.000	-.095	.000	.000	.000	.111	-			
O	.000	.000	.000	.000	.000	.000	.000	.000	.000	-		
C	.000	.000	.000	.000	.000	.000	.000	.086	.000	.000	-	
N	.039	.000	.000	.077	.000	.000	.000	-.103	-.085	.000	.000	-

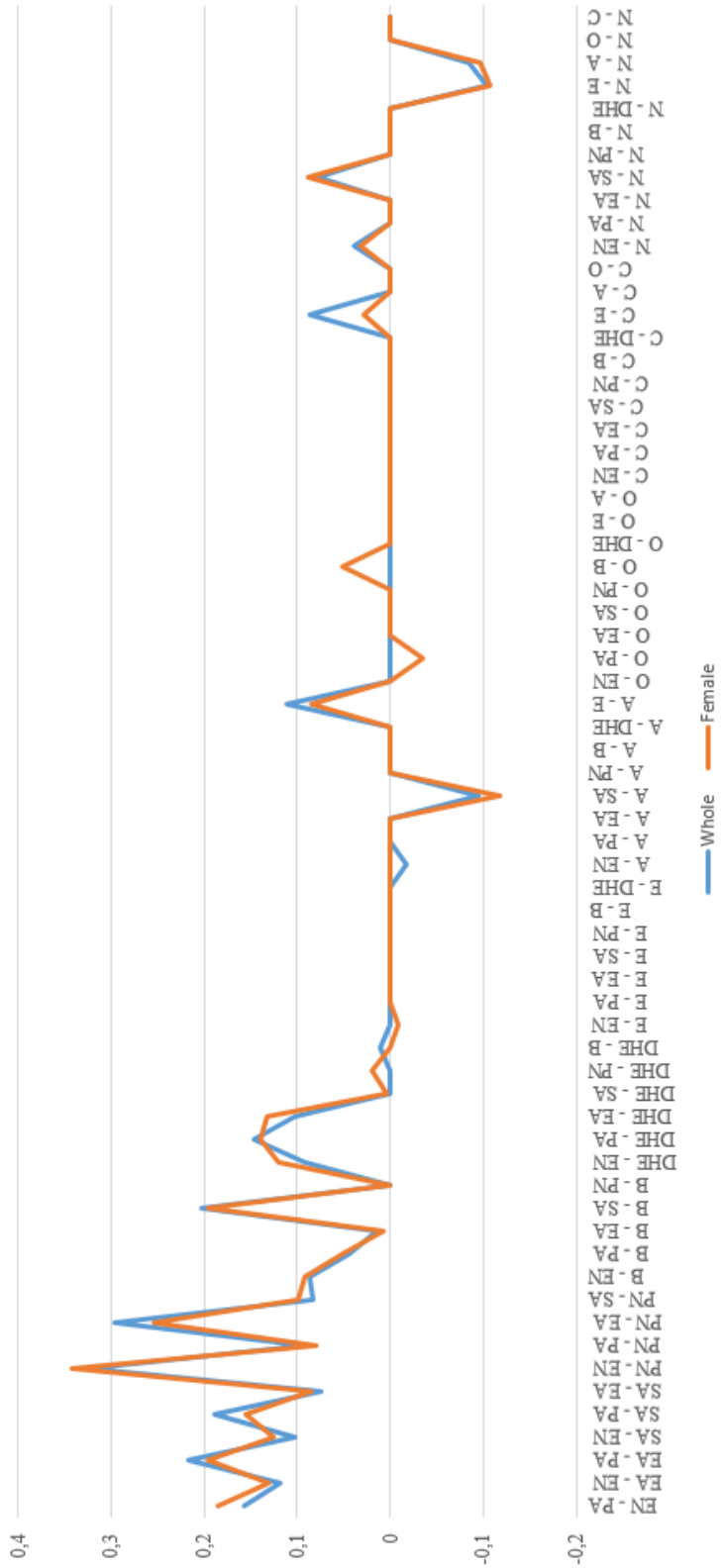
Appendix C

Weights matrix female subset

	Network											
	EN	PA	EA	SA	PN	B	DHE	E	A	O	C	N
EN	-											
PA	.185	-										
EA	.130	.195	-									
SA	.125	.156	.085	-								
PN	.342	.080	.254	.099	-							
B	.092	.052	.008	.196	.000	-						
DHE	.120	.140	.133	.003	.019	.000	-					
E	-.008	.000	.000	.000	.000	.000	.000	-				
A	.000	.000	.000	-.118	.000	.000	.000	.084	-			
O	.000	-.035	.000	.000	.000	.051	.000	.000	.000	-		
C	.000	.000	.000	.000	.000	.000	.000	.029	.000	.000	-	
N	.032	.000	.000	.088	.000	.000	.000	-.108	-.097	.000	.000	-

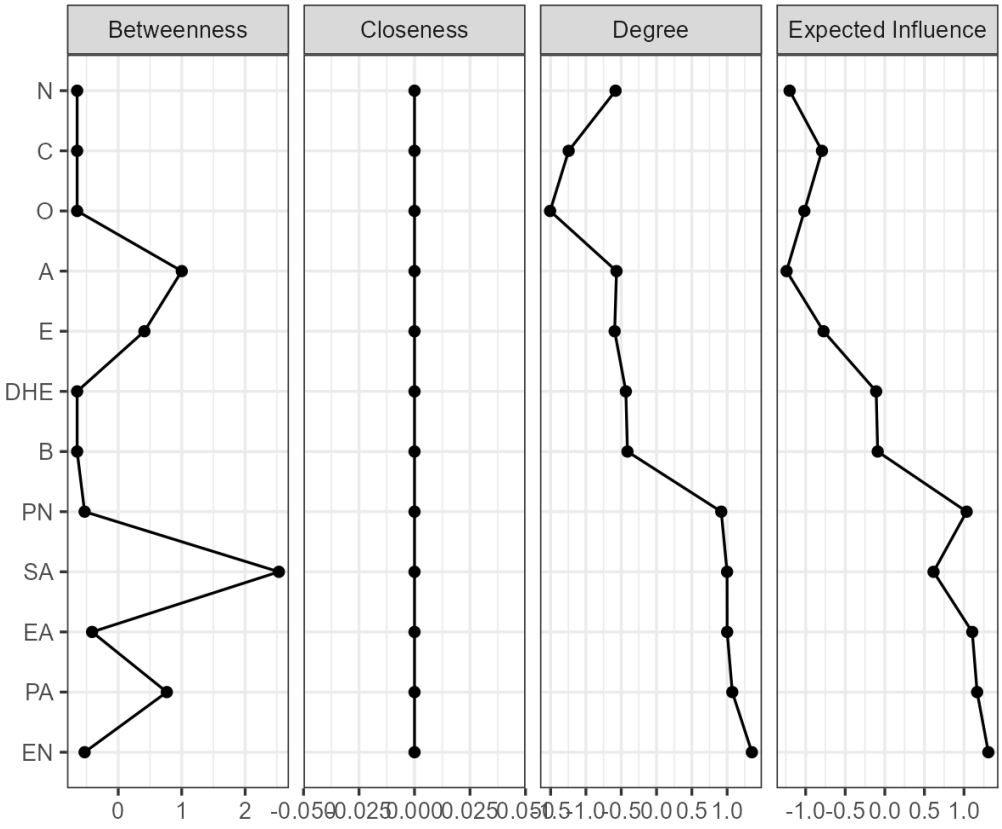
Appendix D

Line graph of edge weights of networks 1 and 2



Appendix E

Centrality plot mixed-gender population



Appendix F

Centrality plot female subset