Personality and Individual Differences 207 (2023) 112115

Contents lists available at ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

The five-factor model's personality traits and social and emotional loneliness: Two large-scale studies among Norwegian students

Eilin K. Erevik [a,*], Øystein Vedaa [a,b,c], Ståle Pallesen [a], Mari Hysing [a], Børge Sivertsen [b,c,d]

[a] Department of Psychosocial Science, University of Bergen, Post box 7807, 5020 Bergen, Norway
[b] Department of Health Promotion, Norwegian Institute of Public Health, Post box 973 Sentrum, N-5808 Bergen, Norway
[c] Department of Mental Health, Norwegian University of Science and Technology, Olav Kyrres gate 9, NO-7491 Trondheim, Norway
[d] Department of Research & Innovation, Helse-Fonna HF, Post box 2170, 5504 Haugesund, Norway

ARTICLE INFO

Keywords:
Big five
Five-factor model
Extraversion
Agreeableness
Conscientiousness
Neuroticism
Openness

ABSTRACT

The current study aimed to investigate the associations between the Five-Factor Model (FFM)`s traits and loneliness among Norwegian university/college students. Sample 1 consisted of students who participated in a national, Norwegian survey in 2014 ($N = 13{,}035$), while Sample 2 consisted of students who participated in a regional survey in Bergen, Norway in 2016 ($N = 4338$). Linear regression analyses were conducted, with the FFM's traits as independent variables and overall loneliness, social loneliness, and emotional loneliness as dependent variables. Two-way interactions between the traits were investigated. In the crude analyses, extraversion, agreeableness, conscientiousness, and openness were inversely associated with the different loneliness constructs while neuroticism was positively associated. Of the different traits, extraversion and neuroticism had the strongest associations to loneliness. Extraversion and agreeableness were more strongly associated with social compared to emotional loneliness. Neuroticism was more strongly associated with social compared to emotional loneliness in Sample 1 and more strongly associated with emotional compared to social loneliness in Sample 2. Several interaction effects between traits were statistically significant, but none were above a predefined cut-off for meaningful effect. Future research on personality traits and loneliness should aim to delineate the mechanisms and causality of the relationships.

1. Introduction

Loneliness is a common and distressing state and associated with serious adverse consequences (e.g., shortened life expectancy, cognitive decline; Hawkley & Cacioppo, 2010; Holt-Lunstad et al., 2015; Vanhalst et al., 2013). Although several definitions of loneliness have been suggested, a common denominator seems to be that loneliness entails a subjective and distressing experience of having inadequate social relationships (Bekhet et al., 2008; Hawkley & Cacioppo, 2010; Perlman & Peplau, 1981; Tiwari, 2013). Both subjective experience and the actual social situation are hypothesised and found to predict loneliness. The associations between social relationship characteristics and loneliness are, however, often found to be small to moderate, hence subjective experience of social relationships is reckoned to be most important for the development of loneliness (Green et al., 2001; Hawkley & Cacioppo, 2010; Luhmann & Hawkley, 2016; Perlman & Peplau, 1981; Russell et al., 1984). Different subtypes of loneliness have been suggested (Bekhet et al., 2008; Diehl et al., 2018; Russell et al., 1984; Tiwari, 2013; Weiss, 1973). One common distinction is between social and emotional loneliness, in which the former refers to the experience of lack of companionship, whereas emotional loneliness denotes an experience of lack of close relationships (Diehl et al., 2018; Russell et al., 1984; Weiss, 1973).

Students in higher education have high rates of loneliness, and there are indications that loneliness is increasing in this group (Dagnew & Dagne, 2019; Diehl et al., 2018; Hysing et al., 2020). Hence, there is a need for understanding determinants of student loneliness. Personality traits may be one class of predictors, as such characteristics have been found to be predictors of a range of life outcomes (Roberts et al., 2007). The current study aimed to investigate the associations between The Five-Factor Model (FFM) personality traits and loneliness, including different subtypes of loneliness (i.e., social and emotional loneliness)

* Corresponding author.
E-mail addresses: eilin.erevik@uib.no (E.K. Erevik), Oystein.Vedaa@fhi.no (Ø. Vedaa), Staale.Pallesen@uib.no (S. Pallesen), Mari.Hysing@uib.no (M. Hysing), Borge.Sivertsen@fhi.no (B. Sivertsen).

https://doi.org/10.1016/j.paid.2023.112115
Received 20 January 2022; Received in revised form 27 December 2022; Accepted 24 January 2023
Available online 14 March 2023

among Norwegian students. Another aim was to investigate trait-by-trait interactions in the relationship between the FFM traits and loneliness. The current study is the first to investigate the associations between the FFM traits and loneliness among Norwegian students, specifically. Further, the current study is among the first (possible the first) to investigate trait interactions in the relationship between the FFM traits and loneliness.

1.1. The FFM and loneliness

Considering how loneliness is conceptualized, it is apparent that differences in loneliness can stem from different expectations of social relationships, different perceptions of social relationships, differences in actual social relationship, and/or differences in how one reacts to perceived discrepancies between preferred and actual social relationships (Luhmann & Hawkley, 2016; Perlman & Peplau, 1981; Vanhalst et al., 2015). Personality traits might predict both social needs and expectations, the type of social stimuli the individual pay attention to, the quantity and quality of social relationships, and/or how the individual reacts to a perceived discrepancy between desired and actual social relationships (Buecker et al., 2020; Costa & McCrae, 1992; Feiler & Kleinbaum, 2015; Harris & Vazire, 2016; Jonason & Sherman, 2020).

FFM includes the traits extraversion, agreeableness, conscientiousness, neuroticism, and openness and is the most acknowledged and used taxonomy of personality traits (Costa & McCrae, 1992; Larsen & Buss, 2005). Evolutionary psychology can shed some light as to which FFM traits that might contribute to loneliness. From this perspective it is theorised that all FFM traits will have both benefit and costs, depending on the situation/environment (Buss, 1991; Buss, 2008; Nettle, 2006). A decreased or increased tendency for loneliness might be one type of cost/benefit. From an evolutionary perspective one might expect personality traits to affect loneliness by influencing an individual's motivation and priorities related to social relationships (Buss, 1991; Buss, 2008; Nettle, 2006). Further, evolutionary psychology also suggests the FFM traits might have an influence on loneliness more indirectly by affecting how others respond to one, as it is assumed that humans have an evolutionarily developed tendency to evaluate and chose friends and partners based on the FFM traits (Buss, 1991). Based on evolutionary psychology and theoretical formulations regarding the FFM traits, one might expect that extraversion and agreeableness could contribute to decreased loneliness, and that neuroticism might increase loneliness. Extraversion is associated with an increased sensitivity for reward, a sensitivity that may also apply for positive social stimuli (e.g., others laughing), which may further contribute to less loneliness (Abdellaoui et al., 2019;Costa & McCrae, 1992; Nettle, 2006). Agreeableness may buffer against loneliness by making the individual more likely to trust others, which may foster emotional closeness, and hence reduce loneliness, particularly emotional loneliness (Costa & McCrae, 1992; Nettle, 2006). Neuroticism is associated with an increased sensitivity for punishment, including social punishment such as social exclusion, which may increase the risk of loneliness (Abdellaoui et al., 2019; Costa & McCrae, 1992; Hawkley & Cacioppo, 2010; Nettle, 2006). Based on the conceptualisation of conscientiousness and openness (Costa & McCrae, 1992; Nettle, 2006), these traits seem less relevant for loneliness compared to the other three traits. However, all the traits in FFM may have some influence on loneliness by affecting the individual's popularity as a partner or friend, in which individuals that are reliable (i.e., have higher scores on conscientiousness) and smart (i.e., have higher scores on openness) may be more popular as partners/friends (Buss, 1991; Buss, 2008; Costa & McCrae, 1992; Nettle, 2006).

Empirical findings regarding the FFM traits and loneliness are mostly in line with what one would expect based on theoretical formulations (Abdellaoui et al., 2019; Buecker et al., 2020; Flett et al., 2016; Keldal & Abdullah, 2016; Vanhalst et al., 2013). A large meta-analysis found extraversion ($r = -0.370$), agreeableness ($r = -0.243$), conscientiousness ($r = -0.202$), and openness ($r = -0.107$) to be inversely associated with loneliness, and neuroticism ($r = 0.358$) to be positively associated with loneliness (Buecker et al., 2020). The causality regarding the relationship between personality traits and loneliness appears to be complex. Although many would expect personality traits to predict loneliness, loneliness has also been found to predict changes in personality traits (Buecker et al., 2020; Mund & Neyer, 2016; Mund & Neyer, 2019). Mund and Neyer (2016) investigated the bi-directional relationship between personality traits and loneliness among young, German adults in a longitudinal study. They found that neuroticism predicted later loneliness scores, while loneliness scores predicted later scores on neuroticism (positive direction), extraversion (inverse direction), and conscientiousness (inverse direction; Mund & Neyer, 2016). In addition to the possible bi-directional causality in the relationship between personality traits and loneliness, the relationship might also in part be explained by third variables (e.g., the other personality traits or childhood maltreatment; Buecker et al., 2020; Flett et al., 2016; Hengartner et al., 2015; Mund & Neyer, 2016; Mund & Neyer, 2019).

