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WEB PAPER

Study-related health and behavior patterns of medical students: A longitudinal study

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Abstract

Background: Little is known about specific health risks and resources and their development influencing medical students' stress.

Aim: To evaluate the development of quality of life and study-related behavior and experience patterns among medical students.

Methods: Data were collected in the first ($n = 112$ of 182 in 2006) and the fourth semesters ($n = 164$ of 176 in 2008). The instruments "Work-Related Behavior and Experience Patterns" (AVEM, including four main patterns: "Health", "Unambitious," "Overexertion," "Burnout") and "Short Form-12 Health Survey (SF-12)" were used at both points in time.

Results: The medical students scored significantly lower on mental health compared with reference samples of young adults. The proportion of students with a healthy pattern decreased from 47.3% (95% CI 38.1–56.5%) in the first semester to 36.9% (29.4–44.4%) in the fourth semester. This corresponded to an increase in the proportion of students at risk for burnout from 7.1% (2.3–11.9%) to 20% (13.8–26.2%). At both time points, female students had a higher risk for overexertion and a lower prevalence of a healthy pattern than male students.

Conclusion: Our data provide evidence for a decrease in the healthy pattern and an increase in the burnout pattern. Intervention is needed, especially for students at risk for burnout.

Introduction

To work with and to help people in need are still important reasons for young people choosing a medical career (McManus et al. 2006). While medical training is focused on patient care, personal stress and the potential health risks of medical education and work life are seldom addressed. In a longitudinal study at the two universities of Zürich ($n = 1382$), compared to students of other faculties, medical students were in a particularly poor physical (tension, gastro-intestinal symptoms) and mental condition (anxiety, stress, and exhaustion) at the beginning and after 1 year of study. The gain in knowledge and expertise was accompanied by a loss in personal and social competence. The decrease in personal health was especially prominent in women (Bachmann et al. 1999). Similar findings have been reported from medical schools in Anglo-American or European countries (Guthrie et al. 1998; Givens & Tjia 2002; Dahlin et al. 2007). Dyrbye et al. (2006b) saw a high prevalence of depression and anxiety among US medical students during the later years of training, with distress levels higher than in the general population as well as in age-matched peers. While the physical quality of life (QOL) of medical students was better than that of the general population, the mental QOL was poorer (Dyrbye et al. 2006a). It has, therefore, been proposed that physician burnout has its origin in medical school or earlier (Wolf et al. 1991). Only one dissertation reports similar findings for the QOL in German medical students (Pranada 2005) and German longitudinal data are lacking. Workload, competition, sleep deprivation, the emotional impact of the dissection course, or the suffering and dying of patients contribute to medical students' stress and their deteriorating health (Dyrbye et al. 2006b). Personality (McManus et al. 2004), coping styles (Dunn et al. 2008), and work–family conflicts (Fuss et al. 2008) have also been shown to be associated with an increased risk of emotional exhaustion or burnout.

A perspective of salutogenesis (Antonovsky 1987) does not focus primarily on professional stress and risk factors for illness but on resources, such as optimism, hardiness, self-efficacy, sense of coherence, and social support, which might be effective in preventing illness and promoting health (Ayers

Practice points

- Already at the beginning of medical education, a proportion of students present with a risk for burnout.
- The proportion of these students increases while the proportion of those in good health decreases.
- Longitudinal data throughout medical education and professional work life and reports about evaluated interventions to improve the coping capacity of students would be valuable.
- Educators should look at gender sensitive ways of modifying behavior and environmental conditions to foster students' mental health.

