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LISTEN! A qualitative approach to improve well-being in medical school.

Dissertation

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Zusammenfassung

Medizinstudierende haben weltweit ein hohes Risiko für bestimmte psychische Erkrankungen. Während Stressoren und Auslöser mittlerweile gut untersucht wurden, ist wenig bekannt darüber, wie sich die psychische Gesundheit von Medizinstudierenden erhalten und fördern lässt. Diese Dissertation beschäftigt sich mit der Frage, wie Medizinstudierende selbst verschiedene Maßnahmen zur Förderung psychischer Gesundheit beurteilen. Zur Untersuchung der Fragestellung wurde ein qualitativer partizipativer Ansatz gewählt. Im Rahmen einer Studie wurden Fokusgruppen mit 71 Medizinstudierenden durchgeführt. Die Studierenden wurden nach Veränderungswünschen für ihr Studium gefragt. Außerdem sollten sie etablierte Maßnahmen zur Förderung der Gesundheit von Medizinstudierenden aus der Literatur beurteilen. Es zeigte sich, dass Studierende verhältnisbasierte Maßnahmen bevorzugten und kritisch gegenüber Maßnahmen aus der Literatur standen. In einer zweiten Studie wurden 26 Medizinstudierende im Rahmen von Fokusgruppen nach ihrer Meinung zu internet- und mobilgestützten Interventionen (IMIs) gefragt. IMIs können zur Förderung und Erhaltung der psychischen Gesundheit von Studierenden eingesetzt werden. Allerdings gibt es nur wenige Erkenntnisse über die Akzeptanz von IMIs bei Medizinstudierenden. Ziel der zweiten Studie war es daher, die Einstellung und Akzeptanz von Medizinstudenten gegenüber IMIs zu untersuchen. Die Ergebnisse deuten auf eine insgesamt positive Einstellung zu IMIs zur Förderung der psychischen Gesundheit hin. Allerdings äußerten die Studierenden Bedenken hinsichtlich des Einsatzes von IMIs bei schweren psychischen Erkrankungen und in akuten Krisen. Gesamt betrachtet liefern die Ergebnisse der beiden Studien neue Erkenntnisse über Interventionen zur Verbesserung des Wohlbefindens im Medizinstudium sowie die Möglichkeit von IMIs, bestimmte Lücken in der Versorgung zu decken. Ein Modell zur Implementierung der in den beiden Studien vorgeschlagenen Interventionen wird vorgestellt.

Summary

Accumulating evidence indicates that medical students have a high risk for certain mental illnesses worldwide. While stressors and causes have been thoroughly examined, little is known about medical students' perceptions of well-being interventions. This dissertation explores how medical students perceive interventions that aim to improve their well-being using a qualitative and participatory approach. In a first study, focus groups with 71 medical students were conducted. Students were asked for suggestions regarding changes they would like to see in medical school. Furthermore, they were asked to rate interventions that have been described in the literature. The results indicated that medical students prefer setting-based interventions. They viewed certain interventions proposed in the literature critically. In a second study, 26 medical students were asked about their preferences regarding internet- and mobile-based interventions (IMIs). IMIs have shown to be an effective tool for promoting university students' mental health and well-being. However, evidence regarding medical students' acceptance of IMIs is scarce. Thus, the study aimed to explore medical students' attitudes and acceptance of IMIs. The results suggest overall positive views regarding IMIs for mental health promotion. However, students voiced concerns regarding IMI use for severe mental illnesses and acute crises. Overall, the results of the two studies provide important insights into interventions that can potentially improve medical student well-being regarding medical school and the opportunity to close certain treatment gaps with IMIs. A conceptual model for the implementation of interventions suggested by students in both studies is presented.

List of abbreviations

CBT Cognitive Behavioural Therapy

IMI Internet- and mobile-based intervention

MHL Mental health literacy

US Unites States of America

WHO World Health Organization

Table of contents

1 Introduction 1

1.1 Background 1

1.2 Prevalence of common mental illnesses among medical students 1

1.3 Medical school distress 3

1.3.1 Medical school stressors 3

1.3.2 Subpopulations at higher risk for specific stressors 4

1.4 The role of medical student well-being 5

1.4.1 Interventions to improve medical student well-being 6

1.5 Threats and challenges to mental well-being 8

1.5.1 Undertreatment 8

1.5.2 Stigmatization in the medical field 8

1.5.3 Medical student well-being and education during the COVID-19 pandemic 9

1.6 IMIs and their potential for mental health promotion in medical school 9

1.7 Aims of dissertation 11

2 Students' perspectives on interventions to reduce stress in medical school: A qualitative study. Dederichs, M., Weber, J., Muth, T., Angerer, P., & Loerbroks, A. PloS one, 15(10), e0240587 (2020). 13

3 Exploring medical students' views on digital mental health interventions: A qualitative study. Dederichs, M., Weber, J., Pischke, C. R., Angerer, P., & Apolinário-Hagen, J. Internet Interventions, 100398 (2021). 14

4 Discussion 15

4.1 Medical students' suggestions to improve well-being in medical school 16

4.2 Medical students' views on IMIs for mental health promotion 18

4.3 Common findings and differences regarding IMIs and interventions to improve well-being in medical school 20

4.4 A conceptual framework for well-being in medical school considering the student perspective - The AMIS-model 21

4.4.1 Advocates 23

4.4.2 Mentality & Culture 24

4.1.3 Information & Education 25

4.1.4 Structures 26

4.2 Strengths and limitations 28

4.2.1 Research questions and study design 28

4.2.2 Sample 28

4.2.3 Data collection and analysis 29

4.3 Implications 30

4.3.1 Implications for future practice 30

4.3.2 Implications for future research 31
4.4 Conclusions 32
5 Literature 33

1 Introduction

1.1 Background

In the last decade, mental health has been widely recognized as an important public health topic and globally prioritized (WHO, 2013, UN, 2015). Some mental illnesses, such as depression, have been identified as leading causes of disability (WHO and WorldBank, 2011). People with a severe mental illness have a higher risk of dying by suicide compared to the general population (Fu et al., 2021). Suicide has been described as “occupational hazard” among physicians as they are more likely to die by suicide than non-physicians (Albuquerque and Tulk, 2019, Schernhammer and Colditz, 2004, Poorman, 2019). Poor mental health is also an issue among students enrolled in medical school: Medical students have an elevated risk for mental illnesses worldwide compared to age-matched individuals in the general population (Rotenstein et al., 2016). The following chapter aims to provide an overview of the most prevalent mental illnesses among medical students.

1.2 Prevalence of common mental illnesses among medical students

Anxiety: According to a recent meta-analysis, the global point prevalence of anxiety among medical students is 33,8% (Tian-Ci Quek et al., 2019). Thus, one in three medical students worldwide experiences symptoms of anxiety and the overall prevalence is considerably higher compared to that observed in the general population (Tian-Ci Quek et al., 2019).

Burnout: Burnout is highly prevalent in medical education. A recent systematic review and meta-analysis including 24 studies and 17431 medical students worldwide estimated the prevalence for burnout in medical students to be 44.2% (Frajerman et al., 2019). A study among 587 German medical students revealed a burnout rate of 35% on average (Erschens et al., 2018b). Burnout is correlated to suicidal ideation and other psychiatric disorders, such as depression and anxiety (IsHak et al., 2013, Koutsimani et al., 2019). Notably, burnout in medical education is associated with dropout: students with burnout are more likely to consider leaving medical school (Dyrbye et al., 2010a).

Depression: In a meta-analysis including 167 cross-sectional studies and 16 longitudinal studies from 43 countries 27.2% of medical students screened positive for depression (Rotenstein et al., 2016). In a study among 592 medical students at the University of Düsseldorf in Germany, 4.7% of participants met criteria for a diagnosis of major depression. Another 5.8% of students reported depressive symptoms (Wege et al., 2016). Similarly, in a study among 651 German medical students 5.8% displayed clinically relevant symptoms of depression and 13.1% showed mild symptoms of depression (Jurkat et al., 2011).

