

Did Stress Prevalence Among Adolescents in Scandinavia Change from 2000 to 2019? A literature review

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Abstract

Background: Prolonged stress is a risk factor for developing mental illness and stress-related diseases. As there has been an increase in self-reported psychological symptoms and diagnosis of mental illness among Scandinavian adolescents, more knowledge of stress prevalence in this age group is needed.

Aim: This literature review will investigate a possible increase in stress prevalence among Scandinavian adolescents, aged 13-18, between the years 2000 and 2019.

Methods: A systematic literature search was conducted in the PubMed and PsycInfo databases. In addition, a grey literature search was conducted to find relevant surveys and reports. Altogether, nine papers and nine surveys, and reports containing relevant data were identified, assessed for risk of bias, and included in the analysis.

Results: The results show higher stress scores among the older participants in the age group 13-18 years and a gender difference, where girls score higher than boys. The literature neither supports nor rejects the hypothesis that stress levels have increased among adolescents in Scandinavia, from year 2000 to 2019. Only two of the included studies used a validated stress questionnaire and there was a substantial risk of non-response bias. Therefore, the existing literature is considered insufficient to determine if there has been an increase in stress over time. A majority of the papers, surveys, and reports had moderate risk of bias.

Conclusions: Further research using validated stress questionnaires in representative populations is needed to investigate changes in stress prevalence among Scandinavian adolescents. Also, the age and gender difference in stress prevalence among 13-18-year-olds may be of relevance for planning preventive interventions to reduce stress.

Keywords: Adolescents, Scandinavia, Literature review, Trends

1. Introduction

During the last 20 years, there has been an increase in self-reported psychological symptoms and in the incidence of mental illness among adolescents in Norway, Sweden, and Denmark (1–3). There is a gender difference, where girls are more often diagnosed with depression and anxiety and report higher levels of psychological symptoms than boys. These findings are in line with what is observed in other Western countries (4). Whether this trend is caused by an increase in adolescents becoming mentally ill or if it is a result of better diagnosis and

less taboo concerning mental health, is not clear. It may be a combination of both, but there is still uncertainty regarding factors causing this trend (3).

Some research points to a possible increase in school-related stress during the 2000's (5,6). Others discuss that adolescents might experience demands in more areas of life than previous generations (7). For example, widespread use of social media may give rise to both more focus on body image and to present oneself in a positive manner to the outer world. This can also amplify social comparison, which is prevalent in adolescence (8). As the trends

for how one should appear are in rapid change, the demands to live in line with the expected norms can be high. Societal changes, such as a stronger focus on individual achievement in education and career, may also result in higher expectations of the individual (6). When combining these factors, one can hypothesize that adolescents may experience demands in more areas of life than previous generations. If the perceived demands exceed the person's perceived abilities to deal with them, stress can occur (9). Prolonged high stress level is a risk factor for developing mental illness, such as depression and anxiety (10). Therefore, it could be hypothesized that an increase in stress among Scandinavian adolescents, is related to the increase in diagnoses of mental illness and self-reported psychological symptoms.

Among young adults aged 16-24, stress increased in Denmark during the 2000's (11,12). The same trend is seen in Sweden, for 16-29-year-olds (13). The results show a gender difference, where girls both have higher prevalence and a higher stress increase than boys. As the age groups were heterogenous, it is not certain whether this trend reflects stress among adolescents, aged 13-18. Also, it could be that stress levels and factors causing stress, differ for a 16-year-old compared to a 24-year-old. This insight can be relevant in designing stress interventions, as there is a need to address the factors that cause most stress in the specific age groups. It can also be of value in gaining more knowledge of factors that can affect the mental health of adolescents in Scandinavia, in order to apply better preventive interventions.

Defining adolescence can be difficult. The meaning of the term has changed over time and is affected by several factors, such as culture and an earlier onset of puberty among girls in Western countries (14,15). The World Health Organization defines adolescence as the age period 10-19, representing the phase between childhood and adulthood (16). In addressing stress, this definition does not take into consideration that what can be considered stressful for a 10-year-old in primary school may differ from a 19-year-old possibly attending university. In designing interventions to reduce stress, this information can be of relevance. Further, Due et al. (17) have argued that outside the age range 16-24, there is a lack of knowledge of stress prevalence for Danish adolescents over time. To our knowledge, the same is the case for Sweden and Norway. Therefore, this literature review will examine studies with adolescents aged 13-18, as this age group is more likely to constitute adolescents attending secondary- or upper-secondary high school, their environments are more similar and thereby more appropriate to compare, both across studies and over time. We limited the scope of this review to these three

countries since they have both similar school systems and cultural backgrounds, which makes them suitable to compare.

