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Associations of somatic and internalising symptoms with school absences: a national survey from Finland

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ABSTRACT

Objective To examine associations of somatic and internalising mental health symptoms with school absences and how experiencing multiple symptoms influences the risk of school absences compared to single symptoms.

Methods The School Health Promotion study is a national survey conducted biennially in Finland by the Finnish Institute of Health and Welfare. We used data collected between 1996 and 2019. Each survey included between 32 439 and 92 227 participants from grades eight and nine (ages 13–17 years). Five somatic symptoms (neck pain, back pain, stomach ache, headache and sleep issues) and symptoms of anxiety and depression were assessed. School absences were reported as excused absences due to an illness and unexcused absences.

Results Somatic symptoms correlated with each other (0.27–0.46), with internalising symptoms (0.20–0.34) and both types of school absences (0.09–0.25). An increasing number of reported somatic symptoms was associated with higher odds for both types of school absences (cumulative OR (COR) 1.73–6.55 for excused and 1.49–4.28 for unexcused absences when students exhibited 1–5 somatic symptoms). Symptoms of depression showed a stronger association with unexcused absences than excused absences (COR 2.37 vs 1.50). Experiencing one somatic symptom or symptoms of anxiety was equally associated with excused and unexcused absences (interaction effect coefficients 0.95 and 0.94, respectively). When both somatic and internalising symptoms were present, COR was highest for excused absences (11.29). Experiencing two somatic symptoms increased the odds of weekly excused absences significantly (OR 9.60).

Conclusions Accumulation of somatic and internalising symptoms is associated with an increased risk of both excused and unexcused school absences. These results warrant multidisciplinary co-operation when planning and implementing interventions for absences.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ School absences have a negative impact on adolescent development. Both somatic and internalising mental health symptoms are associated with absences.

WHAT THIS STUDY ADDS

⇒ The more somatic and internalising symptoms a student reports, the higher the odds for school absences. Experiencing symptoms of depression was more strongly associated with unexcused absences than excused absences.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ The results highlight the need for collaboration between teachers and school healthcare professionals when intervening in any school absences.

INTRODUCTION

Education is a key determinant of adolescent health, yet educational attainment may be threatened by school absences.[1] School absences are commonly divided into excused absences, which occur with the knowledge and permission of school personnel and/or caregivers and unexcused absences (also known as truancy). Both types of absences are detrimental, potentially causing academic difficulties, challenges in social relationships with peers in addition to lower educational attainment and poor health in adulthood.[2–5] School absences are associated with anxiety and depression[6 7] (aka internalising symptoms), both of which increase in prevalence during adolescence.[8 9] Most often, anxiety precedes depression, and previous studies have established their comorbidity.[10–13]

Anxiety and depression are frequently associated with different somatic symptoms such as headache, stomachache and back pain.[13] Adolescents often seek treatment for somatic symptoms rather than mental health issues, potentially causing a delay in the diagnosis of a mental health issue. Overlooking the co-occurrence of somatic

and mental health symptoms may result in unnecessary and costly examinations for somatic conditions.[14] The opposite is also possible: the rise in the prevalence of different internalising symptoms might promote looking for a mental health reason over a somatic symptom. Furthermore, different pain symptoms may correlate with each other,[15] increase the risk of depression,[16] exacerbate pre-existing mental health symptoms[17] and predict future mental health disorders.[18] Different somatic symptoms are also a common reason for school absences,[19] but their prevalence has varied between populations.[20–23]

School absences have been separately associated with somatic symptoms and internalising mental health symptoms (after this referred to as internalising symptoms).[6 7 19] However, the associations of both somatic and internalising symptoms with school absences have not been compared or combined before. We wanted to explore the associations between somatic symptoms, internalising symptoms and different types of school absences, especially among students who experience several co-occurring somatic and/or internalising symptoms. Thus, we aimed to examine:

1. How the prevalence of different somatic symptoms has changed from 1996 to 2019.
2. How different somatic symptoms associate with each other, internalising symptoms and school absences.
3. How different types of school absences are associated with multiple somatic and internalising symptoms?

