



Symptoms of disturbed eating behavior risk: Gender and study factors in a cross-sectional study of two Norwegian medical schools

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ABSTRACT

Background: Studies about medical student's stress associated with disturbed eating behavior are scarce.

Objectives: To study the explanatory role of curricular factors and distress in disturbed eating behavior among medical students and whether this varies according to gender, study stage, curriculum model, study stress and mental distress.

Methods: The cross-sectional sample surveyed consisted of Norwegian medical students at two faculties with different curricular models (traditional and integrated). The total response rate was 64% (1044/1635). We tested differences in disturbed eating behavior symptoms (EDS) and their correlates using stepwise linear regression analysis.

Results: In total, 18.3% were cases of disturbed eating behavior symptoms, including 23.5% of female and 5.6% of male participants. Disturbed eating behavior symptoms were independently associated with the medical school stress factors "medical school is cold and threatening" ($\beta = 0.07, p = .041$), "worries about work and competence" ($\beta = 0.15, p < .001$) and "worries about finances and accommodation" ($\beta = 0.07, p = .018$), in addition to female gender ($\beta = 0.30, p < .001$), mental distress ($\beta = 0.17, p < .001$), and body mass index ($\beta = 0.28, p < .001$). The variables explained 28.9% of the variance in disturbed eating behavior symptoms, and medical school stress contributed 9%. "Worries about work and competence" was more important among the female students.

Conclusions: Nearly one in five female medical students in the current sample reported symptoms of disturbed eating behavior. The symptoms were associated with medical school stress factors, mental distress, and body mass index.

1. Introduction

High levels of academic stress and workload during medical education that can lead to mental health problems is a longstanding issue (Dyrbye et al., 2006; Slavin et al., 2014). Medical students with disturbed eating may be at risk of eating disorders (EDs). The prevalence of disturbed eating ranges from 6.5% to 17.8% among undergraduate students (Cilliers et al., 2006; León-Vázquez et al., 2017; Sepulveda et al., 2008), compared with 10.5% among medical students (Jahrami et al., 2019a). Nevertheless, we lack studies on the importance of stress factors in medical school for disturbed eating behavior.

It is important to recognize the symptoms of disturbed eating, since individuals concerned may be at risk of developing a full-blown ED. The

present cross sectional study aims to identify stress-factors in medical school that are linked to such symptoms, while controlling for factors related to disturbed eating such as mental distress and body mass index (Jahrami et al., 2019a; Puccio et al., 2016). A person with disturbed eating often engages in the same behaviors as those with an ED, and such symptoms may represent a risk of later eating disorder (Rosenvinge et al., 2001).

Female students are at greater risk of developing EDs and distress in response to medical school than their male counterparts (Dyrbye et al., 2006; Hope & Henderson, 2014; Striegel-Moore & Bulik, 2007). The percentage of Norwegian women entering medical school has increased from approximately 60% of first year students in 1993 to 71.6% in 2015 (Norwegian Centre for Research Data, 2017). This corresponds with

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numbers in the United States (Barzansky & Etzel, 2007). This implies an expected higher prevalence of disturbed eating among today's medical students.

Studies on eating behavior and possible EDs among medical students have hitherto focused on such risk factors as gender, age, body mass index, and manifestations of these behaviors and disorders (Jahrami et al., 2019b). Studies on the relationship between stress factors in medical school and disturbed eating behaviors are scarce. This is surprising, as the relationship between stress and disturbed eating behaviors is widely acknowledged (e.g., Greeno & Wing, 1994; Oliver & Wardle, 1999; Serlachius et al., 2007). Studying medicine is highly demanding and worries about future competence and endurance in medical school was an independent predictor of postgraduate emotional exhaustion in a Swedish study (Dahlin et al., 2010). Perceived medical school stress is an adjusted predictor of mental health treatment needs in the fourth postgraduate year among Norwegian medical students (Tysen et al., 2001). Together, it is reasonable to assume that both stress and mental distress is associated with symptoms of disturbed eating.