The main aim of this literature review is to examine the prevalence, and possible increase, in self-reported stress among Scandinavian adolescents aged 13-18 between year 2000 and 2019. Outside of school-related stress, which may have increased over time (5,6), there is a lack of knowledge of whether general stress has increased over time. Also, a possible increase in school-related stress does not consider other factors that constitute the experience of stress among adolescents that may have changed from year 2000 to 2019 (i.e., body image, peer pressure, social media, or a cumulative effect of changes in all these factors). Further, the concept is not broad enough to encompass stress as a phenomenon. Therefore, this review will focus on papers, surveys, and reports that investigate the stress phenomenon on a wider scale.

2. Methods

The literature review was conducted and reported according to the guidelines in the PRISMA-statement (18).

2.1. Study selection

As the age constituting adolescence is not standardized, and with a lack of knowledge of stress prevalence in age groups outside of 16-24 and 16-29 in Scandinavia, this literature review used PubMed's definition of adolescence, age 13-18 (19). A cut-off was set, where maximum 10 % of the participants could be outside this age range for the included studies. The inclusion criteria were: 1) The studies were conducted in the time period 2000-2019; 2) The study population was either Swedish, Danish or Norwegian; 3) The study population was between 13-18 years of age; 4) Stress was measured through self-reported questions/questionnaires; 5) The questions/questionnaires could be compared with other studies; 6) The study was published in a peer-review journal. In cases where several studies conducted research on the same population, the study with a comparable stress question/ questionnaire was preferred.

Exclusion criteria were: 1) The studies had clinical populations; 2) The studies only measured school-related stress; 3) The study was an abstract, a systematic review or a protocol.

The surveys and reports included were identified through a grey literature search. Relevant surveys and reports were found through an extensive search on Google and governmental web pages, for the respective Scandinavian countries. A chain search was also conducted, identifying surveys through citations in other literature. All of the criteria for inclusion of the surveys and reports followed those

of the studies, except the criterion of publication in a peer-review journal – which was not applicable.

For surveys and reports categorizing their study population by grade levels in school, grade levels were translated into approximate age. This takes into consideration that the Scandinavian countries have different grading systems (i.e., in Sweden students start in 9th grade the year they become 15 years old, compared to 10th grade in Norway). Also, to better reflect the actual age of the study populations, the translation into approximate age is based on the time the survey was taken (i.e., spring semester versus fall semester).

2.2. Search strategy

The papers included in this review, were identified through systematic searches of the PubMed and PsycInfo databases on April 20, 2020. The grey literature search was conducted during the same period. Therefore, the papers, surveys, and reports included in the analysis are not affected by possible contributions to stress caused by the Corona pandemic. The search strategy was produced to best target stress self-reported by adolescents between 13-18 years of age in Norway, Sweden and Denmark, from year 2000-2019. A description of the search string for PubMed and PsycInfo, can be found in Supplemental Appendix A.

2.3. Results

(a) Study selection: The searches in PubMed and PsycInfo, resulted in 4651 identified papers. After removing duplicates, 3893 unique papers were screened through reading titles and abstracts. Among these, 132 papers with study characteristics possibly being in line with the inclusion criteria, were assessed in full text. Finally, nine papers met the criteria for inclusion.

After searching Google, websites of national health authorities, and conducting a chain search, 25 reports and surveys were assessed in full-text, and nine met the criteria for inclusion. All the included papers, surveys, and reports were assessed for risk of bias (see Supplemental Appendix B), by the use of the Newcastle-Ottawa quality assessment scale (NOS) (see Supplemental Appendix C).

3. Results

3.1 Stress prevalence

(a) Sweden:

The results from the Swedish surveys and studies (see Table 1), ranging from year 2000 to 2019, do not indicate that there has been a change in stress prevalence among 13-18-year-old adolescents in this time period. The Swedish Level-of-Living Survey for Children (Child LNU) from year 2000 and 2010 do not imply a change in stress prevalence among

Swedish adolescents, aged 13-18 (see Supplemental Table 2). Even though there was an increase of 1.7 % of participants who were stressed at least once a week in 2010 compared to 2000, this may be due to a larger percentage of 16-18-year-olds in the 2010 population (55, 2%) versus 44,6 % in year 2000. This is supported by the age difference in stress scores, as 16-18-year-olds scored higher than 13-15-year-olds in both years. There was a small increase in stress among girls aged 13-15 and 16-18 between the years 2000 and 2010, and for boys aged 13-15 (see Supplemental Table 2). However, the changes are rather small, and the limited number of participants makes changes in percentages more variable, so they are not considered sufficient to reflect a real increase in stress for these groups. The Living Conditions Surveys of Children (Child-ULF), from year 2008-2014, do not indicate a change in stress prevalence for the age group 13-18 during this time period. However, girls aged 13-15 and boys aged 16-18, had increased stress scores in the years 2012-2013, with similar results in 2013-2014, compared to 2008 (see Supplemental Table 3). Why the change occurred in these age groups and differed between genders is not known. A small number of participants in combination with low response rates (41), could possibly lead to random fluctuations in the results. There was no increase in stress in the Child-ULF surveys from 2016-2019, among 16-18-year-old participants (see Supplemental Table 4). The results from 2016-2019 were not compared to the 2008-2014 Child-ULF surveys, due to changes in the stress question. In Children and Young in Scania, there was an increase in stress scores for pupils aged 15-16 and 17-18 in Scania County, from year 2012 to 2016 (see Supplemental Table 5). The change occurred among both genders but was more prominent among the girls. As the increase in stress co-varied with an increase in self-reported psychological symptoms from 2012 to 2016 (25), the causality of the factors is unclear. This is further complicated by the use of a non-validated question to measure stress.

