



Adolescent personality traits, low self-esteem and self-harm hospitalisation: a 15-year follow-up of the Norwegian Young-HUNT1 cohort

Asbjørn Junker¹ · Hans Morten Nordahl^{1,2} · Johan Håkon Bjørngaard^{3,4} · Ottar Bjerkeset^{1,5}

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Abstract

Affective disorders are closely related to self-harm and suicidal behaviours. Less is known about how adolescent personality traits and self-esteem influence the development of later self-harm. We examined associations between personality traits such as neuroticism, psychoticism and extroversion, and self-esteem, in adolescence, and the risk of future self-harm hospitalisation. Baseline information from 13 to 19-year-old participants in the Norwegian Young-HUNT1 study in 1995–97 ($n = 8965$) was linked to endpoint data recorded from participants' hospital records, describing self-harm hospitalisation episodes within the catchment area. Crude and adjusted hazard ratios (HR) were estimated by Cox regression analyses. A one-unit increase on the 0–6 scale for neuroticism was associated with a HR of 1.29, 95% confidence interval (CI) 1.14–1.47. Corresponding HR for psychoticism was 1.30, 95% CI 1.03–1.63 per unit increase, and for extroversion risk was reduced (HR 0.89, 95% CI 0.77–1.04). Positive perception of self-esteem was more strongly associated with reduced risk of self-harm hospitalisation (HR per unit increase on the 0–12 scale was 0.74, 95% CI 0.68–0.82). Additional adjustment for alcohol use and symptoms of combined anxiety and depression symptoms attenuated effect estimates, in particular for neuroticism (HR 1.13, 95% CI 0.96–1.32) and psychoticism (HR 1.07, 95% CI 0.82–1.40). In contrast, self-esteem associations remained largely the same after adjustment. Our results indicate that brief assessments of personality and self-esteem might add additional relevant information, and could be included as a supplement to standard suicidal risk assessment in adolescents.

Keywords Self-harm · Hospitalisation · Adolescence · Personality traits · Self-esteem

Background

Self-harm is in the European context often defined as any intentional self-poisoning or self-injury, irrespective of motivation or suicidal intent [1]. Self-harm is a major health challenge among youth [2], and there are indications of an increased occurrence in some European countries during the recent decades [3, 4]. The behaviour in itself is inherently challenging, and also those who study the phenomenon encounter difficulties; terms and definitions of self-harming behaviour are inconsistently used [5, 6], as no terminology consensus has been established. A self-harm episode may result in anything from no or minor physical damage, to completed suicide. This has implications for the reported occurrence of self-harming behaviour, and estimates among adolescents range from a few to over 50%, depending on differences in context, definitions of self-harm and methods used.

✉ Asbjørn Junker
asbjorn.junker@gmail.com

¹ Department of Mental Health, Faculty of Medicine and Health Sciences, NTNU – Norwegian University of Science and Technology, Trondheim, Norway

² St. Olavs University Hospital, Nidaros DPS, Trondheim, Norway

³ Department of Public Health and Nursing, Faculty of Medicine and Health Sciences, NTNU – Norwegian University of Science and Technology, Trondheim, Norway

⁴ Forensic Department and Research Centre Brøset, St. Olavs University Hospital, Trondheim, Norway

⁵ Faculty of Nursing and Health Sciences, Nord University, Levanger, Norway

Non-suicidal self-injury (including only behaviour explicitly without an intention to die) was implemented in the fifth version of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as a condition that need further study. The separation of non-suicidal self-injury from suicide attempts (self-harm with presence of any degree of suicidal intention) has gained popularity in Northern America, based on evidence suggestive of distinct characteristics and motivations between the two [7]. In a Swedish study including over 1000 adolescents, it was found that various subgroups and patterns of non-suicidal self-injury might have different developmental and clinical implications [8], but questions have been raised regarding the evidence base behind the suggested dichotomization [9, 10]. Nonetheless, in a review analysing literature published between 2005 and 2011, authors noted that estimates of self-harm were comparable and independent of whether studies applied a ‘self-harm’ or ‘non-suicidal self-injury’ definition of self-injurious behaviour [9]. Throughout this paper, we use the terms self-harm or self-harming behaviour, except when we directly refer to research where other definitions (such as non-suicidal self-injury absent of suicidal intention) have been used. Of further note, this study targets only the medically most severe acts of self-harm—episodes requiring hospital admission for treatment.

