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The Role of Social and Life Skills in Adolescents Who Self-harm. Survey Responses from a National Sample of Norwegian Adolescents

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The Role of Social and Life Skills in Adolescents Who Self-harm. Survey Responses from a National Sample of Norwegian Adolescents

ABSTRACT

Objective: Social and life skills (SLS) may be important in the prevention and treatment of self-harm, but few studies have described this relationship. We examined three components of SLS in adolescents who reported receiving a diagnosis of self-harm from a clinician (clinically-diagnosed self-harm) and investigated if social interactions, coping strategies, emotional regulation/aggression buffered their emotional pain.

Design: Cross-sectional.

Setting: National screening prior to military service.

Participants: A number of 176 284 residents of Norway born in 1999-2001 received a declaration of health. We included 171 486 persons (84 153 young women, 49%; 87 333 young men, 51%) who were 17 ($n = 167$ 855) or 18 years of age ($n = 3631$) when they completed the declaration.

Outcome measure: Clinically-diagnosed self-harm, defined as self-harm that the adolescents stated had been diagnosed by a clinician.

Results: Three percent of the adolescents reported clinically-diagnosed self-harm. Emotional regulation/aggression was independently associated with clinically-diagnosed self-harm (odds ratio (OR) = 1.33, 95% confidence interval (CI) 1.31-1.36). The three components of SLS added little to the prediction of clinically-diagnosed self-harm ($\Delta R^2 = .02$). Among the three SLS-components, only emotional regulation/aggression was independently associated with clinically-diagnosed self-harm (Odds ratio (OR) 1.33, 95% confidence interval (CI) 1.31-

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1.36). Compared to young women with clinically-diagnosed self-harm, the young men in this group scored slightly worse on social interactions and emotional regulation/aggression.

Conclusion: Young women and young men who reported clinically-diagnosed self-harm experienced significantly more emotional pain and had worse emotional regulation/aggression than other adolescents. When this was taken into account, they did not have worse social interactions or coping strategies.

Keywords: adolescents, self-harm, social interaction, coping skills, emotional regulation, military selection

Strengths and limitations of this study

- This study adds to previous research by providing data on self-harm diagnosed by a clinician in a near complete national sample of adolescents.

- Close to 90% of all 17-year-olds who lived in Norway in 2016-2018 participated.

- The topic of self-harm was very crude and only asked to the respondents who had received a diagnosis from a clinician.

- The questionnaire did not include a full scale on social and life skills.

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INTRODUCTION

Self-harm among adolescents is a serious public health problem. The prevalence of self-harm in this population has been estimated at around 15% and is constantly increasing.[1 2] Adolescents who self-harm often experience psychosocial difficulties later in life[3] and are at increased risk of premature death, particularly by suicide, alcohol, or drug overdose.[4 5] Important contributors to self-harm include sexual or physical abuse, trauma, familial problems, and psychiatric disorders.[6] Most of the current research on the topic is based on bio-psychosocial frameworks that demonstrate the complex pathways of self-harm. These models show how social vulnerability interacts with an individual's biological predispositions and psychological characteristics, and demonstrate how factors such as sex, emotional regulation capacity, and impulsivity moderate and mediate the associations between negative life events and self-harm.[6-8] No effective interventions against self-harming behaviour have been established, but dialectical behavioural therapy and developmental group therapy have shown promise.[9 10] Moreover, some evidence suggests that self-harm among adolescents can be reduced by improving psychosocial environments in schools.[11]

The idea that self-harm can be prevented through community and friendships builds on key theories in suicidology, which claim that self-harm may occur in response to lower social integration or invalidating emotional environments.[12-15] Young people are usually able to acquire a range of social and life skills (SLS) that allow them to connect with, interact with, and relate positively to other people,[16] and that are applicable across a wide range of contexts in daily life and risk situations. The most important SLS are usually considered to be self-awareness; empathy; communication and interpersonal skills; and coping with emotions and stress.[16] However, adolescents who self-harm tend to have worse scores on these important SLS; they are usually poor problem-solvers with limited access to communication and inadequate emotional regulating strategies.[17 18] Because adolescents who self-harm

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often respond to internal or external stimuli with rapid and impulsive reactions,[19] it may be hard for them to make well-considered, socially acceptable choices. They frequently report difficulties in making new friends, arguments with others, loneliness, interpersonal isolation, and/or bullying.[20 21]

Despite the fact that self-harm in adolescence is closely associated with psychiatric problems and may lead to severe outcomes, few adolescents seek medical or psychological treatment for this behaviour.[1 22] Moreover, many patients who self-harm are not correctly diagnosed with this behaviour.[23] Interventions that aim to strengthen SLS [24 25] may help prevent and treat self-harm, as improved SLS may help adolescents buffer difficult emotions, diminish the negative social consequences of self-harm, and increase communication and help-seeking behaviour. However, the mechanisms by which SLS may influence self-harm have not been thoroughly explored,[7] and studies that describe SLS among self-harming adolescents are an important step in identifying the most effective treatment and preventive strategies.

The present study investigated SLS in adolescents who reported receiving a diagnosis of self-harm from a clinician (clinically-diagnosed self-harm) in a nearly complete national population of adolescents. Our first aim was to characterise SLS in those who reported clinically-diagnosed self-harm and to compare components of SLS among adolescents with and without clinically-diagnosed self-harm. Based on well-documented knowledge, we hypothesised that adolescents who reported clinically-diagnosed self-harm would be characterised by more school absence and more emotional pain than others.[6 26] We also hypothesised that those with clinically-diagnosed self-harm would have less favourable scores on SLS components. We examined if components of SLS contributed to the prediction of clinically-diagnosed self-harm, or buffered emotional pain. Lastly, because there are clear sex differences in self-harming behaviour, impulsivity, and coping among adolescents,[7 8] we

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examined SLS among those who reported clinically-diagnosed self-harm in sex-stratified analyses.

MATERIAL AND METHODS

In Norway, pursuant to the Defence Act, any person residing in the country who reaches the age of 17 must submit a declaration of health to the Armed Forces' Human Relations and Conscription Center (AFHRCC), which is used for military selection. In principle, all citizens are eligible to serve, but the AFHRCC does collect some information about health, education, and social security benefits and penalties from various registries to identify anyone unfit for military service, and these individuals are exempt from completing the declaration. The declaration is internet-based; respondents must identify themselves with an electronic ID before they complete the declaration, and they must confirm that they understand that incorrect answers can lead to criminal liability under the law. Data from the declarations are stored in the Norwegian Armed Forces Health Registry (NAFHR) and are available for research in accordance with the purpose of the registry.[27]

Ethics approval

The data for this study were taken from the NAFHR, which has approval to hold personal identifiable information for the Norwegian Armed Forces' personnel and conscripts, and to produce statistics and research in anonymous form without consent from the data subjects.[27 28] Therefore, it was not necessary to obtain personal consent to participate in this study. Data analyses were conducted by employees of the Norwegian Army Joint Medical Services in accordance with the regulations of the NAFHR and international ethical guidelines for medical research.[29]

Patient and public involvement

We did not include patient or public involvement in the conduct of the present study.