To summarize, regarding the Swedish studies, the results do not indicate an increase in stress prevalence. The stress scores were 0,4 SD units higher in the 2007 population in Landstedt & Gådin (26) compared to the 2014 population in Åström et al. (27) (see Supplemental Table 6). The difference in stress prevalence was similar for both genders; 0,38 SD units higher among the girls and 0,4 SD units higher among the boys in the 2007 population in Landstedt & Gådin (26). One reason for this may be age differences between the populations, as the participants in Landstedt & Gådin (26) were on average 17 years of age, compared to 15,9 (SD = 1.6) years in Åström et al. (27). This consideration is supported by higher stress scores among the older

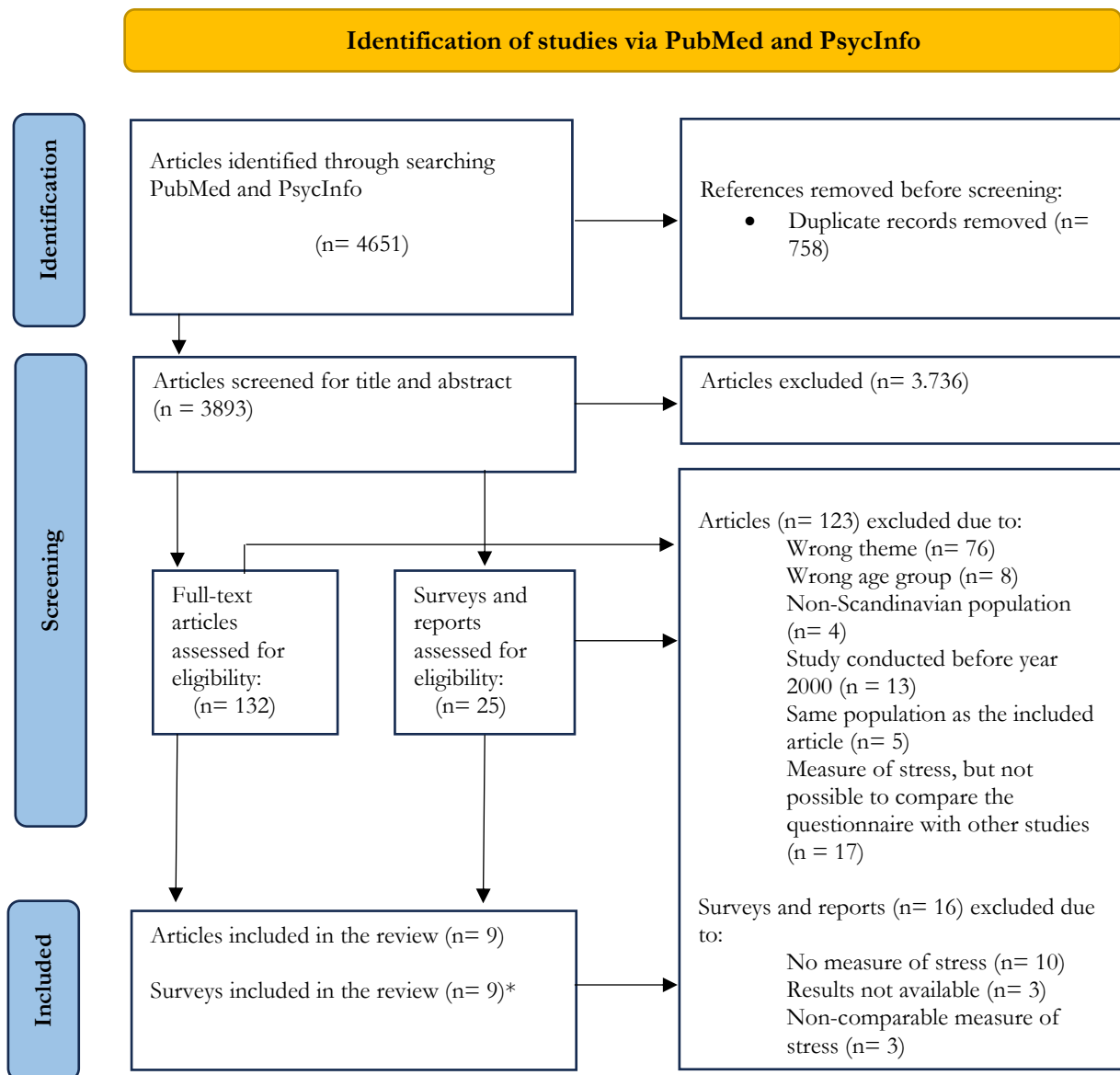


FIGURE 1. PRISMA Flow-Diagram showing the process of identification, screening, eligibility assessment and inclusion in the analysis.