While self-harming behaviour often has been linked to psychiatric disorders such as PTSD, major depression, schizophrenia and borderline personality disorder [11, 12], it is also commonly found among adolescents without a known psychiatric diagnosis [13–18]. Evidence from a recent review of 32 longitudinal studies suggests a peak incidence of both non-suicidal self-injury and self-harm in early adolescence, followed by a decrease in late adolescence/early adulthood [19].

A bio-psycho-social model in which the susceptibility of mental illness is increased, is often used to explain and understand the complexity of self-harming behaviours [20]. Other important explanatory factors include difficulties regulating affective and cognitive states, which leads to maladaptive behaviour in response to stressors [21], and where personality traits act as important modifiers [22].

The five-factor model [23] and the three-factor model by Eysenck [24, 25] are examples of widely accepted personality models. Neuroticism is a defined personality trait in both models, and also known as emotional instability or negative affectivity. With increasing neuroticism, ordinary situations are more likely interpreted as threatening, negative stimuli evoke stronger reactions, and negative emotions are experienced in more prolonged states. The extroversion–introversion dimension (found in both models) describes outgoing, positive, active and action-oriented personalities on one end, and on the other end are personalities with lower need for external stimuli,

often viewed as quiet and less social, with greater need of time alone. The psychoticism trait (Eysenck’s model) is inversely related to empathy and five-factor model traits of agreeableness and conscientiousness, and refers to traits associated with recklessness, aggressiveness, self-interest and interpersonal hostility and impulsivity. In addition, a high psychoticism score is associated with increased vulnerability for developing psychosis. A meta-analytic reliability generalization study reported adequate reliability for extroversion and neuroticism scale scores, while psychoticism scale scores often had poorer reliability [26].

Hitherto, differences in personality conceptualisation, accompanied by a similar diversity of personality models used, have complicated attempts to delineate the specific contribution to risk of self-harming behaviour. Neuroticism, openness to experience [27], impulsivity [28] and aggression [29] have been linked to non-suicidal self-injury. Both neuroticism and extroversion might be related to suicidal ideation [30], and neuroticism, hopelessness, and, to a lesser extent, extroversion, have been classified as potentially useful traits in screening for risk of suicidal behaviours [22]. Only a few studies have examined the relationship between personality traits and self-harming behaviour (e.g., suicide attempts) within a prospective design. In a birth cohort of more than 1000 young adults from New Zealand, high neuroticism and novelty seeking and low self-esteem in early adolescence were associated with suicidal ideation and suicide attempts [31, 32]. Further, biased cognitive style and depressive symptoms were associated with non-suicidal self-injury over 2½ years of follow-up in a community study of 97 American youth aged 11–14 at baseline [33].

Self-esteem is closely related to affective disorder, and depression in particular. In a large meta-analysis, authors concluded that low self-esteem increased the vulnerability for developing depression, but that the relationship between low self-esteem and anxiety was more balanced and bidirectional [34]. Like personality, self-esteem is partially influenced by genetics, as they are both probably rooted in earlier temperamental characteristics [35]. Self-esteem is not considered a personality trait per se, but is related to and may influence other personality traits [35]. In addition to increased risk of self-harm via anxiety and depression, low self-esteem has also been linked to the development [36], presence [37] and repetition [38] of self-harming behaviours, though the effect magnitude has been debated [39].

More longitudinal studies within community populations are required to further reveal how personality plays a part in mechanisms underlying self-harming behaviour. Against this backdrop, we aimed at contributing in filling this gap by exploring associations between indicators of personality traits and self-esteem and later self-harm hospitalisation, in a prospective follow-up of 8965 adolescents that participated in the Norwegian population-based Young-HUNT1 Study.

Method

Study population and setting

All adolescents between 13 and 19 years of age ($n = 10,202$) living in Nord-Trøndelag County, Norway, were in 1995–1997 invited to participate in Young-HUNT1 [40]. The majority of participants completed the study questionnaire at school in a test-like setting. Absentees because of illness or other reasons were invited to participate when they returned to school, or were mailed the questionnaire for completion at home. A total of 8983 adolescents (88%) returned the study questionnaire. Trained nurses performed a clinical examination (e.g., blood pressure, height, and weight) of participants within 1 month after the questionnaire was completed (Fig. 1).