The relationship between personality traits and loneliness might depend somewhat on the type of loneliness assessed and the measurements used. Social and emotional loneliness have been theorised and found to have different antecedent (Russell et al., 1984; Weiss, 1973). Hence, one might expect the two subtypes of loneliness to show a differentiated relationship to the different FFM traits. Few studies have compared the associations between the FFM traits and different subtypes of loneliness. Teppers et al. (2013) found that extraversion was associated with peer- but not parent-related loneliness among Belgian high school and university students. In Buecker et al. (2020)'s meta-analysis, extraversion was found to be more strongly (inversely) associated with social compared to other types of loneliness. Further, Buecker et al. (2020) found stronger associations between personality traits and loneliness when loneliness was measured using the UCLA Loneliness Scale (Russell, 1996) compared to other scales.

In addition to potentially being influenced by the type of loneliness measured and the measurement instrument used, the relationship is also likely to depend on the types of covariates controlled for. The other traits in the FFM might act as third variables in the relationship between one specific trait and loneliness as the different traits are known to be associated with each other (Abdellaoui et al., 2019; Buecker et al., 2020; Musek, 2007). In Buecker et al. (2020)`s meta-analysis, adjusting for the other traits affected the relationships between the traits and loneliness, in particular the association between openness and loneliness, which became non-significant when the other traits were adjusted for. It might be challenging to interpret the findings when all FFM traits are adjusted for. It is argued that control variables should only be included if it is reasonable to expect that they primarily are a cause of the independent variable(s) of interest and the dependent variable, and that control variables that might be outcomes of or mediators in the relationship between the independent and dependent variables should not be included (Elwert & Winship, 2014; Spector & Brannick, 2011). In the case of the FFM personality traits, the causal relationship between the traits is not fully understood, which may make it unclear how one should interpret findings concerning one trait when the other traits are adjusted for.

Further, it might be expected that the relationship between one specific trait and loneliness is moderated by other traits. There has been a great deal of interest concerning how the FFM traits may interact in the prediction of outcomes (Vize et al., 2022). There are, however, few studies investigating such interactions, in part due the large sample sizes needed to investigate interactions (Vize et al., 2022). Accordingly, few studies have investigated possible interactions between traits in the relationship between traits and loneliness. In one study investigating possible interaction effects between the traits in Eysenck's model in predicting loneliness no statistically significant interaction effects were found (Saklofske & Yackulic, 1989).

1.1.1. The FFM traits and loneliness among Norwegian students

The associations between the FFM traits and loneliness may depend somewhat on group affiliation (Buecker et al., 2020). The assumption that the associations between traits and loneliness depend on group affiliation is supported by evolutionary notions regarding personality which suggest that the adaptability of different traits will depend on environmental factors (Buss, 1991). In this regard, Buecker et al. (2020) found extraversion to be more strongly (inversely) associated with loneliness among younger individuals, like students, while the inverse association between openness and loneliness were weaker among younger individuals, compared to older. Further, one study found extraversion to be more strongly (inversely) associated and agreeableness and conscientiousness to be less (less inversely) associated with loneliness among adolescents compared to older adults (Butkovic et al., 2012). Hence, one may expect extraversion to have the strongest associations with loneliness among students, and that other traits may be less important in this population. Extraversion may be relatively more important among students than other social groups because their social environment is ambiguous and unstructured. The ambiguity of students` social environment might imply that extraversion becomes a particularly important loneliness buffer because extraversion is associated with an increased attentiveness toward positive social stimuli (Abdellaoui et al., 2019). Individual differences in perception are known to be more pronounced in ambiguous situations (Voss et al., 2008). Further, having high scores on extraversion might be particularly beneficial in less structured settings (like the student setting) because extraversion is associated with increased social initiative and confidence (Costa & McCrae, 1992; Ying, 2002).

Previous studies on the FFM and loneliness among students have found the same/similar trends as studies on other populations (i.e., inverse associations between extraversion, agreeableness, and conscientiousness and loneliness, and positive associations between neuroticism and loneliness; Flett et al., 2016; Keldal & Abdullah, 2016; Panda, 2016; Teppers et al., 2013). Findings regarding the association between openness and loneliness among students are less clear, as some studies have found an inverse association (Panda, 2016), a positive association (Keldal & Abdullah, 2016; Teppers et al., 2013), and no statistically significant association (Flett et al., 2016). In line with the assumption that the associations between the FFM traits and loneliness may depend somewhat on social setting, one could hypothesise that the associations between personality traits and loneliness among students may depend somewhat on country as culture may play a role in the relationship.

Higher education is readily available for most young people in Norway compared to many other countries as it is free of charge and because students receive grants and favourable loans. Due to the availability of higher education in Norway, there may be more within-group variation in personality traits (and other characteristics) among Norwegian students compared to other student populations who may be more homogeneous due to stronger selection. To the best of our knowledge, no previous study has investigated the association between the FFM and loneliness among Norwegian students.

1.2. Aims and hypotheses

The current study aimed to investigate the associations between the FFM traits and loneliness (including social and emotional loneliness, specifically) among Norwegian college/university students. In addition, the study aimed to investigate if the FFM traits may interact in the relationship with loneliness. Data from two different student samples, in which different measures of personality and loneliness were used, were analysed. Based on findings in previous research, the following hypotheses were made: H_1 Extraversion will be inversely associated with loneliness. H_2 Agreeableness will be inversely associated with loneliness. H_3 Conscientiousness will be inversely associated with loneliness. H_4 Neuroticism will be positively associated with loneliness. H_5 Openness will be inversely associated with loneliness. H_6 Extraversion will be more strongly associated with social compared to emotional loneliness. H_7 The associations between personality traits and loneliness will be stronger when loneliness is measured by Roberts UCLA Loneliness Scale compared to when it is measured by the Social and Emotional Loneliness Scale. H_8 Of the different traits, extraversion will have the strongest associations with loneliness. Due to the dearth of studies investigating interaction effects between traits in the relationship with loneliness, no hypotheses regarding possible interaction effects were made. The hypotheses were not pre-registered.

2. Methods

2.1. Procedures and samples

Two samples were included in the current study. Sample 1 consisted of students who participated in the SHoT-study in 2014 (Sivertsen et al., 2019). In SHoT 2014, a random sample of students at the largest institutions for higher education in Norway were invited by e-mail to participate in an online survey. In total 13,663 students (29 %) agreed to participate. In total 13,035 students had valid responses to at least one of the included measures of loneliness. Ethical approval for SHOT 2014 was obtained from the Norwegian Data Inspectorate for Social Sciences, and informed written consent was received from all participants prior to data collection.

Sample 2 consisted of students who participated in a follow-up survey in 2016, hereinafter referred to as the Bergen-study. The data collection in 2016 was a follow-up of a survey study from 2015, in which students at the four largest institutions for higher education in Bergen, Norway, were invited to participate. A total of 11,236 (39.4 %) agreed to participate. A total of 5217 (51.5 %) participated in the 2016 survey, and Sample 2 consisted of the 4338 of these who reported to still be students. Both surveys were online, and students were invited by email. The study protocol for the 2015 and 2016 surveys were approved by the Regional Committee for Medical and Health Related Ethics, Western Norway (no. *omitted for anonymous review*), and the Norwegian Data Protection Authority (no. *omitted for anonymous review*). Participants were presented with an informed consent page where they had to mark that they consented to participation before they could respond to the survey.

The studies were carried out in accordance with the Declaration of Helsinki (World Medical Association, 2013).

Sample characteristics are described in Table 1. Sample 1 consisted of 58.6 % women and Sample 2 consisted of 64.5 % women. The age span was 18 to 35 years in Sample 1 and 18 to 64 years in Sample 2. The most prevalent age group was 23–25-year-olds in both samples (36.8 % in Sample 1 and 37.2 % in Sample 2). Differences between samples in terms of age and gender distributions were investigated with chi-square tests. The effect sizes of the differences were reported as phi coefficients, in which coefficients of 0.10, 0.30, and 0.50 represent small, moderate, and large effect sizes, respectively (Cohen, 1988). There were statistically significant differences between the two samples both in terms of age (phi = 0.22) and gender (phi = 0.02) distributions. Compared to Sample 2, Sample 1 consisted of more students in the age group 18–20 years (12 % in Sample 1 versus 6.2 % in Sample 2). Further, 5.1 % in Sample 2 were in the age group 35 years and older, while students in this age group was not invited to participate in SHoT. In terms of gender, there were more women (and less men) in Sample 2 compared to in Sample 1 (64.5 % women in Sample 2 and 58.6 % in Sample 1).