Substance use: Literature regarding substance use among medical students is scarce and outdated (Ayala et al., 2017, Dumitrascu et al., 2014). Available data suggest that alcohol is the most common substance and consumed by over 90% of medical students (Ayala et al., 2017, Merlo et al., 2017). In a study among 1137 US medical students, over 70% reported binge drinking and 22.7% using marijuana during medical school (Merlo et al., 2017). Almost 4% of students in this study considered their drug use to be problematic (Merlo et al., 2017). Cannabis is the most used illicit substance among medical students (Roncero et al., 2015). A systematic review and meta-analysis estimated its overall pooled prevalence of lifetime use among medical students to be 31.4% (Papazisis et al., 2018). Apart from alcohol and marijuana, the use of stimulants and opioids is concerning: A cross-sectional study among 444 Iranian medical students and residents found that 11% used amphetamine and methylphenidate, mainly to improve concentration (Fallah et al., 2018). In a systematic review, the prevalence of methylphenidate use in the last year among medical students ranged from 3% to 16% (Finger et al., 2013). Also here the main reason for consumption was to enhance academic performance. A recent cluster-controlled trial among 1255 German students, including medical students, found that alcohol and tobacco were the most common substances (Pischke et al., 2021). Almost 17% indicated drinking alcohol three or more times a week and 11.7% reported using tobacco three or more times a week. The use of performance enhancing drugs however was reported very rarely in this study (0.007%) (Pischke et al., 2021).

Suicidal ideation: Suicide is the second leading cause of death among US college students and medical residents and the most serious consequence of untreated mental illness (Yaghmour et al., 2017, Turner et al., 2013, Nuzzarello and Goldberg, 2004). A

meta-analysis involved 21002 medical students and 24 studies examining suicidal ideation (Rotenstein et al., 2016). The summary prevalence considering assessments of suicidal ideation in a period of the past two weeks to the past 12 months was estimated to be 11.1%, ranging from 7.4% to 24.2% (Rotenstein et al., 2016). In a recent systematic review including 17 studies from 13 countries and a total of 13244 medical students, suicidal ideation ranged from 1.8% to 53.6% (Coentre and Góis, 2018). Depression, being diagnosed with a mental illness, lower socioeconomic status or financial difficulties, substance use and parental negligence were most frequently associated factors (Coentre and Góis, 2018).

1.3 Medical school distress

Medical school entails a number of stressors of which some are unique to medical education. While specific conditions in medical schools worldwide certainly differ, there are many common challenges that medical students face. This chapter gives an overview of relevant stressors for medical students.

1.3.1 Medical school stressors

Psychological distress in medical school is likely caused by a variety of different factors. Stressors do not necessarily remain the same throughout the course of obtaining a medical degree. The first year of medical school requires extensive adaptation as medical students transition into a challenging and new environment (Moffat et al., 2004, Erschens et al., 2018a, Hill et al., 2018). Further, medical students often move to a new city or location to begin medical school (Vitaliano et al., 1989). This may separate them from family and friends and destabilize their social support networks (Belay Ababu et al., 2018, Dyrbye et al., 2005). As medical students advance in their medical education, stressors, such as poor teaching quality and the feeling of being inadequately prepared for clinical tasks, might become more relevant (Weber et al., 2019). On the other hand, some stressors accompany medical students throughout their entire education: Financial concerns and, in some countries, loan debt are common among medical students (Rajapuram et al., 2020). Moreover, they regularly witness the suffering or death of patients (Jedlicska et al., 2019, Dyrbye et al., 2005). Another relevant stressor are toxic facets of medical school itself. Harassment of medical students is well-documented and includes different forms of mistreatment, such as verbal or physical abuse (Hill et al., 2020, Fnais et al., 2014). In many studies,

academic factors have been identified as further stressors. These include high workload and time pressure due to the comprehensive curriculum and schedule, exam frequency and performance pressure (Erschens et al., 2018a, Gazzaz et al., 2018, Imran et al., 2016, Weber et al., 2019). These stressors have serious implications on medical students' mental health. Especially academic stress has been described as most common stressor and important predictor for anxiety, depression, and overall poor mental health in medical students (Steiner-Hofbauer and Holzinger, 2020, Voltmer et al., 2012).

1.3.2 Subpopulations at higher risk for specific stressors

As outlined in the previous chapter, medical students encounter a variety of challenges during their training. Some groups of medical students are at higher risk of experiencing certain stressors because of individual characteristics. These include (but are not limited to) female students, LGBTQ+ students, students with disabilities, and students belonging to racial/ethnic minorities. Structures in medical education pose a challenge to the inclusion of these groups (Meeks and Jain, 2018, Dyrbye et al., 2007, Hill et al., 2020, Fnais et al., 2014).

Female students: In a survey including 343 German medical students, 53.1% stated to have experienced or witnessed sexual harassment (Jendretzky et al., 2020). Female medical students were three times more likely to have personally experienced sexual harassment. A meta-analysis estimated the prevalence of gender discrimination during undergraduate medical training and clerkship to be 49.8% and sexual harassment to be 33.3% (Fnais et al., 2014). Sixteen studies examining gender differences in discrimination and harassment among medical trainees reported a higher rate among female trainees compared to male trainees (Fnais et al., 2014). In twelve studies, these differences were statistically significant (Fnais et al., 2014).

Students with a disability: Novel findings suggest that disability is a risk factor for severe stress in medical school (Rajapuram et al., 2020). In a recent survey study, 9% of 3162 medical students reported a disability or chronic illness (Rajapuram et al., 2020). Students with a disability or chronic illness had a significantly higher risk to experience severe distress in medical school compared to those without (Rajapuram et al., 2020). Students with a disability might encounter barriers in medical education

such as stigma and stereotypes or the lack of clear policies in the disability disclosure and accommodation process (Meeks and Jain, 2018).

LGBTQ+ students: Non-heterosexual students display significantly higher levels of depression (Lapinski and Sexton, 2014) and have a greater risk of depressive symptoms and anxiety than their heterosexual peers (Przedworski et al., 2015). They are also more likely to experience discrimination and harassment (Nama et al., 2017, Przedworski et al., 2015). In a study surveying 1334 US medical students, 66.1% reported perceiving their campus climate as non-inclusive or LGBTQ+ friendly (Lapinski and Sexton, 2014).

Students belonging to racial/ethnic minorities: In a study with 3080 medical students across five US medical schools, racial/ethnic minority students were more likely to report mistreatment, such as racial discrimination or prejudice during their studies (Dyrbye et al., 2007). A recent large survey study among 27504 US medical graduate students found that multiracial students or those belonging to racial/ethnic minorities experienced significantly more mistreatment and discrimination in medical school compared to their white peers (Hill et al., 2020).

If a student belongs to more than one of these groups, the stressors can combine. For instance, female students belonging to racial/ethnic minorities reported the highest levels of racial discrimination compared to male students belonging to a racial/ethnic minority as well as male and female students not belonging to a racial/ethnic minority (Hill et al., 2020). This chapter illustrates that disparities regarding stressors and mental health between different groups exist. These should be taken into consideration when designing interventions and additional support to students of these groups should be offered.

1.4 The role of medical student well-being

The well-being of medical students should be prioritized by medical schools for two reasons: First, it should be a priority in order to promote and maintain health among medical students. Further, higher levels of well-being are associated with better academic performance and reduced dropout rates (Aboalshamat et al., 2015, Dyrbye et al., 2010b, Bruffaerts et al., 2018). Second, medical student well-being is the first

step towards physician well-being. The promotion of mental health consequently needs to start in medical school. If mental health issues in medical students remain untreated, they might be carried into their future practice (IsHak et al., 2009). Results of a recent systematic review and meta-analysis suggest that depressive symptoms among physicians are associated with an increased risk for perceived medical errors (Pereira-Lima et al., 2019). A cross-sectional study with 1354 US physicians revealed that burnout was associated with 44% to 48% greater odds of self-reported medical errors (Menon et al., 2020). Psychological distress and sleep-related impairment are also associated with increased risk of self-reported medical errors (Trockel et al., 2020, West et al., 2009). In a prospective cohort-study including 123 residents, participants with depression made 6.2 times more medication errors compared to participants without depression (Fahrenkopf et al., 2008). It is important to note that a condition or disorder alone not necessarily implies impairment (Sulmasy and Bledsoe, 2019). Thus, the presence of a condition, including mental illness, needs to be distinguished from physician's impairment.