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Participants

In 2016-2018, 176 284 residents of Norway born in 1999-2001 received the declaration of

health from the AFHRCC. We included 171 486 persons (84 153 young women, 49%; 87 333

young men, 51%) who were 17 (*n* = 167 855) or 18 years of age (*n* = 3631) when they

completed the declaration. The study sample represented 97% of those who received

declaration and 87% of all 17-year-olds registered as residents during the 3-year study

period.[30]

Measures

In the declaration, adolescents were presented with a list of 23 conditions and were asked to

check only the conditions for which they had received diagnosis from a clinician. Those who

checked "self -harm" were categorised as having clinically-diagnosed self-harm.

Questions on school absence and emotional pain were as follows:

Have you been absent from school/work over a total of 8 weeks in the last 12 months?
(*No/Yes, but I have fully recovered/Yes, and I have not recovered*).

Do feelings of anxiety, mental distress or depression negatively affect your daily life?
(*No/Yes, but very little/Yes, significantly/Yes, I receive treatment for this*).

The adolescents assessed how well they felt and functioned socially by rating their agreement

with 11 statements about social life, stress, emotional regulation, and aggression on a four-

point scale (1=strong agreement, 4=strong disagreement, low scores indicated better skills). In

order to reduce the number of items, we conducted a principal component analysis (PCA),

applying Jolliffes' criterion [31] and Varimax rotation. The Kaiser-Meyer-Olkin measure of

sampling adequacy was 0.86. An inspection of the scree plot revealed a break after the third

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component, thus we decided to use three components – social interactions, coping strategies, and emotional regulation/aggression – for further investigation. This three-component solution explained 59% of the total variance. Social interactions, contributed 23% to the variance, and included four items about friends and getting along with other people. Coping strategies consisted of three items about taking initiative, sense of responsibility, and coping with stress, and explained 19% of the variance. Finally, emotional regulation/aggression was constructed from three questions about anger, fighting, and self-control, and explained 15% of the variance. One item about sleeping problems loaded equally on the second and third component, and was omitted from further analyses. Cronbach's alpha (α) for social interaction was 0.79; α = 0.73 for coping strategies; and α = 0.52 for emotional regulation/aggression.

Statistical analyses

School absence was coded 1-3 and emotional pain was coded 1-4 (1 = No). We constructed a sum-score for each of the components of SLS by adding the values of the items included, with low scores indicating better social interactions, better coping strategies, and better emotional regulation/less aggression. All variables were analysed as continuous variables.

We used descriptive statistics to investigate school absence, emotional pain, and the three components of SLS in adolescents who reported clinically-diagnosed self-harm compared to those who did not. Pearson's chi-square test and Mann Whitney U-test were used to test for statistically significant differences between groups. Because our study sample had a narrow age-range, age was not included in the analyses.

Hierarchical multiple regression with robust standard errors was conducted to assess whether, and to what extent, worse scores on social interactions, coping strategies, and emotional regulation/aggression were associated with reporting clinically-diagnosed self-harm after

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controlling for school absence and emotional pain. Sex and school absence were entered in the first step (Model 1), emotional pain was included in the second step (Model 2), and social interaction, coping strategies, and emotional regulation/aggression were entered in the third and last step (Model 3). We examined possible sex differences by re-running the multivariate analyses stratified by sex and comparing young men and women who reported clinically-diagnosed self-harm, using descriptive statistics and logistic regression. Effect sizes for mean group differences were calculated in terms of Hedges' *g (g)*.[32] The analyses were performed in Stata 14.2, StataCorp LLC, Texas, USA.

RESULTS

Three percent (3.2%) of our sample of Norwegian adolescents reported clinically-diagnosed self-harm; 5.4% of young women and 1.1% of young men. The majority (86.5%) of these adolescents reported some degree of emotional pain, compared to 23.6% of those who did not report clinically-diagnosed self-harm.

Social and life skills in adolescents with and without clinically-diagnosed self-harm

In bivariate analyses, adolescents with clinically-diagnosed self-harm had worse scores on social interactions; coping strategies; and emotional regulation/aggression than those without (Table 1 and Figure 1). The differences were medium to large according to Cohen's labels (1988) for effect sizes.

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Table 1

Components of social and life skills (SLS) in adolescents who did and did not report clinically-diagnosed self-harm

	Total $N = 171\ 486$		Did not report clinically-diagnosed self-harm $n = 165\ 979$ (96.79%)		Reported clinically-diagnosed self-harm $n = 5507$ (3.21%)			
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Hedges'g*	*p-value*
School absence >8 weeks in the last year	0.05	0.31	0.04	0.29	0.24	0.63	-0.64	<.001
Emotional pain	1.38	0.75	1.33	0.69	2.77	1.05	-2.02	<.001
Social interactions	6.1	2.11	6.05	2.07	7.68	2.64	-0.77	<.001
Coping strategies	5.87	2.02	5.82	2.00	7.17	2.18	-0.66	<.001
Emotional regulation/aggression	3.94	1.19	3.90	1.15	5.11	1.70	-1.03	<.001

SD: standard deviation

[Figure 1. in here]

The components of SLS correlated with emotional pain with medium strength. Pearson correlation coefficients (r) were: $r = .37$ (social interactions), $r = .33$ (coping strategies), $r = .31$ (emotional regulation/aggression).

In hierarchical multiple regression, emotional pain had a statistically significant contribution to the prediction of clinically-diagnosed self-harm ($\Delta R^2 = .17$) ($F(1, 171\ 486) = 9651.29$, $p \leq .001$) (Table 2). Conversely, the inclusion of the three SLS components contributed only a small amount (2%, $F(3, 171486) = 1021.39$, $p \leq .001$), and reduced the strength of the association between emotional pain and clinically-diagnosed self-harm by 12%. Among the three components of SLS, only emotional regulation/aggression remained statistically significantly associated with clinically-diagnosed self-harm in the full model (Model 3). This was true for both sexes (Table 3).

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Table 2
Hierarchical logistic regression results for predicting clinically-diagnosed self-harm (N = 171 486)

	Crude OR (95% CI)	Model 1 $OR_{adj.}$ (95% CI)	Model 2 $OR_{adj.}$ (95% CI)	Model 3 $OR_{adj.}$ (95% CI)
Sex				
Female	Ref.	Ref.	Ref.	Ref.
Male	0.19 (0.18, 0.21)	0.20 (0.19, 0.22)	0.34 (0.32, 0.37)	0.31 (0.29, 0.34)
School absence	2.56 (2.45, 2.68)	2.36 (2.26, 2.47)	1.04 (0.99, 1.10)	1 (0.94, 1.06)
Emotional pain	3.77 (3.68, 3.86)		3.44 (3.35, 3.52)	3.02 (2.94, 3.11)
Social interaction	1.33 (1.30, 1.32)			1.01 (0.99, 1.03)
Coping strategies	1.33 (1.32, 1.35)			1.00 (0.98, 1.01)
Emotional regulation/aggression	1.62 (1.63, 1.68)			1.33 (1.31, 1.36)
Delta R^2			0.176	0.021
Pseudo R^2		0.076	0.252	0.273