METHODS

Study design, setting and population

The School Health Promotion study is a national survey conducted by the Finnish Institute of Health and Welfare.[24] Since 2013, data have been collected biennially in the whole country. Prior to this data were collected in Southern, Eastern and Northern Finland in even-numbered years and Western and Central Finland in odd-numbered years.[13] Participation is voluntary, and students complete the survey anonymously during school hours under teacher supervision. Students can complete the questionnaire either electronically or in paper format.[24] In 2015, technical difficulties with the electronic questionnaires reduced the response rate.[25] Data from this study have previously been used to report, for example, changes in prevalences of internalising mental health symptoms.[26 27]

In Finland, compulsory education starts the year a child turns 7 years old and ends when they turn 18 years old. Students in grades eight and 9 are usually aged 14–16 years old. As there might be sporadic students who are still 13 years old or have already turned 17 years old, we excluded responses where the self-reported age was under 12 years or at least 18 years. Data used in our analyses were collected between 1996 and 2019.

MEASURES

Demographics

Before 2019, the official sex was assessed with the question: 'what is your gender?'. In 2019, the wording was revised to "'what is your official gender?'. For both versions, the response options were 'boy' and 'girl'. Students reported their grade (8 or 9) consistently throughout the study period using the same question: 'which grade are you in?'. Socioeconomic status (SES) was based on student-reported maternal education level which has been used in research previously as well.[28] The four response options included: 'comprehensive school or equivalent' (ie, 9 years of education), 'upper secondary school, high school or vocational education institution' (ie, 12 years of education), 'occupational studies in addition to upper secondary school, high school or vocational education institution' and 'university, university of applied sciences or other higher education institution'.

School absences, somatic symptoms and internalising symptoms

The item used to measure school absences changed during our study period and thus we only use data from 2017 and 2019. In 2017 and 2019, the item read: 'How often during this school year have you experienced the following: (a) unexcused absences or skipping school or (b) absences due to an illness?' The response options for both types of absences were 'not at all', 'a few times in the year', 'every month', 'every week' and 'daily or almost daily'. Since even short absences may be harmful, we used no cut-offs for these outcome measures.

Throughout our study period, the same item was used to measure somatic symptoms: 'During the last 6 months, have you experienced any of the following symptoms and how often?'. Students were asked about neck or shoulder pain, lower back pain, stomach ache, headache and sleep problems (defined as trouble falling asleep or waking up during the night). The response options were: 'seldom or never', 'approximately once a month', 'approximately once a week' and 'almost daily'. Experiencing one or two somatic symptoms occasionally can be considered normal, even unavoidable.[23 29 30] Thus, we focused on symptoms experienced at least weekly.

The items used to measure internalising symptoms have changed multiple times and changes in their prevalences have been reported previously.[31 32] Here, we focus on years 2017 and 2019. Symptoms of anxiety were assessed with the Generalized Anxiety Disorder-7 scale,[33] which has been validated for adolescents.[31] The official cut-off for moderate anxiety (>10 points) was used.[32] Symptoms of depression were measured with the Beck Depression Index-6, a shortened version of the Beck Depression Inventory used to screen for depressed mood and major depressive disorder among adolescents.[34] Students were considered to show symptoms of depression if they scored four points or more, a cut-off which is lower than commonly used.[34] The lower cut-off is used

by the Finnish Institute of Health and Welfare that has gathered the data and organised it for research purposes.

Statistical methods

Descriptive statistics include percentages. The prevalence of weekly or more frequent somatic symptoms was evaluated from years 1996 to 2019.