Stress factors that interfere with eating and weight are also relevant for students' daily functioning and can affect students' ability to cope with and endure medical school (Dyrbye et al., 2011). Though study model, or curriculum varies between faculties, a common denominator is that the medical study poses high demands that may cause distress and even disturbed eating behaviors (Slavin et al., 2014). The present study investigated two universities with different curricular models. One follows a *traditional* curriculum with frequent exams and focuses on students' basic knowledge during the first two years, and before their first patient contact. The other follows an *integrated* curriculum with annual exams, problem-based learning, and early patient contact. Whether disturbed eating behavior varies according to study model has yet to be studied.

The etiology of EDs is complex and may involve both genetic and environmental risk factors (Mitchison & Hay, 2014). Body mass index (BMI) is an important variable here, with some students struggling with preceding obesity or low-weight problems before entering medical school (Phelan et al., 2015; Weigel et al., 2016). A study of Norwegian adolescents shows that eating problems attribute to increased BMI and depressive symptoms among females (von Soest & Wichström, 2014). We control for BMI in the present study to disentangle independent effects of medical school stress on symptoms of disturbed eating.

Identification of "modifiable" stress-related risk factors can enable interventions to reduce development of EDs and to increase the factors that contributes to stress resilience. The present study aimed to address the following research questions:

- 1) What is the frequency of symptoms of disturbed eating among medical students? Are there any gender differences?
- 2) Are any specific stress factors related to medical school independently associated with symptoms of disturbed eating, when controlled for mental distress and BMI?
- 3) What is the relative impact of medical school factors on symptoms of disturbed eating?

2. Material and methods

2.1. Procedure

We used a cross-sectional electronic survey to collect baseline data from medical students at two out of in total four medical faculties in Norway. One faculty runs a traditional curriculum and the other provides an integrated curriculum using a problem-based learning model involving early patient contact from the first study semester. All registered medical students at all stages of the six-year curriculum at the time of the data collection comprised the eligible sample. The samples were drawn with approval from each faculty administration, which also provided e-mail addresses. The data collection of four weeks took place

from February to March 2015. Invitations, log-on information, and weekly reminders to non-responders were given by email. Student union representatives provided information about the study prior and during the data collection in lectures and on a private project Facebook page. Participation was voluntary and anonymous, and participants gave electronic informed consent. In case of distress when filling in the questionnaire, participants could refer to a named psychiatrist, the student health service, or the emergency services. The regional ethics committee approved the project (ref. no 2013/2408).

2.2. Sample

In total, 1635 students were invited to participate (traditional $n = 919$ and integrated $n = 712$). The total response rate was 64% (1044/1635), with a rate of 73% at the integrated faculty and 57% at the traditional faculty. Of the respondents, 71% (740) were female, and mean age was 24.9 (3.1) years. An analysis of representativeness showed that a higher proportion of the study sample were female students (71%) compared to the gender distribution in the eligible sample ($N = 1635$), where 65% were women ($\chi^2 = 9.17$, $\phi = 0.059$, $df = 1$, $p = .003$). Participants were distributed evenly across early-, mid-, and final study years.

2.3. Measures

The dependent variable was the *Eating Disturbance Scale* (EDS) which has previously been validated in Norwegian students (Rosenvinge et al., 2001). EDS consists of five items referring to the previous month: (1) "Are you satisfied with your eating habits?"; (2) "Have you eaten to comfort yourself or because you were unhappy?"; (3) "Have you felt guilty about eating?"; (4) "Have you felt that it was necessary for you to use a strict diet or other eating rituals to control your eating?"; and (5) "Have you felt that you are too fat?" Responses on item 1 where 1 = *very satisfied* and 7 = *very unsatisfied*. Responses on items 2 to 5 range from 1 = *never* to 7 = *every day*, with higher scores reflecting greater disturbed eating ($\alpha = 0.55$). Scale reduction showed that alpha increased from 0.55 to 0.85 when excluding the first item. Hence, we based the mean sum score on four items (items 2 to 5). A value of 4.1 (one *SD* above the sample mean; $M = 2.6$, $SD = 1.5$) was used as a cut-off point for being at risk of an ED in the present study (Rosenvinge et al., 2001).