1.4.1 Interventions to improve medical student well-being

In response to observing a high prevalence of mental illness in the student body, several medical faculties implemented interventions to reduce relevant stressors and pressure on medical students (e.g. (Slavin, 2019, Seritan et al., 2015, Dyrbye et al., 2019)) which will be briefly presented here. For a more detailed description of interventions to improve student well-being in medical school, please see the first of the two publications related to this dissertation (Dederichs et al., 2020). Generally, interventions to improve well-being in medical school can be divided into two categories: individual-based and setting-based interventions. Individual-based interventions focus on the individual and can include training of mindfulness, stress management or relaxation techniques, and wellness programs (Witt et al., 2019, Daya and Hearn, 2018). Setting-based interventions aim for changes at an organisational level (Dooris, 2009, Fernandez et al., 2016).

In medical school these could comprise interventions for the reduction of time spent in class and coursework or the implementation of pass-fail grading systems (Ange et al., 2018, Aboalshamat et al., 2015, Slavin et al., 2014, Spring et al., 2011). Research suggests that pass-fail grading improves medical student well-being through a reduction in stress and competition without negatively affecting academic performance (Spring et al., 2011, Ange et al., 2018, White and Fantone, 2010). Therefore, it has

been implemented by various universities (Reed et al., 2011, Bloodgood et al., 2009, Rohe et al., 2006). Another element to improve medical student well-being that can be found in many medical faculties are peer-to-peer mentoring programs (Andre et al., 2017, Slockers et al., 1981). While there is some evidence that they reduce stress and facilitate the transition into medical school, the overall quality of the evidence is low (Akinla et al., 2018). First, only few studies have investigated peer-to-peer mentoring programs for medical students. Second, existing studies are mostly descriptive and lack objective measures to evaluate the outcome (Akinla et al., 2018). Balint groups were originally created for physicians to improve the doctor-patient relationship but have also been suggested for medical students (Balint, 1955, Parker and Leggett, 2012, Clarke and Coleman, 2002). They offer a room to discuss difficult interactions with patients in a group setting with usually six to twelve members and one or two Balint group leaders (Van Roy et al., 2015). Studies with medical students and residents suggest positive responses towards Balint groups (Torppa et al., 2008, Atkinson and Rosenstock, 2015, Huang et al., 2020). However, the overall quality of the existing evidence is limited (Monk et al., 2018). Furthermore, a variety of individual-based interventions that aim to increase resilience and well-being in medical school have been proposed (Witt et al., 2019). For instance, these can include mindfulness, stress management or relaxation techniques (Witt et al., 2019, Wasson et al., 2016). While they appear to reduce stress, anxiety and depression in the short term, long term effects still need to be investigated (Witt et al., 2019).

Overall, the quality of data supporting the effectiveness of interventions to improve medical student well-being remains low and experts have deemed current efforts by medical schools to be insufficient (Slavin, 2021, Wasson et al., 2016). Moreover, little is known about how medical students think about these interventions. This is of great importance for two reasons: For one, medical students know their own education and its challenges best. Further, it is crucial that students accept new interventions that concern their well-being in medical education. Therefore, they should be included in the design process for new interventions.

1.5 Threats and challenges to mental well-being

1.5.1 Undertreatment

There is a significant undertreatment of mental health issues among medical students. Only 15.7% of medical students with depression seek treatment (Rotenstein et al., 2016). However, if diagnosis and treatment are delayed, this can yield negative health outcomes, such as a higher risk of future depressive episodes (Ghio et al., 2014). A shorter duration of untreated depression, on the other hand, yields positive effects on treatment response and remission (Ghio et al., 2014). Therefore, early detection and intervention are crucial and barriers to seeking care need to be identified and addressed.

1.5.2 Stigmatization in the medical field

Reluctance to seek help among medical students has been at least partly attributed to perceived stigma and concerns about confidentiality (Chew-Graham et al., 2003, Fletcher et al., 2020, Tjia et al., 2005). Stigmatization of individuals with mental illness is still prevalent in the medical profession overall, where the image of the "invincible healer" persists and reaching out for help might be perceived as sign of weakness (Miller and McGowen, 2000, Wallace, 2012, Dunn et al., 2008, Nedrow et al., 2013). Physicians do not seem to allow themselves the same care they recommend to their patients: A recent survey study among 2106 female physicians found that 69% of those with a self-perceived mental health problem did not access treatment because they feared their colleagues finding out, feared appearing incompetent, or believed that a diagnosis would be embarrassing or shameful (Gold et al., 2016).

But where does stigma in the medical profession originate? The culture and climate in medical education may play a role. In a survey including 873 medical students across six US medical schools, 15.8% of students reported observing supervisors violate students' confidentiality by revealing their mental health problems to others (Dyrbye et al., 2015). Fifty-six percent of students noticed their peers disclosing this confidential information to others. Moreover, 11.6% reported supervisors extending fewer opportunities to students with mental health problems and 12.9% reported supervisors judging these students negatively. In cases of students with burnout who had previously sought care, the likelihood of observing this negative judgement by supervisors was twice as high compared to students without burnout. Almost 50% of medical students in the study were concerned that the disclosure of

mental health problems would cause residency program directors to pass over their application (Dyrbye et al., 2015).

1.5.3 Medical student well-being and education during the COVID-19 pandemic

The years 2020 and 2021 have been particularly challenging in terms of mental health preservation and promotion. The global COVID-19 pandemic affected the mental well-being of the general population worldwide due to a variety of factors, including social isolation, fear of contracting the virus or loss of income (Mertens et al., 2020, Banerjee and Rai, 2020, Williams et al., 2020, Shevlin et al., 2020, Hyland et al., 2020, Pfefferbaum and North, 2020, Inkster and 2021). Healthcare workers have a higher risk of contracting COVID-19 than the general population which does not only threaten their physical but also their mental health (Bernstein and Gold, 2020). The pandemic increased levels of stress for many health care workers and medical students as well (Abdulghani et al., 2020, Lyons et al., 2020, Galbraith et al., 2021). Recent studies suggest that overall well-being among medical students decreased substantially during the pandemic (Lyons et al., 2020). Students who reported confirmed cases among family members had higher risks of depressive symptoms (Wang et al., 2020). Emotional exhaustion was found to be increased in final year students who faced the challenge of an expedited graduation and lacked practical experience before starting their work as frontline workers (Zis et al., 2021, Byrne et al., 2020, Siddique, 2020). Moreover, the pandemic disrupted traditional medical education for medical students globally and required rapid changes, such as the uptake of digital learning, switching to online examinations and restructuring clinical trainings (Sahu, 2020, Byrne et al., 2020, Sharma and Bhaskar, 2020, Rose, 2020).

1.6 IMIs and their potential for mental health promotion in medical school

Telemedicine and remote education can minimize health risks during the pandemic, especially for vulnerable medical students (Sharma and Bhaskar, 2020). Moreover, the pandemic has required new ways of offering mental health support (Sharma and Bhaskar, 2020). Thus, digital interventions that promote mental health have become more important than ever before. Their potential for the promotion of medical student well-being will be elaborated in the current chapter. IMIs can

potentially augment und complement college mental health systems on site by offering constant and readily available, cost-effective, and anonymous help which can be flexibly accessed with respect to time and location (Kern et al., 2018, Archangeli et al., 2017, Harrer et al., 2018). As typical barriers to accessing face-to-face services can be overcome with IMIs, they are especially valuable for students who are hesitant about seeking help (Harrer et al., 2018, Ryan et al., 2010), independent from the pandemic.