We excluded nine participants because they experienced their first self-harm hospitalisation episode before they participated in Young-HUNT1. An additional nine participants were excluded because they were registered as lost to follow-up within Nord-Trøndelag before Young-HUNT1 participation. The remaining cohort analysed in the current study consisted of 8965 adolescents.

All Young-HUNT1 participants gave written informed consent to use the data for medical research, and an additional parental consent was obtained for participants under 16 years of age. The current study was approved by the Regional Committee for Medical and Health Research Ethics (2010/1924-3).

Measurements

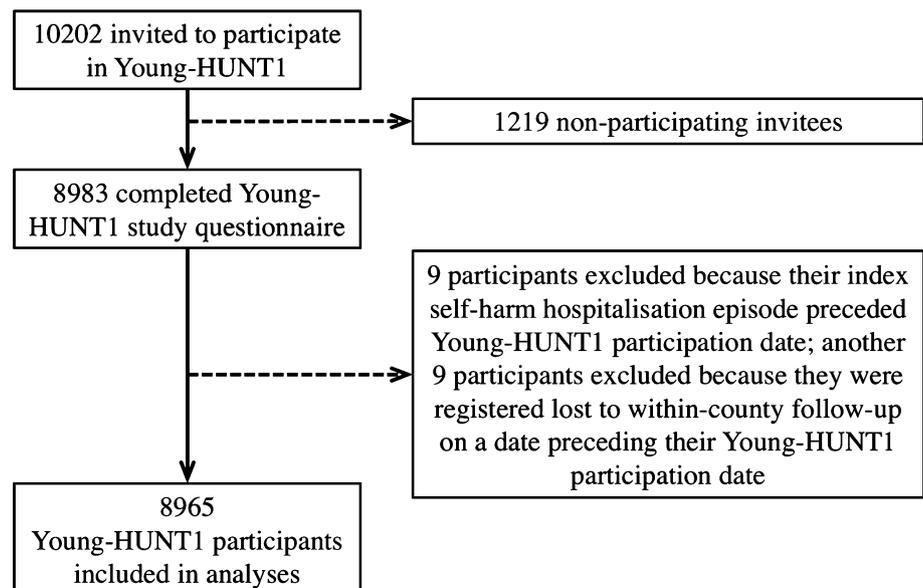
Self-harm hospitalisation

A detailed description of the extraction of outcome data from hospital-based patient records has been previously reported [41]. The main outcome in the present study was defined as the first self-harm-related hospital admission that a Young-HUNT1 participant experienced at one of the two hospitals in the catchment area of the study population. We utilised patient administrative system data to identify everyone within the age range of possible participants in Young-HUNT1. Then, we included all acute hospitalisations from 1 January 1995 to 31 December 2010 in a comprehensive search for self-harm hospitalisation episodes. All search-positive episodes were controlled by manual inspection of the relevant patient record entry. Unintended accidents or injuries, and cases with no or uncertain intention of self-harm or attempted suicide were not included as self-harm hospitalisation episodes.

Adolescent personality and self-esteem

Eighteen items from the Eysenck Personality Questionnaire (EPQ) [25, 42] were included in the Young-HUNT1 questionnaire. Wording was slightly modified from the original version to better suit the youngest participants. The personality traits assessed are extroversion–introversion (item example: “Are you a relatively lively person?”), neuroticism (item example: “Are your feelings easily hurt?”) and psychoticism (item example: “Do you like to tease people even though it may hurt them?”), with six items for each dimension. Participants received one point

Fig. 1 Flow diagram of participant selection process



for each positive response with a maximal score of six per subscale, and higher scores indicated higher trait exposure. Cronbach's alphas in our data material were extroversion = 0.60, neuroticism = 0.65 and psychoticism = 0.34.

Self-esteem was assessed with a four-item version of the Rosenberg Self-Esteem Scale [43]. A Norwegian version was previously validated in an adolescent sample [44], and the four-item version correlation to the original version is estimated at 0.95, with an alpha reliability at 0.78 [45]. Two positive ("I take a positive attitude toward myself" and "I feel that I am a person of worth, at least on an equal plane with others") and two negative ("I certainly feel useless at times" and "I feel I do not have much to be proud of") statements were rated on a 4-point Likert scale. Responses to negative statements were reversed, and all responses were summed to a total score (0–12, higher score indicating higher self-esteem) used in the analyses as a categorical variable.