2.2. Measurements

2.2.1. Demographics

In both studies, participants were asked to report gender (response options: woman; man) and age. In SHoT the response options for the age question were: 18–20 years; 21–22 years; 23–25 years; 26–28 years; 29–34 years (students who were 35 years or older were not invited to

Table 1
Samples descriptives.

	Sample 1, *N* = 13,035	Sample 2, *N* = 4338	Significance tests and effect sizes
	M (*SD*)/%	*M* (*SD*)/%	
Demographics			
Age			Phi = 0.22***
18–20 years	12.0 %	6.2 %	
21–22 years	26.2 %	29.0 %	
23–25 years	36.8 %	37.2 %	
26–28 years	15.5 %	15.2 %	
29–34 years	9.6 %	7.3 %	
35+ years	0 %	5.1 %	
Gender			Phi = 0.02*
Man	41.4 %	35.5 %	
Woman	58.6 %	64.5 %	
Personality[a]			
Extraversion	17.5 (4.6)	13.9 (3.7)	
Agreeableness	20.8 (4.8)	16.8 (2.8)	
Conscientiousness	18.8 (5.2)	14.6 (3.2)	
Neuroticism	15.5 (4.9)	11.2 (3.7)	
Openness	18.4 (4.6)	14.6 (3.3)	
Loneliness[b]	22.4 (7.0)	6.1 (4.3)	
Social loneliness	10.9 (3.7)	1.5 (1.7)	
Emotional loneliness	11.5 (4.8)	4.5 (3.0)	

Note. *M* = mean, *SD* = standard deviation.
[a] Sample 1 = BFI-20, scores range from 4 to 28 for each trait, Sample 2 = Scores on Mini-IPIP, scores range from 4 to 20 for each trait.
[b] Sample 1 = Scores on ESLS, total scores range from 10 to 50 and facet scores range from 5 to 25, Sample 2 = Total score on RULS-8, scores range from 0 to 24 and facet scores range from 0 to 9 for social loneliness and 0–15 for emotional loneliness.
* $p < .05$.
*** $p < .001$.

participate in the study). In the Bergen-study, age was measured as a continuous variable (from 16 to 100 years). To aid comparison between samples, the age data from the Bergen-study were converted into the same age categories as those used in SHoT.

2.2.2. Personality

In SHoT, the FFM traits were assessed by the 20-items short version of the Big Five Inventory (BFI-20; Engvik & Clausen, 2011). Respondents answering BFI-20 are presented with a range of different adjective pairs representing opposite traits (e.g., warm vs. cold) and asked to indicate which of these adjectives that best describe them on a scale from one to seven, where one and seven represents the opposite traits (e.g., 1 = warm and 7 = cold). Scores on BFI-20 range from 4 to 28 for each trait. In the SHoT, BFI-20 obtained Cronbach's alphas of 0.72, 0.79, 0.85, 0.77, and 0.80 for the sub-scales measuring extraversion, agreeableness, conscientiousness, neuroticism, and openness, respectively.

In the Bergen-study, the FFM traits were assessed by the 20-item International Personality Item Pool (Mini-IPIP; Donnellan et al., 2006). In Mini-IPIP respondents are asked to indicate to which degree different statements (e.g., "I am the life of the party") reflects their typical behaviour. Response options in Mini-IPIP range from "very wrong" (1) to "very right" (5). Total scores range from 4 to 20 for each trait. In the Bergen-study, Mini-IPIP obtained Cronbach's alphas of 0.83, 0.80, 0.69, 0.77, and 0.75 for the items measuring extraversion, agreeableness, conscientiousness, neuroticism, and openness, respectively.

2.2.3. Loneliness

In SHoT, loneliness was assessed by the Emotional and Social Loneliness Scale (ESLS; Shaver & Brennan, 1991; Wittenberg, 1986). ESLS has 10 items, in which five items pertain to social and emotional loneliness, respectively. When answering ESLS the respondents are asked to indicate how often they have felt the way expressed in specific statements (e.g., "I don't get much satisfaction from the group I participate in") the last year (response options: never; seldom; sometimes; often; very often). Overall/full scale scores range from 10 to 50, while subscale scores (on social and emotional loneliness) range from 5 to 25. The full-scale instrument and the subscales assessing social and emotional loneliness, obtained Cronbach's alphas of 0.80, 0.82, and 0.75, respectively.

In the Bergen-study, loneliness was assessed by the 8-items Roberts UCLA Loneliness Scale (RULS-8; Roberts et al., 1993). In RULS-8 respondents are asked to indicate to which degree different statements (e.g., "I feel isolated from others") describe their experiences (response options: never; seldom; sometimes; often). Overall/full scale scores range from 0 to 24. In the Bergen-study RULS-8 obtained a Cronbach's alpha of 0.81. Versions of the UCLA Loneliness Scale have been conceptualized to assess social and emotional loneliness, respectively (von Soest et al., 2020; Wieczorek et al., 2021). In the current study social loneliness was assessed by three of the RULS-8 items, scores range from 0 to 9, and emotional loneliness was assessed by the other five RULS-8 items, scores range from 0 to 15. The items coded as assessing social loneliness were: "I feel in tune with people around me" (reversed coded), "I feel part of a group of friends" (reversed coded), and "I can find companionship when I want it" (reversed coded). The subscales assessing social and emotional loneliness, obtained Cronbach's alphas of 0.70 and 0.72, respectively.

2.3. Analyses

Crude and multivariate linear regression analyses were conducted in Sample 1 and 2. Assumptions for linear regression analyses in terms multicollinearity, linearity, normality, and homoscedasticity were tested before conducting the analyses, and no major violation was found. Bivariate correlations were run to test for multicollinearity (in addition to examining the variance inflation factors) and to describe the data. Pallant (2013)`s suggested cut-offs for multicollinearity, i.e., correlations above 0.7 between independent variables, were applied in the interpretation of the bivariate correlations. Disattenuated correlations between personality traits and loneliness were calculated, by dividing the correlations by the square root of the product of the reliability of both variables in the correlation (Spearman, 1904), to account for possible differences in the reliability of either measure. In the regression analyses, the dependent variables were overall loneliness, social loneliness, and emotional loneliness (loneliness or loneliness constructs will be used as collective terms). Crude analyses were conducted in step 1 where each personality trait was entered separately as an independent variable. In addition, one analysis in which all five personality traits were included as independent variables was run (i.e., step 2), this analysis was conducted to aid comparison with previous findings as the other traits are adjusted for in some previous studies. Finally, two-way interactions between the traits were investigated by adding the z-scored version of the two traits in question and their product as independent variables in linear regression analyses in which overall loneliness was the dependent variable. The R^2 of the interaction terms were also calculated in which a cut-off of 0.03 was used as a cut-off for a meaningful interaction (O'Connor & Dvorak, 2001; Vize et al., 2022). The associations between the personality traits and loneliness were reported as completely standardizes betas. Completely standardized beta is an effect size, where values of 0.10, 0.30, and 0.50 are regarded as reflecting small, moderate, and large effect sizes, respectively (Cohen, 1988), and values below 0.10 might be considered as very small. The completely standardized betas obtained, represent how much standard deviation increase/decrease one will see in the dependent variable with one standard deviation increase in the independent variable. To aid comparison of different effect sizes, the betas` 95 % *CI*s were calculated and depicted in a forest plot (Cumming & Finch, 2005; Gelman & Stern, 2006).

IBM SPSS Statistics 27 for Windows was used for all statistical analyses. The syntax used in the current study is available at ResearchBox

(*link omitted for anonymous review*). Missing data were deleted listwise. In Sample 1, 12.6 % of cases were excluded in the regression analyses while 3.6 % of the cases were excluded in Sample 2. Although the percentage of cases excluded in Sample 1 was somewhat high, the missing data were primarily linked to the dependent variables (i.e., loneliness) thus listwise deletion was considered as a satisfactory approach (Jakobsen et al., 2017).

3. Results

The results of the bivariate correlation analyses are illustrated in Table 2 (for Sample 1) and Table 3 (for Sample 2). There was no indication of multicollinearity.

The results of the regression analyses on the association between personality traits and loneliness are shown in Table 4. In the crude analyses in both samples, extraversion, agreeableness, conscientiousness, and openness were inversely associated with all loneliness constructs, while neuroticism was positively associated with all loneliness constructs. In the adjusted analyses in both samples, extraversion, agreeableness, and conscientiousness were inversely, and neuroticism and openness were positively, associated with all loneliness constructs. All these associations were statistically significant ($p < .05$), except for the following associations: openness and social loneliness in the crude analysis in Sample 2, conscientiousness and social loneliness in the adjusted analysis in Sample 1, and openness and emotional loneliness in the adjusted analysis in Sample 2. In general, adjusting for the other traits in FFM weakened the associations between the traits and loneliness.

