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Exploring medical students' views on digital mental health interventions: A qualitative study

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ABSTRACT

Background: Medical students show a relatively high prevalence for common mental disorders. Only few of those in need for treatment seek professional help. Therefore, easily accessible interventions are required. While several evidence-based internet- and mobile-based interventions (IMIs) have been proposed, little is known about medical students' attitudes towards using them.
Objective: We aimed to explore the views of medical students on IMIs as well as facilitators and barriers to use them and gain first insights into their preferences for tailored IMIs.
Methods: We conducted four focus groups with 26 medical students enrolled at a German medical school in March 2020. Focus groups were audio-recorded, transcribed and analyzed following established approaches for qualitative content analysis.
Results: Medical students valued IMIs for their low-threshold and flexible access, their potential to bridge waiting times and as a first step towards face-to-face-therapy. However, medical students preferred face-to-face interventions in case of severe mental health problems. The main disadvantages named by students included difficulties to find or decide on suitable IMIs based on clear quality criteria, fear of a misdiagnosis and lack of personalisation and human interaction. Some students also questioned the effectiveness of IMIs. Easy handling, flexible use, data safety and easily understandable terms of use were believed to facilitate the uptake of IMIs, whereas technical problems, frequent notifications, required internet access, need to register, lack of anonymity, high time expenditure and costs were reported to hinder their use. Most students did not prefer IMIs tailored to medical students but rather wanted to use IMIs suitable for students of all disciplines.
Conclusion: Our results suggest overall positive views regarding IMIs for mental health promotion but concerns regarding their use for severe mental disorders and acute crises. Our findings indicate that IMIs may represent promising tools for stress prevention and early interventions for medical students. Students explicitly stated to prefer quality-approved IMIs recommended and provided by their university.

1. Introduction

Internet- and mobile-based interventions (IMIs) offer new ways of increasing the access to psychological counseling and therapeutic support by providing help anonymously and independently of location and time (Andersson et al., 2019; Ebert et al., 2018a; Ebert et al., 2018b). Considering the current challenges during to the SARS-CoV-2 pandemic, online access to professionally guided psychological interventions has become crucial to maintain mental health services across health care systems worldwide (Torous et al., 2020). Digitalization of health care is an ongoing challenge in many health care systems worldwide (Nøhr et al., 2015; McLoughlin et al., 2017). In Germany, for example, the Digital Healthcare Act passed in 2019 allows for online consultations and the prescription of medical apps by physicians and thus represents a milestone for telemedicine as well as for the process of integrating IMIs into German health care (DVG Federal Ministry of Health, 2019).

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However, despite several IMIs being evaluated as effective (Andrews et al., 2018; Carlbring et al., 2018), low levels of uptake have been observed in various countries, including Germany (Gaebel et al., 2020). Lacking awareness of evidence-based IMIs, as well as scepticism towards the quality and effectiveness of online interventions have been suggested as key barriers for their utilization (Ebert et al., 2019b). Hence, in order to increase acceptance of IMIS, it is important to explore the attitudes and needs regarding IMIs for specific target groups and to subsequently tailor them to individual needs (Ebert et al., 2015). Tailoring an intervention according to the individual users' needs has previously been identified as an essential factor examining IMIs (Batterham and Calear, 2017; Bolinski et al., 2018).