We used Spearman correlations to examine the correlations of somatic symptoms and internalising symptoms with each other and with excused and unexcused school absences. For these correlations, we used data from years 2017 and 2019 as these were the most recent years in our dataset with a consistent measure for both internalising symptoms and school absences. We evaluated the strength of correlations using previously published categories[35]: r<0.20 signified a very weak correlation, r 0.20–0.39 a weak correlation and r 0.40–0.59 a moderate correlation.

We estimated cumulative ORs (COR) and ORs of school absence with 95% CIs with three different symptom categorisations as independent variables. All models used data from years 2017 and 2019 for reasons mentioned previously. We used interaction models to calculate the ratio between different school absence types with the accumulation of somatic and internalising symptoms.

In the first case, we used COR and estimated the association of excused and unexcused absences as well as absences in general using an accumulating number of somatic symptoms as an independent variable. We only included students who reported experiencing somatic symptoms at least weekly. In contrast, we included all reported absences without any cut-offs. For comparison, we also estimated CORs for situations where the student experiences either one of the internalising symptoms without any somatic symptoms. We used a model with an interaction term to estimate the ratio between different school absence type CORs.

In the second case, we grouped symptoms to reflect reality where a proportion of students tend to report experiencing multiple somatic symptoms simultaneously.[13 36] Thus, we grouped the somatic symptoms based on experiences of one to three of the five somatic symptoms, again including students who experienced the symptoms at least weekly. We then added internalising symptoms to the model: first symptoms of anxiety and then symptoms of depression, as this is the usual order in which they occur, in addition to the somatic symptoms. Finally, we added experiences of four or five of the five somatic symptoms and then the internalising symptoms, first symptoms of anxiety and then symptoms of depression. Furthermore, we estimated the CORs for both absence types as well as absences in general. Additionally, we used a model with an interaction term to estimate the ratio between different school absences type CORs.

In the third case, we conducted multinomial regression analysis to estimate the association of the accumulation of different symptoms with different frequencies of school absences. We did these calculations for both types of school absences as well as absences in general. Again, the number of symptoms was an independent variable. First, we calculated ORs for situations where the student experiences either one somatic symptom or one internalising symptom. Then, we increased the number of both somatic and internalising symptoms in a stepwise manner.

Data availability is reported for each analysis separately. All analyses were adjusted by official sex, grade and SES. For all analyses, we considered p<0.01 to be significant. All analyses were carried out with SAS software, V.9.4.

Patient and public involvement

Patients and/or the public were not involved in the design, conduct, reporting or dissemination plans of this research.

RESULTS

Between 1996 and 2019, 1 029 014 students completed the survey (online supplemental table 1). Annual response rates varied between 63–84%. Both official sexes and grades were represented almost equally (online supplemental table 1).

The prevalence of somatic symptoms

A greater percentage of girls reported experiencing somatic symptoms than boys did (figure 1). From 2006 to 2019, the prevalence of different somatic symptoms remained relatively stable.

The correlation of somatic symptoms with each other, internalising symptoms and school absences

Somatic symptoms correlated with every variable used in the analysis are provided in table 1.

Older students and students with a low SES background reported more somatic symptoms (online supplemental table 2).

Associations between multiple symptoms and school absences

The odds for excused and unexcused absences increased as a function of the number of somatic symptoms (table 2). Generally, somatic symptoms showed a stronger association with excused than unexcused absences, but symptoms of depression showed a stronger association with unexcused than excused absences. Based on the interaction term, experiencing a single somatic symptom or symptoms of anxiety was equally associated with both types of absences.

Anxious and depressive symptoms combined with somatic symptoms were associated with increased odds of school absences (table 3). Experiencing four

Figure 1 The percentage of eighth and ninth grade students who report experiences of somatic symptoms at least weekly from 1996 to 2019.