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et al. 2007). In pursuing the question how people stay healthy while enduring professional stress, Schaarschmidt and Fischer (2008) integrated these concepts in health psychology in a theoretical and methodological framework describing 11 dimensions from the domains of professional commitment, resistance to stress, and emotional well-being that could either be risks or resources for health. According to this model, the analysis of configuration characteristics across the 11 scales is more valuable than the scores on a single dimension. For example, high scores in the dimension of career ambition may not be a health risk in itself. If, however, these are combined with low scores in the dimension of emotional distancing from work, this combination may set the individual at a higher risk. This is in line with Tyssen et al. (2007) who affirm that *types* of personality give a more comprehensive picture of an individual's character than the *dimensions* of personality alone. In a cluster analysis of the dimensions of the initial AVEM sample group ($n = 1598$ of diverse professions), Schaarschmidt and Fischer (2008) identified four characteristic configurations which have been described as "Health" (pattern G), "Unambitious" (pattern S), "Overexertion" (risk pattern A) and "Burnout" (risk pattern B). The risk patterns A and B have been shown to be correlated with elevated health risks. The burnout-related risk pattern B scored highest on the scale of emotional exhaustion of the Maslach Burnout Inventory (MBI; Schaarschmidt & Fischer 2008). In three cross-sectional studies at different points in medical education and work life, Voltmer et al. (2008) used this framework to show that fifth-year medical students and physicians early in their careers presented with lower fractions of a healthy pattern, and higher fractions of a burnout pattern, than students in the first year. To our knowledge, no longitudinal data confirming the development indicated by these cross-sectional results are available for medical students.

This study aims to measure the development of QOL and study-related behavior and experience patterns among medical students from first to fourth semesters of medical school in a longitudinal design. Based on previous cross-sectional studies, we hypothesized that medical students would report a decrease in mental health and health-related dimensions associated with a reduction in healthy patterns and an increase in risk of burnout during this time. With regard to results in teachers (Schaarschmidt & Fischer 2008) and physicians (Voltmer et al. 2008), we also hypothesized that this trend is stronger among the female students, due to lower scores in the domains of professional ambition and resistance toward stress.

Methods

Survey and participants

The course of medical education in Germany takes 6 years. First two pre-clinical years (physiology, biochemistry, anatomy, etc.) followed by a first exam, then three clinical years, followed by the sixth year with practice in different departments of hospitals, and with an extensive final exam at the end.

Students of the public university of Lübeck in northern Germany were surveyed with an online questionnaire shortly after entering medical school (first semester) in 2006 and a paper questionnaire in their fourth semester (end of year two) in 2008. The paper questionnaire was distributed and collected during a teaching session. The study was approved by the ethics committee of the University of Freiburg in a minimal risk review.

Instruments

The questionnaire comprised demographic questions and two standard instruments: The questionnaire: "Work-Related Behavior and Experience Patterns" (Schaarschmidt & Fischer 2008; Kieschke & Schaarschmidt 2008) and the "Short Form-12 Health Survey (SF-12)" as a measure of QOL (Bullinger & Kirchberger 1998).

Work-related behavior and experience patterns

The AVEM was developed to collect self-reported data about personal experiences with work-related stress and typical coping behaviors. The instrument comprises 11 separate dimensions discussed in health psychology as either health risks or resources (Table 1). These scales cover the following three major domains: (1) professional commitment, (2) resistance toward stress, and (3) emotional well-being (in the context of work). Each scale comprises 6 items with response options presented as 5-point Likert scales ranging from 1: I strongly disagree to 5: I strongly agree.

Scale reliability was assessed in samples of different professions. The median Cronbach's α was 0.81 (minimum 0.79, maximum 0.86). The instrument is also applicable for student samples (scale reliability of students (psychology, business, education) Cronbach's α 0.74–0.89). In our survey,

Table 1. AVEM dimensions with item examples. The 11 dimensions can be divided into three domains: professional commitment (1–5), resistance toward stress (6–8), and emotional well-being (9–11).

	AVEM dimensions (*Item example*)
1	Subjective significance of work (*Studying medicine is the most important element in my life*)
2	Career ambition (*I want to achieve more in my career than most people I know*)
3	Tendency to exert (*If necessary, I will work until I am exhausted*)
4	Striving for perfection (*My work should never contain errors or deficiencies*)
5	Emotional distancing (*After work is over I can forget about it quickly*)
6	Resignation tendencies (*I quickly resign myself to lack of success*)
7	Offensive coping with problems (*For me, difficulties are there to overcome*)
8	Balance and mental stability (*I don't get upset easily*)
9	Satisfaction with work (*Until now I have been successful in school/my studies*)
10	Satisfaction with life (*So far, I have been satisfied with my life*)
11	Experience of social support (*My partner/the person I am closest to shows understanding for my studies*)

we used a version adapted for students (Table 1). The median Cronbach's α in our sample was 0.84 (minimum 0.74, maximum 0.87).