OR: odds ratio, CI: confidence interval

Table 3
Hierarchical logistic regression results for predicting clinically-diagnosed self-harm stratified by sex (N = 171 486)

Female (N = 84,153)	Crude OR (95% CI)	Model 1 $OR_{adj.}$ (95% CI)	Model 2 $OR_{adj.}$ (95% CI)
School absence	2.30 (2.18, 2.41)	1.06 (1.007, 1.13)	1.02 (0.96, 1.09)
Emotional pain	3.28 (3.19, 3.38)	3.25 (3.16, 3.34)	2.88 (2.80, 2.97)
Social interaction	1.28 (1.26, 1.29)		1 (0.99, 1.02)
Coping strategies	1.30 (1.28, 1.31)		1 (0.98, 1.02)
Emotional regulation/aggression	1.73 (1.70, 1.76)		1.33 (1.30, 1.37)
Delta R^2		.187	.020
Pseudo R^2		.209	.230

Male (N = 87,333)	Crude OR (95% CI)	Model 1 $OR_{adj.}$ (95% CI)	Model 2 $OR_{adj.}$ (95% CI)
School absence	2.75 (2.47, 3.07)	0.93 (0.82, 1.05)	0.88 (.78, 1)
Emotional pain	4.22 (3.99, 4.45)	4.26 (4.05, 4.5)	3.67 (3.44, 3.91)
Social interaction	1.37 (1.34, 1.41)		1.03 (0.99, 1.07)
Coping strategies	1.41 (1.37, 1.45)		1 (0.96, 1.04)
Emotional regulation/aggression	1.66 (1.61, 1.71)		1.32 (1.27, 1.37)
Delta R^2		.191	.023
Pseudo R^2		.212	.235

OR: odds ratio, CI: confidence interval

Sex differences in social and life skills in adolescents with clinically-diagnosed self-harm

About half of young men (55.2%) and a similar portion of young women (53.1%) who reported clinically-diagnosed self-harm said that they were little or significantly disturbed by emotional pain on a daily basis. However, significantly fewer young men received treatment for this (25% vs. 35% of young women). Consequently, more young men than young women

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with clinically-diagnosed self-harm reported that they were not disturbed by emotional pain daily. Young men with clinically-diagnosed self-harm had worse social interactions and a worse ability to regulate emotions/aggression than young women in this group. Nevertheless, sex differences were generally small or insignificant (Table 4).

Table 4.
Social and life skills in adolescents with clinically-diagnosed self-harm by sex, $n = 5507$

	Descriptive statistics						Logistic regression	
	Female		Male				Female = reference	
	Mean	SD	Mean	SD	p-value	Hedges'g	OR_{adj}	95 % CI
School absence	0.25	0.64	0.21	0.58	0.38	0.05	0.96	0.85-1.09
Emotional pain	2.82	1.04	2.56	1.06	<.001	0.20	0.70	0.65-0.76
Social interaction	7.62	2.6	7.97	2.77	<.001	-0.13	1.06	1.03-1.10
Coping strategies	7.13	2.17	7.33	2.20	0.02	-0.08	1.01	0.97-1.05
Emotional regulation/aggression	5.06	1.65	5.37	1.89	<.001	-0.18	1.12	1.07-1.17

SD: standard deviation, OR: odds ratio, CI: confidence interval

DISCUSSION

This national comprehensive study included close to 90% of all 17-year-olds who lived in Norway at the study period. Three percent of the adolescents reported clinically-diagnosed self-harm, i.e., that they had received a diagnosis of self-harm from a clinician. These adolescents were less able to regulate emotions and aggression, and the majority were disturbed by mental distress, anxiety, and depression. However, worse social interactions and worse coping strategies added little to the prediction of clinically-diagnosed self-harm, and the sex differences in our results were few and small.

Surveys estimate that 15-20% of adolescents self-harm, and among these, 10-20% contact health care services.[1 2] Based on these estimates, the portion of adolescents who reported clinically-diagnosed self-harm in this study is within the expected range, but no data for exact comparison are available. The characteristics of the adolescents who reported clinically-diagnosed self-harm are concurrent with well-established knowledge that self-harm is

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strongly associated with intense emotional pain, worse social relations, worse coping strategies, and more impulsivity.[6 17 19 21] The small sex differences we found about SLS in clinically-diagnosed self-harm tended towards previous research that observed more aggression among self-harming young men than young women.[25 33]

In our study, both young men and young women with clinically-diagnosed self-harm experienced more emotional rather than social problems when compared to other adolescents. Their emotional distress hindered school attendance, and social interactions and coping strategies did not seem to buffer the pain to any appreciable degree. This could support the hypothesis that coping changes inversely with depression in self-harming adolescents,[18] or it could be due to limitations in the measurements in our study. It is possible that those who were clinically diagnosed with self-harm had received treatment, which may have improved their SLS to the level of the reference group at the time they submitted their health declaration.[24] However, we do not have records on their medical treatment and cannot tell whether they had received any psychiatric treatment or SLS training. Most likely, those who had clinically-diagnosed self-harm had various types of health care contacts, treatment, and follow-up, which had various impacts on their SLS. Alternatively, it is possible that the SLS of adolescents who reported clinically-diagnosed self-harm in our study did not differ from those of other adolescents in the first place. Facilitators of help-seeking behaviour include social support and encouragement from others.[1 34 35] Thus, it is plausible that factors such as social relations, communication skills, initiative, and less aggression are core characteristics of self-harming adolescents who actually get in contact with health care.

The lack of clear sex differences in SLS that we observed was very interesting. It could be related to our study methods, e.g., the items on which emotional regulation/aggression was based may have captured anger expressed outwardly, which is more typical of boys and men, better than internal anger, which is more typical in young women.[33] However, we speculate

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that common sex differences in self-harm and its associated factors are more evident in the less severe part of the behavioural spectrum. It may be that boys who have mild emotional difficulties do not engage in self-harm directly, but rather regulate their distress and even inflict pain on themselves by participating in anti-social, risky, or athletic activities where they are exposed to physical strain, injuries, or accidents.[36 37] Moreover, in terms of social function and aggression, sex may be a less important factor among those who suffer so much that they recognise their behaviour as self-harm, take the step to seek treatment, and actually have their condition recognised and diagnosed by a clinician.

Strengths

To our knowledge, no previous study has examined clinically-diagnosed self-harm in a near complete national cohort of adolescents. The data in this study was collected by the Norwegian Armed Forces. Adolescents were obligated to submit their declaration of health by law; they knew that they could be called in for an in-person medical examination to verify their answers, and they knew that giving incorrect information could have consequences, which minimises the risk of selection and reporting bias. Most previous cohort studies and cross-sectional surveys have been conducted among students in selected schools.[1] Therefore, we argue that the present study adds to the existing literature through its increased generalisability and validity compared to previous research.