Fig. 1 depicts a forest plot of the effect sizes from the crude models and their 95 % *CIs*. In the crude analysis most associations had small or moderate effect sizes, while the associations between openness and loneliness were very small (i.e., below 0.10). Extraversion and neuroticism, especially the former, had the strongest associations with the loneliness constructs. When comparing the associations between the traits and social versus emotional loneliness in the crude analyses, we considered associations between a trait and social versus emotional loneliness to be markedly different in a sample if there were no overlap in the associations` 95 % *CIs*. Based on this criterion, extraversion and agreeableness had stronger associations to social compared to emotional loneliness in both samples. Neuroticism was more strongly associated with social compared to emotional loneliness in Sample 1 and more strongly associated with emotional compared to social loneliness in Sample 2. In terms of the different loneliness measures/samples, most associations were strongest in Sample 2. The disattenuated correlations of the relationships between the personality traits and loneliness showed similar patterns as those found in the regression models (in terms of differences between traits, loneliness constructs, and samples) which suggest that these patterns could not be explained by differences in the reliability of measures.

The results from the interaction analyses are displayed in Table 5. Although several interaction effects were statistically significant, however, none were above the set cut-off for meaningful effect.

4. Discussion

The current study aimed to investigate the relationship between the FFM traits and loneliness among Norwegian college/university students. As a part of this investigation, the study also aimed to investigate the relationship between the FFM trait and social and emotional loneliness, specifically, and possible interactions between traits in the relationship with loneliness. Extraversion, agreeableness, conscientiousness, and openness were found to be inversely associated with loneliness, while neuroticism was positively associated with loneliness. Extraversion had the strongest association to loneliness, followed by neuroticism. Extraversion and agreeableness were more strongly associated with social compared to emotional loneliness. Several interaction effects were statistically significant, but none were above the predefined cut-off for meaningful effects. All hypotheses were supported, and the findings represent a replication of previous findings in a novel setting (Norwegian higher education; Buecker et al., 2020). The current study contributes with novel findings by investigating possible interaction effects between traits in the relationship with loneliness. Further, the findings concerning a differentiated relationship between agreeableness and neuroticism and social versus emotional loneliness are novel.

The observed associations between personality traits and loneliness could have several explanations. It appears to be the norm to assume that the main causal pathway in the relationship between personality traits and loneliness is from trait to loneliness (Buecker et al., 2020). As the findings concerning associations between specific traits and loneliness were in line with previous findings, and our hypotheses, we will only briefly discuss possible explanations and limit the discussion to the traits that were most strongly associated with loneliness, i.e., extraversion and neuroticism. The finding that extraversion and neuroticism had the strongest association with loneliness is in line with previous studies (Abdellaoui et al., 2019; Buecker et al., 2020). The associations between extraversion, neuroticism, and loneliness might be explained by

Table 2
Pearson's correlations between variables in Sample 1, $N = 13{,}035$.

Variable	1	2	3	4	5	6	7	8	9	10
1. Age[a]	–									
2. Gender[b]	−0.072***	–								
3. Extraversion	0.014	0.085***	–							
4. Agreeableness	0.033***	0.143***	0.319***	–						
5. Conscientiousness	−0.063***	0.137***	0.258***	0.338***	–					
6. Neuroticism	0.015	0.248***	−0.263***	−0.105***	−0.080***	–				
7. Openness	0.076***	−0.057***	0.269***	0.316***	0.093***	−0.118***	–			
8. Loneliness[c]	−0.033***	−0.104***	−0.316***	−0.193***	−0.144***	0.236***	−0.045***	–		
9. Social loneliness[c]	0.049***	−0.046***	−0.359***	−0.184***	−0.131***	0.301***	−0.040***	0.779***	–	
10. Emotional loneliness[c]	−0.085***	−0.119***	−0.189***	−0.142***	−0.109***	0.117***	−0.033***	0.872***	0.373***	–
Disattenuated correlations with loneliness	–	–	*−0.416*	*−0.243*	*−0.175*	*0.301*	*−0.056*	–		
Disattenuated correlations with social loneliness	–	–	*−0.467*	*−0.229*	*−0.157*	*0.379*	*−0.049*	*0.962*	–	
Disattenuated correlations with emotional loneliness	–	–	*−0.257*	*−0.184*	*−0.137*	*0.154*	*−0.043*	*1.126*	*0.476*	–

* $p < .05$.
** $p < .01$.
*** $p < .001$.
[a] 0 = 18–20 years, 1 = 21–22 years, 2 = 23–25 years, 3 = 26–28 years, 4 = 29–34 years, 5 = 35+ years.
[b] 1 = Woman, 0 = Man.
[c] Scores on ESLS.

Table 3
Pearson's correlations between variables in Sample 2, $N = 4338$.

Variable	1	2	3	4	5	6	7	8	9	10
1. Age[a]	–									
2. Gender[b]	−0.074***	–								
3. Extraversion	−0.029	0.068***	–							
4. Agreeableness	−0.018	0.311***	0.349***	–						
5. Conscientiousness	−0.046**	0.137***	0.141***	0.176***	–					
6. Neuroticism	−0.016	0.319***	−0.151***	0.062***	−0.172***	–				
7. Openness	0.099***	−0.161***	0.157***	0.108***	−0.086***	−0.023	–			
8. Loneliness[c]	0.059***	−0.015	−0.421***	−0.268***	−0.236***	0.417***	−0.037*	–		
9. Social loneliness[c]	0.077**	−0.063**	−0.448**	−0.303**	−0.204**	0.320**	−0.029	0.846**	–	
10. Emotional loneliness[c]	0.041**	0.014	−0.351**	−0.214**	−0.223**	0.417**	−0.037*	0.955**	0.650**	–
Disattenuated correlations with loneliness	–	–	−0.513	−0.333	−0.316	0.528	−0.047	–		
Disattenuated correlations with social loneliness	–	–	−0.588	−0.405	−0.294	0.436	−0.040	1.124	–	
Disattenuated correlations with emotional loneliness	–	–	−0.454	−0.282	−0.316	0.560	−0.050	1.251	0.916	–

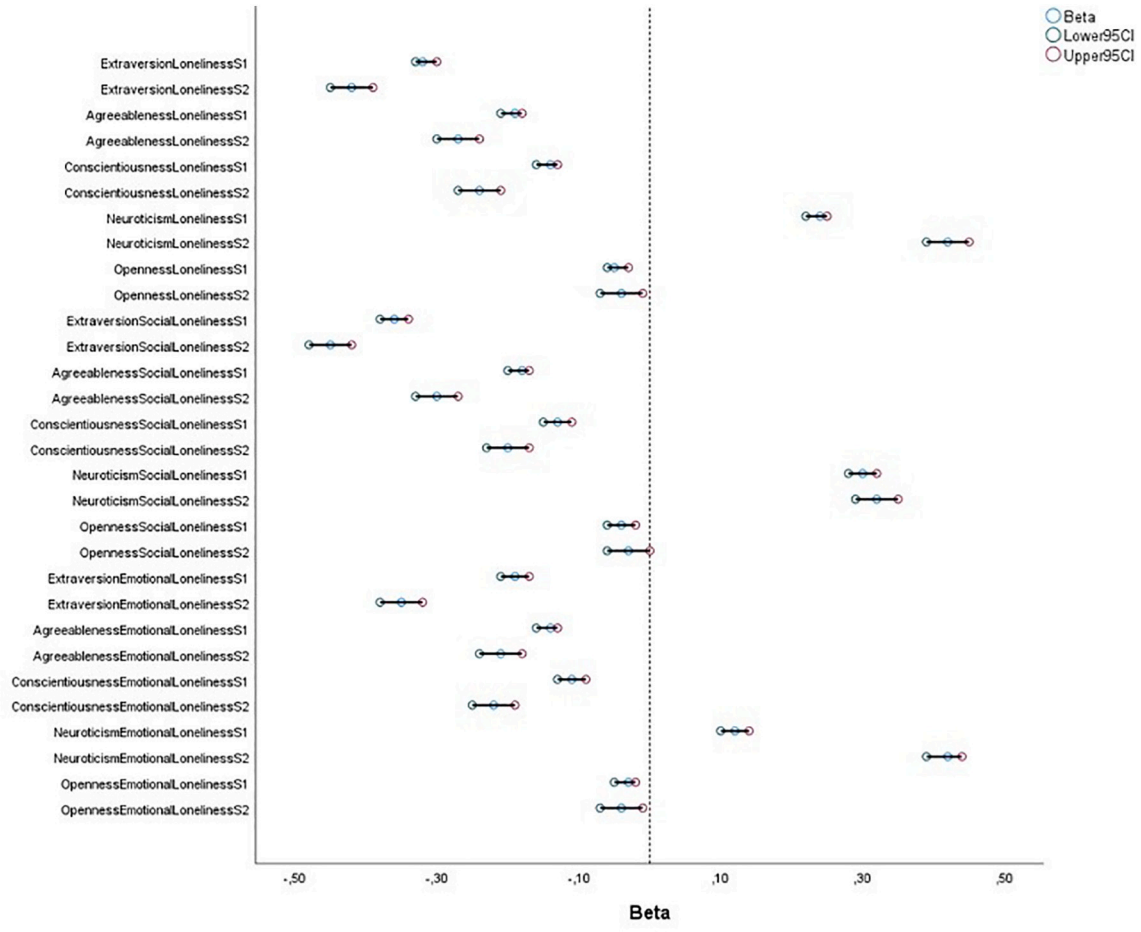
[a] 0 = 18–20 years, 1 = 21–22 years, 2 = 23–25 years, 3 = 26–28 years, 4 = 29–34 years, 5 = 35+ years.
[b] 1 = Woman, 0 = Man.
[c] Scores on RULS-8.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 4
Personality and loneliness, linear multiple regression analyses.

