Mental Health-Related Digital Use by University Students: A Systematic Review

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Abstract

Introduction: *Mental health problems are common among students at university, representing a major public health concern. The internet and new technologies are widely used by students and represent a significant resource to them for mental health information and support.*

Aim: *The aim of this systematic review is to summarize and critique studies of mental health-related digital use (including purposes, advantages, and barriers) by students worldwide, to support the implementation of future digital mental health interventions targeting university students.*

Methods: *We searched for peer-reviewed articles published between January 2008 and May 2018 by using Pubmed, Google Scholar, PsycINFO, PsycARTICLES, Psychology and Behavioral Sciences Collection, and SocINDEX. Studies were coded by author, year of publication, country, research design, recruitment and sampling, data collection, analysis method, key findings, and mean quality score. Outcomes were synthetized through the textual narrative synthesis method.*

Results: *Of the 1,487 titles and abstracts screened, 24 articles were critically reviewed. Sample sizes ranged from 19 to 6,034 participants. The two key findings were that students worldwide have a high need for mental health information and are prepared to use digital tools for their mental health and well-being. However, they are currently struggling to discern trustworthy information online and are expressing a desire for reliable devices handling their sensitive data.*

Conclusions: *Through the description of patterns in university students' mental health-related digital use, this review outlines important features for potential web- and mobile-based interventions for promoting mental health and preventing mental illness at the university.*

Keywords: *e-health, m-health, telepsychiatry, education, consumer health information, health information on the web, knowledge management, university students, e-mental health, telemedicine*

Introduction

The mental health of students at university is of growing concern, with prevalence rates for students' mental health problems (i.e., mood and anxiety disorders, addictive behaviors, full-blown mental health disorders) increasing in recent years.[1] A multitude of social and academic stressors may trigger mental health problems in students, such as the developmentally challenging transition to adulthood, the pressure to succeed, and competition with peers.[2] As a result of stigmatizing attitudes toward mental health problems, young people, and especially boys, tend to avoid face-to-face consultations and try to manage their situation alone.[3]

The internet and web- and mobile-based technologies have opened up new opportunities to improve individuals' mental health. The use of online information and communication technologies to deliver mental health information and support (e-mental health)[4] is an expanding field encompassing mental well-being promotion, prevention of mental illnesses, and treatment of mental health problems. e-Mental health can include, but is not limited to, instant messaging and video-based counseling services (also known as telehealth or telepsychiatry); consumer information portals ranging from Wikipedia to government-endorsed health websites: online support groups, chat rooms, forums, and social networks; mobile phone applications; online assessment or diagnostic tools; blogs and podcasts; therapeutic gaming programs; and virtual reality systems.[5]

It has been reported that e-mental health is very appealing to young people and especially students, who represent one of the largest consumers of digital devices.[6] The production of

informative websites and digital applications for mental health has skyrocketed in the past decade[7] and first results of the effectiveness of these devices among youth are beginning to be disseminated.[8–10]

Notwithstanding the current widespread availability of these devices and the several emerging studies evaluating their efficacy, there is a lack of consolidated information on e-mental health use among students. The purpose of this study is, thus, to conduct a systematic analysis of the international literature published in the past decade on mental health-related digital use for information and support by university students and to use the results to give direction for the development of digital mental health interventions addressed to this public. The specific aims of this study are: (1) to describe the profiles and needs of students using e-mental health; (2) to identify the advantages and barriers to mental health-related digital use for students.

Methods

SEARCH STRATEGY

We conducted a systematic review in accordance to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (PRISMA).[11] The review was registered on the International Prospective Register of Systematic Reviews (PROSPERO), registration number CRD42018100031. The search was conducted between January and May 2018.

Relevant studies were identified by the following search terms: (1) information seeking, (2) support seeking, (3) university students, (4) mental health, and (5) internet and new technologies. To be included in the review, at least one of the following two terms were required to be included: (1) information seeking and (2) support seeking. To maximize the sensitivity of the search, we combined free-text and Medical Subject Headings (MeSH) terms by using Boolean operators as reported in the *Supplementary Data*. Studies were selected from a search of the following major electronic databases: Pubmed, Google Scholar and PsycINFO, PsycARTICLES, Psychology and Behavioral Sciences Collection, and SocINDEX via EBSCOHost. A supplementary hand search was performed to identify additional relevant publications by reviewing the reference lists of the included articles, and by searching articles from key medical informatics journals.

SELECTION CRITERIA

Only peer-reviewed studies written in English in the decade 2008–2018 were included, regardless of the location of the study. Quantitative, qualitative, and mixed-methods studies, systematic reviews, meta-analysis, randomized controlled trials, and other experimental studies were included only if they reported survey data on mental health-related digital use by university students aged 18–30 years.