Table 1 Correlations of somatic symptoms experienced at least weekly with other somatic symptoms, internalising symptoms and school absences, based on data gathered in 2017 and 2019

	Excused absences	*Unexcused absences*	*Anxiety (GAD 7*)*	*Depression (BDI-6†)*	*Neck pain*	*Back pain*	*Stomach ache*	*Headache*
Neck pain	0.092	0.143	0.235	0.209				
Back pain	0.120	0.134	0.220	0.200	0.462			
Stomach ache	0.120	0.191	0.265	0.240	0.257	0.265		
Headache	0.148	0.248	0.268	0.255	0.330	0.238	0.310	
Sleep issues	0.185	0.180	0.326	0.340	0.239	0.214	0.263	0.288

Number of observations varied between 133 783 and 137 264. For all correlations, p<0.01.
*GAD-7 is a validated method to test for general anxiety.
†BDI-6 was used to test for depression symptoms.
BDI-6, abbreviated version of Beck Depression Index; GAD-7, Generalized Anxiety Disorder scale.

to five somatic symptoms was equally associated with excused and unexcused absences.

The odds of weekly absences increase as the student reports more symptoms. Experiencing one to two somatic symptoms was associated with significantly higher odds of weekly excused absences compared with a situation without any symptoms (table 4). The accumulation of symptoms increases the odds of weekly unexcused absences as well. In online supplemental table 3, we present the odds for all levels of school absences.

DISCUSSION

In our study, the percentage of adolescents reporting somatic symptoms remained relatively stable between 2006 and 2019. The cumulative number of somatic symptoms was associated with increasing odds of both excused and unexcused school absences. Symptoms of anxiety were associated with both types of absences and associated with smaller odds of school absences than experiencing any one of the five somatic symptoms. Symptoms of depression increased the odds of unexcused absences more than excused absences. Combined somatic and internalising symptoms were associated with both excused and unexcused school absences.

We chose to focus on somatic symptoms that the participants reported experiencing at least weekly, as previous studies have shown that a significant number of children and adolescents report experiencing different somatic symptoms on a monthly basis.[23] The symptoms included in our study might be associated with minor injuries.[30] Neck and/or back pain can be caused by prolonged sitting or poor ergonomics. Stomach ache might be related to the phase of the menstrual cycle. A headache can be a consequence of forgotten corrective lenses. Occasional sleep difficulties are a common symptom of stress. Thus, we decided to focus on somatic symptoms that the participants reported experiencing weekly.

Table 2 Cumulative ORs for excused and unexcused school absences when a student experiences multiple somatic symptoms, anxiety or depression, based on data from 2017 and 2019

	Excused absences*		Unexcused absences†		All absences‡		Interaction effect§
Experienced symptoms	COR¶	95% CI	COR	95% CI	COR¶	95% CI	Coefficient
One somatic symptom**	1.73**	1.68 to 1.79	1.49**	1.44 to 1.55	1.32**	1.35 to 1.46	0.95
Two somatic symptoms**	2.52*	2.42 to 2.62	1.90*	1.82 to 1.98	1.61*	1.57 to 1.65	0.89**
Three somatic symptoms**	3.38**	3.21 to 3.56	2.28**	2.16 to 2.40	1.91**	1.85 to 1.98	0.84**
Four somatic symptoms**	4.53**	4.19 to 4.88	2.87**	2.65 to 3.10	2.35**	2.23 to 2.47	0.85*
Five somatic symptoms**	6.55**	5.87 to 7.31	4.31**	3.86 to 4.81	3.40**	3.15 to 3.66	1.07
Symptoms of anxiety††	1.53**	1.27 to 1.84	1.48**	1.21 to 1.81	1.25**	1.12 to 1.40	0.94
Symptoms of depression‡‡	1.50**	1.36 to 1.65	2.37**	2.16 to 2.59	1.53**	1.45 to 1.62	1.80**

*p< 0.01, **p< 0.001.
*Number of responses used in the analysis for excused absences was 112 731.
†Number of responses used in the analysis for unexcused absences was 112 706.
‡Number of responses used in the analysis for all absences was 112 731.
§Interaction effects test the impact of unexcused absences in relation to excused absences.
¶All analyses were controlled for sex, grade and socioeconomic status.
**Students reported any of the somatic symptoms (neck pain, back pain, stomach ache, headache or sleep issues) at least weekly.
††Symptoms of anxiety measured with GAD-7 scale.
‡‡Symptoms of depression measured with BDI-6 scale.
BDI-6, abbreviated version of Beck Depression Index; COR, cumulative OR; GAD-7, Generalized Anxiety Disorder scale.