	Sample 1, $n = 11,396$						Sample 2, $n = 4181$					
	Overall loneliness	*p*	Social loneliness	*p*	Emotional loneliness	*p*	Overall loneliness	*p*	Social loneliness	*p*	Emotional loneliness	*p*
	Beta [95 % *CI*]		Beta [95 % *CI*]		Beta [95 % *CI*]		Beta [95 % *CI*]		Beta [95 % *CI*]		Beta [95 % *CI*]	
Crude models												
Extraversion	**−0.32 [−0.33, −0.30]**	<0.001	**−0.36 [−0.38, −0.34]**	<0.001	**−0.19 [−0.21, −0.17]**	<0.001	**−0.42 [−0.45, −0.39]**	<0.001	**−0.45 [−0.48, −0.42]**	<0.001	**−0.35 [−0.38, −0.32]**	<0.001
Agreeableness	**−0.19 [−0.21, −0.18]**	<0.001	**−0.18 [−0.20, −0.17]**	<0.001	**−0.14 [−0.16, −0.13]**	<0.001	**−0.27 [−0.30, −0.24]**	<0.001	**−0.30 [−0.33, −0.27]**	<0.001	**−0.21 [−0.24, −0.18]**	<0.001
Conscientiousness	**−0.14 [−0.16, −0.13]**	<0.001	**−0.13 [−0.15, −0.11]**	<0.001	**−0.11 [−0.13, −0.09]**	<0.001	**−0.24 [−0.27, −0.21]**	<0.001	**−0.20 [−0.23, −0.17]**	<0.001	**−0.22 [−0.25, −0.19]**	<0.001
Neuroticism	**0.24 [0.22, 0.25]**	<0.001	**0.30 [0.28, 0.32]**	<0.001	**0.12 [0.10, 0.14]**	<0.001	**0.42 [0.39, 0.45]**	<0.001	**0.32 [0.29, 0.35]**	<0.001	**0.42 [0.39, 0.44]**	<0.001
Openness	**−0.05 [−0.06, −0.03]**	<0.001	**−0.04 [−0.06, −0.02]**	<0.001	**−0.03 [−0.05, −0.02]**	<0.001	**−0.04 [−0.07, −0.01]**	0.015	−0.03 [−0.06, 0.00]	0.063	**−0.04 [−0.07, −0.01]**	0.016
Adjusted for other traits												
Extraversion	**−0.25 [−0.27, −0.23]**	<0.001	**−0.30 [−0.31, −0.28]**	<0.001	**−0.14 [−0.16, −0.12]**	<0.001	**−0.30 [−0.32, −0.27]**	<0.001	**−0.34 [−0.36, −0.31]**	<0.001	**−0.23 [−0.26, −0.21]**	<0.001
Agreeableness	**−0.11 [−0.13, −0.09]**	<0.001	**−0.09 [−0.11, −0.07]**	<0.001	**−0.09 [−0.11, −0.07]**	<0.001	**−0.18 [−0.20, −0.15]**	<0.001	**−0.20 [−0.22, −0.17]**	<0.001	**−0.14 [−0.17, −0.11]**	<0.001
Conscientiousness	**−0.04 [−0.06, −0.02]**	<0.001	−0.02 [−0.03, 0.00]	0.064	**−0.04 [−0.06, −0.02]**	<0.001	**−0.10 [−0.13, −0.07]**	<0.001	**−0.07 [−0.10, −0.05]**	<0.001	**−0.10 [−0.13, −0.08]**	<0.001
Neuroticism	**0.17 [0.15, 0.18]**	<0.001	**0.22 [0.21, 0.24]**	<0.001	**0.07 [0.05, 0.09]**	<0.001	**0.37 [0.34, 0.39]**	<0.001	**0.27 [0.25, 0.30]**	<0.001	**0.37 [0.35, 0.40]**	<0.001
Openness	**0.08 [0.07, 0.10]**	<0.001	**0.10 [0.08, 0.12]**	<0.001	**0.05 [0.03, 0.07]**	<0.001	**0.03 [0.00, 0.05]**	0.037	**0.04 [0.02, 0.07]**	<0.001	0.01 [−0.01, 0.04]	0.316

Note. CI = confidence interval. Statistically significant findings (i.e., $p < .05$) are marked with bold font. In Sample 1 loneliness scores are based on scores on ESLS, while in Sample 2 loneliness scores are based on scores on RULS-8.

individuals with higher extraversion and neuroticism scores having a higher likelihood of paying attention to positive and negative stimuli, respectively (Abdellaoui et al., 2019; Costa & McCrae, 1992). Loneliness has been found to be associated with a decreased sensitivity toward positive social stimuli and an increased sensitivity to negative social stimuli (Abdellaoui et al., 2019; Cacioppo et al., 2009; Cacioppo et al., 2015). Hence, individuals with higher extraversion scores might be less lonely because they are more sensitive toward positive social cues, while individuals with higher neuroticism scores might be lonelier because they are more sensitive toward negative social cues. In addition,



Note. S1 = Sample 1, *S2* = Sample 2, *95CI* = 95% confidence interval.

Fig. 1. Forest plot of effect sizes in the crude relationship between personality traits and loneliness.

Table 5
Interactions between personality traits on loneliness, linear multiple regression analyses.

	Sample 1, n = 11,396			Sample 2, n = 4181		
	B [95 % CI]/Beta	p	R^2 (Only interaction term)	B [95 % CI]/Beta	p	R^2 (Only interaction term)
Interactions between traits						
Extraversion × Agreeableness	−0.13 [−0.15, −0.12]/−0.14	<0.001	0.005	0.05 [0.02, 0.07]/0.05	<0.001	0.019
Extraversion × Conscientiousness	−0.05 [−0.06, −0.03]/−0.05	<0.001	0.001	0.03 [0.00, 0.06]/0.03	0.031	0.001
Extraversion × Neuroticism	0.00 [−0.01, 0.02]/0.00	0.623	0.000	−0.06 [−0.08, −0.03]/−0.06	<0.001	0.004
Extraversion × Openness	−0.04 [−0.05, −0.02]/−0.04	<0.001	0.001	0.02 [−0.01, 0.04]/0.02	0.174	0.001
Agreeableness × Conscientiousness	−0.14 [−0.16, −0.13]/−0.18	<0.001	0.007	−0.01 [−0.03, 0.02]/−0.01	0.733	0.001
Agreeableness × Neuroticism	0.10 [0.09, 0.12]/0.11	<0.001	0.010	−0.07 [−0.09, −0.04]/−0.07	<0.001	0.002
Agreeableness × Openness	−0.11 [−0.13, −0.10]/−0.14	<0.001	0.002	0.03 [0.00, 0.06]/0.03	0.030	0.002
Conscientiousness × Neuroticism	0.03 [0.01, 0.04]/0.03	0.001	0.000	−0.04 [−0.06, −0.01]/−0.04	0.006	0.002
Conscientiousness × Openness	−0.05 [−0.06, −0.03]/−0.05	<0.001	0.002	0.05 [0.02, 0.08]/0.05	0.001	0.001
Neuroticism × Openness	0.03 [0.01, 0.05]/0.03	<0.001	0.002	−0.02 [−0.05, 0.01]/−0.02	0.151	0.000

Note. CI = confidence interval.

extraversion and neuroticism may also influence loneliness by affecting the number or quality of friendships (Feiler & Kleinbaum, 2015; Harris & Vazire, 2016) as extraversion scores have been associated with having more friends (Feiler & Kleinbaum, 2015), while neuroticism has been found to be associated with reduced relationship quality in friendships (Harris & Vazire, 2016).