Limitations

The results of this study must be interpreted in light of some limitations. The cross-sectional design implies that we cannot determine the directionality of the associations between SLS and clinically-diagnosed self-harm. Moreover, the questionnaire that we used was developed for military selection and not for research purposes, which has implications for the measures and limited the analyses in our study. The topic of self-harm in the declaration was very crude

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and only asked to the respondents who had received a diagnosis from a clinician. Because our

reference group included adolescents who self-harmed but had not been diagnosed by a

clinician, our risks are most likely underestimated, and cannot be generalised to the majority

of self-harming adolescents who do not contact health care or do not receive a clinical

diagnosis for self-harm.[1 38] We did not control for other mental disorders. Neither could we

investigate SLS with respect to self-harming methods, frequency of self-harm, suicide

intention, help-seeking behaviour, or treatment. The questionnaire did not include a full SLS

scale. We only had access to a few items that do not directly translate to the definition of SLS,

and these items have not been validated in previous research. To compensate for this, we

performed a PCA, which improves accuracy and removes dimensions that only contribute

noise; the PCA reduced the number of items into three meaningful components. About 10%

of the adolescents in this cohort did not submit their declaration of health to the AFHRCC at

the expected age. This may represent the most deprived adolescents, because non-

participation or postponed submission is often due to mental illness. It is unknown if non-

participation is linked to self-harm and health care contacts.

Implications

The results of this study are relevant to physicians and psychologists who provide clinical

treatment to adolescents who engage in self-harm, as well as for prevention and future

research. We argue that our results support previous suggestions that treatment and

preventative strategies against self-harm must aim to teach adolescents how to regulate

difficult emotions.[39] Further, interventions that focus on increasing social functioning in

self-harming adolescents by strengthening school participation, social relations, and coping

may be less effective if emotional care is not also provided.[25 40] Because self-harm is

strongly associated with school absence, it can be difficult to reach adolescents who self-harm

in school-based suicide prevention or life skills programmes.[26]

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Our observations provide empirical evidence for further research on SLS and self-harm. More

refined categories and validated instruments for SLS will maximise the possibilities of finding

true differences between groups. Future investigations could focus on SLS among self-

harming adolescents who go untreated compared to those who obtain help, which could be a

valuable contribution to targeted interventions. Follow-up studies that investigate whether

SLS in adolescence are related to morbidity and mortality later in life may clarify whether

SLS improve outcomes in self-harming adolescents.

Availability of data and materials

The data that support the findings of this study are available from The Norwegian Armed

Forces Health Registry but restrictions apply to the availability of these data, which were used

under license for the current study, and so are not publicly available. Data are however

available from the authors upon reasonable request and with permission of The Norwegian

Armed Forces Health Registry.

Competing interests

The authors declare that they have no competing interests. The authors alone are responsible

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Authors contributions

EOC initially explored the data and facilitated for data analyses. EAF designed the study, performed the statistical analyses and drafted the manuscript. All authors contributed in the design of the study and the interpretation of the results. The manuscript was circulated repeatedly between the authors for critical revisions. All authors have read and approved the final version of the manuscript.

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Figure 2. Components of social and life skills in Norwegian adolescents presented as percentages with best and worst scores in adolescents who did and did not report clinically-diagnosed self-harm, N = 171 486.
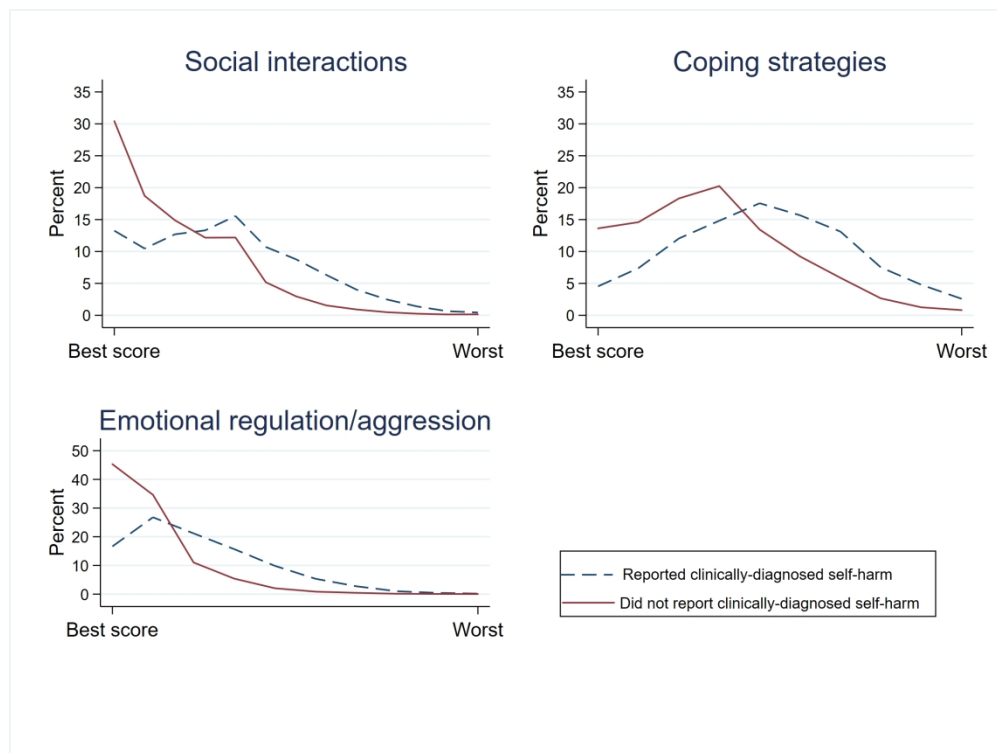
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Figure 1. Components of social and life skills in Norwegian adolescents presented as percentages with best and worst scores in adolescents who did and did not report clinically-diagnosed self-harm, N = 171 486.

846x635mm (72 x 72 DPI)

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-8
Bias	9	Describe any efforts to address potential sources of bias	*8-9*
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8-9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8-9
		(*b*) Describe any methods used to examine subgroups and interactions	8-9
		(*c*) Explain how missing data were addressed	na
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	na
		(*e*) Describe any sensitivity analyses	na
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	15
		(c) Consider use of a flow diagram	na
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7, 9, 10
		(b) Indicate number of participants with missing data for each variable of interest	na
Outcome data	15*	Report numbers of outcome events or summary measures	9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-12
		(*b*) Report category boundaries when continuous variables were categorized	8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	10
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7-8 (PCA)
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14-15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-16
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Social and life skills in adolescents who have self-harmed: analysis of survey responses from a national sample of adolescents in Norway

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ABSTRACT

Objective: Social and life skills (SLS) may be important in the prevention and treatment of self-harm, but few studies have described this relationship. We examined three components of SLS in adolescents who reported self-harm that was, according to themselves, diagnosed by a clinician.

Design: Cross-sectional.

Setting: National screening prior to military service.

Participants: 176 284 residents of Norway born in 1999-2001 received a declaration of health. We included 171 486 individuals (84 153 [49%] women and 87 333 [51%] men) who were 17 ($n = 167\ 855$) or 18 years of age ($n = 3631$) when they completed the declaration.