Covariates and demographic characteristics

In addition to age, we adjusted for the potentially confounding effect of gender and socioeconomic status on the associations between self-esteem and personality traits, and self-harm hospitalisation. Statistics Norway registered the highest completed educational level for Young-HUNT1 participants' parents, on 1 October the year each participant turned 16 years old. We designated parental educational level as proxy for socioeconomic status, categorized education level as primary, intermediate or tertiary, and included this as a covariate in the adjusted regression models.

In an additional regression model, we also adjusted for alcohol use and symptoms of anxiety and depression. These variables could exist on a causal pathway between personality traits and self-harm, and should accordingly be considered mediating factors. Additionally, we cannot rule out the possibility that responders' mood and alcohol use have influenced their responses to personality variables while simultaneously influencing risk of self-harm hospitalisation. If this is the case, anxiety and depression symptoms and alcohol use should be considered confounders. Symptoms of anxiety and depression the two previous weeks before attending Young-HUNT1 were assessed with a brief version of Hopkins Symptom Checklist (SCL-5) [46]. As described more detailed in a previous paper [47], participants scoring above the chosen cut-off (set at 2.0 on a 1–4 scale) were considered having caseness symptoms of anxiety and depression. In line with previous studies on this cohort [48], adolescent alcohol use was categorized as high or low, according to whether or not participants reported to have been drunk more than 10 times.

Statistical analyses

All data were analysed using Stata version 12 for Mac [49]. We estimated hazard ratios (HR) by applying Cox proportional hazard regression analyses, and used attained age as time axis. We defined the follow-up period as starting on the day each participant completed the Young-HUNT1 questionnaire, and ending with the first occurring of the following alternatives: they experienced their first self-harm hospitalisation; they moved out of Nord-Trøndelag County or were otherwise lost to within-county follow-up; they died; or the date 31 December 2010 was reached. The average follow-up time was 11.9 years. Hazard ratios (HR) were reported with 95% confidence intervals (95% CI).

Results

Table 1 presents the main characteristics of the total study sample at baseline. In the self-harm hospitalisation group, the number of men ($n=26$) was less than half that of women ($n=63$). Self-poisoning was the most common method used (81% of all patients; $n=72$), both among males (69% of male patients; $n=18$) and females (86% of female patients; $n=54$). For self-cutting—the second-most common method (15% of all patients; total $n=13$), a similar difference was observed (12% of male patients; $n=3$, and 16% of female patients; $n=10$). Alcohol inebriation was more equally common across gender (54% of female patients; $n=34$, and 50% of male patients; $n=13$). Compared to females, the relative percentage of males who used other methods than alcohol or medication self-poisoning, was three- to fourfold, but total number of patients was less than 5 in all these groups, and therefore, subject to higher uncertainty.

Patients in the self-harm hospitalisation group had higher levels of psychoticism and neuroticism in adolescence, and lower level of extroversion than the other participants. Mean total self-esteem score was also lower in the self-harm hospitalisation group. There were no substantial differences in alcohol use, but percentwise distribution of caseness symptoms of anxiety and depression was three times higher in the self-harm hospitalisation group.

Table 2 presents crude and adjusted self-harm hospitalisation HRs for all personality trait and self-esteem indices, including single-trait items. Initial adjustments for the potential confounding effect of gender and socioeconomic status generated minor changes to most effect estimates, but larger changes to some psychoticism items. Total scores on neuroticism and psychoticism trait subscales were substantially associated with adjusted self-harm hospitalisation risk. However, both subscale effect estimates were markedly attenuated with additional adjustments for a possible confounding or mediating effect of anxiety and