The finding that extraversion was more strongly associated with social as compared to emotional loneliness likely reflects that individuals with high scores on extraversion have characteristics that may be particularly beneficial for both enjoying and creating large social network (hence alleviating social loneliness) as they tend to enjoy and excel in social situations in which several people are gathered, while these characteristics may have less of an effect on the experience, number, and quality of close relationships (Anderson et al., 2001; Costa & McCrae, 1992; Feiler & Kleinbaum, 2015). Agreeableness was also more strongly associated with social compared to emotional loneliness. This finding might be surprising as one could reason that agreeableness might be particularly important for emotional loneliness because

agreeableness is associated with higher levels of trust which may also enhance emotional closeness (Costa & McCrae, 1992; Nettle, 2006). The finding that agreeableness was more strongly associated with social as compared to emotional loneliness might be related to the agreeableness facet compliance (Costa & McCrae, 1992). Compliance might be more important for maintaining a social network as it may facilitate cooperation/agreement which may be more important when several people are involved, but less important in close relationship. Neuroticism had a differentiated relationship to social versus emotional loneliness as well. In Sample 1, neuroticism was more strongly associated with social compared to emotional loneliness, while the opposite was the case in Sample 2. Regarding the finding in Sample 2 in which neuroticism was more strongly associated with emotional compared to social loneliness, one could speculate that this might reflect that those with higher scores on neuroticism have a stronger, and hence more difficult to satisfy, need for emotional closeness. The finding in Sample 1, that neuroticism was more strongly associated with social compared to emotional loneliness might be explained by the measurement of social loneliness in Sample 1. Two of the five items measuring emotional loneliness in ESLS pertain to having a romantic partner. Single female students with higher neuroticism scores have been found to have a higher likelihood of entering romantic relationships, compared to single female students with lower neuroticism scores (Erevik et al., 2020). Hence, neuroticism might be less positively associated with emotional loneliness as measured by ESLS due to the association between neuroticism and being in a romantic relationship.

The personality traits had stronger associations with loneliness in Sample 2/when measured by RULS-8 as compared to in Sample 1/when measured by ESLS. Possible explanations to this finding are not apparent. The statements in RULS-8 are mostly framed in terms of subjective experience (e.g., "I feel part of a group of friends"), while the statements in ESLS appear to be framed in a more factual manner (e.g., "I belong to a network of friends"). As all levels of the different personality traits may be sociably adaptive in some situations (Buss, 1991; Judge et al., 2009); it could be speculated that the traits may have a stronger effect on one's subjective experience of loneliness compared to one's actual social situation. The finding that the personality traits were more strongly associated with loneliness in Sample 2 compared to Sample 1 may also be explained by other factors than the loneliness measures, such as differences between the samples or in the instruments used to measure personality traits. Sample 1 consisted of students studying in smaller or larger cities throughout Norway, while Sample 2 consisted solely of students studying in Bergen (the second largest city in Norway). One could speculate that personality traits may have a larger effect on loneliness in larger cities where the social environment is more ambiguous (which may increase the influence of individual differences in perception). Further, one can speculate that the individual must make more of an effort to form social relationships in larger cities compared to in smaller places where "everyone knows everyone" which may also increase the effect of personality traits on loneliness. Further, the personality measures used in Sample 1 and 2 are quite different in the way the questions are framed. In the BFI-20 (used in Sample 1) respondents are asked to indicate the degree to which different adjectives describe them, while in the Mini-IPIP respondents are asked to indicate the degree to which different statements describe them. Adjectives may prompt a more outward orientation in which the respondent place emphasis on how others perceive them, while statements might prompt a more inward orientation in which the respondents focus more on their own experiences. If traits have a stronger effect on one's subjective experience of loneliness compared to one's actual social situation, it might make sense that a personality measure that might be more subjectively framed (Mini-IPIP) has stronger associations with loneliness compared to a more objectively framed measure (BFI-20).

Adjusting for the other traits weakened the associations between specific traits and loneliness. The uncertainty regarding the causal relationship between traits hampers the interpretation of these findings. Possible explanations to the observed lack of meaningful trait-by-trait interactions are not apparent, although this finding is in line with previous findings on other outcomes than loneliness (Vize et al., 2022).

The current design precludes conclusions regarding whether the relationship between personality traits and loneliness among students differ from the relationship in other groups. One could, however, assume that extraversion in particular might have stronger ties with loneliness among students compared to non-students due to the ambiguous and unstructured nature of student life, where paying attention to positive social stimuli and being willing and able to take initiative to make friends (as individuals with higher extraversion scores tend to be) could be particularly important (Abdellaoui et al., 2019; Costa & McCrae, 1992; Diehl et al., 2018; Pittman & Richmond, 2008; Rice, 1992). One could further speculate that extraversion might be a particularly important protective factor against social loneliness among students, compared to in other populations, as it might be more important to be comfortable with taking social initiative to create a social network (alleviating social loneliness) as a student compared to in other stages of life (e.g., at the workplace). With regards to possible differences in the relationship between personality traits and loneliness among Norwegian students compared to students from other countries, the pattern observed in the current study in which extraversion, agreeableness, conscientiousness, and openness were inversely associated with loneliness and neuroticism was positively associated with loneliness, is overall in line with the findings in studies with students from other countries (Flett et al., 2016; Keldal & Abdullah, 2016; Panda, 2016; Teppers et al., 2013). Further, the current findings do not differ consistently from other studies among students in terms of the magnitude of effect sizes (Flett et al., 2016; Keldal & Abdullah, 2016; Panda, 2016; Teppers et al., 2013).

4.1. Implications

The current study may have some implications for future research. The observed associations between personality traits and loneliness suggest that it is important to include personality traits when investigating predictors of loneliness. Further, future research should investigate the mechanisms and causality behind the relationship between personality traits and loneliness, in which there is a need for studies using other designs than cross-sectional survey designs, e.g., longitudinal studies and/or qualitative studies.

4.2. Limitations and strengths

The inclusion of two large samples and the use of different measures of loneliness and personality are important assets of the current study. These strengths are all likely to contribute to robust findings and increase the generalisability of the findings.

The use of two samples and different measures both in terms of personality and loneliness instruments may also be considered as a limitation precludes conclusions concerning whether it was differences between samples, the personality instrument used, and/or the loneliness instruments used, that caused differences in findings. Further, the number of samples and instruments resulted in a great number of significance tests being conducted. The number of significance tests could also be viewed as a limitation as it increases the likelihood of some of the findings reflecting type I error. In particularly the findings concerning openness should be interpreted with caution, as the effect sizes were very small. Further, the cross-sectional design is another limitation with the current study as it precludes conclusions regarding directionality. It is conceivable that the traits contribute to loneliness, that loneliness contributes to the development of certain traits, and that both traits and loneliness are in part explained by common third factors (Buecker et al., 2020; Mund & Neyer, 2019). Childhood maltreatment might be a particularly important third factor as this variable has been found to predict both personality development and later loneliness levels (Flett

et al., 2016; Hengartner et al., 2015). It may seem reasonable to assume that the main pathway concerning the relationship is from personality traits to loneliness as it appears to be assumed that personality traits are more stable from an early age, compared to loneliness. There is, however, a need for longitudinal studies investigating this assumption. The fact that all data were based on self-report is another limitation as it increases the risk of findings being influenced by the common method bias (Podsakoff et al., 2003). As personality traits and loneliness, are in part based on internal subjective experiences, self-report might be the most reasonable approach, at least for the measurement of loneliness. Personality traits could, however, also be measured by observer report to ensure the robustness of findings. Finally, an important limitation is the rather low response rates which may pose a threat to the generalisability of the current results. However, in contrast to prevalence studies, the findings in studies focusing on associations, like the current study, are generally less affected by selection bias (Manolio & Collins, 2010; Nilsen et al., 2009). Also, this limitation is far from unique for the current study as low response rates are a common problem in survey research (Sheehan, 2001; Tolonen et al., 2006).

4.3. Conclusions

In the current study among Norwegian students, extraversion, agreeableness, conscientiousness, and openness were inversely, and neuroticism was positively associated with loneliness. Of the different traits, extraversion and neuroticism had the strongest associations to loneliness. Extraversion and agreeableness were more strongly associated with social compared to emotional loneliness. Several interaction effects between traits turned out statistically significant, but none were above a predefined cut-off for meaningful effect. Future research on personality traits and loneliness should aim to delineate the mechanisms and causality in the relationship.

Funding

The data collection was funded by the University of Bergen, Bergen municipality, and the three largest student welfare organisations in Norway (SiO, Sammen and SiT). No specific grant was received for conducting the current study. The funding sources were not involved in deciding the study design, in the data collection, in the analysis and interpretation of data, in the writing of the report, or in the decision to submit the article for publication.

CRediT authorship contribution statement

Eilin K. Erevik: Conceptualization, Methodology, Data curation, Formal analysis, Visualization, Writing – original draft, Writing – review & editing, Project administration, Funding acquisition. **Øystein Vedaa:** Methodology, Writing – review & editing. **Ståle Pallesen:** Conceptualization, Writing – review & editing, Project administration, Funding acquisition. **Mari Hysing:** Writing – review & editing. **Børge Sivertsen:** Conceptualization, Methodology, Data curation, Writing – review & editing, Project administration, Funding acquisition.