Accumulating evidence indicates that medical students show high prevalence of different mental illnesses worldwide (Rotenstein et al., 2016; Tian-Ci Quek et al., 2019). At the same time, only few of those in need seek help: Previous research suggests a treatment gap among university students despite treatment options being available (Auerbach et al., 2016; Givens and Tjia, 2002). Delayed diagnosis and treatment of some mental disorders are associated with negative health outcomes and poorer academic performance (Rotenstein et al., 2016; Ghio et al., 2014; Bruffaerts et al., 2018). Therefore, prevention and early interventions are essential to protect university students' mental health and easily accessible, scalable, and convenient solutions are required. IMIs have shown to be an effective tool for university students' mental health and well-being (Harrer et al., 2019). Especially in a highly competitive environment like medical school where some students still fear being stigmatized for having mental health problems (Dyrbye et al., 2008; Givens and Tjia, 2002; Schwenk et al., 2010; Chew-Graham et al., 2003), IMIs can be a discrete solution. However, evidence regarding medical students' views on IMIs is scarce. Most literature so far explores perceptions towards IMIs of the student population as a whole and does not focus on medical students (e.g. (Holtz et al., 2020). Research with medical students suggests that they have little experience with IMIs and digital health but provides little insights into why medical students are reluctant to use these services. A quantitative and qualitative survey study investigating the acceptance of mental health apps among medical students found a lack of awareness and knowledge about available mental health apps (Mayer et al., 2019). A recent qualitative study explored medical students' opinions towards digital health in medical practice and education (Edirippulige et al., 2020). While medical students acknowledged the importance of digital health for their future practice, their understanding of inter alia the terminology was limited. This knowledge gap is particularly problematic, as medical students represent not only users but also future health care providers who will shape future healthcare, including the adoption of IMIs, through their professional advice and prescriptions (Mayer et al., 2019) Therefore, it is crucial to consider the preferences and needs of medical students as future health care professionals for the implementation and design of IMIs across different stages of the digitalization of health care. At the same time, medical students can benefit from IMIs for their personal use. This study aims to contribute to the growing body of literature regarding IMIs for mental health promotion in the general medical student population through a qualitative approach.

We aim to investigate the following three questions:

1) What are the attitudes towards IMIs for mental health promotion among medical students? What are medical students' attitudes on advantages and disadvantages of IMIs?
2) How is the acceptance of IMIs for mental health promotion in general (intentions to use and prior use) among medical students? What are most important facilitating factors and barriers to participation in IMIs perceived by medical students?
3) Do medical students prefer IMIs that are targeted or tailored to the specific needs of medical students over generic IMIs?

2. Methods

2.1. Setting

Qualitative designs are especially suitable to answer explorative research questions without the need of presuppositions from previous research (Mazzola et al., 2011; Meyer et al., 2012; Kitzinger, 1995). Therefore, we chose a qualitative design for this study. Focus groups were conducted as a voluntary part from a five-day elective workshop on mHealth for medical students that took place from March 2, 2020 until March 6, 2020 at the medical school of the Heinrich Heine University Düsseldorf in Germany. The elective workshop focused on participatory design approaches and mental health app prototyping. Two focus groups were conducted on the second day and two focus groups were conducted on the third day of the workshop. All participants were provided with basic information on IMIs during the first day in order to foster a common understanding for the discussion. We chose to conduct four groups due to the limited number of students in the workshop. When we found that data saturation was reached with these four groups and no new content emerged, we decided not to conduct further focus groups with another cohort of medical students.

2.2. Participants

Participants were recruited from an elective seminar on co-design of mental health apps for medical students at a medical faculty in Germany. Inclusion criteria were a minimum age of 18 years and participation in the workshop. All participants were medical students from the third to tenth semester. Participation was explicitly on a voluntary basis. All workshop participants gave their written informed consent prior to the start of the focus groups. They were informed that non-participation in the focus groups had no consequences regarding study credits. As incentive, participants were informed that they could receive a summary of aggregated findings and that their comments could contribute to the further development of health services at their medical school. No monetary compensation was offered.

This study was approved by the ethics committee of the Medical Faculty of Heinrich Heine University of Düsseldorf as part of a sub study of the project *Healthy Learning in Dusseldorf* (HeLD 2 study number 4041).