Table 1 Descriptive baseline characteristics of the study sample

	Self-harm hospitalisation			
	Yes		No	
	<i>N</i> (%)	Mean (SD)	<i>N</i> (%)	Mean (SD)
Gender				
Male	26 (29.2)		4494 (50.6)	
Female	63 (70.8)		4391 (49.4)	
Age		15.9 (1.9)		16.0 (1.8)
Alcohol use				
Been drunk ≤ 10 times	45 (50.6)		4669 (52.6)	
Been drunk > 10 times	30 (33.7)		2564 (28.9)	
Missing	14 (15.7)		1643 (18.5)	
Anxiety and depression symptoms				
Below caseness level	58 (65.2)		7845 (88.3)	
Above caseness level	28 (31.4)		857 (9.7)	
Missing	3 (3.4)		174 (2.0)	
Socioeconomic status				
Primary	9 (10.1)		661 (7.5)	
Secondary	14 (15.7)		2198 (24.8)	
Tertiary	66 (74.2)		5997 (67.5)	
Missing	0 (0)		20 (0.2)	
Personality traits (0–6)				
Psychoticism		0.79 (1.04)		0.68 (0.91)
Extroversion		4.50 (1.76)		4.66 (1.36)
Neuroticism		3.69 (1.75)		2.78 (1.78)
Self-esteem (0–12)		6.43 (2.61)		8.16 (2.11)
Total	89		8876	

Results are reported as numbers and percentages [*N* (%)] for categorical variables, and mean and standard deviation [mean (SD)] for continuous variables

depression symptoms and alcohol use. Neuroticism HR was reduced from 1.29 to 1.13, and corresponding reduction for psychoticism HR was 1.30 to 1.07. Total score on the extroversion subscale demonstrated a moderate negative association, yet much of this effect disappeared with adjustments for anxiety and depression and alcohol use (HR changed from 0.89 to 0.96). Of eighteen single items, four from neuroticism, two from psychoticism, and one item from the extroversion subscale were all substantially associated with increased self-harm hospitalisation risk with adjustment for gender and socioeconomic status only. For extroversion, all items but one displayed HRs below 1.00. Usually taking the first step to make new friends was moderately associated with higher risk, as opposed to liking to meet new people, which was associated with a substantially reduced risk. With final adjustments, a considerable association appeared between one psychoticism item (“Do you like to be on time for appointments?”) and self-harm hospitalisation. Total self-esteem subscale score and all four single self-esteem items were inversely related to self-harm hospitalisation, and these associations remained largely unchanged, also after final adjustments.

Discussion

The main aim of this study was to explore how personality traits and self-esteem in adolescence, as indexed with short-versions of Eysenck Personality Questionnaire and Rosenberg Self-Esteem Scale, are associated to risk of future self-harm hospitalisation. In this long-term follow-up study of 8965 Norwegian adolescents, and in accordance with recent meta-analysis results [50], our findings indicated that neurotic-type personality in adolescence is a risk factor for young adult self-harm hospitalisation. We also demonstrated a similar, yet somewhat weaker association for psychoticism trait. Hazard ratios were attenuated in the final adjusted analyses, suggesting that symptoms of anxiety and depression explain much of the elevated risk associated with these personality traits. Keeping in mind that low self-esteem seems to predict later depression [34], we might have expected a corresponding attenuation for the association between self-esteem and self-harm. High self-esteem was indeed associated with substantially reduced self-harm hospitalisation risk, yet the association

Table 2 Adolescent personality traits, self-esteem, and self-harm hospitalisation hazard ratios (HR) (crude and adjusted models)