People not only differ in the total score of each scale but also in the specific combination of their scale scores. A cluster analysis of the initial AVEM sample group comprising 1598 representatives from different professions, revealed a four-cluster solution. The same cluster solution was replicated with sufficient concurrence in 10 random samples drawn from the same 1598 test subjects (average $\kappa > 0.80$; Appendix).

The four different types of work-related behavior and experience patterns derived from the cluster analysis are described as

(1) Pattern G ("Health"): High scores in the dimensions of professional ambition, resistance against stress and emotional well-being.
(2) Pattern S ("Unambitious"): Low scores in the dimensions of professional ambition but medium to high scores in the dimensions of resistance to stress and emotional well-being. The reduced working motivation could be a sign of less interest in work than in other areas of life, or a sign of inner frustration from work.
(3) Risk pattern A ("Overexertion"): Very high scores in the dimensions of professional ambition, lower scores in the dimensions of resistance to stress and emotional well-being. Pattern A shows many similarities to the concept of type-A behavior described as a risk factor for coronary artery disease and myocardial infarction.
(4) Risk pattern B ("Burnout"): Low scores in the dimensions related to professional commitment, resistance to stress, and emotional well-being. This pattern represents the core symptoms of burnout (Appendix).

The concurrence of the individual data score of study participants and the four reference profiles can be estimated by a weighted linear combination (based on an algorithm of discriminant analysis). According to the highest concurrence of profiles, each person is assigned to one pattern only (e.g., probability scores $p_G = 0.75$, $p_S = 0.15$, $p_A = 0.06$, and $p_B = 0.04$ classified as pattern G; Schaarschmidt & Fischer 2008).

The validity of the instrument was supported by moderate to good correlations with scales that measured related constructs. There is a high correlation of the patterns with the traits of neuroticism and extraversion. People with the healthy behavioral pattern G scored low on neuroticism and high in extraversion, whereas people with the burnout-related risk pattern B scored high on neuroticism and low on extraversion. All patterns differed significantly in psychological complaints, with risk pattern B showing the lowest scores in self-esteem and perceived performance and highest scores in exhaustion. The health relevance of the patterns was supported by significant correlations with a broad set of criteria, such as emotional stability (measured with Freiburger Personality Inventory, FPI), mental and physical condition (Gießen test; Berlin Procedure for the Neurosis Diagnostics, BVND), sickness-related absence, blood pressure, heart rate, type-A behavior (Questionnaire Analyses of Stress Relevant Coping, FABA), and burnout (MBI; Schaarschmidt & Fischer 2008).

Short Form-12 Health Survey

The SF-12 is developed from the original SF-36 Health Survey (http://www.sf-36.org/tools/sf36.shtml). The instrument is a self-report of subjective health, and assesses the following aspects: physical functioning, role limitations due to physical and emotional health problems, freedom from bodily pain, general health perception, vitality, social functioning, and mental health. A summary score of physical and mental health can be calculated from these eight dimensions that account for more than 90% of the variance of the SF-36 results (Bullinger & Kirchberger 1998, Kudielka et al. 2005).

Data analyses

Data analyses were conducted with SPSS for Windows, version 15.0 (SPSS Inc., Chicago, IL). For categorical variables, data were analyzed using χ^2-tests and proportions with 95% confidence intervals for the total student groups. For the 80 students with data from both time points, we used the Bowker test. Univariate analysis was reported as percentages. For continuous variables, data were analyzed using two-tailed *t*-tests and analyses of variance (total student groups) or analyses of variance for repeated measures (only students with data at t1 and t2, adjusted for sex). Univariate analysis of this data was reported as means and standard deviation (SD).

Results

Response rate and sample description

The response rates were 61.5% (112/182) initially, and 93.2% (164/176) the second time. Eighty students completed both questionnaires (identified by an identical self-generated code). The mean age of the first semester students, was 20.9 (SD 3.2) years and 70.5% were female. In fourth semester students, the mean age was 22.8 years (SD 3.3), with 67.7% female. The fourth semester students could be viewed as a full population sample. In first year students, compared to the whole freshman group, the respondents were younger (20.9 *vs.* 22.1 years, $p < 0.05$), with more females (70.5% *vs.* 66.5%, n.s.).