Outcome measure: The main outcome was clinically-diagnosed self-harm, defined as self-harm that the adolescents themselves stated had been diagnosed by a clinician. Components of SLS were social interactions; coping strategies; and emotional regulation/aggression. The association between SLS and self-reported clinically-diagnosed self-harm was assessed in hierarchical multiple regression models controlling for sex; school absence; and feelings of emotional pain.

Results: Three percent ($n = 5507$) of the adolescents reported clinically-diagnosed self-harm. The three components of SLS together added little to the prediction of clinically-diagnosed self-harm ($\Delta R^2 = .02$). After controlling for school absence and emotional pain, emotional regulation/aggression was the only SLS-component that was independently associated with clinically-diagnosed self-harm (odds ratio (OR) 1.33, 95% confidence interval (CI) 1.31-1.36). The young men who said they had been clinically diagnosed for self-harm scored

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slightly worse on social interactions (Hedge's g (g) $= -$ 0.13, p<.001) and emotional

regulation/aggression ($g = -$ 0.18, p<.001) than the young women in this group.

Conclusion: Young women and young men who reported clinically-diagnosed self-harm had

more problems with emotional regulation/aggression than other adolescents, but did not have

worse social interactions or coping strategies.

Keywords: adolescents, self-harm, social interaction, coping skills, emotional regulation,

military selection

Strengths and limitations of this study

- This study examined adolescents who engaged in self-harm in a near complete national

  cohort of adolescents.

- Among those who were invited, 97% submitted their responses, and close to 90% of all

  17-year-olds who lived in Norway in 2016-2018 participated.

- The topic of self-harm was very crude and only asked to the respondents who stated that

  self-harm had been diagnosed by a clinician.

- The questionnaire did not include a full scale on social and life skills.

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INTRODUCTION

Self-harm among adolescents is a serious public health problem. The prevalence of self-harm in this population has been estimated at around 15% and is constantly increasing.[1 2] Adolescents who self-harm often experience psychosocial difficulties later in life[3] and are at increased risk of premature death, particularly by suicide, alcohol, or drug overdose.[4 5] Important contributors to self-harm include sexual or physical abuse, trauma, familial problems, and psychiatric disorders.[6] Most of the current research on the topic is based on bio-psychosocial frameworks that demonstrate the complex pathways of self-harm. These models show how social vulnerability interacts with an individual's biological predispositions and psychological characteristics, and demonstrate how factors such as sex, emotional regulation capacity, and impulsivity moderate and mediate the associations between negative life events and self-harm.[6-8]

No effective interventions against self-harming behaviour have been established, but dialectical behavioural therapy and developmental group therapy have shown promise.[9 10] Moreover, some evidence suggests that self-harm among adolescents can be reduced by improving psychosocial environments in schools.[11]

The idea that self-harm can be prevented through community and friendships builds on key theories in suicidology, which claim that self-harm may occur in response to lower social integration or invalidating emotional environments.[12-15] Young people are usually able to acquire a range of social and life skills (SLS) that allow them to connect with, interact with, and relate positively to other people,[16] and that are applicable across a wide range of contexts in daily life and risk situations. The most important SLS are usually considered to be self-awareness; empathy; communication and interpersonal skills; and coping with emotions and stress.[16] However, adolescents who self-harm tend to have worse scores on these important SLS; they are usually poor problem-solvers with limited access to communication

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and inadequate emotional regulating strategies.[17 18] Because adolescents who self-harm often respond to internal or external stimuli with rapid and impulsive reactions,[19] it may be hard for them to make well-considered, socially acceptable choices. They frequently report difficulties in making new friends, arguments with others, loneliness, interpersonal isolation, and/or bullying.[20 21]

Despite the fact that self-harm in adolescence is closely associated with psychiatric problems and may lead to severe outcomes, few adolescents seek medical or psychological treatment for this behaviour.[1 22] Moreover, many patients who self-harm are not correctly diagnosed with this behaviour.[23] Interventions that aim to strengthen SLS [24 25] may help prevent and treat self-harm, as improved SLS may help adolescents buffer difficult emotions, diminish the negative social consequences of self-harm, and increase communication and help-seeking behaviour. However, the mechanisms by which SLS may influence self-harm have not been thoroughly explored.[7] Studies that describe SLS among self-harming adolescents are an important step in identifying the most effective treatment and preventive strategies.

The present study investigated SLS in adolescents who reported having received a diagnosis of self-harm from a clinician in a nearly complete national population of adolescents. Our first aim was to characterise SLS in those who reported clinically-diagnosed self-harm and to compare their SLS with adolescents who did not report clinically-diagnosed self-harm. We hypothesised that those who reported clinically-diagnosed self-harm would have less favourable scores on SLS components.

It is well known that most adolescents who self-harm suffer from significant emotional pain.[6] Furthermore, there is emerging evidence of an association between school absence and self-harm.[26] Emotional pain and school-absenteeism has many negative effects on social functioning and may hinder the social training that usually happens in school.[25]

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We wanted to examine to what extend components of SLS contributed to the prediction of clinically-diagnosed self-harm when such emotional and functional problems were considered. Lastly, because there are clear sex differences in self-harming behaviour, impulsivity, and coping among adolescents,[7 8] we examined SLS among those who reported clinically-diagnosed self-harm in sex-stratified analyses.

MATERIAL AND METHODS

In Norway, pursuant to the Defence Act, any person residing in the country who reaches the age of 17 must submit a declaration of health to the Armed Forces' Human Relations and Conscription Center (AFHRCC), which is used for military selection. In principle, all citizens are eligible to serve, but the AFHRCC does collect some information about health, education, and social security benefits and penalties from various registries to identify anyone unfit for military service, and these individuals are exempt from completing the declaration. The declaration is internet-based; respondents must identify themselves with an electronic ID before they complete the declaration, and they must confirm that they understand that incorrect answers can lead to criminal liability under the law. Data from the declarations are stored in the Norwegian Armed Forces Health Registry (NAFHR) and are available for research that is in accordance with the purpose of the registry and international ethical guidelines for medical research.[27 28 29]

Ethics approval

The data for this study were taken from the NAFHR, which has approval to hold personal identifiable information for the Norwegian Armed Forces' personnel and conscripts, and to produce statistics and research in anonymous form without consent from the data subjects. Therefore, it was not necessary to obtain personal consent to participate in this study. Data analyses were conducted by employees of the Norwegian Army Joint Medical Services in

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accordance with the regulations of the NAFHR and international ethical guidelines for medical research.

Participants

In 2016-2018, 176 284 residents of Norway born in 1999-2001 received the declaration of health from the AFHRCC. We included 171 486 persons (84 153 young women, 49%; 87 333 young men, 51%) who were 17 ($n = 167$ 855) or 18 years of age ($n = 3631$) when they completed the declaration. The study sample represented 97% of those who received the declaration and 87% of all 17-year-olds registered as residents during the 3-year study period.[30]

Measures

Self-harm

In the declaration, adolescents were presented with a list of 23 conditions and were asked to check only the conditions for which they had received diagnosis from a clinician. Those who checked "self -harm" (*have you harmed yourself intentionally?)* were categorised as having clinically-diagnosed self-harm.