2.3. Materials and procedure

After the provision of written informed consent, participants were asked to fill out a brief baseline questionnaire assessing sociodemographic characteristics of participants and prior experience with IMIs. This questionnaire was adapted from another project (Apolinário-Hagen et al., 2018) including focus groups with psychology students in the participatory development of a mental health app. Participants were asked about their age, gender and semester, interest in web-based or app-based digital health interventions (answer options: yes, no), current or past use of apps for stress management (answer options: yes, no, other) and whether they use lifestyle or behavior change apps (rating scale ranging from 1 = no to 5 = several times a day).

JAH and MD moderated two focus groups each. JW and Annegret Dreher (see acknowledgements) took field notes. The focus groups followed a focus group guide developed by MD and JAH who are qualified psychologists and have experience with research on IMI acceptance and qualitative study design, especially with focus groups in mental health research in university settings. JAH is a postdoctoral researcher with a main scope on e-mental health acceptance and public attitudes on e-mental health services, mainly using quantitative research methods.

In the beginning of each focus group, students were asked an opening question about their coping strategies in medical school to help start the conversation and get comfortable in the setting.

Then, the relevant questions for this study were discussed, as shown

in Table 1: Firstly, students were asked about their general opinion regarding IMIs and about advantages and disadvantages of IMIs as well as intentions to use IMIs for mental health purposes. Participants were then asked about facilitating factors and barriers in connection with IMI use. The next part addressed the question whether participants would like to use IMIs that are tailored for medical students. At the end of the focus groups, participants could comment on their general preferences regarding eHealth and add everything of importance for them that had not been addressed so far. This last question does not lay within the scope of this paper and will be reported elsewhere.

2.4. Data analysis

All focus groups were audio-recorded and transcribed verbatim. The focus groups were held in German and the quotes included in this article were translated by a professional translator from German into English. The content was analyzed using the software MAXQDA 18 (VERBI) following established approaches for qualitative content analysis according to Mayring (2014). Three deductive main categories (attitudes towards IMIs, acceptance of IMIs, preference for tailoring to medical students) were formed according to the research questions prior to the analysis. During qualitative analysis, new subcategories within these main categories were formed by inductive category formation according to the content of the discussions and suitable text passages were then assigned to these subcategories. After MD completed the first round of coding the data, JW reviewed the coding scheme. It was then adapted, and a second coding round was performed by MD. Subsequently, the coding scheme was reviewed again by JW and some further adaptations were discussed. Finally, JAH approved the categories. As there were only minor adaptations, two coding rounds were considered sufficient. The completed checklist of consolidated criteria for reporting qualitative research (COREQ; (Tong et al., 2007)) can be found in the supplementary material.

3. Results

In total, 26 individuals (n = 17 women) participated in four focus groups. Groups consisted of six to seven participants. They included preclinical and clinical students from 3rd to 10th semester. Participants' ages ranged between 18 and 30 years (Mean = 23,35; SD = 3,73). The focus groups lasted between 42 and 66 min.

In the questionnaire, 73% of participants stated interest in using a health-related IMI. Nineteen percent of participants stated to already use or have used an app for stress management. Thirty-five percent of participants reported to never have used an app that promotes a healthier lifestyle.

Table 1
Focus group topic guide.

Focus group topic guide.
Introductory question:
"What helps you personally to cope in medical school? What has worked for you, what has not?"
Key questions regarding ideas for IMIs for mental health promotion:
a) "What do you think about digital mental health interventions? What advantages and disadvantages do you see?"
b) "What could affect your use of digital mental health interventions? What are common facilitating factors and barriers in your opinion?
c) "Should digital mental health interventions be targeted in some way? Would you prefer to use an intervention that is tailored to the needs of medical students over a non-tailored intervention?"
Outlook:
"Which other eHealth services would you like to use? Is there anything else you would like to add? Have we discussed everything that is of importance for you?"

3.1. Attitudes towards IMIs

3.1.1. Perceived advantages of IMIs

Overall, medical students had a generally positive view on IMIs as an additional tool to traditional mental health services provided by the university. They stated that IMIs might be beneficial to get accustomed to face-to face-counseling for instance in case of social anxiety, as one student suggested:

> "[…] for some people who have major problems with social anxiety, this might be a nice way to open up a little and then maybe, when they are readier, they can go to a therapist and talk face to face."