IMIs have been proposed for both prevention and treatment of a variety of mental illnesses, including depression, anxiety, bipolar disorder, or schizophrenia (Firth et al., 2017, Firth and Torous, 2015, Nicholas et al., 2015, Ebert et al., 2017, Deady et al., 2017). Domhardt et al. defined IMIs as "predominantly self-guided psychosocial interventions implemented by means of a prescriptive online program or mobile-based app, used by individuals seeking health-related support" (Domhardt et al., 2018, S. 34). According to Ebert et al. (2017), IMIs can be differentiated based on their technical implementation (e.g., augmented reality), their area of application (e.g., prevention), their theory base (e.g., cognitive or behavioural) or their degree of human support (e.g., guided self-help). Some IMIs have been found to achieve similar effects in the treatment of anxiety and mood disorders as traditional face-to-face therapy, especially when they are professionally guided and based on Cognitive Behavioural Therapy (CBT) (Andersson et al., 2019, Richards and Richardson, 2012). Moreover, research suggests that IMIs improve depression, anxiety, stress, and well-being among university students (Harrer et al., 2019, Lattie et al., 2019a, Davies et al., 2014). However, while IMIs are a promising tool to maintain and improve student mental health, they are underutilized on college campuses (Toscos et al., 2018, Kern et al., 2018). One reason for this might be the challenge to identify a suitable and clinically approved IMI from the broad selection of available IMIs (Torous and Roberts, 2017, Torous et al., 2018). Moreover, the quality of many available IMIs seems questionable (Torous et al., 2018). Another reason for the low uptake might be that IMIs are not well known among medical students: in a cross-sectional study including 80 medical and psychology students in Germany, only 1.3% stated to have ever used an e-mental health app (Mayer et al., 2019). Generally, face-to-face counselling seems to be preferred over digital interventions (March et al., 2018, Peynenburg et al., 2020). A third reason for the low uptake of IMIs could be that currently available IMIs fail to match individual needs (Mayer et al., 2019). Understanding individual needs might help increase acceptance, usage, and effectiveness of such digital tools (Apolinário-Hagen

et al., 2020). Learning about medical students' preferences and needs regarding IMIs seems therefore crucial, especially considering that their knowledge and use of IMIs will not only affect their personal health but also that of their future patients (Wade et al., 2014, Mayer et al., 2019). Overall, IMIs yield great potential and may significantly improve treatment accessibility.

1.7 Aims of dissertation

Medical students' poor mental health requires immediate, effective, and sustainable action. Moreover, stressors which also affect students without a mental health condition should be addressed and interventions that promote mental well-being should be established. So far, the student perspective on interventions to improve well-being has been largely neglected. However, it is of great importance for two reasons: First, involvement of medical students allows for direct insights into students' opinions and, importantly, specific explanations for why they consider specific interventions to be useful or not. Second, it ensures that the problem is tackled at the root. No dean, no faculty member and no counsellor knows medical students' needs and preferences regarding medical school better than the population itself. Therefore, this dissertation aims to shed light on the medical student perspective by giving them the opportunity to propose and discuss interventions to improve their well-being in medical school. Further, little is known about medical students' attitudes and acceptance of IMIs. This is problematic as IMIs may have great potential for promoting and maintaining student health. Especially during the ongoing COVID-19 pandemic, IMIs present a remote and safe support structure. Moreover, IMIs are of great relevance for medical students' future practice. Learning more about their requests for digital mental health solutions is therefore crucial and might facilitate the implementation of IMIs into medical school.

Overall, the aims of this dissertation are as follows:

1) To explore how medical students perceive different interventions proposed in the scientific literature and what specific changes they desire concerning medical school.

2) To examine medical students' attitudes towards and acceptance of IMIs for mental health promotion and their preferences regarding tailored IMIs.

Focus groups were chosen as a qualitative and participative methodological approach to achieve one main goal: to listen and to obtain findings pertaining to the outlined research questions.

Ethical approval for conducting the studies was obtained from the Ethics Committee of the Medical Faculty of Heinrich Heine University of Düsseldorf (study number 4041).

2 Students' perspectives on interventions to reduce stress in medical school: A qualitative study. Dederichs, M., Weber, J., Muth, T., Angerer, P., & Loerbroks, A. PloS one, 15(10), e0240587 (2020).

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4 Discussion

Medical students' poor mental health is a concern for medical schools worldwide (Rotenstein et al., 2016). This dissertation aimed to explore interventions that can foster well-being in medical school and are approved by medical students themselves. Two focus group studies with medical students from a German university were conducted to explore medical students' needs and preferences regarding different interventions. The first study investigated medical students' ideas for and opinions on interventions aimed at increasing well-being in medical school. The second study investigated medical students' attitudes and acceptance towards IMIs and whether they prefer tailored IMIs for medical students. A short description of both studies including the main results can be found in table 1. In the following, the main results of both studies will be described and discussed in the context of previous research.

Table 1. Main results of both studies included in this dissertation.

Study details	**Aims**	**Sample and Focus groups**	**Medical students' suggestions 1) for medical school 2) for IMIs**
Dederichs et al., 2020	Explore which interventions to reduce stress in medical school medical students suggest and how they perceive interventions in the literature	71 medical students from the faculty of medicine in Düsseldorf (age: M = 23.71, SD = 3.5) 8 groups consisting of 5-16 participants; duration: 90-130 minutes	• Guidelines for teaching content • Improved information management • Improved preparation for and organisation of clinical traineeship • Laxer attendance rules • More information and education on available counselling services and mental health • More thorough preparation and more preparation time for second state examination • New registration procedures for elective subjects • Online lectures • Parallel scheduling of corresponding practical and clinical phases • Reduced number of elective subjects • Refresher courses • Regulations for the absence of lecturers • Restricted number of subjects per exam

Dederichs et al., 2021	Explore views of medical students on IMIs and gain insights into their preferences and needs regarding IMIs	26 medical students (age: M = 23.35, SD = 3.73) 4 groups consisting of 6-7 participants; duration: 42-66 minutes	• Adjustable notifications • Comprehensible terms of use • Data safety and confidentiality • Easy and quick handling • Evidence-based • Flexible use timewise • No advertisements • No costs • No required internet access • Proof of quality and effectiveness • Provision and promotion by university • Technical maintenance and support • Tested and approved by peers • User-friendly design and user-interface

4.1 Medical students' suggestions to improve well-being in medical school

Dederichs et al. (2020) explored medical students' opinions on interventions that improve well-being in medical school through eight focus groups. Medical students were asked about their ideas and discussed interventions that have been described in the literature. They suggested a variety of ideas and solutions to challenges they encounter in medical school (see table 1). One suggestion that recurred throughout the focus groups was the demand for more transparent and reliable information on existing counselling and support services. Students also wished for better information management in general e.g., concerning administration. Students proposed changes to organisational issues and claimed that many of these could easily be prevented. For instance, the current registration procedure for elective subjects was perceived to induce high levels of stress as students need to register at midnight on a first-come-first-serve basis. Thus, students suggested revising the system so that it considers students' preferences and assigns them to elective subjects accordingly or that the time of selection is changed to noon instead of midnight. Moreover, students suggested an adaptation of the current attendance rule so they would not have to repeat a mandatory subject in case of missing a class due to sickness. Students expressed concern that they felt that they were not allowed to get sick because of this

attendance rule. A number of students' ideas to effectively reduce their stress in medical school were directly related to teaching and lectures. Online lectures were believed to increase flexibility and offer the possibility to learn at their own pace and schedule or preferred time of day. Students also proposed a protocol that students could follow in case a lecturer is absent. One of the most highlighted requests by students in the clinical phase was more time to prepare for the second state examination. Students perceived the current amount of time for preparation to be insufficient and requested at least 100 days in which they did not have other exams or lectures.

The study presents novel findings. For instance, medical students requested many changes at an organisational level, suggesting that changes in the medical school environment are most desirable. Many of these seem feasible to implement (e.g., more information on available counselling services and better overall information management). To date, efforts by medical schools have often focused on individual-level behaviour changes towards stress reduction, such as mindfulness trainings or guided meditation (Witt et al., 2019, Shiralkar et al., 2013, Daya and Hearn, 2018, Wasson et al., 2016, Slavin, 2016). However, previous research suggests promising results in universities which have implemented organizational interventions such as well-being programs. For instance, the Saint Louis University School of Medicine in the US has switched to a pass-fail grading system, reduced class time and curricular content, and implemented a mindfulness curriculum (Slavin, 2019). After implementation, preclinical medical students had lower levels of depressive symptoms, anxiety symptoms and stress compared to students prior to the wellness program (Slavin et al., 2014).