2.4. Independent variables

Body mass index (BMI) was based on self-reports of weight and height, using the standard formula kg/m^2 . We used the World Health Organization classifications: underweight as $\text{BMI} \leq 18.49 \text{ kg/m}^2$; normal weight as $\text{BMI} 18.5\text{--}24.9 \text{ kg/m}^2$; overweight as $\text{BMI} 25\text{--}29.9 \text{ kg/m}^2$; and obesity as $\text{BMI} \geq 30 \text{ kg/m}^2$.

Mental distress was measured by the General Health Questionnaire 12 (GHQ-12) (Goldberg et al., 1997) to assess perceived psychological distress in the past six months ($\alpha = 0.87$). Responses were on a scale from 1 = *not at all* to 4 = *much more than usual*. We used the standard scoring method (0,0,1,1), with a cut-off of ≥ 4 to indicate poor mental health and need for treatment (Goldberg et al., 1997).

Study stress was measured by the Perceived Medical School Stress scale (PMSS) (Bramness et al., 1991; Vitaliano et al., 1984). The scale includes 13 items that measure pressures and stress experienced in medical school. Responses are on a scale from 1 to 5, where a high score indicates high stress. A principal component analysis confirmed a three-factor structure (Sletta et al., 2019; Tysen et al., 2001). PMSS Factor 1 "Medical school is cold and threatening" (6 items, $\alpha = 0.79$); PMSS Factor 2 "Worries about work and competence" (4 items, $\alpha = 0.72$); and PMSS Factor 3 "Worries about finance and accommodation" (2 items, $\alpha = 0.72$).

Demographic characteristics included age, gender (1 = male, 2 = female); faculty (1 = integrated, 2 = traditional); and semester (1st-

12th).

2.5. Statistics

We used variance analyses, such as *t*-tests and linear regression to study continuous variables, and table analyses and Chi-Square to study categorical variables. Effect sizes for between-group differences were estimated by Cohen's *d* (0.02-0.49 = small; 0.50-0.79 = moderate; ≥0.8 = large effects) (Abbate-Daga et al., 2013). To study the relative effect of medical school stress on disturbed eating behavior, the variables were entered into a hierarchical multiple linear regression model in four blocks (forced enter, Table 3), yielding four models. The level of significance was set at 5% (*p* < .05).

3. Results

3.1. Prevalence of EDS

Table 1 shows the characteristics of the sample. The average mean score on EDS-4 was 2.6 (1.5); female students scored higher, 2.9 (1.5) compared with male students (1.9 [1.1]; *t* = -10.41, *p* < .001, *d* = 0.71). In total, 191 (18.3%) students scored above the cut-off for a probable ED (23.5% of females and 5.6% of males). A sensitivity analysis with respect to probable ED among the female students, with all non-responders expected not to be cases, yielded a prevalence of 15%. Students at the traditional program, 2.7 (1.5) scored higher on EDS-4 than those at the integrated program (2.5 [1.5]; *t* = -2.38, *p* < .015), though the effect size was small (*d* = 0.15).

Average BMI for the total sample was 22.8 kg/m², with most of the students (81.2%) having a normal weight. Male students had a higher BMI, 23.8 (2.5) compared with female students (22.3 [3.3]; *t* = 7.91, *p* < .001, *d* = 0.44). When divided according to BMI, 29 (2.8%) were underweight, 848 (81.2%) were normal, 148 (14.2%) were overweight, and 19 (1.8%) were obese. There was no faculty difference in BMI.

3.2. Factors associated with EDS

Table 2 shows that the following medical school variables had a significant correlation with EDs: female sex, faculty, BMI, PMSS Factor 1, PMSS Factor 2, PMSS Factor 3, and mental distress.

In the first model of the regression analysis (Table 3) female gender (*p* < .001) and traditional faculty (*p* = .032) were significant. When entering medical school stress variables in the second model the traditional faculty was no longer significant.

Mental distress gave an additional contribution (*p* < .001) in model 3. When entering BMI in model 4 (*p* < .001), all three PMSS factors remained significant. The total explained variance of EDS-4 in the final model was 28.9%, and the PMSS factors alone contributed with 9%, or 31.1% of the total explained variance.