participants in the Child-ULF surveys from 2008-2014, and in Children and Young in Scania in 2012 and 2016. Further, the participants in the two studies came from different counties in Sweden, which could have influenced the results due to socio-economic factors. There is no indication of an increase in stress between the 2011 population in Thorsen et al. (28) and the 2014-2017 population in von Rosen et al. (29) (see Supplemental Table 7). The stress scores were 0,02 SD units higher for the 2014-2017 population in von Rosen et al. (29); 0,07 SD units for the girls and -0,11 SD units for the boys. The populations in Thorsen et al. (28) and von Rosen et al. (29) were similar in age but came from different parts of Sweden.

Therefore, socio-economic factors could have influenced the results. Also, the low participation rate (24 %) in Thorsen et al. (28), could have influenced the results, as the participants may differ in characteristics related to levels of stress.

(b) Denmark

None of the Danish surveys indicate that there has been an increase in stress prevalence between the years 2003 and 2019, among 13-18-year-old adolescents (see Table 1). The surveys Monitoring of Young people's Lifestyle and Everyday Life (MULD), from the years 2003, 2004 and 2006, have similar stress scores for the age group 16-18 – which

TABLE 1. Description of the population and study design of the included papers, surveys, and reports, N=18. The sample size and gender distribution reflect the number of participants between 13-18 years of age, who answered the stress questions. "Year" is the year the population was assessed. Surveys with Scandinavian titles, have been translated to English titles, when appropriate.

Author, year of publication	Country	Year	Sample size and girls%	Study design	Age of population Range (mean (SD)) Data for = Age bracket extracted for this study.	Stress measures	General findings	Changes in stress ("–" indicates that the data are compared to the row below)
The Swedish Level-of-Living Survey for Children (Child-LNU) 2000 (20,21)	Sweden	2000	784 (50,5)	Survey, cross-sectional	10-18, (n/a) Data for: 13-18	Single item (non-validated, "During the past six months, how often have you had the following problems? "I felt stressed")	Age difference in stress scores, where the 16-18-year-olds score higher than the 13-15-year-olds. Gender difference in stress, where girls score higher than boys.	–
Child-LNU 2010 (22)	Sweden	2010	640 (50,9)	Survey, cross-sectional	10-18, (n/a) Data for: 13-18	Single item (non-validated, "During the past six months, how often have you had the following problems? "I felt stressed")	Age difference in stress scores, where the 16-18-year-olds score higher than the 13-15-year-olds. Gender difference in stress, where girls score higher than boys.	No increase in stress from year 2000 to 2010
The Living Conditions Survey of Children (Child-ULF) 2008-2014 (23)	Sweden	2008-2014	7816 (51,5)	Survey, cross-sectional	10-18 (n/a) Data for: 13-18	Single item (non-validated, "During the past six months, how often have you had the following problems? "I felt stressed")	Age difference in stress prevalence, where the 16-18-year-olds score higher than the 13-15-year-olds. Gender difference in stress, where girls score higher than boys.	No increase in stress in the years 2008-2014
Child-ULF 2016-2019 (24)	Sweden	2016-2019	1360 (51,7)	Survey, cross-sectional	12-18 (n/a) Data for: 16-18	Two items (non-validated, "Have you felt stress at some point during the last month?" and "Has it happened every day, a few times a week, once a week or less often?")	Gender difference in stress, where girls score higher than boys.	No increase in stress from 2016-2019
Children and Young in Scania (25)	Sweden	2012-2016	36 327 (49)	Survey, cross-sectional	Grade 6, grade 9 and second grade in upper secondary school (approximate age, respectively: 12-13, 15-16, 17-18) Data for: 15-16, 17-18	Single item (non-validated, "Do you feel stressed in everyday life?")	Age difference in stress, where the 17-18-year-olds score higher than the 15-16-year-olds. Gender difference in stress, where girls score higher than boys.	Increase in stress from 2012 to 2016
Landstedt & Gådin (26)	Sweden	2007	1663 (49)	Cross-sectional	17 (n/a)	Single item (non-validated, "During the past 3 months, how often have you felt stressed?")	Gender difference in stress, where girls score higher than boys.	–
Åström et al. (27)	Sweden	2014	6532 (50)	Cross-sectional	15,9 (1,6)	Single item (non-validated, "During the past 3 months, how often have you felt stressed?")	Gender difference in stress, where girls score higher than boys.	No increase in stress from 2007 to 2014
Thorsen et al. (28)	Sweden	2011	179 (71)	Cross-sectional	16,9 (n/a)	Cohen's Perceived Stress Scale, 14 items (validated)	Non-significant gender difference in stress, where girls score higher than boys.	–