School absence and emotional pain:

Questions on school absence and emotional pain were as follows:

Have you been absent from school/work over a total of 8 weeks due to injury or illness in the last 12 months? (*No/Yes, but I have fully recovered/Yes, and I have not recovered).*

Do feelings of anxiety, mental distress or depression negatively affect your daily life? (*No/Yes, but very little/Yes, significantly/Yes, I receive treatment for this).*

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School absence was coded 1-3 and emotional pain was coded 1-4 (1 = No).

<u>Social and life skills:</u>

The adolescents assessed how well they felt and functioned socially by rating their agreement

with 11 statements about social life, stress, emotional regulation, and aggression on a four-

point scale (1=strong agreement, 4=strong disagreement). Eight of the statements were

formulated in a positive way (i.e. *I usually feel well when I am at school and with friends*)

thus lower scores indicated better skills. The remaining questions were formulated so that

lower scores indicated more problem behaviour, therefore we reversed the scores on these

three questions before computing the total score for the scale.

In order to reduce the number of items, we conducted a principal component analysis (PCA),

applying Jolliffes' criterion [31] and Varimax rotation. The Kaiser-Meyer-Olkin measure of

sampling adequacy was 0.86. An inspection of the scree plot revealed a break after the third

component, thus we decided to use three components – social interactions, coping strategies,

and emotional regulation/aggression – for further investigation. This three-component

solution explained 59% of the total variance. Social interactions, contributed 23% to the

variance, and included four items about friends and getting along with other people. Coping

strategies consisted of three items about taking initiative, sense of responsibility, and coping

with stress, and explained 19% of the variance. Finally, emotional regulation/aggression was

constructed from three questions about anger, fighting, and self-control, and explained 15% of

the variance. One item about sleeping problems loaded equally on the second and third

component, and was omitted from further analyses. Cronbach's alpha (α) for social interaction

was 0.79; α = 0.73 for coping strategies; and α = 0.52 for emotional regulation/aggression.

We constructed a sum-score for each of the three components of SLS by adding the values of

the items included. Higher scores indicating worse social interactions, worse coping

strategies, and worse emotional regulation/less aggression.

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Statistical analyses

All variables were analysed as continuous variables. We used descriptive statistics to investigate school absence, emotional pain, and the three components of SLS in adolescents who reported clinically-diagnosed self-harm compared to those who did not. Pearson's chi-square test and Mann Whitney U-test were used to test for statistically significant differences between groups. Effect sizes for mean group differences were calculated in terms of Hedges' *g (g)*.[32] Because our study sample had a narrow age-range, age was not included in the analyses. Univariate descriptive analyses are presented in Table 1.

Hierarchical multiple regression with robust standard errors was conducted to assess whether, and to what extent, worse scores on social interactions, coping strategies, and emotional regulation/aggression were associated with reporting clinically-diagnosed self-harm after controlling for school absence and emotional pain (Table 2 and 3). Sex and school absence were entered in the first step (Model 1), emotional pain was included in the second step (Model 2), and social interaction, coping strategies, and emotional regulation/aggression were entered in the third and last step (Model 3). We examined possible sex differences by re-running the multivariate analyses stratified by sex and comparing young men and women who reported clinically-diagnosed self-harm, using descriptive statistics and logistic regression. The analyses were performed in Stata 14.2, StataCorp LLC, Texas, USA.

Patient and public involvement

We did not include patient or public involvement in the conduction of the present study.

RESULTS

3.2% (n = 5507) of our sample of Norwegian adolescents reported clinically-diagnosed self-harm; 5.4% of young women (*n* = 4538) and 1.1% of young men (*n* = 969). The majority (*n* = 4763, 86.5%) of these adolescents reported some degree of emotional pain, compared to

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23.6% (*n* = 39201) of those who did not report clinically-diagnosed self-harm. Furthermore;

adolescents who reported clinically-diagnosed self-harm had more school absence compared

to those who did not (Table 1).

Social and life skills in adolescents who did and did not report clinically-diagnosed self-

harm

In bivariate analyses, adolescents who reported clinically-diagnosed self-harm had worse

scores on social interactions; coping strategies; and emotional regulation/aggression than

those who did not report clinically-diagnosed self-harm (Table 1 and Figure 1). The

differences were medium to large according to Cohen's labels (1988) for effect sizes.

Table 1
Differences in social and life skills (SLS) between adolescents who did and did not report clinically-diagnosed self-harm.

	Total *N* = 171 486		Did not report clinically-diagnosed self-harm *n* = 165 979 (96.79%)		Reported clinically-diagnosed self-harm *n* = 5507 (3.21%)			
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Hedges'g*	*p-value*
School absence >8 weeks in the last year	0.05	0.31	0.04	0.29	0.24	0.63	-0.64	<.001
Emotional pain	1.38	0.75	1.33	0.69	2.77	1.05	-2.02	<.001
Social interactions	6.1	2.11	6.05	2.07	7.68	2.64	-0.77	<.001
Coping strategies	5.87	2.02	5.82	2.00	7.17	2.18	-0.66	<.001
Emotional regulation/aggression	3.94	1.19	3.90	1.15	5.11	1.70	-1.03	<.001

SD: standard deviation

[Figure 1. in here]

The components of SLS correlated with emotional pain with medium strength. Pearson

correlation coefficients (r) were: *r* = .37 (social interactions), *r* = .33 (coping strategies), *r* =

.31 (emotional regulation/aggression) (all p-values ≤ .001). Correlations between SLS and

school absence were small, but statistically significant with p-values ≤ .001.

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In hierarchical multiple regression, emotional pain had a statistically significant contribution to the prediction of self-reported clinically-diagnosed self-harm ($\Delta R^2 = .17$) ($F(1, 171\ 486) = 9651.29$, $p \leq .001$) (Table 2). Conversely, the inclusion of the three SLS components contributed only a small amount (2%, $F(3, 171486) = 1021.39$, $p \leq .001$), and reduced the strength of the association between emotional pain and self-reported clinically-diagnosed self-harm by 12%. Among the three components of SLS, only emotional regulation/aggression remained statistically significantly associated with self-reported clinically-diagnosed self-harm in the full model (Model 3). This was true for both sexes (Table 3).