Furthermore, students valued IMIs to bridge waiting time until a face-to-face counseling session was available.

Across the focus groups, most students were willing to try IMIs such as mental health apps at least for a short period of time. Especially the holidays and the beginning of the semester were preferred dates to test the app at ease:

> "I think I would find it helpful if there was an app that you could try out for a week, for example during the holidays. Or at the beginning of the semester, when one's level of stress is still manageable, to see if it's helping me or not."

Some students reported that they already had had good experiences with IMIs, such as apps for meditation.

Students reported quick access, higher frequency than face-to-face appointments, local flexibility and low threshold access as advantages of IMIs. Participants valued the possibility of anonymous use of IMIs which they believed to lower the threshold for using IMIs. Furthermore, IMIs were believed not only to be useful for therapy but also to be powerful tools for primary and secondary prevention of mental illnesses. Some students thought that IMIs could only provide primary prevention. In terms of secondary prevention participants believed IMIs to be a potentially powerful diagnostic tool that could help self-assessment. The app could assess the users' mental health and prompt them to seek help, if a mental health problem has become clinically relevant, as one student explained:

> "Maybe an app like this to help assess one's own condition. Many in med school don't notice that they are completely overworked and actually have a problem. And […] with the help of questions from the app, if one is told that there is a problem, one might act sooner."

Students further stated that even in case of an emergency, an IMI could provide suitable contacts and valuable information in order to help other students in need.

3.1.2. Perceived disadvantages of IMIs

Students perceived different disadvantages of IMIs. Some students stated that it was difficult to choose one particular mental health app out of the large number of existing commercial apps publicly available in the app stores. They pointed out that it could be confusing to identify evidence-based IMIs and to select the right IMI for a specific problem: One student specifically criticized the lack of guidance and orientation if one wants to find an evidence-based and effective mental health app:

> "What I find difficult is that there is a vastly big offering and [that it is] absolutely not clear, which app does what and which one is more evidence-based. And therefore it is a lot and many bad things are on the market. And this I see very critically."

Moreover, participants felt that a number of risks could be related to the use of IMIs. They were concerned that unguided use of IMIs might not detect deterioration of users' mental health. It might evoke a false sense of security for users who believe to be self-treating their condition

sufficiently. They also discussed that IMIs should not provide a diagnosis. On the one hand, students raised the concern that IMIs are not capable of interpreting subtle cues, such as body language. On the other hand, participants stated that an unguided IMI is incapable of detecting deliberate false statements (e.g. while screening or monitoring). Therefore, some students argued that a clinical judgement or diagnosis should always be made by a health care professional, such as a psychiatrist. However, students were open to use IMIs as a complement and extension of face-to-face therapy but hesitant of using IMIs as a standalone treatment as the following quote suggests:

> "I would like it better together with therapy […] like I keep a diary and my therapist can use it to check: How is my progress? How do I feel at the time when I am not at therapy? But to me it could never completely replace a therapist. I need someone I can look in the eye."

Additionally, medical students thought IMIs to lack personalisation to individual needs and to therefore not be able to offer tailored solutions to individuals with mental health problems as real health care professionals would offer. They also thought that IMIs would not be able to notice specific environmental cues (e.g. the weather) when recommending exercises for behavioral change, as one student explained:

> "Maybe the app tells me "You seem to be depressed, maybe you should go every day for a one hour walk" or something like that. But then it rains and I really don't want to go for a walk and I don't have an alternative or the app doesn't give me a guideline on how to behave in different situations."

Some students reported to prefer face-to-face support because they felt safer by talking to a real person and because IMIs lack certain human qualities (e.g. competence and experience of a doctor or human interaction and warmth). Some students also questioned the effectiveness of IMIs, especially in case of severe mental illnesses.