Behavior and experience patterns

Figure 1 shows the health-related behavior and experience patterns of the medical students in their first and fourth semesters in a cross-sectional view. There was a significant difference in the distribution of patterns between the first and the fourth semesters ($\chi^2 = 9.241$, d$f = 3$, $p = 0.026$, $V = 0.184$). The healthy pattern G declined substantially, especially in men, with a corresponding increase in the resigned risk pattern B. In the first semester, women had a higher prevalence of a risk pattern for overexertion than men (20.3% *vs.* 9.1%). In the fourth semester, this difference between women and men was still present, but had converged (17.6% *vs.* 13.5%). In the first semester, females also had a lower fraction of the healthy pattern than the men (44.3% *vs.* 54.5%), with a reduction in both groups in the fourth semester (36.1% *vs.* 38.5%). None of the gender differences between the first and fourth semester were statistically significant.

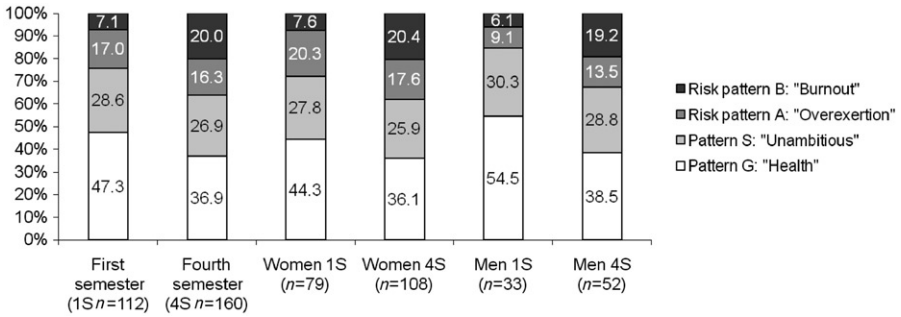

Figure 1. Behavior and experience patterns of medical students in the first (2006) and the fourth semesters (2008).

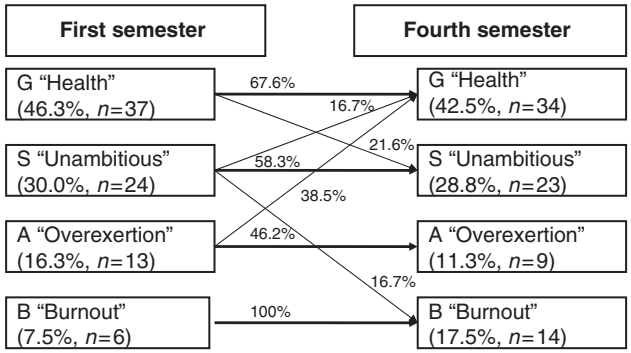

Figure 2. Pattern crossovers from the first (2006) to the fourth semester (2008). Percentages are presented only for the major pattern shifts, and therefore do not sum to 100%.

For 80 students, matched pairs of observations at both time points were obtained. Figure 2 shows that there is a high stability of the behavior and experience patterns, especially for the burnout pattern B (100%) and the healthy pattern G (67.6%). Changes of patterns show the same direction seen in the total samples. A similar proportion of students initially demonstrating the unambitious pattern S changed to the healthy pattern G as they did to the burnout pattern B (16.7% for both). Nearly forty percent (38.5%) of the students changed from the risk pattern A (overexertion) to the healthy pattern G.

Health relevant dimensions

For students where data could be obtained at both time points, a significant decrease in sum scores was seen in five health-relevant dimensions, three in the domain of professional ambition, one in the domains of both resistance to stress and emotional well-being (Figure 3). The strongest effect size was the decrease in the dimensions striving for perfection ($F(1,78)=13.91$, $p<0.001$, effect size $\eta^2=0.151$) and subjective significance of work ($F(1,78)=5.37$, $p=0.023$, effect size $\eta^2=0.064$).

Quality of life (physical and mental health scores of the SF-12)

At both time points, the physical and mental health scores of the medical students who provided data at both measuring points were significantly lower compared to a reference group of young adults (Bullinger & Kirchberger 1998; Table 2). There was a non-significant reduction in physical and mental health scores over time (data not shown).