Table 2

Hierarchical logistic regression results for predicting self-reported clinically-diagnosed self-harm ($N = 171\ 486$)

	Crude OR (95% CI)	Model 1 OR$_{adj.}$ (95% CI)	Model 2 OR$_{adj.}$ (95% CI)	Model 3 OR$_{adj.}$ (95% CI)
Sex				
Female	Ref.	Ref.	Ref.	Ref.
Male	0.19 (0.18, 0.21)	0.20 (0.19, 0.22)	0.34 (0.32, 0.37)	0.31 (0.29, 0.34)
School absence	2.56 (2.45, 2.68)	2.36 (2.26, 2.47)	1.04 (0.99, 1.10)	1 (0.94, 1.06)
Emotional pain	3.77 (3.68, 3.86)		3.44 (3.35, 3.52)	3.02 (2.94, 3.11)
Social interaction	1.33 (1.30, 1.32)			1.01 (0.99, 1.03)
Coping strategies	1.33 (1.32, 1.35)			1.00 (0.98, 1.01)
Emotional regulation/aggression	1.62 (1.63, 1.68)			1.33 (1.31, 1.36)
Delta R^2			0.176	0.021
Pseudo R^2		0.076	0.252	0.273

OR: odds ratio, CI: confidence interval

Table 3

Hierarchical logistic regression results for predicting self-reported clinically-diagnosed self-harm stratified by sex ($N = 171\ 486$)

	Crude OR (95% CI)	Model 1 OR$_{adj.}$ (95% CI)	Model 2 OR$_{adj.}$ (95% CI)
Female ($N = 84,153$)			
School absence	2.30 (2.18, 2.41)	1.06 (1.007, 1.13)	1.02 (0.96, 1.09)
Emotional pain	3.28 (3.19, 3.38)	3.25 (3.16, 3.34)	2.88 (2.80, 2.97)
Social interaction	1.28 (1.26, 1.29)		1 (0.99, 1.02)
Coping strategies	1.30 (1.28, 1.31)		1 (0.98, 1.02)
Emotional regulation/aggression	1.73 (1.70, 1.76)		1.33 (1.30, 1.37)
Delta R^2		.187	.020
Pseudo R^2		.209	.230
	Crude OR	Model 1	Model 2

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Male (*N* = 87,333)	(95% CI)	$OR_{adj.}$ (95% CI)	$OR_{adj.}$ (95% CI)
School absence	2.75 (2.47, 3.07)	0.93 (0.82, 1.05)	0.88 (.78, 1)
Emotional pain	4.22 (3.99, 4.45)	4.26 (4.05, 4.5)	3.67 (3.44, 3.91)
Social interaction	1.37 (1.34, 1.41)		1.03 (0.99, 1.07)
Coping strategies	1.41 (1.37, 1.45)		1 (0.96, 1.04)
Emotional regulation/aggression	1.66 (1.61, 1.71)		1.32 (1.27, 1.37)
Delta R^2		.191	.023
Pseudo R^2		.212	.235

OR: odds ratio, CI: confidence interval

Sex differences in social and life skills in adolescents who reported clinically-diagnosed self-harm

About half of young men (*n* = 535, 55.2%) and a similar portion of young women (*n* = 2411, 53.1%) who reported clinically-diagnosed self-harm said that they were little or significantly disturbed by emotional pain on a daily basis. However, significantly fewer young men received treatment for this: 25% vs. 35% of young women (245 men and 1572 women) . Consequently, more young men than young women who reported clinically-diagnosed self-harm said that they were not disturbed by emotional pain daily (respectively 189 (19.5%) of the men and 555 (12.2%) of the women ($\chi 2$ [3, n=5507] =53.2, $p \leq .001$). Young men who reported clinically-diagnosed self-harm had worse social interactions and a worse ability to regulate emotions/aggression than young women in this group. Nevertheless, sex differences were generally small or insignificant (Table 4).

Table 4.
Social and life skills in adolescents who reported clinically-diagnosed self-harm by sex, *n* = 5507

	Descriptive statistics						Logistic regression	
	Female		Male				Female = reference	
	Mean	SD	Mean	SD	*p*-value	Hedges'g	OR_{adj}	95 % CI
School absence	0.25	0.64	0.21	0.58	0.38	0.05	0.96	0.85-1.09
Emotional pain	2.82	1.04	2.56	1.06	<.001	0.20	0.70	0.65-0.76
Social interaction	7.62	2.6	7.97	2.77	<.001	-0.13	1.06	1.03-1.10
Coping strategies	7.13	2.17	7.33	2.20	0.02	-0.08	1.01	0.97-1.05
Emotional regulation/aggression	5.06	1.65	5.37	1.89	<.001	-0.18	1.12	1.07-1.17

SD: standard deviation, OR: odds ratio, CI: confidence interval

DISCUSSION

This national comprehensive study included close to 90% of all 17-year-olds who lived in Norway at the study period. Three percent of the adolescents reported clinically-diagnosed self-harm, i.e., that they themselves reported having received a diagnosis of self-harm from a clinician. The majority of these adolescents were more often disturbed by mental distress, anxiety, and depression and they were less able to regulate negative emotions and aggression than other adolescents. However, worse social interactions and worse coping strategies added little to the prediction of self-reported clinically-diagnosed self-harm, and the sex differences in our results were few and small.

Surveys estimate that 15-20% of adolescents self-harm, and among these, 10-20% contact health care services.[1 2] Based on these estimates, the portion of adolescents who reported clinically-diagnosed self-harm in this study is within the expected range, but no data for exact comparison are available. The characteristics of the adolescents who reported clinically-diagnosed self-harm are concurrent with well-established knowledge that self-harm is strongly associated with intense emotional pain, worse social relations, worse coping strategies, and more impulsivity.[6 17 19 21] The small sex differences we found about SLS in clinically-diagnosed self-harm tended towards previous research that observed more aggression among self-harming young men than young women.[25 33]

In our study, both young men and young women who reported clinically-diagnosed self-harm experienced more emotional rather than social problems when compared to other adolescents, and social interactions and coping strategies did not seem to buffer the emotional pain to any appreciable degree. This could support the hypothesis that coping changes inversely with depression in self-harming adolescents,[18] or it could be due to limitations in the measurements in our study. It is possible that those who reported clinically diagnosed self-harm had received treatment, which may have improved their SLS to the level of the

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reference group at the time they submitted their health declaration.[24] However, we did not have information on the timing of self-harm. Nor did we have access to records on their medical treatment and cannot tell whether they had received any psychiatric treatment or SLS training. Most likely, those who reported clinically-diagnosed self-harm had various types of health care contacts, treatment, and follow-up, which most likely had various impacts on their SLS. Alternatively, it is possible that the SLS of adolescents who reported clinically-diagnosed self-harm in our study did not differ from those of other adolescents in the first place. Facilitators of help-seeking behaviour include social support and encouragement from others.[1 34 35] Thus, it is plausible that factors such as social relations, communication skills, initiative, and less aggression are core characteristics of those self-harming adolescents who actually get in contact with health care.

The lack of clear sex differences in SLS that we observed was very interesting. It could be related to our study methods, e.g., the items on which emotional regulation/aggression was based may have captured anger expressed outwardly, which is more typical of boys and men, better than internal anger, which is more typical in young women.[33] However, we speculate that common sex differences in self-harm and its associated factors are more evident in the less severe part of the behavioural spectrum. It may be that boys who have mild emotional difficulties do not engage in self-harm directly, but rather regulate their distress and even inflict pain on themselves by participating in anti-social, risky, or athletic activities where they are exposed to physical strain, injuries, or accidents.[36 37] Moreover, in terms of social function and aggression, sex may be a less important factor among those who suffer so much that they recognise their behaviour as self-harm, take the step to seek treatment, and actually have their condition recognised and diagnosed by a clinician.

Strengths

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To our knowledge, no previous study has examined self-harm that most likely had been clinically treated in a near complete national cohort of adolescents. The data in this study was collected by the Norwegian Armed Forces. Adolescents were obligated to submit their declaration of health by law; they knew that they could be called in for an in-person medical examination to verify their answers, and they knew that giving incorrect information could have consequences, which minimises the risk of selection and reporting bias. Most previous cohort studies and cross-sectional surveys have been conducted among students in selected schools.[1] Therefore, we argue that the present study adds to the existing literature through its increased generalisability and validity compared to previous research.