Declaration of competing interest

None.

Data availability

Data from Sample 1 (the SHoT-study) are available upon reasonable request. SHoT data are administrated by the Norwegian Institute of Public Health. Approval from a Norwegian regional committee for medical and health research ethics (https://helseforskning.etikkom.no) is a requirement for data access. Data from Sample 2 are not available as the participants in Sample 2 were guaranteed that only three named researchers would have access to their data. The syntax used in the current study is available at ResearchBox (https://researchbox.org/892).

Acknowledgements

The authors wish to thank all students participating in the studies, as well as the three largest student welfare organisations in Norway (SiO, Sammen and SiT) who initiated and designed the SHoT-study. Further the authors want to thank Trude Remme for her contribution to the data collection process in one of the two surveys. Finally, we want to thank the two anonymous reviewers for their thorough review and helpful comments.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.paid.2023.112115.

References

Abdellaoui, A., Chen, H. Y., Willemsen, G., Ehli, E. A., Davies, G. E., Verweij, K. J., Nivard, M. G., de Geus, E. J. C., Boomsma, D. I., & Cacioppo, J. T. (2019). Associations between loneliness and personality are mostly driven by a genetic association with neuroticism. *Journal of Personality, 87*(2), 386–397. https://doi.org/10.1111/jopy.12397

Anderson, C., John, O. P., Keltner, D., & Kring, A. M. (2001). Who attains social status? Effects of personality and physical attractiveness in social groups. *Journal of Personality and Social Psychology, 81*(1), 116–132. https://doi.org/10.1037/0022-3514.81.1.116

Bekhet, A. K., Zauszniewski, J. A., & Nakhla, W. E. (2008). Loneliness: A concept analysis. *Nursing Forum, 43*(4), 207–213. https://doi.org/10.1111/j.1744-6198.2008.00114.x

Buecker, S., Maes, M., Denissen, J. J., Luhmann, M., & Laceulle, O. M. (2020). Loneliness and the big five personality traits: A meta-analysis. *European Journal of Personality, 34*(1), 8–28. https://doi.org/10.1002/per.2229

Buss, D. M. (1991). Evolutionary personality psychology. *Annual Review of Psychology, 42*(1), 459–491.

Buss, D. M. (2008). Human nature and individual differences: Evolution of human personality. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), *Handbook of personality: Theory and research* (pp. 29–60). Guilford.

Butkovic, A., Brkovic, I., & Bratko, D. (2012). Predicting well-being from personality in adolescents and older adults. *Journal of Happiness Studies, 13*, 455–467. https://doi.org/10.1007/s10902-011-9273-7

Cacioppo, J. T., Norris, C. J., Decety, J., Monteleone, G., & Nusbaum, H. (2009). In the eye of the beholder: Individual differences in perceived social isolation predict regional brain activation to social stimuli. *Journal of Cognitive Neuroscience, 21*(1), 83–92. https://doi.org/10.1162/jocn.2009.21007

Cacioppo, S., Balogh, S., & Cacioppo, J. T. (2015). Implicit attention to negative social, in contrast to nonsocial, words in the stroop task differs between individuals high and low in loneliness: Evidence from event-related brain microstates. *Cortex, 70*, 213–233. https://doi.org/10.1016/j.cortex.2015.05.032

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. Erlbaum.

Costa, P. T., Jr., & McCrae, R. R., Jr. (1992). *Revised NEO Personality Inventory (NEO-PI-R) and the NEO Five-Factor Inventory (NEO-FFI) professional manual*. Psychological Assessment Resources.

Cumming, G., & Finch, S. (2005). Inference by eye: Confidence intervals and how to read pictures of data. *American Psychologist, 60*(2), 170–180. https://doi.org/10.1037/0003-066X.60.2.170

Dagnew, B., & Dagne, H. (2019). Year of study as predictor of loneliness among students of University of Gondar. *BMC Research Notes, 12*(1), 1–6. https://doi.org/10.1186/s13104-019-4274-4

Diehl, K., Jansen, C., Ishchanova, K., & Hilger-Kolb, J. (2018). Loneliness at universities: Determinants of emotional and social loneliness among students. *International Journal of Environmental Research and Public Health, 15*(9), 1865. https://doi.org/10.3390/ijerph15091865

Donnellan, M. B., Oswald, F. L., Baird, B. M., & Lucas, R. E. (2006). The mini-IPIP scales: Tiny-yet-effective measures of the big five factors of personality. *Psychological Assessment, 18*(2), 192–203. https://doi.org/10.1037/1040-3590.18.2.192

Elwert, F., & Winship, C. (2014). Endogenous selection bias: The problem of conditioning on a collider variable. *Annual Review of Sociology, 40*, 31–53. https://doi.org/10.1146/annurev-soc-071913-043455

Engvik, H., & Clausen, S. E. (2011). Norsk kortversjon av big five inventory (BFI-20) [A norwegian short version of the big five inventory (BFI-20)]. *Tidsskrift for Norsk Psykologforening, 48*(9), 869–872. https://psykologtidsskriftet.no/oppsummert/2011/09/norsk-kortversjon-av-big-five-inventory-bfi-20.

Erevik, E. K., Pallesen, S., Andreassen, C. S., Vedaa, Ø., Skogstad, A., Dhir, A., & Torsheim, T. (2020). Demographics, personality and substance-use characteristics associated with forming romantic relationships. *Evolutionary Psychological Science, 6*(1), 1–13. https://doi.org/10.1007/s40806-019-00203-2

Feiler, D. C., & Kleinbaum, A. M. (2015). Popularity, similarity, and the network extraversion bias. *Psychological Science, 26*(5), 593–603. https://doi.org/10.1177/0956797615569580

Flett, G. L., Goldstein, A. L., Pechenkov, I. G., Nepon, T., & Wekerle, C. (2016). Antecedents, correlates, and consequences of feeling like you don't matter: Associations with maltreatment, loneliness, social anxiety, and the five-factor model. *Personality and Individual Differences, 92*, 52–56. https://doi.org/10.1016/j.paid.2015.12.014

Gelman, A., & Stern, H. (2006). The difference between "significant" and "not significant" is not itself statistically significant. *The American Statistician, 60*(4), 328–331. https://doi.org/10.1198/000313006X152649

Green, L. R., Richardson, D. S., Lago, T., & Schatten-Jones, E. C. (2001). Network correlates of social and emotional loneliness in young and older adults. *Personality and Social Psychology Bulletin, 27*(3), 281–288. https://doi.org/10.1177/0146167201273002

Harris, K., & Vazire, S. (2016). On friendship development and the big five personality traits. *Social and Personality Psychology Compass, 10*(11), 647–667. https://doi.org/10.1111/spc3.12287

Hawkley, L. C., & Cacioppo, J. T. (2010). Loneliness matters: A theoretical and empirical review of consequences and mechanisms. *Annals of Behavioral Medicine, 40*(2), 218–227. https://doi.org/10.1007/s12160-010-9210-8

Hengartner, M. P., Cohen, L. J., Rodgers, S., Müller, M., Roessler, W., & Ajdacic-Gross, V. (2015). Association between childhood maltreatment and normal adult personality traits: Exploration of an understudied field. *Journal of Personality Disorders, 29*(1), 1–14, 101521pedi201428143.

Holt-Lunstad, J., Smith, T. B., Baker, M., Harris, T., & Stephenson, D. (2015). Loneliness and social isolation as risk factors for mortality: A meta-analytic review. *Perspectives on Psychological Science, 10*(2), 227–237. https://doi.org/10.1177/1745691614568352

Hysing, M., Petrie, K. J., Bøe, T., Lønning, K. J., & Sivertsen, B. (2020). Only the lonely: A study of loneliness among university students in Norway. *Clinical Psychology in Europe, 2*(1), Article e2781. https://doi.org/10.32872/cpe.v2i1.2781

Jakobsen, J. C., Gluud, C., Wetterslev, J., & Winkel, P. (2017). When and how should multiple imputation be used for handling missing data in randomised clinical trials: A practical guide with flowcharts. *BMC Medical Research Methodology, 17*(1), 1–10. https://doi.org/10.1186/s12874-017-0442-1

Jonason, P. K., & Sherman, R. A. (2020). Personality and the perception of situations: The big five and dark triad traits. *Personality and Individual Differences, 163*, Article 110081. https://doi.org/10.1016/j.paid.2020.110081

Judge, T. A., Piccolo, R. F., & Kosalka, T. (2009). The bright and dark sides of leader traits: A review and theoretical extension of the leader trait paradigm. *The Leadership Quarterly, 20*(6), 855–875. https://doi.org/10.1016/j.leaqua.2009.09.004

Keldal, G., & Abdullah, A. T. L. I. (2016). University students' personality traits as predictors of their loneliness levels. *Çukurova Üniversitesi Eğitim Fakültesi Dergisi, 45*(2), 131–146.