Table 3 Cumulative ORs for school absences when a student experiences a combination of somatic and internalising symptoms, based on data from 2017 and 2019

	Excused absences*		Unexcused absences†		All absences‡		Interaction effect§
Number of symptoms	COR¶	95% CI	COR¶	95% CI	COR¶	95% CI	Coefficient
1–3 somatic symptoms**	2.10**	2.05 to 2.16	1.71**	1.66 to 1.76	1.46**	1.44 to 1.48	0.96
1–3 somatic symptoms and anxiety††	3.05**	2.81 to 3.30	2.46	2.26 to 2.68	1.87**	1.78 to 1.97	0.94
1–3 somatic symptoms, anxiety and depression‡‡	4.68**	4.45 to 4.92	4.20**	3.99 to 4.42	2.85**	2.76 to 2.95	1.28**
4–5 somatic symptoms**	4.75**	4.46 to 5.06	3.18	2.98 to 3.40	2.50**	2.40 to 2.61	1.00
4–5 somatic symptoms and anxiety††	6.04**	5.28 to 6.92	3.39**	2.94 to 3.91	2.74**	2.50 to 3.01	0.77*
4–5 somatic symptoms, anxiety and depression‡‡	11.26**	10.49 to 11.98	7.88**	7.42 to 8.37	5.91**	5.67 to 6.16	1.52**

*p< 0.01, **p< 0.001.
*Number of responses used in the analysis for excused absences was 131 763.
†Number of responses used in the analysis for unexcused absences was 131 746.
‡Number of responses used in the analysis for all absences was 125 373.
§Interaction effects test the impact of unexcused absences in relation to excused absences.
¶All analyses were controlled for sex, grade and socioeconomic status.
**Students reported any of the somatic symptoms: neck pain, back pain, stomach ache, headache or sleep issues.
††Anxiety measured with GAD-7 scale.
‡‡Depression measured with BDI-6 scale.
BDI-6, abbreviated version of Beck Depression Index; GAD-7, Generalized Anxiety Disorder scale.

Previous research has established that both excused and unexcused absences are harmful.[2 4] Differentiating absences into two categories might send a signal that absences due to an illness are more acceptable than unexcused absences. Since the beginning of the millennium, Finnish schools have used different electronic student management systems to record school absences. During our study period, there were separate instructions for how to intervene in different types of school absences and the instructions tended to focus on unexcused school absences.[37] The instruction on how to reduce school absences rarely mentioned the possibility of including school healthcare workers in the process.[37] As different symptoms were associated with both types of school absences, it seems justified to recommend multiprofessional intervention methods when aiming to reduce school absences.

The connection between school absences and both somatic and internalising symptoms has been established in previous studies.[6 7 37] In our study, accumulation of somatic symptoms was associated with increasing odds for both excused and unexcused absences from school. The risk of excused absences seemed to increase linearly as the number of somatic symptoms increased. The risk of unexcused absences was, however, also associated with somatic symptoms: for example, experiencing three symptoms doubled the odds for unexcused absences. To our knowledge, these are novel findings which highlight the importance of comprehensive evaluation of all school absences. Somatic symptoms and both types of school absences may also have shared origins, such as caring for a family member or experiences of bullying. These are stressors that might make a student more susceptible to somatic symptoms and also trigger unexcused absences.[38 39]

As observed previously, girls reported experiencing more somatic symptoms than did boys and older students reported more somatic symptoms than younger students.[15 22] In our study, back pain and stomach ache were less frequent than in a systematic review published in 2024.[36] The systematic review included all children under the age of 19, which may explain the difference since the review had a broader age range than our study.