Author	Country	Year	N	Design	Age	Scale	Findings	Notes
von Rosen et al. (29)	Sweden	2014-2017	391 (67)	Cross-sectional	17,9 (1.0)	Cohen's Perceived Stress Scale, 14 items (validated)	Gender difference in stress, where girls score higher than boys.	No increase in stress from 2011 to 2014-2017
Monitoring of Young people's Lifestyle and Everyday Life (MULD) (30-32)	Denmark	2003-2004-2006	5591 (58,6)	Survey, cross-sectional	16-20 (n/a) Data for: 16-18	Single item (non-validated, Stress was included under: "Have you been bothered by any of the pain or discomfort mentioned below in the last 14 days?")	Gender difference in stress, where girls score higher than boys.	No increase in stress between the years 2003, 2004 and 2006
The Danish National Youth Study 2014 (33)	Denmark	2014	60 801 (60,5)	Survey, cross-sectional	≤ 16-20, 21-25. Data for: 15-18	Single item (non-validated, "How often do you feel stressed?")	Gender difference in stress, where girls score higher than boys.	–
The Danish National Youth Study 2019 (34)	Denmark	2019	22 734 (56,6)	Survey, cross-sectional	≤ 16-20, 21-25. Data for: 15-18	Single item (non-validated, "How often do you feel stressed?")	Gender difference in stress, where girls score higher than boys.	No increase in stress from 2014 to 2019
Ungdata 18 and Ungdata 19 (7, 35)	Norway	2017-2018-2019	272 488	Survey, cross-sectional	Grade 8-VG3 (approximate age: 13-19)	Single item (non-validated, "Have you experienced so many demands during the last week that you had trouble coping with it?")	Age difference in stress, where the 18-19-year-olds score higher than the 13-14-year-olds. Gender difference in stress, where girls score higher than boys.	No increase in stress between the years 2017-2018 and 2019
Moksnes et al. (36)	Norway	2005	648 (50,5)	Cross-sectional	13-18 (n/a)	Adolescent Stress Questionnaire, Norwegian version (validated)	Gender difference in stress, where girls score higher than boys.	–
Moksnes et al. (37)	Norway	2006	1508 (51,1)	Cross-sectional	13-18 (14,9 (1,5))	Adolescent Stress Questionnaire, Norwegian version (validated)	Gender difference in stress, where girls score higher than boys.	No increase in stress from 2005 to 2006
Moksnes et al. (38)	Norway	2008	1183 (51,2)	Cross-sectional	13-18 (15,56 (1,8))	Adolescent Stress Questionnaire, Norwegian version (validated)	Gender difference in stress, where girls score higher than boys.	–
Moksnes and Haugan (39)	Norway	2011	1239 (51,2)	Cross-sectional	13-18 (15,00 (1,6))	Adolescent Stress Questionnaire, Norwegian version (validated)	Gender difference in stress, where girls score higher than boys.	No increase in stress from 2008 to 2011
Moksnes et al. (40)	Norway	2016	1507 (53,4)	Cross-sectional	15-21 (17 (1))	Adolescent Stress Questionnaire, Norwegian version (validated)	Gender difference in stress, where girls score higher than boys.	– Possible increase in certain stress domains from 2011 to 2016

indicates no increase in stress for these years (see Supplemental Table 8). The stress scores were a bit higher in the 2004 survey. However, this may be due to a different sampling strategy, where participants from Storstrøms County (now part of Region Zealand) and the municipality of Frederiksberg were invited in addition to a national sample (32). The 2003-survey had participants from Aarhus and Copenhagen in addition to a national sample, while the 2006-survey only used a national representative sample (30,31). Results from The Danish National Youth Study do not show any increase in stress for Danish 15-18-year-olds, when comparing the years 2014 and 2019 (see Supplemental Table 9). The survey from 2019 included more school programs than in 2014, and as the stress scores for 15-18-year-olds were not stratified on school programs, it is possible that this could affect the results (34,42). In this context, it should be noted that students from the school program “Højere forberedelseseksamen” had the largest percentage of pupils within the category “stressed daily” in The Danish National Youth Study in 2019, which could imply that a certain group of Danish adolescents experience more stress (34).