Discussion

We studied the QOL and the study-related behavior and experience patterns of a cohort of German medical students in their first and fourth semesters. The distribution of patterns differed significantly between students in the first and the fourth semesters. The proportion of students with a healthy pattern decreased and the proportion of students with a burnout-related risk pattern increased, confirming our hypothesis. This was true for all students, as well as for those students where data were obtained at both time points. Compared to their male colleagues, female students had a lower proportion of a healthy pattern and a higher proportion of a pattern at risk for overexertion. However, these differences were statistically not significant. The physical health scores in the first but not in the fourth semester were higher, the mental health scores at both times were lower than that of a reference sample of young adults.

Other studies also report that students are relatively healthy when they enter medical school, but that their health deteriorates during the following years. Satisfaction with life decreases (Kjeldstadli et al. 2006), while anxiety and depression increase (Rosal et al. 1997; Bachmann et al. 1999). High scores of emotional exhaustion (40.1%) and depersonalization (31.8%) were seen in medical students at seven US medical schools, and 30.6% had low scores on personal accomplishment. In total, almost fifty percent (49.6%) met the criteria for burnout (Dyrbye et al. 2008). Though measured with a different instrument, these proportions are higher than the fraction of students with the burnout-related risk pattern reported here.

There is a high stability of patterns among students where data could be obtained at both measuring points. This might be seen as advantageous in students with the healthy pattern. However, there seems to be a limited potential of spontaneous improvement for students with the burnout-related risk pattern. After 1 year in US medical schools, 73.2% of students who were burnt out remained so, while 31.3% of students who were not burnt out at baseline experienced it after 1 year (Dyrbye et al. 2008). Students with the burnout risk pattern may lack the energy for change. This is different in students with the pattern at risk for overexertion and might explain the

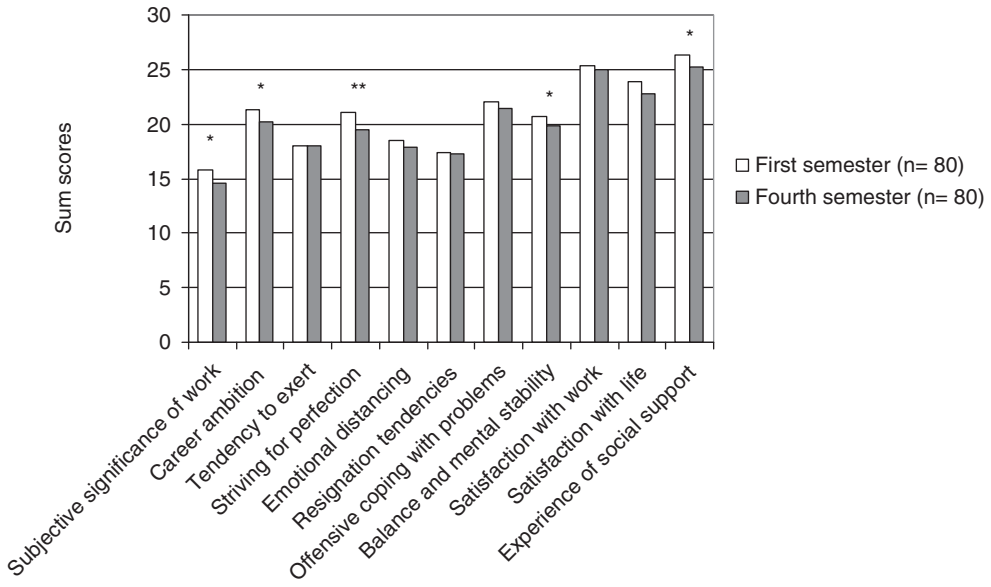

Figure 3. Changes in health-relevant dimensions of medical students from the first (2006) to fourth (2008) semester (*$p < 0.05$, **$p < 0.01$; adjusted for gender).

Table 2. Physical and mental health scores of medical students in the first (2006) and fourth semesters (2008) who provided data at both measuring points, compared with a reference sample of young adults.