	N ^a	Crude ^b HR (95% CI)	Adjusted ^c HR (95% CI)	N ^d	Adjusted ^d HR (95% CI)
Personality traits					
Neuroticism subscale (0–6) ^e	83	1.35 (1.19–1.53)	1.29 (1.14–1.47)	70	1.13 (0.96–1.32)
Are your feelings easily hurt? YES	87	2.57 (1.57–4.20)	2.03 (1.22–3.37)	74	1.49 (0.84–2.65)
Do you often feel that you lose interest? YES	87	2.38 (1.48–3.80)	2.29 (1.43–3.66)	74	1.65 (0.97–2.81)
Are you often worried? YES	87	2.21 (1.45–3.37)	1.96 (1.28–3.00)	74	1.37 (0.81–2.31)
Do you worry that terrible things might happen? YES	86	1.33 (0.87–2.04)	1.19 (0.78–1.83)	73	0.81 (0.50–1.32)
Do you often feel tired and indifferent/unmotivated without reason? YES	87	1.57 (1.02–2.42)	1.47 (0.96–2.27)	74	1.17 (0.70–1.97)
Are you bothered by an embarrassing experience long after it happens? YES	86	1.76 (1.15–2.69)	1.60 (1.05–2.45)	73	1.27 (0.79–2.06)
Psychoticism subscale (0–6) ^e	77	1.13 (0.90–1.41)	1.30 (1.03–1.63)	65	1.07 (0.82–1.40)
Would you be upset by seeing a child or animal suffer? (reversed) NO	88	0.99 (0.46–2.14)	1.42 (0.64–3.12)	75	1.26 (0.50–3.19)
Do you like to tease people even though it may hurt them? YES	86	0.84 (0.49–1.44)	1.13 (0.65–1.99)	73	1.10 (0.62–1.96)
Are good manners and cleanliness important to you? (reversed) NO	87	0.73 (0.32–1.67)	0.90 (0.39–2.08)	74	0.69 (0.25–1.90)
Do you like to be on time for appointments? (reversed) NO	86	0.67 (0.31–1.44)	0.69 (0.32–1.50)	73	0.29 (0.09–0.91)
Do many people try to avoid you? YES	84	2.18 (1.18–4.01)	2.18 (1.18–4.01)	71	1.78 (0.91–3.49)
Do people tell you a lot of lies? YES	82	2.24 (1.33–3.78)	2.58 (1.52–4.38)	70	1.57 (0.85–2.93)
Extroversion subscale (0–6) ^e	78	0.91 (0.78–1.07)	0.89 (0.77–1.04)	67	0.96 (0.80–1.14)
Are you a relatively lively person? YES	87	0.67 (0.37–1.24)	0.62 (0.34–1.14)	74	0.69 (0.35–1.36)
Do you like meeting new people? YES	88	0.42 (0.22–0.79)	0.37 (0.20–0.69)	75	0.47 (0.23–0.96)
Do you usually take the first step to make new friends? YES	83	1.37 (0.89–2.13)	1.35 (0.87–2.10)	71	1.40 (0.87–2.24)
Are you mostly quiet when you are around other people? (reversed) NO	86	0.88 (0.54–1.42)	0.83 (0.51–1.35)	74	0.93 (0.54–1.59)
Are you a life-of-the-party-type person? YES	86	0.66 (0.42–1.04)	0.67 (0.43–1.06)	74	0.70 (0.42–1.16)
Do you like to have a lot of life and excitement around you? YES	84	0.92 (0.56–1.53)	0.83 (0.50–1.37)	71	0.96 (0.54–1.72)
Rosenberg self-esteem scale (0–12) ^e	80	0.72 (0.66–0.79)	0.74 (0.68–0.82)	69	0.78 (0.70–0.87)
I take a positive attitude toward myself ^e	85	0.40 (0.30–0.54)	0.46 (0.34–0.62)	72	0.53 (0.38–0.76)
I certainly feel useless at times (reversed) ^e	82	0.45 (0.34–0.59)	0.49 (0.37–0.65)	70	0.56 (0.41–0.78)
I feel I do not have much to be proud of (reversed) ^e	83	0.46 (0.36–0.59)	0.49 (0.38–0.63)	71	0.56 (0.41–0.75)
I feel that I'm a person of worth, at least on an equal plane with others ^e	82	0.57 (0.43–0.75)	0.62 (0.46–0.82)	71	0.67 (0.49–0.92)

^aA varying total number of self-harm hospitalisation patients included in the complete case analyses

^bAdjusted for age (as time axis)

^cAdjusted for age (as time axis), gender and socioeconomic status at baseline

^dAdjusted as ^c, plus symptoms of anxiety and depression and alcohol use. Reduced *N* due to missing data concerning alcohol use and anxiety and depression symptoms

^eResults describe HR for one step scale increments, e.g., from 4 to 5 points

was largely independent of adjustments. There was a tendency for reduced risk associated with the trait extroversion, but we could not leave out chance as a possible explanation. Furthermore, much of this association seemed to be explained by anxiety and depression symptoms or alcohol use.