(c) Norway

The results from the surveys “Ungdata 18” and “Ungdata 19”, do not indicate an increase in stress between the years 2017-2018 and 2019 for Norwegian adolescents aged 13-19 (see Supplemental Table 10). Of notice, the numbers of participants who experienced so much stress in their everyday life that they had trouble handling it, increased most from age 13-14 to age 14-15 for girls (11 % to 16 %), flattened out in age 16-17 and 17-18 (17 %), and peaked in age 18-19 (19 %) (7,35). For boys, the numbers peaked as well in age 18-19 (8 %) but were both lower and more stable than for the girls (7,35).

The stress scores for all the stress domains were not higher in the 2006 population in Moksnes et al. (37) than in the 2005 population (36). Rather, the scores were a bit higher in the 2005 population (see Supplemental Table 11). This might be due to the age difference between the populations, where the 2005 population on average was 1 year older. This assumption is supported by the findings of age's influence on stress, from Child-ULF 2008-2014 (see Supplemental Table 3) and Ungdata (see Supplemental Table 10). For the 2008, 2011 and 2016 populations, there was a difference in scores on the stress domains (see Supplemental Table 12). The participants in the 2008 population (38) had higher scores than the 2011 population (39), which does not indicate an increase in stress for these years. However, the 2016 population (40) had the highest stress scores of all these studies. As the studies were

conducted in the same geographical area in Mid-Norway, the results may indicate that stress increased from 2008 to 2016, among 13-18-year-olds in Mid-Norway (38–40). However, as the participants in the 2016 population on average were approximately 1,5 years older than the study population in 2008, and 2 years older than the study population in 2011 (see Supplemental Table 12), the results may reflect age differences between the populations rather than an increase in stress.

3.2. Gender difference in stress prevalence

There was a gender difference in stress prevalence, where girls scored higher than boys in all the papers, surveys, and reports that provided stress scores stratified on gender. Data from Ungdata 18 and Ungdata 19, suggest that it is especially from age 13-14 to age 14-15 (approximate ages for grade 8 and grade 9 in the Norwegian school system), that the gender difference seems to occur (see Supplemental Table 10). The results from Child-ULF 2008-2014 show that the gender difference in stress scores is higher in the age group 16-18 compared to 13-15 (see Supplemental Table 3). The same pattern is also seen in Children and Young in Scania, where the gender difference in stress is higher among pupils aged 17-18 than for the 15-16-year-olds (see Supplemental Table 5). Also, in all the studies conducted by Moksnes and different co-authors (i.e. (36,39)), girls scored significantly higher than boys on a majority of the stress domains (see Supplemental Table 11 and Supplemental Table 12). These findings are strengthened by the use of a validated stress questionnaire (ASQ-N) in all the studies. Thus, the data show that there is pervasive gender difference in stress among adolescents, aged 13-18, in Scandinavia and those differences increase with age.

3.3. Age differences in stress prevalence

All papers, surveys, and reports that provided data stratified on age among 13-18-year-old Scandinavian adolescents, show that stress scores increase with age. For instance, in Child-LNU from 2010 the percentage of 13-15-year-olds that were stressed at least once a week was 44,3 %, compared to 55,4 % of the 16-18-year-olds (see Supplemental Table 2). The results from Ungdata 18 and Ungdata 19 (see Supplemental Table 10), show that stress scores were highest among the oldest participants (approximate age 18-19; final year of upper secondary school), which may be due to the importance of final school grades for further educational opportunities (43). Further, the age difference in stress is influenced by gender as well, in that boys seem to have lower and more stable stress scores than girls. Overall, the findings indicate that stress may increase with age within the age group 13-18, and more so for the girls.

3.4. Risk of bias

A general finding from the included papers, surveys, and reports on stress among 13-18-year-old adolescents in Scandinavia, is the use of nonvalidated stress questions/questionnaires, possible non-response bias, and populations that are not representative on the national scale.

The use of non-validated stress questions is an issue in all the Swedish surveys. Therefore, one cannot conclude that they measured Swedish adolescents' real experience of stress. The low response rate and possible non-response bias in the Child-ULF surveys from 2008-2014 and 2016-2019 (41,44), are issues concerning the representativeness of the study population and generalizability of the results. The surveys Children and Young in Scania from 2012 and 2016, had high numbers of participants and high response rates – i.e. 82 % in grade 9 (approximate age 15-16) in 2012 (25). This is a strength for the representativeness of the results for adolescents aged 15-16 and 17-18, who attend lower secondary and upper secondary school, in Scania County. Even though the results showed an increase in stress from 2012 to 2016, the use of a non-validated stress question is a concern for the validity of the results. Further, the results cannot be generalized outside of Scania County, as other counties in Sweden may differ in socio-economic factors related to stress among adolescents. Thorsen et al. (28) and von Rosen et al. (29) used a validated questionnaire to measure stress (Cohen's Perceived Stress Scale), and the study populations were similar in age, which makes a comparison of stress scores more appropriate. However, the low participation rate in Thorsen et al. (28) is a challenge regarding the representativeness of the study population, and as the two study populations come from different, specific parts of Sweden, the results cannot be generalized to a national scale for Swedish adolescents.