DATA EXTRACTION AND QUALITY ASSESSMENT

Records identified in the literature search were evaluated in a three-step approach. First, all identified titles and abstracts were screened for eligibility by three public health students (J.B., T.C., and J.S.) supervised by one researcher (I.M.). Second, potentially relevant articles were retrieved and full-text articles were read independently by the students and the researcher who was in charge of extracting all data. Third, a final list of publications for full-text review was established and validated by a second researcher (A.H.). Articles considered relevant were independently reviewed in full-text by the two researchers (I.M. and A.H.) in conjunction with selection criteria. Any discrepancies were reviewed by a third researcher (C.T.) and finally resolved through consensus. Quality appraisal was conducted by two researchers (I.M. and A.H.) using a scoring sheet based on the National Institutes of Health Quality Assessment Tool for Observational Cohort and Cross-Sectional Studies[12] and the Critical Appraisal Skills Program quality assessment tool.[13] The maximum quality score was 10. Scores were classified as poor (<4), fair (4–8), or good (>8). Final scores were the mean of the two scores attributed by each research independently. For scores <4, the third researcher (C.T.) was asked to arbitrate the final score. Lastly, articles were excluded if study quality was rated as poor. Data were sorted in categories, including author, year of publication, country, research design, recruitment and sampling, data collection, analysis method, key findings, and mean quality score.

Results

The search yielded a total of 1,487 articles, with 27 articles meeting the criteria for inclusion in the final review. Methodological quality assessment led to the exclusion of another three articles[14–16] that were rated as poor (quality score of 3.5). As a result, 24 articles were included. *Figure 1* shows a flowchart of the study selection process.

Table 1 outlines the characteristics of the 24 studies included in the review presented in chronological order: 18 quantitative studies, 4 qualitative studies, 1 mixed-methods study, and 1 systematic review. The majority of the studies ($n = 20$) were conducted in English-speaking countries. A European multi-center study (France, Ireland, Italy and Spain)[17] was also included. The remaining three studies were conducted in Norway,[18] Spain,[19] and Malaysia.[20] In total, 22,024 participants took part in the selected studies, with individual sample sizes varying from 19[21] to 6,034 participants.[22] Response rate

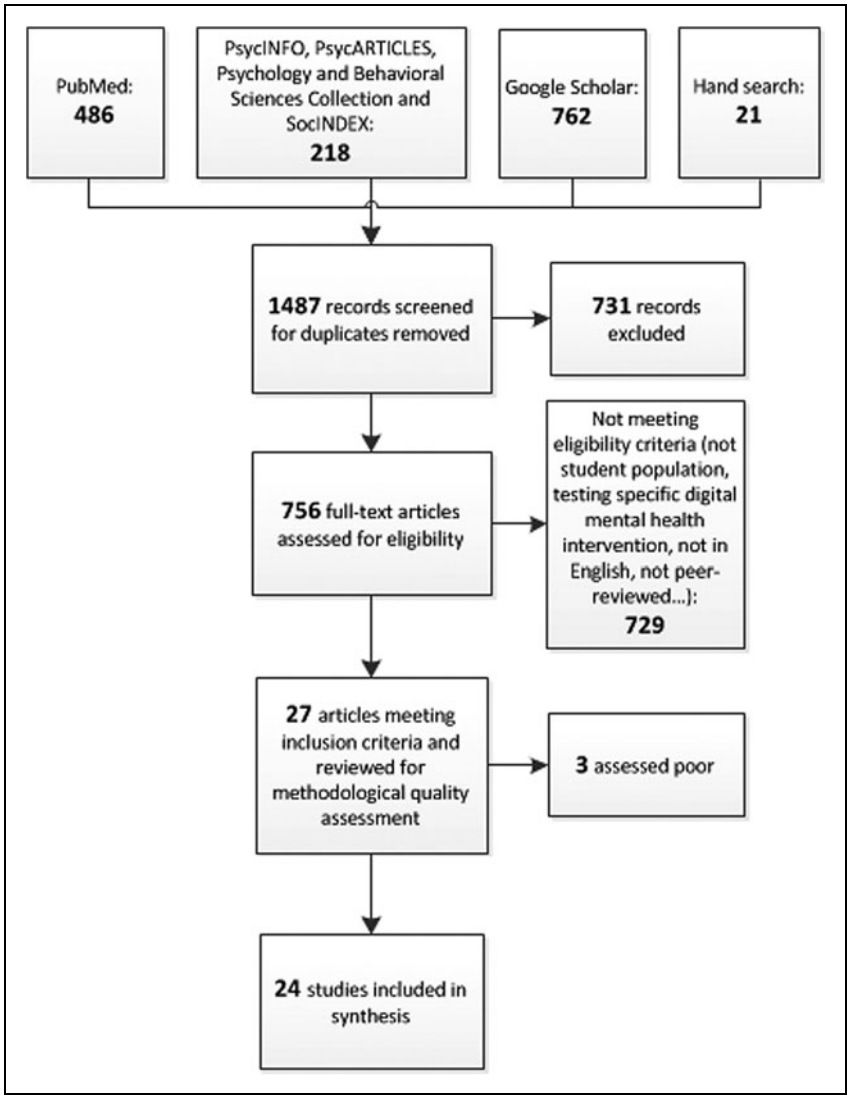

Fig. 1. Flow diagram of literature search according to PRISMA. PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

was provided only by two studies and was, respectively, 58.3%[18] and 10%.[23] Sample size was calculated only in one study.[24] All studies included mixed gender with female students making up the largest groups, representing from 52.6%[21,25] to 77.6%[26] of the sample, excluding three studies.[17,27,28] Finally, three studies reported results on specific ethnic groups: Asian American[28,29] and Latino.[30]