The odds of unexcused absences were greater than the odds of excused absences when students reported symptoms of depression, which has been reported previously.[7] ompared with the studies included in the systematic review by Finning *et al*, our study had a considerable number of participants which makes the findings comparable. However, our study had a lower cut-off for depression than conventionally used, so even milder feelings of depression might lower the threshold for unexcused absences. This connection highlights why unexcused absences should not be viewed simply as rule-breaking behaviour but as a possible sign of distress. Future studies should aim to discover how often students with unexcused absences exhibit symptoms of depression.

When students reported both somatic and internalising symptoms, the odds of both types of school absences increased and the odds for excused absences became greater than the risk for unexcused absences. The interaction effect reminds us that it might be difficult to know the sequel that connects school absences with the different symptoms. For instance, the coefficient for experiencing four to five somatic symptoms alludes to an equal association with both types of school absences. A student might

Table 4 ORs and 95% CIs for frequency levels of monthly and weekly school absences when a student experiences a combination of somatic and internalising symptoms, based on data from 2017 and 2019.

	Excused absences*		Unexcused absences†		All absences‡	
Number of symptoms§	Every month	Every week	Every month	Every week	Every month	Every week
One somatic symptom§	2.28** 2.15 to 2.43	4.24** 3.61 to 4.97	1.80** 1.67 to 1.94	2.09** 1.83 to 2.39	1.88** 1.81 to 1.95	2.63** 2.38 to 2.92
Symptoms of anxiety¶	1.78** 1.29 to 2.47	3.07** 1.39 to 6.80	1.29** 0.79 to 2.10	3.41 1.90 to 6.10	1.67** 1.36 to 2.04	3.19** 2.00 to 5.07
Symptoms of depression**	1.74** 1.46 to 2.07	3.63** 2.46 to 5.37	3.32 2.80 to 3.93	4.52 3.44 to 5.94	2.09** 1.89 to 2.31	4.15** 3.32 to 5.17
Two somatic symptoms§	3.75 3.46 to 4.06	9.60* 8.11 to 11.37	2.43** 2.23 to 2.65	3.48** 3.02 to 4.02	2.59** 2.49 to 2.70	4.72** 4.27 to 5.27
Three somatic symptoms§	5.43** 4.85 to 6.10	16.91** 13.88 to 20.60	3.14 2.83 to 3.49	5.07 4.30 to 5.98	3.27* 3.11 to 3.45	7.10 6.31 to 7.99
1–3 somatic symptoms and anxiety¶	4.55 3.83 to 5.40	17.56* 13.44 to 22.96	3.63 3.10 to 4.25	4.89 3.78 to 6.33	3.23 2.98 to 3.50	7.68 6.49 to 9.09
1–3 somatic symptoms, anxiety and depression**	6.61** 5.88 to 7.43	36.71** 30.59 to 44.06	6.25** 5.68 to 6.87	14.95** 13.04 to 17.14	4.75** 4.51 to 5.01	18.51** 16.71 to 20.51
Four somatic symptoms§	6.56** 5.50 to 7.82	25.69** 19.92 to 33.12	4.22** 3.66 to 4.86	6.88* 5.55 to 8.53	4.15** 3.85 to 4.47	10.46** 9.02 to 12.12
Five somatic symptoms§	5.41* 4.28 to 6.83	25.93** 18.86 to 35.65	6.56** 5.46 to 7.89	8.89** 6.64 to 11.90	5.22** 4.68 to 5.81	14.30** 11.81 to 17.32
4–5 somatic symptoms and anxiety¶	8.81** 6.19 to 12.53	48.41** 31.51 to 74.37	5.15** 4.00 to 6.64	9.11** 6.33 to 13.10	4.95** 4.33 to 5.67	16.10** 12.82 to 20.22
4–5 somatic symptoms, anxiety and depression**	6.68** 5.81 to 7.68	53.85** 44.25 to 65.52	8.83** 7.91 to 9.86	23.05** 19.86 to 26.74	6.43** 6.03 to 6.85	31.99** 29.69 to 35.66