Regarding risk of bias in the Danish literature, all surveys used non-validated stress questions. The inclusion of pain-related discomfort in the MULD survey's stress-question prompts a critical examination of whether the survey genuinely measured stress. While the survey's broad scope encompassing various aspects of adolescent well-being is commendable, the incorporation of pain in the stress question may introduce ambiguity into the stress measurement. In addition, the use of different sampling strategies in the MULD surveys is a challenge regarding both the representativeness of the study populations and comparisons of stress scores between the MULD surveys. The Danish National Youth Studies from 2014 and 2019, may be considered representative for Danish 15-18-year-

olds attending upper secondary school in 2014 and 2019, as they sampled a representative study population and had adequate response rates, however certain school programs were not well-represented (33,45). Overall, due to the limitations in the literature, one cannot conclude that the Danish surveys ranging from year 2003 to 2019, did capture the real experience of stress among 13-18-year-old adolescents.

The large number of participants, high response rates and wide representativeness of Norwegian adolescents bolster our confidence in the results from Ungdata 18 and Ungdata 19 (7,35). However, the use of a non-validated stress question and lack of information on non-respondents, makes it unclear whether the real experience of stress has been captured and whether non-respondents differ in characteristics that could be related to stress. The use of a validated stress questionnaire is a strength of the studies conducted by Moksnes and co-authors. As the studies were conducted in Mid-Norway, the results cannot necessarily be generalized to the entire Norwegian or Scandinavian adolescent population. Also, age differences and geographical factors regarding the study populations – i.e., if the students attended urban versus rural schools – may have influenced the stress scores.

3.5. Non-response bias

A majority of the papers, surveys, and reports did not report characteristics of non-respondents. This is an issue, since non-respondents could differ in characteristics related to stress prevalence. For instance, Moksnes et al. (40) provide information on the response rate in their 2016 study population, which was 65.1 %, but do not give any information on the non-respondents. Therefore, one cannot exclude the possibility that non-respondents differ in characteristics related to prevalence of stress. This is probably a larger issue in Child-ULF 2008-2014, and 2016-2019. The participants in Child-ULF were children of participants in the adult Swedish Living Conditions Surveys (ULF) for the respective years (41). As non-respondents in the ULF surveys were more likely to have a non-Western background, lower income and lower education, the adolescents who did not participate in Child-ULF may also have these characteristics, that could be related to higher levels of stress (41). Further, the total share of non-respondents in the Child-ULF and ULF surveys increased from 60 % in 2010 to 72 % in 2017 (41). As the majority of the papers, surveys, and reports do not provide sufficient information on non-respondents, one cannot exclude the possibility that they differ in characteristics related to prevalence of stress. Overall, this is a challenge in relation to the representativeness and generalizability of the results

among Scandinavian adolescents, aged 13-18, in the time period of the years 2000-2019.

4. Discussion

The literature does not immediately support the hypothesis that stress levels have increased among adolescents aged 13-18 in Scandinavia, from year 2000 to 2019. However, it does not reject it either. As there is a lack of surveys using validated stress questions or questionnaires, and a limited number of papers, surveys, and reports investigating stress prevalence in comparable populations, the available data may be considered insufficient to give a definite answer to whether there has been an increase in stress prevalence or not in Scandinavian adolescents from year 2000 to 2019.

4.1. Findings

A general finding in the Scandinavian literature is a gender difference in stress levels, and an increase in stress levels with age from 13 to 18 years. This is similar to the pattern found in self-reported psychological symptoms for this age group (35), and for the personality trait Neuroticism (46), which is a risk factor for developing mental illness (47). Girls scored higher on stress in all the papers, surveys, and reports included in the literature review that stratified scores on gender. Results from Ungdata 18 and Ungdata 19 (7,35) suggest that the gender difference arises from age 13-14 to age 14-15. This is in line with findings regarding the onset of gender difference in depressive symptoms (48). The identified gender differences in adolescent stress levels, highlight complex interplays of sociocultural, biological, and psychosocial factors. Societal expectations, hormonal fluctuations, and coping mechanisms contribute to varied stress experiences. Differences in peer and parental relationships, along with distinct educational pressures, also play a role. Understanding these nuanced dynamics is crucial for tailored interventions to support the mental well-being of adolescents across genders. Further research is needed to explore these factors comprehensively. Stress increased with age, both for girls and boys. However, the increase was steeper for the girls. These findings imply that levels of stress increase from age 13 to 18 in Scandinavia. This underlines the importance of viewing 13-18-year-olds as a heterogeneous group in relation to stress. Therefore, comparisons across- and between studies with large age-spans for adolescence, should be undertaken with caution and under consideration of the age and gender composition of the different populations.