In Dederichs et al. (2020), students were also asked to appraise several interventions that have been suggested in the literature, such as pass-fail grading, Balint groups, peer-to-peer mentoring programs, and self-management courses. While students were in favour of a peer-to-peer mentoring program, opinions concerning Balint groups were mixed. These findings are in line with previous research: Peer-to-peer mentoring programs appear to be beneficial for first-year students in terms of psychosocial and academic support (Altonji et al., 2019, Gunn et al., 2017). A systematic review of Balint groups in undergraduate medical education reports heterogenous ratings regarding the perceived efficacy of the groups (Monk et al., 2018). Moreover, it suggests that Balint groups are more accepted and valued if they

are optional instead of mandatory (Monk et al., 2018). Students in the first study also were in favour of optional, non-mandatory Balint groups (Dederichs et al., 2020). Interestingly, some students did not favour a pass-fail grading system, especially those students who relied on grades for scholarships. They feared a competitive disadvantage compared to students from other schools with a tiered grading system. Similar concerns were raised regarding the change to a pass-fail grading of the United States Medical Licensing Examination Step 1 in 2022 (Salehi et al., 2020). Some medical students, applicants and program directors anticipate negative consequences for residency program applications such as the prioritization of students from more prestigious medical schools (Lin et al., 2020, Ehrlich et al., 2020, Salehi et al., 2020). Finally, many students approved of self-management courses but were unsure whether these should be implemented into the curriculum, fearing it might cause additional workload. Slavin (2019) reported an initial resistance from students with the implementation of a mindfulness and resilience curriculum at the Saint Louis School of Medicine. After the length of the obligatory part was significantly reduced and optimized to students' needs, the resistance subsided (Slavin, 2019). Thus, if self-management classes are offered, the design should be well-conceived, and students' schedules should be considered.

4.2 Medical students' views on IMIs for mental health promotion

Students identified several facilitators and barriers regarding the use of IMIs and gave insights into their preferences for tailored IMIs (Dederichs et al., 2021). Medical students had mostly positive views on IMIs as they valued them for their potential to bridge waiting times, as a first step towards face-to-face-therapy, their low threshold, and their convenient access (Ebert et al., 2017). In Dederichs et al. (2021) students raised concerns regarding the use of IMIs for treating severe mental health problems and displayed a clear preference for face-to-face counselling in these cases. Fear of a misdiagnosis, lack of personalization and human interaction, questionable effectiveness, as well as the challenge of finding a suitable and evidence-based IMI were perceived disadvantages (Dederichs et al., 2021). Students suggested a range of factors that would facilitate their use of IMIs (see table 1). Interestingly, some of these suggestions were highlighted repeatedly, and mirrored students' concerns with IMIs. Especially data safety and confidentiality were considered to be a main requirement for their willingness to try an IMI. Moreover, students desired proof of

quality and effectiveness of an IMI as a prerequisite for its use. Accordingly, students also stated to prefer IMIs that have been tested. Another factor that was perceived to be crucial for the adoption of IMIs among students is that the IMI is provided free of cost by the university. On the other hand, technical problems, frequent notifications, required internet access, the need to register, lack of anonymity, high time expenditure and costs were perceived as hindrances to the use of IMIs.

Many findings of Dederichs et al. (2021) are in line with previous research. For instance, participants in a mixed-methods study investigating facilitators and barriers for the use of mobile health apps indicated that costs for an app would hinder their adoption (Zhou et al., 2019). Conversely, the flexibility with respect to location and time has been recognized as key advantage of IMIs (Ebert et al., 2017). As stated before, students would only approve of an IMI if it had been evaluated and found to be effective and safe to use. This is important to consider given that the quality of many available IMIs is still questionable (Torous et al., 2018). A systematic review found that IMIs for college students varied substantially regarding their duration, intensity, and rationale (Harrer et al., 2019). Thus, it is unclear whether available IMIs meet students' needs. However, the progressive digitalization of health care can facilitate access to approved IMIs. For example, since December 2019, selected IMIs can be prescribed in Germany (Federal Ministry of Health, 2019). Out of 19 IMIs in total (as of 10.07.2021), ten IMIs are available for the treatment of mental health conditions after being tested and meeting requirements regarding data safety and quality of medical content (The Federal Institute for Drugs and Medical Devices 2020, The Federal Institute for Drugs and Medical Devices 2021). The ten IMIs can be used to treat or complement the treatment of depression, agoraphobia and panic disorder, anxiety, alcohol use disorder and insomnia. However, they can only be prescribed after an official diagnosis is established (Federal Ministry of Health, 2019). These prescribable IMIs are not specifically tailored for students but rather for the general population. While most students did not favour IMIs specifically tailored to the needs of *medical* students, many wanted to use IMIs designed for students in general (Dederichs et al., 2021).

4.3 Common findings and differences regarding IMIs and interventions to improve well-being in medical school

Several common themes emerged across both studies. Students perceived lack of time as a barrier, for instance to use IMIs or to enrol in non-mandatory self-management classes. Students requested that suitable interventions should be time-efficient, flexible, and compatible with their schedule. Time pressure has already been identified as an important stressor in previous research conducted at the University of Düsseldorf (Weber et al., 2019). Moreover, students wished for interventions, such as Balint groups and IMIs, to be available for voluntary usage. Reason for this were, on the one hand, time constraints. On the other hand, some students worried about stigma associated with participating in such interventions. In the first study, these students claimed not wanting to participate in Balint groups due to a fear of stigmatization. In the second study, students suggested disguising an IMI for mental health promotion as something else, so others would not know if they were using it. In both studies, students raised the need for more information regarding mental health problems and interventions. This included a broader and more visible psychological support system consisting of face-to-face counselling, IMIs, and mental health education. Additionally, students in both studies preferred to use these services if they are provided free of cost to them. Finally, both studies show the feasibility of focus groups as participatory method which allows for consideration of the medical student perspective.

In contrast to the first study, students in the second study asked critical questions about IMIs and stated only wanting to use an IMI that had been found to be effective. Moreover, they asked for support from their university to select a suitable and evidence-based IMI. This suggests that students tried to minimize potential risks of using IMIs (Dederichs et al., 2021). In contrast to that, students in the first study did not ask for evidence regarding the effectiveness of interventions proposed in the literature. Their opinions in favour of and against the presented measures were formed based on their own experience in medical school (Dederichs et al., 2020). One possible explanation for the hesitancy towards IMIs could be the lack of familiarity. Roughly one third of students had never used any app for the promotion of a healthy lifestyle (Dederichs et al., 2021). Overall, one could therefore argue that when deciding on something they are familiar with, such as medical school and its challenges, students preferred to make decisions based on their own experience and did not ask for further information on effectiveness. Whereas, when on novel ground as in case with IMIs,

students tried to compensate this lack of knowledge by requesting proof of effectiveness and support by their university as a prerequisite for utilizing IMIs.

4.4 A conceptual framework for well-being in medical school considering the student perspective - The AMIS-model

The AMIS-model is a framework based on the themes and suggestions of medical students in the two studies included in this dissertation (Dederichs et al., 2020, Dederichs et al., 2021). It integrates the results from both studies into four dimensions: *Advocates*, *mentality & culture*, *information & education*, and *structures*. These are briefly introduced here and will be further elaborated in the following chapters.