*p< 0.01, **p< 0.001.
*Number of responses used in the analysis for excused absences was 128 088.
†Number of responses used in the analysis for unexcused absences was 128 064.
‡Number of responses used in the analysis for all absences was 256 152.
§Student reported any of the somatic symptoms: neck pain, back pain, stomach ache, headache or sleep issues.
¶Anxiety measured with GAD-7 scale.
**Depression measured with BDI-6 scale.
BDI-6, abbreviated version of Beck Depression Index; GAD-7, Generalized Anxiety Disorder scale.

have slept poorly due to neck and back pain, which then caused a headache and warranted an excused absence. Or the student might have decided to skip school without permission because they stayed up late gaming and slept poorly, which caused neck and back pain in addition to a headache. Thus, collaboration of teachers and healthcare professionals is necessary when evaluating students with repeated absences from school. In Finland, school personnel often intervene in school absences based on the amount and type of absences the student has and the possibilities for collaboration with healthcare professionals vary.[37] As school absences are associated with both somatic and internalising symptoms, they may enable the identification of adolescents with undiagnosed or undertreated medical issues.

Even excused absences can have a negative impact on the academic performance of a student.[40] Furthermore, as unexcused absences have been associated with depressive symptoms both in our study and previously,[7] they should be addressed as a possible symptom of a medical issue. Thus, multiprofessional and evidence-based guidelines for intervening in school absences could provide support to all professionals working with young people. Existing studies have shown how school absences decrease with interventions including school healthcare workers. Excused absences due to illness have been shown to decrease when the student has been referred to a doctor after surpassing a predetermined cut-off of absences.[41] Simply employing a full-time nurse has been a successful method in reducing absences.[42] These interventions use methods that already exist in schools. Further incorporation of similar methods should thus be globally achievable.

The strengths of this study include the nationally representative, large sample and the systematic data collection. Although the response rate was lower in 2015 due to technical difficulties with the electronic survey, this had little effect on our study as we mainly focused on data

gathered in 2017 and 2019. Data included both somatic and internalising symptoms, which adolescents report frequently in all countries, making our findings globally relatable.[26 27] Internalising symptoms were assessed using evidence-based, validated tools, but the changes in methodology prevented longitudinal data collection of internalising symptoms.

The greatest limitation is that data were based on self-reporting which makes them susceptible to recollection and reporting bias. The participants were minors who might not understand the importance of answering correctly. The response options of official sex provided no consideration of gender diversity. Using maternal education as a proxy for the SES of the student is susceptible to errors as students might be unaware of the educational background of their parents or might not understand the response options, although they could ask for clarifications from the teacher monitoring them while they complete the survey. Since data were collected on a certain school day during the entire study period, selection bias may have occurred. The cut-off for depressive symptoms was lower than usual due to the agency that owns the data; we have taken this into consideration in the Discussion section. Furthermore, the methods to measure internalising symptoms have changed over time, which limits data use. Data were gathered prior to the COVID-19 pandemic, but school absences were not measured in 2021 and the measures for internalising symptoms changed, thus interrupting the data series.

Our study adds to the literature that reflects the intricate nature of school absences as the sum of physical and mental aspects of health. The findings of this study support the concept that school absences are both a psychosocial and a medical problem and should subsequently be addressed through multidisciplinary cooperation.

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Contributors KM, KA, SK and KR conceived of the presented idea. KM, KA, SK and KR designed the computational framework. JE performed the computations. KM, KA, SK, KR and JE analysed the data. All authors discussed the results and contributed to the final manuscript. KM is the guarantor.

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