	Physical health score			Mental health score		
Sample	M (SD)	*p*	*d*	M (SD)	*P*	*d*
Reference ($n = 473$) age 21–30	52.86 (5.42)			51.92 (8.35)		
First semester ($n = 77$)	54.96 (5.33)	<0.001	0.39	45.32 (9.63)	<0.001	−0.73
Fourth semester ($n = 77$)	54.36 (5.42)	=0.02	0.28	44.05 (10.21)	<0.001	−0.74

high transition to the healthy pattern also suggesting a "normalization" of the initial over-commitment.

Gender differences

We also expected a gender difference between the distributions of behavior patterns. While not reaching statistical significance, female students presented a higher fraction of the pattern at risk for overexertion and a lower fraction of the healthy pattern at both time points. Buddeberg-Fischer et al. (2005) also found a tendency for over-commitment in female physicians as a risk factor for a decreased well-being and symptoms of anxiety and depression. A recent review on psychosocial distress in medical students also reported a higher risk for female students (Dyrbye et al. 2006b). Given the fact that the majority of the medical students not only in Germany are female, this gender difference in behavior must be considered in the development of interventions designed to improve the coping capacity of students.

QOL and health dimensions

The psychosocial health risk of students, indicated by their behavior and experience patterns, was confirmed by the results of the SF-12. While physical health among medical students seemed better than among young adults of the same age, the students' mental health scores were lower and decreased over time. The same distribution in physical and mental health scores was reported by US medical students (using the SF-8; Dyrbye et al. 2006a), German medical students (using the SF-12; Pranada 2005), and German physicians (using the SF-36; Jurkat et al. 2003). While the physical health of medical students and physicians appears to be strong, their mental health clearly deserves more attention. It has to be considered that the reference group for the QOL scores was a group of young adults from the general population. References from other student groups that might indicate a characteristic distribution among students would be valuable.

Dimension changes were mostly seen in the domain of professional commitment. The strongest decrease appeared in the subjective significance of work and striving for perfection. Perfectionism has been shown as a trait highly correlated with the current medical students' stress (Enns et al. 2001). This reduction might be seen as a benefit, but since it is also connected with a decrease in the scores of balance and mental stability, and social support, the decrease in desire for perfection may reflect the larger issue of increasing psychosocial strain.

Implications for prevention and health promotion

Our findings emphasize the need for medical schools to invest in efforts to prevent the deterioration of mental health in the course of study on a behavioral as well as a contextual level. This could start by using not only academic achievements or high school grades as criteria for admission to medical education, but also for instance, the ability to deep and strategic learning and communications skills, as suggested by McManus and Vincent (1997). Unfortunately, evidence about reliable and practical selection procedures is scarce. The definition of success is often oriented in length of study or grades. A verifiable operationalization of a "good doctor" seems to be difficult. Personal interviews predict study success only if structured and conducted by well-trained interviewers (Searle & McHarg 2003). For many universities, the effort of this procedure seems too high. They try to find ways to survey "soft skills" with quantitative methods (Bucksch-Beudt et al. 2006). Of the big five personality traits, only conscientiousness predicted preclinical/undergraduate study success. Correlations to clinical/graduate or professional/postgraduate success, if reported, are small (Ferguson et al. 2002). Kjeldstadli et al. (2006) point out that medical schools should encourage students to spend adequate time on their social and personal lives and emphasize the importance of health-promoting coping strategies. Schools should also try to identify students at risk for or experiencing burnout, unfortunately a stable pattern and an increasing group in our results. These changes are even more important in light of the fact that burnout was highly correlated with suicidal ideation, and these thoughts were improved substantially after recovery from burnout (Dyrbye et al. 2008). Information and training on professional health risks, self-awareness, stress management, and coping strategies should be an integrated part of the curriculum to increase resilience, reduce over-commitment, and avoid states of helplessness or hopelessness (Shapiro et al. 2000; Benbassat & Baumal 2005; Dyrbye et al. 2006b; Dunn et al. 2008). Numerous studies report that social support is one of the most important resources in burnout prevention, and the decrease of social support during the course of medical education, as seen in our results, is a major risk factor for psychosocial strain and burnout (Voltmer & Spahn 2009). Mentoring programs could not only optimize integration or academic outcome, but also provide emotional support and encouragement (Dunn et al. 2008). A critical review of the general amount and the qualitative content of the medical curriculum and the learning environment could help medical students adapt to medical school, and keep the learning content manageable (Dyrbye et al. 2006b, 2009).