4.2. Research implications

An increase in stress levels was found for specific age groups in certain years. For instance, among 13-15-

year-old girls and 16-18-year old boys in the Swedish 2012-2013 Child-ULF survey (23) (see Supplemental Table 3). Also, there was an increase in stress among pupils aged 15-16 and 17-18 in Scania County in 2016, compared to 2012 (25) (see Supplemental Table 5). However, due to the use of non-validated stress questions in both surveys, and a possible non-response bias in the Child-ULF surveys, the results may not be considered reliable to reflect an increase in stress prevalence. The most valid information on stress levels measured over time, comes from the studies conducted by Moksnes and different co-authors in Norway (36–40). By using a validated stress questionnaire specifically designed for Norwegian adolescents (Adolescent Stress Questionnaire – ASQ-N), the studies are more likely to capture the real experience of stress. As the ASQ-N has several subscales, the questionnaire can also help to address which domains of life are most relevant for stress among adolescents. This is important, as it can inform the design of stress-reducing interventions. However, even these studies' results are difficult to interpret with respect to a possible increase in stress levels over time, as the populations differ slightly, both in age and rural versus urban composition. As girls scored higher than boys on all subscales, and as stress scores were higher among the older study populations, the results support the general finding of gender differences in stress and an increase of stress levels with age. Again, this exemplifies the importance of not viewing adolescents, aged 13-18, as a homogenous group when it comes to stress. In future research, the use of the ASQ would be helpful to gain a more valid and detailed picture of stress among Scandinavian adolescents. Additionally, it would be relevant to include questions regarding stress related to body image, sports/exercise and social media – as these domains were related to negative stress among adolescents in the Ungdata surveys (7,35) and may become more important stress factors among adolescents due to increased use of Internet and smart phones (49).

4.3. Limitations

As the papers, surveys, and reports included in the literature review were cross-sectional, it is not possible to examine whether other factors have influenced the stress scores. For instance, in Children and Young in Scania, increased stress scores were mirrored by increased scores in self-reported psychological symptoms from 2012 to 2016 (25). As depression and stress covary (50), higher rates of stress may be due to more adolescents experiencing depressive symptoms and possibly mental illness. It might therefore be speculated that changes in other factors could covary with or possibly cause higher

stress scores. This also relates to the issue with the widespread use of non-validated stress questions, as it is uncertain whether the questions have measured the experience of stress itself or possibly other stress-related phenomena, such as depressive symptoms.

Two of the included studies and almost all the included surveys, used single-item measures to assess stress. This could make a comparison of stress scores across the studies and surveys possible. However, due to differences in formulations and time frames in the stress questions, this was not considered appropriate. For instance, the “Child-ULF” surveys from 2008-2014, asked: «During the past 6 months, how often have you had the following problems?» «I felt stressed». “Ungdata” from 2018 and 2019, asked whether the person had experienced so many demands during the last week that they had trouble coping with it. This can lead to a different understanding and response to questions that try to address the same phenomenon, which further makes a comparison challenging. Also, as few papers, surveys and reports measured stress over longer periods of time (i.e., 10-15 years) it is difficult to address possible changes in stress prevalence within the entire range of the study, namely the years 2000-2019. Therefore, based on the present evidence, one cannot entirely exclude the possibility that stress levels may have increased from 2000 – 2019. However, neither do the data support such a conclusion.

Finally, the chosen search strategy can pose a limitation on the number of papers included in the analysis. The two databases, PubMed and PsycInfo, were chosen on the basis that they are among the largest databases within medical literature and mental health. However, one cannot exclude the possibility that adding more databases to the search strategy would lead to findings of more papers relevant to include in the analysis.

4.4. Future directions

Overall, the findings of the present literature review are of relevance both when comparing stress prevalence among adolescents, aged 13-18 across time and for suggesting methodological directions for further research. It is of utmost importance that future research addressing this question uses validated stress items or questionnaires.

A large sample of 13-18-year-olds, with equal representation of each age and gender, recruited from a nationally representative population, would be preferable in future studies. Also, as The Danish National Youth Studies from 2014 and 2019 (34,42), and Ungdata 18 and Ungdata 19 (7,35) show that surveys conducted in schools have high response rates, this may be a good strategy for attaining high response rates and representative populations.

If these conditions are met, it will be possible to investigate possible changes in stress prevalence over time. This can provide information that can be relevant in addressing factors that can affect adolescents’ mental health, and in designing preventive measures.

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Access to research materials

Most of the research material used in the literature review is available online, in the original papers and surveys cited in the list of references. For research material that was received upon request, the name of the author or institution providing the material is specified in the specific supplemental table.

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