> "Well, I don't know, depending on what app you're using, is it really more effective? Or does it come close to therapy? Like, can one really benefit from it instead of looking for a therapist?"

> "I'm wondering, how an app like this is supposed to help someone who is already severely ill?"

These quotes underline that medical students know little about the effectiveness of IMIs and therefore question it.

3.2. Acceptance of IMIs

3.2.1. Facilitating factors

Medical students varied in their acceptance of IMIs in terms of intentions to use them in the future as well as past or current use of mental health apps. Several factors were described that facilitate their acceptance.

Technical maintenance as well as easy and quick handling were reported to be important to increase usability of IMIs, especially regarding the use of mental health apps. Furthermore, students stated that they would prefer flexible use based on their time and need to use the IMIs and would dislike time-consuming IMIs requiring regular commitment and inflexible scheduling.

Data safety was highlighted as a major facilitator for the use of IMIs by our students, especially regarding the sensitive topic of mental health. They expressed that they would like to use IMIs without the requirement to enter personal data and that it would otherwise increase the threshold to use IMIs:

> "I think, for me personally, an important aspect of such an app would be its anonymity, that they don't collect any personal data. Because you already share so much personal information in all kinds of places. And I wouldn't want Facebook to get this [mental health] data of me as well because that's definitely none of their business."

In addition, students asked for easily understandable terms of use especially regarding data security. They require quick access to help when they need it and at the same time want to know what terms of use they are agreeing to, as the following quote indicates:

> "Data security is of great importance in an app. I think it's also too complex. How many people read the terms and conditions? […] I find it even more important in a virtual health app. If I am depressed and I want to download an app but am afraid that my data will be shared somewhere, then I would not think "Let me read another 70 pages of terms and conditions just to be sure my data doesn't get anywhere!" That could be a burden."

Medical students clearly stated to value privacy and discretion regarding mental health problems and would like it to be considered in the design of an IMI. It was important for them that other persons would not recognize the IMI by simply taking a glance at their phone. To ensure confidentiality different design strategies were suggested such as incorporating IMIs in the menu of a general university app or disguising IMIs as something else:

> "I think it would also be important if, for example, […] you use the app and […] someone sitting next to you looks at your mobile phone, […] for example at your workplace, and then this someone notices and talks to you about the app … maybe that you do the design in such a way that you could also pretend it's something else? Because you don't necessarily want to talk about it with everyone."

> "[Make sure] that it's not immediately evident who uses the app. So, if you really had an app you only installed when you really needed help and everyone at university knew that this app existed, then I would see directly if someone was using this app and I would know immediately about everyone in the room, even though I don't even know the person by name, whether they have a problem or not." Participants suggested a number of measures to ensure the provision of a range of suitable, high-quality IMIs for students. They suggested that an IMI provider, such as the university, should conduct a survey to determine for which mental illness students need an IMI the most, and provide it accordingly. Participants stated that they would be more willing to use an IMI that was previously tested and approved by other students. Many participants asked for a proof of quality, safety and effectiveness (e.g. a certificate) for individual IMIs given either by central institutions of universities (e.g. offices of deans, students representatives), experts (researchers, psychologists), independent or governmental institutions or statutory health insurances. In this sense, students especially asked for an overview and recommendations of IMIs given by their university:

> "What I find very important is the recommendation. There is just a huge range [of apps]. And the university has the resources and knowledge to assess it from a psychological perspective. I would find an overview very valuable. For every aspect [like meditation e.g.] a recommendation "this is what we as experts recommend to you.""

Students highlighted the importance of information and proactive IMI promotion by the university in order to encourage their utilization and reported a lack of knowledge of existing support structures. Participants also reported that low or no costs would increase their intention to use IMIs. Many suggested that the university could provide free program access or that costs could be included in semester fees.

3.2.2. Barriers

Frequent push notifications, reminders to rate an IMI in the app store, advertisements, or technical problems - as the following quote suggests - were perceived as barriers to the use of IMIs:

> "If the app were to crash all the time, then I would just stop using it."