Limitations of the study

The initial response rate was lower than expected, therefore we used a different approach the second time, with a very good result. There were only small differences in age and gender between the respondents and the whole freshman class, which makes a systematic selection bias (e.g., differences in concern or attraction by format) in the first semester less likely. However, the number of students where data could be obtained at both measuring points was relatively small, and there is reason to believe that some of the differences in distribution patterns would reach statistical significance if all students had replied at both points in time.

In summary, our study indicates a decrease of the healthy behavior and experience pattern and an increase of the burnout-related behavior pattern in medical students from the first to the fourth semesters. It is important to notice that this development occurs in the pre-clinical years. An aggravation in the clinical years (facing, for example, the emotional burden of ill patients and increasing responsibility) is likely and will be examined with the next survey in this longitudinal study. Given the increasing risk for psychosocial stress and burden, we must remember that medical students, like physicians, are reluctant to seek help for mental symptoms and illness. They also gain a sense of the number of barriers for being treated by professionals (Brimstone et al. 2007). Self-reflection, focused not only on decisions regarding patient care but also on personal health promotion, may be an important issue of medical education and training. Such activities may help to improve not only the health of students and physicians, but also the quality of patient care.

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References

Antonovsky A. 1987. Unraveling the mystery of health – how people manage stress and stay well. San Francisco: Jossey-Bass Publishers.

Ayers S, Baum A, McManus C, Newman S, Wallston K, Weinman J, West R. (eds.) 2007. Cambridge handbook of psychology, health and medicine. Cambridge: Cambridge University Press.

Bachmann B, Berta D, Eggli P, Hornung R. 1999. Macht studieren krank? Die Bedeutung von Belastung und Ressourcen für die Gesundheit der Studierenden. Bern: Huber.

Benbassat J, Baumal R. 2005. Enhancing self-awareness in medical students: An overview of teaching approaches. Acad Med 80:156–161.

Brimstone R, Thistlethwaite JE, Quirk F. 2007. Behaviour of medical students in seeking mental and physical health care: Exploration and comparison with psychology students. Med Educ 41:74–83.

Bucksch-Beudt C, Büchel A, Berkhoff S, Janko S, Kirchhoff A, Kompatscher J, Kraft H-G, Kujumdshiev S, Nürnberger F, Ochsendorf F, et al. 2006. Möglichkeiten und Grenzen der Fragebogen-gestützten Erhebung von Soft skills als Zulassungskriterien zum Medizinstudium. GMS Z Med Ausbildung 23:Doc65.

Buddeberg-Fischer B, Klaghofer R, Buddeberg C. 2005. Arbeitsstress und gesundheitliches Wohlbefinden junger Ärztinnen und Ärzte. Z Psychosom Med Psychother 51:163–178.

Bullinger M, Kirchberger I. 1998. SF-36 Fragebogen zum Gesundheitszustand. Göttingen: Hogrefe.

Dahlin M, Joneborg N, Runeson B. 2007. Performance-based self-esteem and burnout in a cross-sectional study of medical students. Med Teach 29:43–48.

Dunn LB, Iglewicz A, Moutier C. 2008. A conceptual model of medical student well-being: Promoting resilience and preventing burnout. Acad Psychiatry 32:44–53.

Dyrbye LN, Thomas MR, Harper W, Massie FS, Power DV, Eacker A, Szydlo DW, Novotny PJ, Sloan JA, Shanafelt TD. 2009. The learning environment and medical student burnout: A multicentre study. Med Educ 43:274–282.

Dyrbye LN, Thomas MR, Huntington JL, Lawson KL, Novotny PJ, Sloan JA, Shanafelt TD. 2006a. Personal life events and medical student burnout: A multicenter study. Acad Med 81:374–384.

Dyrbye LN, Thomas MR, Massie FS, Power DV, Eacker A, Harper W, Durning S, Moutier C, Szydlo DW, Novotny PJ, et al. 2008. Burnout and suicidal ideation among US medical students. Ann Intern Med 149:334–341.

Dyrbye LN, Thomas MR, Shanafelt TD. 2006b. Systematic review of depression, anxiety, and other indicators of psychological distress among US and Canadian medical students. Acad Med 81:354–373.