Additional interaction analysis between gender and each of the three PMSS factors and GHQ-12, showed that PMSS Factor 2 had a stronger association with EDS-4 among female students compared with male students (β = 0.36 [0.14-0.55], *p* = .001). Fig. 1 presents the interaction by the InterActive data visualization tool (McCabe et al., n.d.). There was no interaction between faculty and the significant predictors on EDS-4.

4. Discussion

The present study shows that about 18.3% of medical students reported symptoms of disturbed eating behavior, with female students at higher risk. These symptoms were related to perceived medical school stress variables even after controlling for mental distress.

The occurrence of symptoms of disturbed eating behavior was 23.5% among the female medical students - a higher percentage than in related studies. A review found an overall pooled prevalence of ED risk of

Table 1
Characteristics of sample; means and standard deviations.

Variable	Total	Faculty		p value* (Cohen's d) [95% CI]	
		Traditional	Integrated	Faculty	Gender
N	1044	524	520		
Age	24.9 (3.1)	24.7 (2.7)	25.1 (3.1)	.037 (0.13) [0.02/ 0.78]	.017 (0.15) [0.09/ 0.92]
Gender					
Male (%)	29.1	28.1	30.2		
Female (%)	70.9	71.9	69.8		
BMI	22.8 (3.2)	22.7 (2.7)	22.8 (3.6)	.493 (0.02) [-0.08/ 0.04]	<.001 (0.44) [0.11/ 0.23]
Underweight (%)	2.8	2.9	2.7		
Normal (%)	81.2	79.6	82.9		
Overweight (%)	14.2	16.2	12.1		
Obese (%)	1.8	1.3	2.3		
Mental distress (GHQ-12)	2.3 (3.0)	2.4 (2.9)	2.3 (3.1)	.888 (0.01) [-0.39/ 0.34]	<.001 (0.25) [-1.18/ 0.42]
Good mental health (%)	73.9	72.9	75.0		
Poor mental health (%)	26.1	27.1	25.0		
Disturbed eating behavior (EDS-4)	2.6 (1.5)	2.7 (1.5)	2.5 (1.5)	.017 (0.15) [-0.27/ 0.03]	<.001 (0.71) [-0.85/ 0.57]
Male	1.9 (1.1)	2.1 (1.3)	1.6 (0.9)		
Female	2.9 (1.5)	2.9 (1.6)	2.8 (1.5)		
EDS-4 mean score over cut-off (%)	18.3	20.6	16.0		
Male (%)	5.6	8.2	3.2		
Female (%)	23.5	25.5	21.5		
Underweight (%)	6.9	13.3	0		
Normal (%)	17.0	18.7	15.3		
Overweight (%)	23.0	28.2	15.9		
Obese (%)	57.9	57.1	58.3		
Medical school stress (PMSS)	2.6 (0.6)	2.7 (0.6)	2.5 (0.6)	<.001 (0.38) [-0.31/ 0.16]	<.001 (0.31) [-0.30/ 0.13]
Factor 1	2.5 (0.7)	2.7 (0.7)	2.3 (0.7)		
Factor 2	3.0 (0.8)	3.0 (0.8)	3.0 (0.9)		
Factor 3	2.2 (1.1)	2.3 (1.1)	2.1 (1.0)		

Note. Factor 1 = Medical school is cold and threatening, Factor 2 = Worries about work and competence, Factor 3 = Worries about finance and accommodation.

* *p* value by independent sample *t*-test.

10.4%, and 13.7% among the females (Greeno & Wing, 1994). A sensitivity analysis found a prevalence of 15% among women in our sample, which still is substantial. The proportion of respondents with normal weight (80%) was higher compared to Norway's general population (51% in 2015 by Statistics Norway). Therefore, a considerable percentage of students of normal weight is at risk of displaying symptoms of disturbed eating behaviors (León-Vázquez et al., 2017). The higher rate among female students may be the result of more body dissatisfaction and a drive for thinness (Weigel et al., 2016).

The medical school stress factors linked to EDS were concerns about

Table 2
Correlations between variables in the model.