Personality traits, self-esteem and self-harm hospitalisation risk

Available evidence indicates a strong association between neuroticism, anxiety and depression [51], and the latter are well-known associates to increased risk of self-harm and suicide [52, 53]. Neuroticism and internalising personality

traits are also probably important predisposing and perpetuating factors for insomnia [54], known to be associated with self-harm and suicide [41, 55]. Disrupted sleep has the potential to influence problem-solving abilities and impulsive/aggressive behaviour negatively directly, and can also act via pathways mediating effects of anxiety and depression. In a study of Belgian adolescents, negative affectivity and lack of effortful control (how one regulates attention and behaviour) was related to non-suicidal self-injury [56]. Neuroticism in adolescence may precede later psychotic symptoms [57], which in turn predicted non-suicidal self-injury and suicide attempts in a sample of Australian adolescents [58]. Moreover, neuroticism and extroversion in American undergraduate students were both associated with suicide ideation, thwarted belongingness and perceived burdensomeness [30]. Together, these findings indicate that people with personalities characterized by high neuroticism are vulnerable to stress, likely to exaggerate negative aspects of everyday situations and to identify and magnify threats in general [59], as well as having an increased likelihood of adopting maladaptive responses to stressors.

In our final regression model, adjustments for anxiety and depression (and alcohol use) attenuated a majority of the associations found. Though many studies come to similar conclusions, findings diverge and the association is not without opposition. For example, no differences in temperament factors were found among adolescent girls with and without self-injurious behaviour [60]. Nevertheless, it remains uncertain whether the attenuation is a result of confounding or mediating effects, probably because both alternatives are relevant. Results from a comprehensive review indicate that personality traits, and neuroticism in particular, predict future onset and course of depression, but also that clinical state (e.g., depression) influence reports of neuroticism trait [61].

In sum, we argue in favour of a clear relationship between neuroticism in adolescence and later self-harm, probably through pathways that also include anxiety and depression.

Our results suggest a possible link between adolescent extroversion and reduced risk for later self-harm hospitalisation. When compared to introvert personalities, extroverts are more likely to contact and talk to others. In turn, this behaviour could explain the lowered risk because more social interaction reduces the risk of loneliness, which together with other features of interpersonal difficulty is associated with self-harming behaviour and suicide [62]. Being open about one's own challenges and difficulties creates a higher likelihood of social support, and thereby reduces self-harm risk via increased chance of finding other and better ways to cope with stressors. These traits might also reduce the risk of developing anxiety and depression. Among Finnish patients with bipolar disorder ($n = 191$) and major depressive disorder ($n = 358$),

extroversion levels did not differ between patient groups, but was somewhat lower in the general population group [63]. One item capturing the social essence of extroversion (“Do you like meeting new people?”) was, in our data, substantially associated with decreased self-harm hospitalisation risk in the partly adjusted regression model, yet the association almost disappeared with full adjustments. There is evidence suggesting that low extroversion may influence risk of self-harm hospitalisation by moderating the relationship between neuroticism and depression [61]. However, the literature is equivocal, and when assessing personality traits in 165 Swedish suicide attempters (with mean age 35.5 years, and of which 11 later died by suicide within the study follow-up time), authors found that the suicide group exhibited higher levels of extroversion [64].

Psychoticism taps into facets of personality that are more strongly exhibited among people more prone to psychosis. Self-harm is often used to handle feelings of dissociation and loss of self-control, features that are typical for psychosis-like experiences. Panic attacks in adolescence have been linked to increased psychoticism in young adulthood, even after adjusting for common risk factors and psychiatric comorbidity [65]. Panic attacks may further indicate an increased vulnerability of general anxiety disorder and similar conditions. Notably, there is a considerable deficiency related to coefficient alpha values for the psychoticism subscale in Eysenck personality questionnaire. An alpha value below 0.5 indicates low internal consistency (reliability), and alpha in our study was 0.34. In EPQ-R (the revised version of Eysenck's Personality Questionnaire), the psychoticism scale included 32 items, with alpha values ranging from 0.73 to 0.81 [42]. Low alpha values may result from poor internal consistency between items, but also from a limited number of test items. Alpha value is reduced if a test is too short [66], and with only six psychoticism items in the current study, this may have led to inaccurate parameter estimates. While unfortunate, a suboptimal reliability score is partly justified by the test's authors [67]. Low alpha value may come from touching several, somewhat different personality facets than for neuroticism only, and reflect that psychoticism may be a collection of distinct and unrelated features, rather than one single entity. Our results demonstrated this multidimensionality, as some single items were moderately to strongly related to higher self-harm risk, while other items were moderately to substantially related to reduced risk. Supporters of the five-factor model have also argued that psychoticism is better described as a construction of an inverse agreeableness and conscientiousness. However, these three personality dimensions were distinctive in their ability to predict multiple outcomes in a sample of almost 800 high school students, and psychoticism explained unique variance over-and-above that

explained by agreeableness and conscientiousness [68]. Either way, results regarding the psychoticism trait need to be interpreted cautiously.