Enns MW, Cox BJ, Sareen J, Freeman P. 2001. Adaptive and maladaptive perfectionism in medical students: A longitudinal investigation. Med Educ 35:1034–1042.

Ferguson E, James D, Madeley L. 2002. Factors associated with success in medical school: Systematic review of the literature. BMJ 324:952–957.

Fuss I, Nubling M, Hasselhorn HM, Schwappach D, Rieger MA. 2008. Working conditions and work-family conflict in German hospital physicians: Psychosocial and organisational predictors and consequences. BMC Public Health 8:353.

Givens JL, Tjia J. 2002. Depressed medical students' use of mental health services and barriers to use. Acad Med 77:918–921.

Guthrie E, Black D, Bagalkote H, Shaw C, Campbell M, Creed F. 1998. Psychological stress and burnout in medical students: A five-year prospective longitudinal study. J R Soc Med 91:237–243.

Jurkat HB, Vollmert C, Reimer C. 2003. Konflikterleben von Ärztinnen und Ärzten im Krankenhaus. Z Psychosom Med Psychother 49:213–231.

Kieschke U, Schaarschmidt U. 2008. Professional commitment and health among teachers in Germany. A typological approach. Learn Instruct 18:429–437.

Kjeldstadli K, Tyssen R, Finset A, Hem E, Gude T, Gronvold NT, Ekeberg O, Vaglum P. 2006. Life satisfaction and resilience in medical school – A six-year longitudinal, nationwide and comparative study. BMC Med Educ 6:48.

Kudielka BM, Hanebuth D, Von Kanel R, Gander ML, Grande G, Fischer JE. 2005. Health-related quality of life measured by the SF12 in working populations: Associations with psychosocial work characteristics. J Occup Health Psychol 10:429–440.

McManus IC, Keeling A, Paice E. 2004. Stress, burnout and doctors' attitudes to work are determined by personality and learning style: A twelve year longitudinal study of UK medical graduates. BMC Med 2:29.

McManus IC, Livingston G, Katona C. 2006. The attractions of medicine: The generic motivations of medical school applicants in relation to demography, personality and achievement. BMC Med Educ 6:11.

McManus C, Vincent CA. 1997. Can future poor performance be identified during selection? In: Lens P, Van Der Waal G, editors. Problem doctors – A conspiracy of silence. Amsterdam, Berlin, Oxford, Tokyo, Washington DC: IOS Press. pp 213–236.

Pranada AB. 2005. Internetbasierte Untersuchung zum Zusammenhang zwischen Schlafqualität, Lebensqualität und dem Verlauf des Studiums bei Bochumer Medizinstudenten. Bochum: Ruhruniversität.

Rosal MC, Ockene IS, Ockene JK, Barrett SV, Ma Y, Hebert JR. 1997. A longitudinal study of students' depression at one medical school. Acad Med 72:542–546.

Schaarschmidt U, Fischer AW. 2008. Arbeitsbezogenes Verhaltens- und Erlebensmuster AVEM. Frankfurt aM: Swets & Zeitlinger.

Searle J, McHarg J. 2003. Selection for medical school: Just pick the right students and the rest is easy! Med Educ 37:458–463.

Shapiro SL, Shapiro DE, Schwartz GE. 2000. Stress management in medical education: A review of the literature. Acad Med 75:748–759.

Tyssen R, Dolatowski FC, Rovik JO, Thorkildsen RF, Ekeberg O, Hem E, Gude T, Gronvold NT, Vaglum P. 2007. Personality traits and types predict medical school stress: A six-year longitudinal and nationwide study. Med Educ 41:781–787.

Voltmer E, Kieschke U, Schwappach DL, Wirsching M, Spahn C. 2008. Psychosocial health risk factors and resources of medical students and physicians: A cross-sectional study. BMC Med Educ 8:46.

Voltmer E, Spahn C. 2009. Social support and physicians' health. Z Psychosom Med Psychother 55:51–69.

Wolf TM, Von Almen TK, Faucett JM, Randall HM, Franklin FA. 1991. Psychosocial changes during the first year of medical school. Med Educ 25:174–181.

Appendix

Relationship between work-related behavior and experience patterns and health-relevant dimensions of the AVEM.