	1	2	3	4	5	6	7	8	9
1. Disturbed eating (EDS-4)									
2. Gender	0.31**								
3. Age	-0.01	-0.07*							
4. Faculty	0.07*	0.02	-0.07*						
5. Semester	-0.04	-0.03***	0.56**	-0.11**					
6. BMI	0.21**	-0.21**	0.20**	-0.01	0.05				
7. PMSS Factor 1	0.28**	0.09**	0.07*	0.26**	0.05	0.05			
8. PMSS Factor 2	0.32**	0.20**	-0.03	0.01	-0.01	-0.05	0.54**		
9. PMSS Factor 3	0.20**	0.08*	0.05	0.11**	-0.07*	0.03	0.27**	0.22**	
10. Mental distress	0.32**	0.12**	0.03	0.01	0.03	0.03	0.36**	0.41**	0.26**

Note. PMSS Factor 1 = Medical school is cold and threatening, PMSS Factor 2 = Worries about work and competence, PMSS Factor 3 = Worries about finance and accommodation.

* $p < .05$.
 ** $p < .01$.
 *** $p < .001$.

Table 3
Linear regression on disturbed eating behavior (EDS-4).

	Model 1			Model 2			Model 3			Model 4		
	β	p	95% CI	β	p	95% CI	β	p	95% CI	β	p	95% CI
Gender	0.31	<.001	0.83-1.21	0.25	<.001	0.65-1.02	0.24	<.001	0.63-0.99	0.30	<.001	0.82-1.18
Age	0.05	.178	-0.01-0.06	0.03	.368	-0.02-0.05	0.03	.372	-0.02-0.05	-0.03	.313	-0.05-0.02
Faculty	0.06	.032	0.02-0.37	0.02	.545	-0.12-0.23	0.03	.304	-0.08-0.26	0.04	.206	-0.06-0.27
Semester	-0.05	.140	-0.06-0.01	-0.05	.164	-0.05-0.01	-0.05	.124	-0.05-0.01	-0.03	.405	-0.04-0.02
Medical school stress												
Factor 1				0.12	<.001	0.12-0.41	0.09	.011	0.04-0.34	0.07	.041	0.01-0.28
Factor 2				0.18	<.001	0.21-0.46	0.13	<.001	0.12-0.36	0.15	<.001	0.16-0.39
Factor 3				0.10	.001	0.06-0.22	0.07	.019	0.02-0.18	0.07	.018	0.02-0.17
Mental distress							0.19	<.001	0.06-0.13	0.17	<.001	0.06-0.12
BMI										0.28	<.001	0.11-0.16
Adjusted R^2	0.098 ($p < .001$)			0.188 ($p < .001$)			0.215 ($p < .001$)			0.289 ($p < .001$)		

Note. Gender: 1 = male, 2 = female; Faculty 1 = integrated, 2 = traditional, Factor 1 = Medical school is cold and threatening, Factor 2 = Worries about work and competence, Factor 3 = Worries about finance and accommodation.

β = standardized beta; CI = confidence intervals.