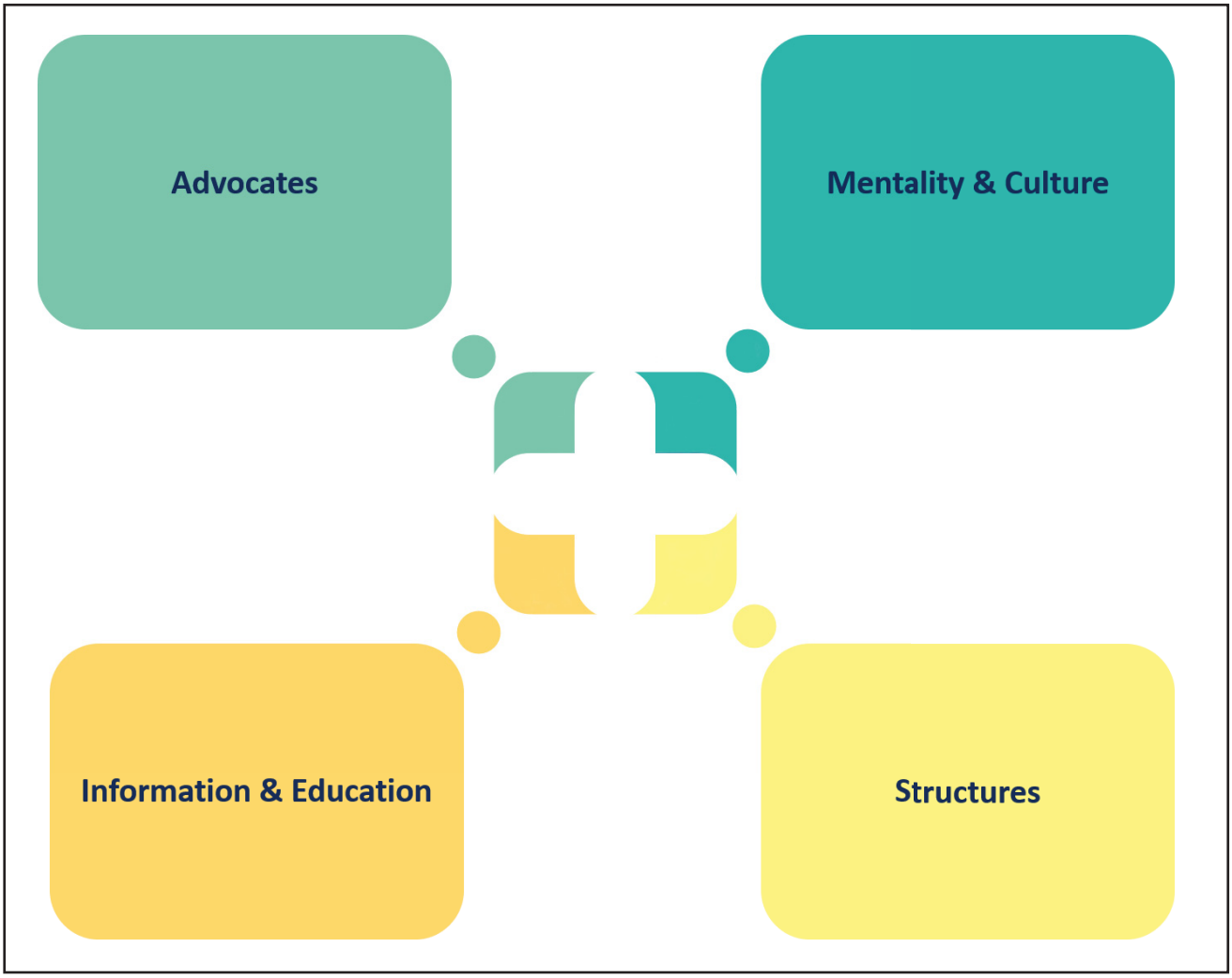

Fig. 1. A conceptual framework for well-being in medical school - The AMIS-model.

***A**dvocates*: Peers, faculty or senior staff that empathize with and support students.

***M**entality & Culture*: A shift in the mentality and mindset of educators and decision-makers towards more health promotion and student-orientation.

***I**nformation & Education*: Psychoeducation and promotion of mental health services.

***S**tructures*: Revision of avoidable sources of stress, such as rules pertaining to attendance and establishment of new structures that help promote well-being.

To develop the AMIS model, medical students' suggestions for interventions to improve their well-being were identified from the two studies included in this dissertation (Dederichs et al., 2020, Dederichs et al., 2021). The data in both studies was analysed using qualitative content analysis, so each study had a coding scheme. The coding schemes from both studies were compared, summarized, and further reduced until the four remaining dimensions were identified. Figure 2 depicts the process of developing the model.

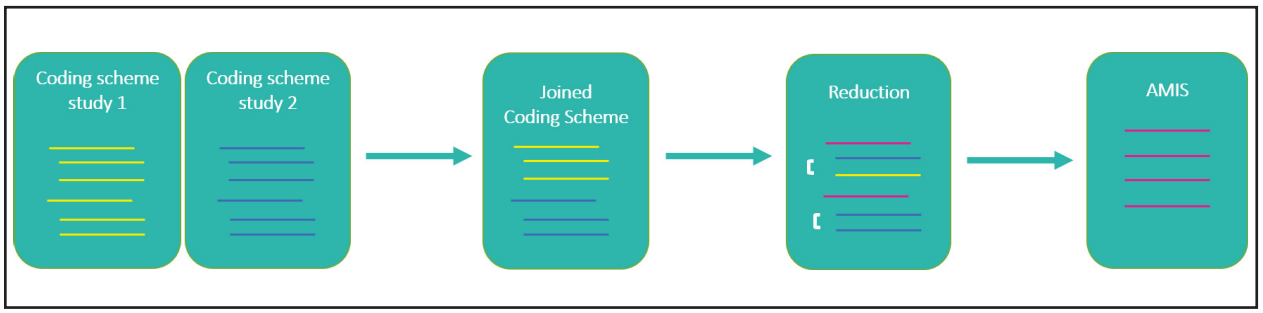

Fig. 2: Model formation procedure. First step: Comparison of the coding schemes of both studies, identification of common themes. Second step: Integration of both coding schemes. Third step: Summary and reduction of the themes. Fourth step: Final result of four dimensions.

The AMIS-model serves as a preliminary framework that aims to visualize different dimensions of medical school that are important for student well-being. Note, that conceptual models of medical student well-being already exist, such as the “coping reservoir” model proposed by Dunn et al. (2008). The model includes positive and negative inputs, which, combined with an individual’s personality and coping style, lead to either burnout or increased resilience. The “coping reservoir” and the AMIS-model highlight the importance of psychosocial support and mentorship. The key difference between both models is that the AMIS-model emphasizes the need for change in the environment rather than in medical students. It depicts opportunities for change in medical education, regardless of students’ personal traits. The “coping reservoir” on the other hand emphasizes the individual student, personal resources, and even

considers the students' personality. A possible explanation of this divergence is that the "coping reservoir" model is based on literature on medical student well-being, whereas the AMIS-model has been directly derived from medical students' recommendations in the two published studies (Dederichs et al., 2020, Dederichs et al., 2021). Hence, our results highlight the necessity of a participatory approach in promoting student well-being. In the next sections, the four dimensions of the model will be further described. Quotations from the two published studies are used for illustration. While the quotations are not mentioned verbatim in the publications, they reflect the published results.

4.4.1 Advocates

"And this one sentence is already enough: "I totally understand you, I've experienced that too." [It] would have been helpful [to hear that] in the first semester."

- Medical student, quote from the focus groups conducted within Dederichs et al. (2020)

"Because I know they've already made it through this [study] block, they've survived it. So just [to have] this role model to see [that] you somehow get through it."

- Medical student, quote from the focus groups conducted within Dederichs et al. (2020)

Advocates have the potential to support medical students and positively influence help-seeking behaviour. In the following, three different forms of support will be presented.

First, the idea of a peer-mentoring program has been well-received in the first study. As research suggests a strong association between low social support and mental distress (Ruud et al., 2020), a peer-mentoring program could have a positive impact on student well-being and help with early detection of students with mental health problems. A systematic review including five studies on peer-mentoring found that peer-mentoring programs for first-year students might facilitate transition into medical school, support personal development and reduce stress (Akinla et al., 2018). However, further research regarding this approach is needed (Akinla et al., 2018).

Second, participants of the first study reported a lack of understanding of their challenges and a lack of interest regarding their education by faculty. They suggested the introduction of a contact person helping them deal with their concerns.