Furthermore, a visually non-appealing design, complex user interfaces and monetary costs were thought to be factors hindering their

use. In this sense, students valued IMIs being intuitive and self-explanatory to use and not being overloaded with visual input or content as one student explained:

> "[It is problematic] if the design is overwhelming […], if I am overstrained by the options of an app […] [and] if I want to get information from an app but don't understand how it is structured and where to get the required information from."

Students reported that they would prefer internet-independent IMIs and would not like to set up an account or to register via mail:

> "I think it's exhausting if you're asked to create a username and password for every nonsense. […]. I find this extremely annoying because I don't want to do anything special with it. I want to use it, see what it has to offer, and not create an account for every hogwash."

Some of the raised concerns comply with the facilitators listed above, such as privacy and data security concerns. Students believed that mental health apps asking for sensitive personal data such as names or access to private photos would not be accepted or used by students with mental health problems. Furthermore, participants perceived lack of anonymity as a barrier to use IMIs. Participants also stated that they would not be willing to use an app that is time-consuming due to time pressure:

> "I would not use an app if it requires a lot of time per day because one doesn't have [time]."

3.3. Tailored solutions for medical students

Participants had different opinions on whether an IMI should offer tailored solutions for medical students. Students in favor of tailored IMIs for suggested that IMIs could build on medical students' knowledge and refer to scientific studies and guidelines. Some students also expressed the wish that IMIs could consider medical school-specific deadlines or tasks and send push notifications about those deadlines or tasks. They also mentioned that an app for medical students would make them feel better addressed and acknowledge medical school as part of students' mental health.

Some students were indecisive. They stated to be willing to try both, a medical student tailored IMI and a general one. They deemed specific tailoring for medical students not mandatorily necessary and depending on the type of IMI. According to them, tailoring would only be beneficial if the IMI considers medical school-specific functions, such as an overview of the curriculum.

However, many students preferred IMIs for all students because IMIs tailored to medical students could marginalize them from other students, while not adding benefit, as the following quote suggests:

> "I think I would prefer an app tailored for students instead for medical students because I don't like to distance myself from other students. And other students have stress as well, some as much as medical students […] and this is why I would prefer a general student app."

Participants stated that there were no differences between them and other student groups in terms of relevant mental health problems such as depression:

> "I mean, what's the difference between depression in a medical student or depression in a sociology student?"

Instead of tailoring IMIs to the needs of medical student, participants suggested that IMIs could be tailored to the needs of students in general. Students argued that, in some cases, tailoring IMIs to specific universities would be sensible (e.g. providing contact details of university-specific counseling services).

Students also suggested that IMIs could be tailored for specific mental health issues or for specific age groups because treatment might differ depending on such factors. Students further expressed a wish for the possibility of tailoring IMIs according to their personal needs and preferences including scheduling and design choices of an app. They suggested this could be achieved through an initial questionnaire that individualized solutions or strategies are based on.

4. Discussion

The aim of the present study was to explore medical students' views on IMIs in order to identify population-specific factors affecting their uptake.

Overall, our findings suggest overall positive attitudes towards IMIS as additional service provided by their university. IMIs were valued especially as a first point of contact due to advantages like quick, low-threshold and flexible access in terms of time and location in contrast to long waiting times for an appointment to start face-to-face psychotherapy. Students also valued IMIs for their potential to bridge waiting times as a first step towards face-to-face-therapy and as a tool for prevention and health promotion. However, medical students preferred face-to-face counseling over a stand-alone IMI for severe mental health issues. The main disadvantages named by students were the lack of overview regarding IMIs on the market, health risks, the fear of a misdiagnosis, lack of personalisation and lack of human qualities. Many students also questioned the effectiveness of IMIs. Technical maintenance, easy and quick handling, flexible use, data safety and confidentiality as well as easily understandable terms of use were believed to facilitate the use of IMIs, whereas technical problems, frequent notifications, or advertisements, required internet access, the need to register, lack of anonymity, high time expenditure and costs were reported to hinder their use. Interestingly, students did not have a preference for IMIs tailored to medical students but rather wanted to use one suitable for students of all disciplines.