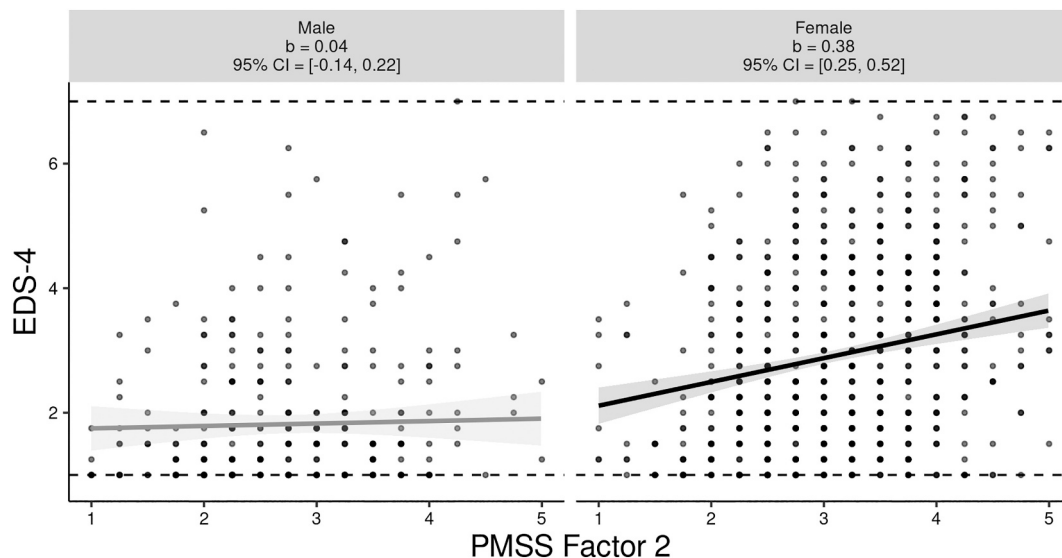


Fig. 1. Disturbed eating behavior increases significantly with increasing worries about work and competence in female students compared with no change among male students. Figure produced using the InterActive data visualization tool (McCabe et al., n.d.).

Note: b = unstandardized beta, EDS-4 = disturbed eating, PMSS Factor 2 = Worries about work and competence.

“work and competence” and “finance and accommodation.” The former was more important among the female students. This corresponds with variables that predict postgraduate emotional exhaustion (Dahlin et al.,

2010) and poor academic performance (Kötter et al., 2014) among medical students.

There was an independent association between mental distress and

disturbed eating behavior symptoms, in keeping with previous studies (Greeno & Wing, 1994; Jahrami et al., 2019b). Because the present study controlled for such symptoms, it seems that perceived medical school stress is an important independent risk factor. The effects were relatively independent of BMI and this indicates the importance of contextual stress and distress as possible risks for disturbed eating in the current sample. Body image fixation, obsessions with food, overeating or hunger are passive ways of coping with stress. The medical curriculum should teach students about more healthy ways of reducing stress, such as mindfulness training, seeking social support, physical exercise, and leisure activities (Slavin et al., 2014).

We found that the initial effect of more disturbed eating in the traditional curriculum faculty might be due to higher levels of perceived medical school stress in this curriculum. Studies have demonstrated similar distress levels in traditional compared with integrated curricula (Gude et al., 2005; Slavin et al., 2014), and this may be due to frequent exams, late exposure to patients in the curriculum and/or pass/fail marks on exams versus pass/fail (Spring et al., 2011).

4.1. Strengths and limitations

Studied the link between medical school pressures and disturbed eating are scarce. The present study involved a large and relatively representative sample; the results are less representative with respect to men in the sample as the response rate was lower among them. EDS might capture more worries over and symptoms of overweight than underweight. This applied to face validity of the items about eating too much/overweight and the linear association with BMI. A measure that captured underweight or anorexia problems would have showed a U-shaped association with BMI. This cross-sectional study cannot infer about causality. Reporting bias may have occurred since people with eating problems tend to either hide or underestimate their symptoms (Abbate-Daga et al., 2013). Still, self-report is a relatively reliable method to measure such estimates as height and weight (Olfert et al., 2018).

Excluding the item about overall dissatisfaction with eating habits could potentially increase reliability of EDS. Preliminary analyses showed that men tended to score higher on this item. Men often idealize a more muscular body type and might display other symptoms of disturbed eating than women (Eik-Nes et al., 2018). This might underestimate male students' scores of disturbed eating. Measures of disturbed eating base and validate mostly on data from female populations (Rae-vuori et al., 2014).

5. Conclusion

The present study found an independent relationship between the following medical school- stress factors and disturbed eating behavior symptoms: Worries and concern about future work and competence and Worries about finance and accommodation. Worries and concerns about their future work and competence was more important among the female students. The effect of medical school stress is present when controlling for other known factors associated with EDS such as mental distress and BMI. Whether interventions to reduce medical school stress might have effect on medical students' disturbed eating behaviors should be investigated further.

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Credit authorship contribution statement

LTL is the project manager and RT is the principal investigator of the current study and responsible for the data collection. ISR wrote the first

draft. LTL, RT and ISR contributed to the conception and design, analysis, interpretation of data and continuously drafting and revising the manuscript critically. All authors read and approved the final version of the manuscript and is accountable for all aspects of the work.

Declaration of competing interest

None declared.

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