Notably, research suggests that students will typically first approach a tutor or faculty member when searching for help (Grant et al., 2015). However, superiors may violate

their students' confidentiality by revealing their psychological problems to others or accessing their medical records without consent (Dyrbye et al., 2015). Thus, training for faculty on responding to a student in distress could be valuable. Furthermore, they could function as role models by disclosing their own challenges and struggles during medical school, thereby normalizing help-seeking (Martin et al., 2020b). In a mixed-methods study, three physicians shared their personal experiences, including one physician's history of mental illness, treatment, and recovery with 53 students (Martin et al., 2020b). By showing their own vulnerability, they combat the prevailing misbelief in medical education that needing help is a sign of weakness, encouraging medical students to ask for help (Martin et al., 2020a).

Third, medical students should be given the room to talk about struggles and concerns regarding medical school. In both studies, students used the opportunity to talk about their challenges in medical school. Similar structures have already been adapted at other universities: At the University of Ottawa in Canada, medical students gather regularly with faculty in so-called "ice-cream rounds" (Hiranandani and Calder-Sprackman, 2020). Here, students are offered the opportunity to talk about challenging experiences in medical education while enjoying ice cream free of cost.

4.4.2 Mentality & Culture

"It has already happened several times that people were made to cry during a test. Or they were run down or told that they are simply wrong here in their studies if they are too stupid to understand something. And of course, I think that if you don't […] perform in a way that the lecturers have expected, they can't be totally happy about it. But that's just not the right way to motivate students."

- Medical student, quote from the focus groups conducted within Dederichs et al. (2021)

In the first study, students reported several cases of harassment from teaching staff. Unfortunately, medical student harassment remains prevalent in medical education (Hill et al., 2020). In a longitudinal survey study including 1946 US medical students, more than half reported mistreatment (Fried et al., 2012). Most common forms of mistreatment were verbal and power mistreatment, originating most frequently from residents and clinical faculty (Fried et al., 2012). Some lecturers see intimidation and harassment in medical education as motivational or beneficial for the learning process and consider them as part of clinical culture (Musselman et al., 2005). In the

first study, medical students requested a complaints office to which they could report mistreatment. An intervention that addresses this kind of concern expressed by students can be seen at the University College Cork which offers complaint forms that students can use to report unprofessional behaviour (Maher et al., 2014). When suggesting a complaints office, students in the first study pointed out that consequences for those who abuse students need to be enforced.

Another problematic aspect of medical culture that students reported is the lack of skills to maintain one's own well-being. Students reported the paradox of knowing how to help a patient, but not themselves (Dederichs et al., 2020). Thus, students suggested these strategies to be taught from early on, e.g., in the form of self-competence classes. Existing courses were considered insufficient in terms of both quality and availability. While medical education should be improved on a setting-based level wherever possible to create a positive learning environment, equipping medical students with tools that increase their resilience through individual-based interventions can be an additional way of supporting them (Daya and Hearn, 2018).

4.1.3 Information & Education

"I would bring it up before it's already too late because that's what happened to us at university. We had someone who probably took his own life due to a mental illness. And in the context of that, there was an information event about who we could turn to if we were feeling depressed. I found that somehow-, well, sure, in the situation it was sort of necessary. But that was something that should have been established in the beginning [of medical school]. […] I think in medicine it is a bit shameful to go to a psychiatrist […]. I think it's something that people don't want to admit to themselves. "Oh, come on, do I have to talk to someone about it now?" Maybe if you say at the very beginning [of medical school]: "It's even more common among medical students. That's perfectly fine. And you can go there and there [for help]." I think that would have somehow taken away a bit of the burden, that you know, if something is wrong, I can turn to this and that person. Yes, I would have established this in the beginning, […] and not when it's too late."

- Medical student, quote from the focus groups conducted within Dederichs et al. (2020)

In both studies, students in all semesters reported a lack of information on available support services. It is crucial that medical students know what to do and have access

to barrier-free support when in crisis. To achieve heightened visibility of existing services, medical schools should actively and frequently promote them. Moreover, students should be encouraged to use these services. In addition to the reported lack of information on support services, a recurring theme in both studies was the necessity for more information on mental health (Dederichs et al., 2020, Dederichs et al., 2021). Mental health literacy (MHL) can increase help-seeking behaviour (Gorczynski et al., 2017). Currently, students might not perceive their need for treatment and think that their, in fact, clinically relevant symptoms of mental illnesses are normal (Eisenberg et al., 2007). As an idea for practical implementation and promotion of MHL in medical school, students in the first study proposed the integration of mental health education into the curriculum through mandatory lectures on mental health. This is already standard practice at certain medical schools. At the University of Missouri School of Medicine in the US, first-year students attend wellness orientation classes (Bagby-Stone, 2021). These aim to decrease the stigma surrounding mental health and encourage students to seek help early (Bagby-Stone, 2021). Moreover, all students are required to participate in an online suicide prevention training.

As students voiced many concerns regarding the use of IMIs, it also seems suitable to educate medical students about their potential risks. For instance, students should be advised not to use IMIs during an acute mental health crisis. Furthermore, students need to be educated on how to use IMIs and recognize the IMIs' limitations by knowing when to reach out for additional help (Lattie et al., 2019b). Moreover, medical students in the second study highlighted the importance of data safety and should therefore be informed on how their data will be processed and used (Dederichs et al., 2021).

4.1.4 Structures

"What I would like to see is a bit of tolerance towards one's own illness, for example. […] you can't allow yourself to be ill at all. Or you can't allow yourself to have a relative die or something like that. Maybe with a medical certificate, the university […] could somehow try to find an alternative date [for the missed class]. But that it's not just like "OK, I was sick for a fortnight, the semester is lost, I have to do it all over again […]." That can't be it. Above all, [medical school] is about health, and that you have to hold yourself back and say, "I'm not allowed to get sick", that's a complete paradox."

- Medical student, quote from the focus groups conducted within (Dederichs et al., 2020)

The category “structures” includes developing new support structures, as well as adapting existing structures and regulations. Students in the first study suggested an adaptation of existing attendance rules. The current regulations at their university demand an attendance of at least 85% presence per subject. However, if a subject consists of only three appointments, all three seminars must be attended. Students argued that especially in cases of important events, such as falling ill or grieving a close family member’s death, students should be granted an exception. For example, an Australian medical school implemented mental health absence days (Adelaide Medical Students' Society, 2021). Students can take unplanned leave for mental health reasons as many times as needed. A doctor’s certificate is not needed if the absence is less than three consecutive days. This permits students to prioritize their well-being.

Students further requested an increase of online lectures for convenience and flexibility. Due to the COVID-19 pandemic, online lectures have been widely implemented and are likely to persist after universities switch to traditional offline lectures again (Sharma and Bhaskar, 2020). However, they may not benefit all students. Preliminary results suggest that online lectures might not be feasible for final year students who rely on clinical training (Zis et al., 2021). Thus, the implementation of this educational format beyond the pandemic and its impact on student well-being will need to be explored in the future.

Finally, there is a need for additional support services. In the first study, students requested a broader psychological support network at their university and facilitated access to existing structures, e.g., through longer opening hours of campus counselling services. The ongoing COVID-19 pandemic requires that support to students is offered remotely (Sharma and Bhaskar, 2020, Busse et al., 2021, Matos Fialho et al., 2021). Integrating IMIs into university counselling services could be a feasible way to augment campus counselling services (Dederichs et al., 2021). Nevertheless, universities also should make an effort to increase their capacities of campus counselling services, as the results of the second study indicate that IMIs do not substitute face-to-face counselling, especially during an acute mental health crisis (Dederichs et al., 2021).

4.2 Strengths and limitations

4.2.1 Research questions and study design

Focus groups, a participatory and qualitative method, were chosen because they yield several advantages: First, qualitative research does not require presuppositions from previous research and is therefore ideal for explorative research questions (Mazzola et al., 2011, Kitzinger, 1995, Meyer et al., 2012). Second, a participatory approach allows to explore interventions by consulting and involving the groups the implementation will affect the most (Jagosh et al., 2012). Accordingly, obtaining students' opinions directly is one of the main strengths of the studies included in this dissertation. A further strength of the first study (Dederichs et al., 2020) is that students were not only asked for their own suggestions to promote well-being in medical school but were also invited to give their opinion on four interventions that have already been described and evaluated in the literature (pass-fail grading, peer-mentoring, Balint groups, and self-management courses). While this selection certainly does not cover all interventions that have been proposed so far, it presents a range of different types of interventions that have been commonly described in previous research (Wasson et al., 2016). Furthermore, this dissertation explored medical students' *opinions* on interventions to improve well-being in medical school. While an evaluation of the feasibility and effectiveness of the proposed interventions was not aimed for in the present studies, further research could explore this.