Some of the advantages of IMIs our participants mentioned were better and faster access to treatment when compared to face-to-face therapy. These advantages have also been identified as drivers for integrating IMIs in the health care system by stakeholders in previous research (Topooco et al., 2017). However, as stated above, most of our participants, even when acknowledging the advantages of IMIs, considered IMIs inferior to face-to-face therapy. Most students seemed to welcome a combination of online interventions through IMIs with face-to-face therapy, a so-called blended concept. IMIs can either be integrated in such a blended concept or be used as a stand-alone treatment (Ebert et al., 2019a; Baumeister et al., 2017). Interestingly, in a focus group study with therapists, IMIs were seen as a useful complement for face-to-face therapy similarly to our findings in this study (Titzler et al., 2018). Furthermore, a systematic review and meta-analysis found that IMIs show higher effects with increased guidance (Richards and Richardson, 2012). Guidance is considered as an important factor to increase acceptance, therapeutic effects and adherence in IMIs (Baumeister et al., 2014). Introducing a blended approach could therefore be more promising than the sole provision of an unguided IMI.

The quantitative analysis of the questionnaires revealed that most students (73%) were willing to try IMIs yet only a small part (19%) of students had first-hand experience with IMIs for any form of stress management previous to the focus groups and 35% of participants had never used any app that promotes a healthier lifestyle. This gap between willingness to try and interest in IMIs on the one hand, and the lack of knowledge about them on the other hand has also been reported in a previous mixed-methods study among European medical students (Machleid et al., 2020).

However, students also had doubts about the effectiveness of IMIs, especially in case of severe mental illnesses. These findings are consistent with earlier research as the use of IMIs being inappropriate in cases of severe mental illness has been a notion in previous studies (Gun et al.,

2011). Moreover, insecurity regarding the quality of IMIs has been documented among medical staff (Larsen et al., 2019; Torous et al., 2018a). As previously stated, medical students in our study were open to the use of IMIs as a potential complement for face-to-face offers. This indicates that IMIs might be suitable for prevention and early interventions. Hence, a possible solution could be offering IMIs for prevention, early intervention and health promotion and face-to-face counseling for more severe mental illnesses. Overall, one needs to bear in mind that in accepting telemedicine physicians are giving up elements of their role, by leaving parts of their work that were previously delivered in person, to technology (Segar et al., 2013). This could be an additional factor contributing to the moderate acceptance of IMIs among medical students in this study.

Participants also stated to be more willing to try an IMI that is provided free of charge to them. This is in line with previous research stating that the second most common reported barrier for the use of mental health services among Australian medical students are costs (Ryan et al., 2017). Participants considered it crucial that IMIs are easy to use and evidence-based. Interestingly, the same facilitators were identified in an interview study with mental health providers (Schueller et al., 2016). Thus, these factors should be taken into account when designing or providing an IMI for medical students.

Previous research found that users often feel incapable of determining which app is helpful to maintain their mental health and which one might be even harmful as the market is flooded with mental health apps that are not evidence-based (Torous et al., 2018b). These concerns were also expressed by our participants who appeared to be more willing to use an IMI recommended and provided by their university.

Data safety was a major factor that contributed to their willingness to use a specific IMI. The concerns raised by our participants resemble perspectives of similar populations. Studies on the acceptance and usage of eHealth technologies by front line workers and mental health providers, for example, showed that both security and privacy concerns play an important role (Wilkowska and Ziefle, 2012; Schueller et al., 2016).