High self-esteem was associated with reduced risk of self-harm hospitalisation, and the effect size was largely unaltered by adjustments. This is consistent with previous reports [32, 62, 69], and demonstrates the difference between self-esteem and personality traits. Low self-esteem may affect self-harm risk via at least two different paths: by reducing problem-solving skills, and by increasing depression and hopelessness [70]. However, there is an important difference between co-occurrence and causal effect, and the previously established notion of self-esteem as a reliable predictor of later adverse outcomes has been challenged [39]. High self-esteem falls into the main resilience category “individual factors” (accompanied by “family support” and “supportive external social networks”) [71]. There might also be a difference in how self-esteem modifies the vulnerability and resilience to suicidal ideation and suicide attempts, as it was related to suicidal ideation, but not suicide attempts in a longitudinal birth cohort study from New Zealand [32]. Moreover, among almost 2000 Australian adolescents, low self-esteem predicted onset of non-suicidal self-injury, and served as mediator between attachment anxiety and non-suicidal self-injury; and high self-esteem-predicted cessation [72]. Thus, it seems that self-esteem might predict non-suicidal self-injury but not self-poisoning and suicide attempts, which also underscore the difference between these behaviours. Facilitating and helping adolescents to further develop a sense of mastery in school and other arenas would likely increase their self-esteem and thus self-harm resilience [73].

Strengths and limitations

The present study has several strengths. First and foremost, in a region where inhabitants are demographically comparable to the Norwegian population in general, almost 90% of all adolescents participated in a population survey providing a wide range of background data. Moreover, information about outcome episodes of self-harm hospitalisations are validated, manually extracted data, collected from hospital record entries for all patients. Together, these data produced up to 15 years of follow-up through adolescence and young adulthood, with a high-positive prediction value and low misclassification bias based on the efforts invested in end-point registration ascertainment.

Nevertheless, our findings must also be interpreted in light of several limitations. To begin with, baseline data were only measured once. Although personality traits are considered relatively stable, some of these factors may have fluctuated during follow-up period. Repeated measures of exposure variables would have been preferable, and should be aimed for in future cohort studies. In addition, as baseline

data were self-reported, there could be some misclassification of personality traits. However, self-report is commonly used, and for practical reasons the only feasible method, in surveys of this magnitude. Given the prospective design of our study, misclassification is likely to be non-differential and provide more conservative estimates. Except for people living in larger cities, our study population is representative for most of the adolescent population in Norway. Reported results are still not generalizable for all self-harm variants, as this study included only those whose self-harm episodes required hospital admission for proper treatment. However, this objective assessment minimizes misclassification and can simultaneously be considered a strength of the study. Even though the sample of self-harm hospitalisation consists of 89 patients, statistical power might be too low to detect some of the potentially clinically important associations in the current study. Some participants moved out of the county (e.g., for higher education), and outcome data on these were unavailable. The likelihood of people receiving hospital care and admission at all may be inversely related to travel distances in remote, rural areas of Nord-Trøndelag, which might have reduced the precision of the results.

Conclusion

We have demonstrated the importance of a personality assessment among adolescents and young adults at risk of developing severe self-harming behaviour. Personality traits greatly influence cognition, coping mechanisms and behaviour, especially when handling crises. As personality is a more stable construct than temporary affective states, personality traits, therefore, have the potential to provide more reliable, predictive information than other state psychological symptoms and mental disorders alone. Our findings imply that neuroticism and psychoticism may function as important risk factors for future self-harm hospitalisation, and that high self-esteem serves as a protective factor. Brief assessments of personality and self-esteem can be included as an addition to standard suicidal risk assessment, and this may aid educational and health care systems in their endeavour to target preventive measures and interventions among adolescents.

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Compliance with ethical standards

Ethical standards This study was approved by the Regional Committee for Medical and Health Research Ethics (2010/1924-3). All participants gave written informed consent to use Young-HUNTI data in medical research, including a parental consent for participants younger than 16 years.

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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