4.2.2 Sample

A strength of both studies included in this dissertation is the diverse sample. Students from different semesters (preclinical and clinical phase), as well as of different ages and genders participated and ensured that a broad range of perspectives and experiences was considered. The proportion of female students in the first study and in the second study were 78.9% and 65.4%, respectively (Dederichs et al., 2020, Dederichs et al., 2021). As this percentage is higher than the current proportion at the Medical Faculty at the University of Düsseldorf (66.0% in December 2020), there might be an overrepresentation of female students' perspectives in the first study. The first study included a particularly broad sample with 71 medical students in eight focus groups. Contrarily, the sample size of 26 participants in the second study is relatively small. However, the limited number of participants per focus group facilitated the

discussion and gave all students room to speak. Furthermore, thematic saturation was reached in both studies (Dederichs et al., 2020, Dederichs et al., 2021). An indicator for this is that no new relevant content is being obtained from further data collection (Guest et al., 2006, Namey et al., 2016).

An additional limitation of both studies is that only students from one university were included in the studies (Dederichs et al., 2020, Dederichs et al., 2021). As some findings might be specific to the environment of the Medical School of the University of Düsseldorf, the transferability of the present results to other medical schools might be limited. However, many of our findings are consistent with previous research, for instance regarding facilitators and barriers for IMI-use, and might therefore be at least partially transferable (Topooco et al., 2017). Additionally, many of the proposed solutions were not university-specific (e.g., request for more mental health education) and therefore can likely be disseminated to other medical schools. Thus, the results grant insights and starting points to improve medical students' well-being. Future research could test the proposed interventions quantitatively among different universities.

Finally, selection bias may be a limitation in data collection. It is possible that in the first study only those students participated who suffer from stress or are especially dissatisfied with medical school (Dederichs et al., 2020). On the other hand, students experiencing stress might not have attended the focus groups because of a lack of time. There was no screening of current stress levels prior to the data collection. Similarly, in the second study, only students familiar with or interested in e-mental health might have participated and potentially identified less disadvantages or barriers (Dederichs et al., 2021). This is especially relevant as the focus groups were held during an elective e-mental health workshop. However, over one-third of students in the second study claimed to have no experience with apps for health promotion and over 80% had never used an app for stress management before.

4.2.3 Data collection and analysis

Focus group facilitators in both studies were members of the teaching staff and one focus group in the first study and all focus groups in the second study were held during a workshop (Dederichs et al., 2020, Dederichs et al., 2021). This could have affected the study observations. On the one hand, it might have elicited a social

desirability bias and reduced willingness to share sensitive topics (Dederichs et al., 2020). On the other hand, it is possible that especially in the second study, positive views on IMIs of the focus group moderators shaped students' opinions prior to the focus groups (Dederichs et al., 2021). However, students spoke very openly about sensitive issues in all focus groups and raised many concerns regarding IMIs in the second study.

The data in both studies were analysed using qualitative content analysis (Dederichs et al., 2020, Dederichs et al., 2021). This method has a theory-guided and systematic approach that allows for the efficient analyzation of larger quantities of text (Mayring, 2019, Mayring, 2010). One limitation regarding qualitative content analysis is the potential loss of meaning of individual cases due to the category-based reduction of the content (Mayring, 2010). A further limitation with regard to the coding procedure is that in the second study, the analysis of the complete material was only performed by one coder (Dederichs et al., 2021). However, the coding scheme was reviewed by a second author and as only few adaptations were suggested, coding by one author was perceived to be sufficient. Additionally, a third author approved the final coding scheme.

4.3 Implications

4.3.1 Implications for future practice

The results of this dissertation are relevant for future practice. Universities planning to implement well-being programs or those with existing well-being programs could benefit from medical students' suggestions for improvement made in the first study (Dederichs et al., 2020). Some of the results that are relevant for other universities include attendance rules, more information and education on available counselling services, and online lectures. However, some of the requests, e.g., regarding scheduling of clinical and theoretical phases or course registration procedures, might be highly specific and will likely differ from medical school to medical school. Therefore, considering the local situation can bring specific relevant insights. Focus groups can be a valuable tool for this as they allow for elaborated explanations into the reasoning of students' propositions.

The second study is one of the few qualitative studies investigating attitudes and acceptance of IMIs in medical students. The results suggest that universities should

pre-select an IMI based on its scientific effectiveness and offer it to their students free of charge (Dederichs et al., 2021). Overall, the findings of the second study are not only relevant for universities and health care providers, but also for developers of IMIs: They yield important indications for the design of an IMI, for instance the wish for a time-efficient and flexible product. Moreover, medical students' suggestions can help to provide students with a suitable IMI in face of the ongoing COVID-19 pandemic. Although IMIs tailored for students which consider relevant issues for students, such as procrastination, already exist (Küchler et al., 2019), a systematic review and meta-analysis on digital mental health interventions among college students revealed that more research is needed to improve user experience and user engagement in this group (Lattie et al., 2019a). Thus, future studies could consider some of the implications made in this dissertation in order to optimize IMIs for the needs of students.

Finally, as depicted in the model, it does not suffice to simply install interventions to increase student well-being. The lack of knowledge of existing structures and perceived lack of support underline the importance of actively promoting well-being and help seeking when it is needed. Mental health literacy and regular communication of existing services can be a first step in this direction.

4.3.2 Implications for future research

Results of the first study suggest that students prioritize setting-based interventions to improve their well-being in medical school (Dederichs et al., 2020). This needs to be tested quantitatively among a broader and more representative student sample including different universities and a greater sample size. The suggestions made by students in both present studies need to be evaluated to determine whether they are accepted by a majority of students. Moreover, further research is needed to assess the acceptance of proposed measures by faculty. Prior to the implementation, the feasibility of envisaged changes should be assessed. While some interventions seem easy to implement (e.g., more information on support services), others might require more resources (e.g., restructuring of the curriculum). Finally, the effectiveness of the proposed interventions needs to be assessed. The importance of evaluating the effectiveness of interventions has been highlighted in previous research. As stated in chapter 4, the Saint Louis University School of Medicine implemented different interventions to improve their students' well-being in

2009 (Slavin, 2019). Since then, students' mental health has been closely monitored to assess the interventions' impact (Slavin, 2019, Slavin et al., 2014). These assessments were crucial to determine if interventions had been successful or required adaptation. (Slavin, 2019). In addition to an evaluation of suggested interventions to improve well-being in medical school, further research is needed to learn how, and which IMIs can complement university counselling services. As it is not clear whether medical student mental health differs from that of students of other disciplines, IMIs could be used as a potential prevention and treatment modality for all students of an university (Puthran et al., 2016, Fatimah and Nadir, 2016, Bunevicius et al., 2008, AlFaris et al., 2016, Nezam et al., 2020). In this case too, future research should investigate the according preferences and needs of potential users.

4.4 Conclusions

Overall, this dissertation provides insights into medical students' opinions about interventions to improve their well-being during medical education through a qualitative and participatory approach. When medical students are invited to actively contribute to the development of health services and interventions at their medical school, this might help to develop feasible and effective solutions, facilitate acceptance, and make students feel heard and valued. Notably, this work suggests that well-being in medical education can be improved through a range of interventions, including IMIs as a resource-friendly solution to augment campus mental health services. The AMIS-model consisting of the four dimensions *advocates, mentality & culture, information & education*, and *structures* can be used as a preliminary framework for future well-being efforts. Ultimately, medical student well-being is the first step towards physicians' well-being. Medical students need to leave medical school well-equipped and healthy, having learned how to prioritize and maintain their well-being. When these students carry this mindset into their own practice and integrate it in the treatment of their patients as well as in their teaching of a new generation of students, this might offer opportunities for change in the culture of medicine towards prioritisation of mental health and selfcare.

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