Medical students suggested that IMIs could be tailored to the needs of students in general or to specific universities, mental illnesses, age groups or personal preferences rather than to medical students. Only few students preferred tailoring an IMI to medical students. This is notable, especially as students indicated not liking the special status that they are often conceded as medical students. They felt that an IMI tailored to medical students would marginalize them even further from other students. To our knowledge, this is the first study exploring medical students' attitudes towards specifically tailored IMIs through a qualitative approach.

4.1. Limitations

Since only students from one university were included in our study, our findings might not be transferable to students from other medical schools. However, most advantages, disadvantages and perceived facilitators and barriers that were mentioned by our study participants were not university-specific and therefore likely apply to students from other medical schools as well. With 26 participants the sample size is relatively small and not representative of the entire student population. Nevertheless, thematic saturation was reached despite the small number of students. The small number of participants per group, while being a limitation, facilitated the discussion and encouraged all students to speak. Most students voiced their opinion on every question. However, there were still some students leading the discussion and holding a higher proportion of speech. As these participants mainly raised off-topic issues like dissatisfaction with the organisation of exams, this was not considered to influence the results. A further limitation of our study might include the fact that only students of an elective workshop on mHealth have participated in the focus groups. It is possible that only those students familiar with or interested in mHealth attended the focus groups. Students with no interest in mHealth could have identified additional disadvantages or barriers not raised by participants in this study. On the other hand, approximately 35% of our participants stated never having used an eHealth app and 81% stated never having used an app for stress management. Furthermore, the fact that participants had basic knowledge on IMIs facilitated focus group discussions. Another factor that might have influenced attitudes of our study participants is the workshop itself as well as JAH and MD teaching the workshop. On the first day of the workshop, we gave an introductory lesson on digital health interventions. Therefore, it is possible that our views on IMIs shaped students' opinions. However, focus groups took place on the following days, where participants mostly worked in groups and were not exposed to further relevant educational content. Moreover, we tried to consider this potential bias by remaining as well-balanced as possible during the focus groups and the coding process. Nevertheless, it is possible that we elicited some bias that we are unaware of.

We chose not to use a clinical sample. We wanted to obtain the opinion of average medical students, because we wanted to explore the potential of IMIs for the broader student population and not only for those students with a relevant mental illness. This could have led to an underrepresentation of medical students currently in need of IMIs. Their opinions, preferences and needs might differ from the students in our sample.

Qualitative content analysis was selected for being a theory-guided and systematic analysis method with the ability to analyse larger quantities of material (Mayring, 2019; Mayring, 2010). However, due to the category-based reduction of the text, individual cases and opinions might lose some meaning (Mayring, 2010). Furthermore, this method reaches its limits analysing deeper structures of a text (Mayring, 2010), which was, however, not aimed for in this study. The fact that the qualitative analysis was not performed by two coders independently might be perceived as a further limitation. However, the coding scheme was reviewed by a second author and only few adaptations were suggested. Furthermore, a third author approved the final coding scheme. Coding by one author was therefore perceived to be sufficient.

4.2. Implications for practice and future research

Our findings imply that IMIs may have some potential for the prevention and therapy of mental illnesses in medical students. IMIs seem especially feasible for bringing the idea of therapy closer to the students, complementing it and making it easier for them to reach out for help. Further research could test an IMI considering the needs and preferences of our study participants that were identified in this study. For instance, the app should be provided by the university and consider data safety. As most participants were not in favor of a tailored solution for medical students, it might be feasible for universities to provide IMIs tailored to all students. As we have argued before, a qualitative approach is necessary in this state of exploration. Quantitative testing with a broader sample of students who did not attend the workshop could help to generate more representative results.

5. Conclusions

This study explored medical students' views on IMIs.

Our results suggest that medical students are willing to try IMIs that promote mental wellbeing, if certain aspects (e.g. data security, free access, quality seals) are addressed. However, in severe cases of mental illness, participants expressed a preference for face-to-face offers. We believe that considering the medical student perspective is a key factor in designing IMIs that will be accepted by them as potential users and future health care providers.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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