Larsen, R. J., & Buss, D. M. (2005). *Personality psychology: Domains of knowledge about human nature* (2nd ed.). McGraw Hill.

Luhmann, M., & Hawkley, L. C. (2016). Age differences in loneliness from late adolescence to oldest old age. *Developmental Psychology, 52*(6), 943–959. https://doi.org/10.1037/dev0000117

Manolio, T. A., & Collins, R. (2010). Enhancing the feasibility of large cohort studies. *JAMA, 304*(20), 2290–2291. https://doi.org/10.1001/jama.2010.1686

Mund, M., & Neyer, F. J. (2016). The winding paths of the lonesome cowboy: Evidence for mutual influences between personality, subjective health, and loneliness. *Journal of Personality, 84*(5), 646–657. https://doi.org/10.1111/jopy.12188

Mund, M., & Neyer, F. J. (2019). Loneliness effects on personality. *International Journal of Behavioral Development, 43*(2), 136–146. https://doi.org/10.1177/0165025418800224

Musek, J. (2007). A general factor of personality: Evidence for the big one in the five-factor model. *Journal of Research in Personality, 41*(6), 1213–1233. https://doi.org/10.1016/j.jrp.2007.02.003

Nettle, D. (2006). The evolution of personality variation in humans and other animals. *American Psychologist, 61*(6), 622–631. https://doi.org/10.1037/0003-066X.61.6.622

Nilsen, R. M., Vollset, S. E., Gjessing, H. K., Skjærven, R., Melve, K. K., Schreuder, P., Alsaker, E. R., Haug, K., Daltveit, A. K., & Magnus, P. (2009). Self-selection and bias in a large prospective pregnancy cohort in Norway. *Paediatric and Perinatal Epidemiology, 23*(6), 597–608. https://doi.org/10.1111/j.1365-3016.2009.01062.x

O'Connor, B. P., & Dvorak, T. (2001). Conditional associations between parental behavior and adolescent problems: A search for personality–environment interactions. *Journal of Research in Personality, 35*(1), 1–26. https://doi.org/10.1006/jrpe.2000.2295

Pallant, J. (2013). *SPSS survival manual*. UK: McGraw-hill education.

Panda, S. (2016). Personality traits and the feeling of loneliness of post-graduate university students. *The International Journal of Indian Psychology, 3*(3), 27–37.

Perlman, D., & Peplau, L. A. (1981). Toward a social psychology of loneliness. In R. Gilmor, & S. Duck (Eds.), *Personal relationships: 3. Personal relationships in disorder* (pp. 33–56). Academic Press.

Pittman, L. D., & Richmond, A. (2008). University belonging, friendship quality, and psychological adjustment during the transition to college. *The Journal of Experimental Education, 76*(4), 343–362. https://doi.org/10.3200/JEXE.76.4.343-362

Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology, 88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Rice, K. G. (1992). Separation-individuation and adjustment to college: A longitudinal study. *Journal of Counseling Psychology, 39*(2), 203–213. https://doi.org/10.1037/0022-0167.39.2.203

Roberts, B. W., Kuncel, N. R., Shiner, R., Caspi, A., & Goldberg, L. R. (2007). The power of personality: The comparative validity of personality traits, socioeconomic status, and cognitive ability for predicting important life outcomes. *Perspectives on Psychological Science, 2*(4), 313–345. https://doi.org/10.1111/j.1745-6916.2007.00047.x

Roberts, R. E., Lewinsohn, P. M., & Seeley, J. R. (1993). A brief measure of loneliness suitable for use with adolescents. *Psychological Reports, 72*, 1379–1391. https://doi.org/10.2466/pr0.1993.72.3c.1379

Russell, D., Cutrona, C. E., Rose, J., & Yurko, K. (1984). Social and emotional loneliness: An examination of Weiss's typology of loneliness. *Journal of Personality and Social Psychology, 46*(6), 1313–1321. https://doi.org/10.1037/0022-3514.46.6.1313

Russell, D. W. (1996). UCLA loneliness scale (Version 3): Reliability, validity, and factor structure. *Journal of Personality Assessment, 66*(1), 20–40. https://doi.org/10.1207/s15327752jpa6601_2

Saklofske, D. H., & Yackulic, R. A. (1989). Personality predictors of loneliness. *Personality and Individual Differences, 10*(4), 467–472. https://doi.org/10.1016/0191-8869(89)90011-1

Shaver, P. R., & Brennan, K. A. (1991). Measures of depression and loneliness. In J. P. Robinson, P. R. Shaver, & L. S. Wrightsman (Eds.), *Measures of personality and social psychological attitudes* (pp. 195–289). Academic Press. https://doi.org/10.1016/B978-0-12-590241-0.50010-1.

Sheehan, K. B. (2001). E-mail survey response rates: A review. *Journal of Computer-Mediated Communication, 6*(2). https://doi.org/10.1111/j.1083-6101.2001.tb00117.x

Sivertsen, B., Råkil, H., Munkvik, E., & Lønning, K. J. (2019). Cohort profile: The SHoT-study, a national health and well-being survey of norwegian university students. *BMJ Open, 9*(1), Article e025200. https://doi.org/10.1136/bmjopen-2018-025200

Spearman, C. (1904). The proof and measurement of association between two things. *The American Journal of Psychology, 15*(1), 72–101. https://doi.org/10.2307/1412159

Spector, P. E., & Brannick, M. T. (2011). Methodological urban legends: The misuse of statistical control variables. *Organizational Research Methods, 14*(2), 287–305. https://doi.org/10.1177/1094428110369842

Teppers, E., Klimstra, T. A., Damme, C. V., Luyckx, K., Vanhalst, J., & Goossens, L. (2013). Personality traits, loneliness, and attitudes toward aloneness in adolescence. *Journal of Social and Personal Relationships, 30*(8), 1045–1063. https://doi.org/10.1177/0265407513481445

Tiwari, S. C. (2013). Loneliness: A disease? *Indian Journal of Psychiatry, 55*(4), 320–322. https://doi.org/10.4103/0019-5545.120536

Tolonen, H., Helakorpi, S., Talala, K., Helasoja, V., Martelin, T., & Prättälä, R. (2006). 25-Year trends and socio-demographic differences in response rates: Finnish adult health behaviour survey. *European Journal of Epidemiology, 21*(6), 409–415. https://doi.org/10.1007/s10654-8

Vanhalst, J., Goossens, L., Luyckx, K., Scholte, R. H., & Engels, R. C. (2013). The development of loneliness from mid-to late adolescence: Trajectory classes, personality traits, and psychosocial functioning. *Journal of Adolescence, 36*(6), 1305–1312. https://doi.org/10.1016/j.adolescence.2012.04.002

Vanhalst, J., Soenens, B., Luyckx, K., Van Petegem, S., Weeks, M. S., & Asher, S. R. (2015). Why do the lonely stay lonely? Chronically lonely adolescents' attributions and emotions in situations of social inclusion and exclusion. *Journal of Personality and Social Psychology, 109*(5), 932–948. https://doi.org/10.1037/pspp0000051

Vize, C. E., Sharpe, B. M., Miller, J. D., Lynam, D. R., & Soto, C. J. (2022). Do the big five personality traits interact to predict life outcomes? Systematically testing the prevalence, nature, and effect size of trait-by-trait moderation. *European Journal of Personality, 08902070221111857*. https://doi.org/10.1177/08902070221111857

von Soest, T., Luhmann, M., & Gerstorf, D. (2020). The development of loneliness through adolescence and young adulthood: Its nature, correlates, and midlife outcomes. *Developmental Psychology, 56*(10), 1919–1934. https://doi.org/10.1037/dev0001102

Voss, A., Rothermund, K., & Brandtstädter, J. (2008). Interpreting ambiguous stimuli: Separating perceptual and judgmental biases. *Journal of Experimental Social Psychology, 44*(4), 1048–1056. https://doi.org/10.1016/j.jesp.2007.10.009

Weiss, R. S. (1973). *Loneliness: The experience of emotional and social isolation*. The MIT Press.

Wieczorek, L. L., Humberg, S., Gerstorf, D., & Wagner, J. (2021). Understanding loneliness in adolescence: A test of competing hypotheses on the interplay of extraversion and neuroticism. *International Journal of Environmental Research and Public Health, 18*(23), 12412. https://doi.org/10.3390/ijerph182312412

Wittenberg, M. (1986). *Emotional and social loneliness: An examination of social skills, attributions, sex role, and object relations perspectives*. University of Rochester. Doctoral dissertation.

World Medical Association. (2013). World Medical Association Declaration of Helsinki ethical principles for medical research involving human subjects. *JAMA: Journal of the American Medical Association, 310*(20), 2191–2194. https://doi.org/10.1001/jama.2013.281053

Ying, Y. W. (2002). Formation of cross-cultural relationships of Taiwanese international students in the United States. *Journal of Community Psychology, 30*(1), 45–55. https://doi.org/10.1002/jcop.1049