Limitations

The results of this study must be interpreted in light of some limitations. The cross-sectional design implies that we cannot determine the directionality of the associations between SLS and clinically-diagnosed self-harm. Moreover, the questionnaire that we used was developed for military selection and not for research purposes, which has implications for the measures and limited the analyses in our study. The topic of self-harm in the declaration was very crude and only asked to the respondents who could state that the self-harm had been diagnosed by a clinician. Consequently, our reference group included adolescents who self-harmed but had not been diagnosed by a clinician. Therefore our risks are most likely underestimated, and cannot be generalised to the majority of self-harming adolescents who do not contact health care or do not receive a clinical diagnosis for self-harm.[1 38] We did not control for other mental disorders. Neither could we investigate SLS with respect to self-harming methods, frequency of self-harm, suicide intention, help-seeking behaviour, or treatment. The questionnaire did not include a full SLS scale. We only had access to a few items that do not directly translate to the definition of SLS, and these items have not been validated in previous research. To compensate for this, we performed a PCA, which improves accuracy and

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removes dimensions that only contribute noise; the PCA reduced the number of items into three meaningful components. About 10% of the adolescents in this cohort did not submit their declaration of health to the AFHRCC at the expected age. This may represent the most deprived adolescents, because non-participation or postponed submission is often due to mental illness. It is unknown if non-participation is linked to self-harm and health care contacts.

Implications

The results of this study are relevant to physicians and psychologists who provide clinical treatment to adolescents who engage in self-harm, as well as for prevention and future research. We argue that our results support previous suggestions that treatment and preventative strategies against self-harm must aim to teach adolescents how to regulate difficult emotions.[39] Further, interventions that focus on increasing social functioning in self-harming adolescents by strengthening school participation, social relations, and coping may be less effective if emotional care is not also provided.[25 40] Because self-harm is associated with school absence, it can be difficult to reach adolescents who self-harm in school-based suicide prevention or life skills programmes.[26] Our observations provide empirical evidence for further research on SLS and self-harm. More refined categories and validated instruments for SLS will maximise the possibilities of finding true differences between groups. Future investigations could focus on SLS among self-harming adolescents who go untreated compared to those who obtain help, which could be a valuable contribution to targeted interventions. Follow-up studies that investigate whether SLS in adolescence are related to morbidity and mortality later in life may clarify whether SLS improve outcomes in self-harming adolescents.

Data availability statement

The data that support the findings of this study are available from The Norwegian Armed Forces Health Registry but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are however available from the authors upon reasonable request and with permission of The Norwegian Armed Forces Health Registry.

Competing interests

The authors declare that they have no competing interests. The authors alone are responsible for the content and writing of the article. The view expressed in this article are those of the authors and are not necessarily those of the associated institutions.

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Authors contributions

Elin Anita Fadum (EAF), Ellen Øen Carlsen (EØC), Maria Ramberg (MR), Leif Aage Strand (LAS), Siri Eldevik Håberg (SEH), Einar Kristian Borud (EKB), and Monica Martinussen (MM) collaborated on the planning of the study. EKB had the responsibility for accessing data, (EØC) initially explored the data and facilitated for data analyses. EAF designed the study, performed the statistical analyses and drafted the manuscript. All authors (EAF, EØC, MR, LAS, SEH, EKB, MM contributed in the design of the study and the interpretation and reports of the results. The manuscript was circulated repeatedly between the authors for critical revisions. All authors have read and approved the final version of the manuscript.

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Figure 2. Components of social and life skills in Norwegian adolescents presented as percentages with best and worst scores in adolescents who did and did not report clinically-diagnosed self-harm, N = 171 486.
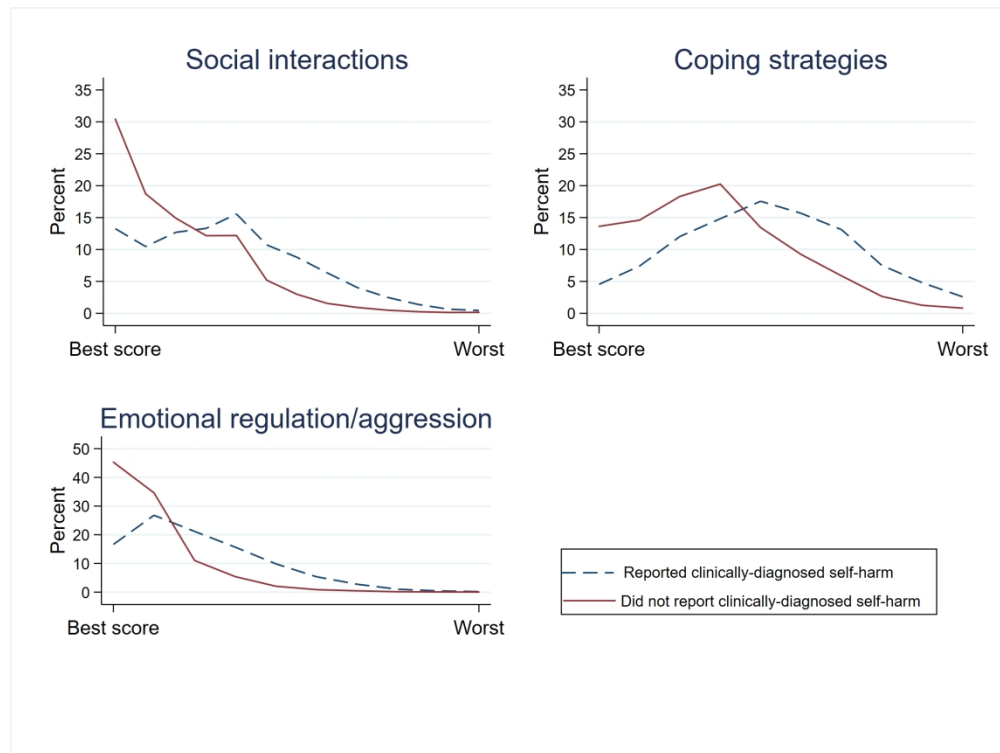
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Figure 1. Components of social and life skills in Norwegian adolescents presented as percentages with best and worst scores in adolescents who did and did not report clinically-diagnosed self-harm, N = 171 486.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	2
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-8
Bias	9	Describe any efforts to address potential sources of bias	*8-9*
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8-9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	8-9
		(*b*) Describe any methods used to examine subgroups and interactions	8-9
		(*c*) Explain how missing data were addressed	na
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	na
		(*e*) Describe any sensitivity analyses	na
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	15
		(c) Consider use of a flow diagram	na
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7, 9, 10
		(b) Indicate number of participants with missing data for each variable of interest	na
Outcome data	15*	Report numbers of outcome events or summary measures	9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	10-12
		(*b*) Report category boundaries when continuous variables were categorized	8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	10
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	7-8 (PCA)
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14-15
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	15-16
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.