STUDENTS' MENTAL HEALTH PROFILES AND NEEDS

All articles reported that the university period, in whatever country, is characterized by a high prevalence of mental health problems, ranging from mild (e.g., academic stress, loneliness, and sadness) to severe troubles (e.g., depression, anxiety). However, university students do not seek treatment for several reasons, including stigma,[31,32] cost and time constraints,[21,22] lack of familiarity or contact with the mental health system,[28] or lack of mental health literacy.[33]

We identified two main typologies of students being mostly likely to use e-mental health: students curious or concerned about their symptoms and willing to acquire psychological skills and self-diagnosis competencies through online resources,[17,24,25,29,32,34–36] and students suffering from a diagnosed mental health disorder and willing to monitor their psychological status or to access care.[18,22,27,31] All other students not using e-mental health reported that they had no need to look for either mental health information or support online.[18,23,32]

Mental health-related digital use was associated with the presence of mental health problems in some studies,[18,26,31,37] but not in others[17,24,29] providing mixing results. Findings on the association between gender and e-mental health use were also unclear: gender differences were little for some authors,[29,38] but strong for others.[17,36]

PURPOSES OF MENTAL HEALTH-RELATED DIGITAL USE

We divided the purposes of mental health-related digital use into two themes: information seeking (including information on symptoms, definition of disorders, patients' and caregivers' stories, description of treatments or therapies etc.) and support seeking (including self-help interventions, peer-to-peer activities, screening tools, educational programs, online therapies delivered by professionals etc.). This coding followed the framework suggested by Park and Kwon.[39] One study investigated students' mental health-related digital use for information seeking, 13 for support seeking, and 10 for both.

Prevalence of use of e-mental health for information seeking ranged from 11.8%[34] to 92.4%[18] with, on average, one student out of three having looked for mental health-related information online at least once in his(her) life. Most searched topics were depression, stress, anxiety and general information on mental health problems, and illnesses that students themselves or their family or friends experienced.[17,24,25,32] Sources of information were text-based search engines, Facebook and other social media, informational sites, and forums.[17,24]

Table 1. Summary of Studies and Their Findings on the Use of e-Mental Health by University Students (Studies: *N*=24)

AUTHOR (YEAR OF PUBLICATION), COUNTRY	RESEARCH DESIGN	RESEARCH AIM	RECRUITMENT AND SAMPLING	DATA COLLECTION, ANALYSIS METHOD	KEY FINDINGS	MEAN QUALITY SCORE
Lintvedt et al. (2008), Norway[18]	Quantitative Descriptive Cross-sectional	To investigate students' need for a web-based cognitive-behavior therapy intervention for preventing depression.	367 (263 female) students from all years and fields; no particular mental health problems; mean age 23.10 years (SD 5.7). Random recruitment during lectures.	Paper survey ANOVA, linear regression, correlations	Information seeking: 92.4% had searched for mental health information online.	5.5
Harris et al. (2009), Australia[37]	Quantitative Descriptive Cross-sectional	To assess variables in relation to online help seeking for suicidal ideation, and to compare with traditional face-to-face sources.	64 (48 female) students from all years and fields; no particular mental health problems; mean age 23.34 years (SD 6.46). Voluntary participation (course credits and small incentives in return).	Online survey (including CES-D 10; GHSQ; MSPSS; PF-SOC) Means, SD, correlations, multiple regression	Support seeking: 37.5% indicated likelihood of using help-sites. 23.4% were willing to use online forums. Suppressive style was associated with going online for help. Depressive symptoms were not associated with going online for help.	4.5
Horgan and Sweeney (2010), Ireland[32]	Quantitative Descriptive Cross-sectional	To elicit the views of university students on using the internet for mental health information and support.	922 (552 female) students from all years and fields of study excluding Nursing and Midwifery students; no particular mental health problems; 18–24 years. Random recruitment from students e-mail list.	Online survey Descriptive statistics	Information seeking: 30.8% had searched for mental health information online, mostly on depression. 6.1% believed the information would be unreliable; and 1.9% would prefer to discuss mental health issues with a qualified person. Support seeking: 68% would use the internet for support. 79.4% would prefer face-to-face support.	8
Ryan et al. (2010), Australia[26]	Quantitative Descriptive Cross-sectional	To explore the potential role of an online intervention for promoting well-being in university students.	254 (197 female) from all years and two nonspecified fields; no particular mental health problems; mean age 23.74 (SD 8.16). Random recruitment through an e-mail invitation.	Online survey (including GHSQ; K10) Descriptive statistics, ANOVA	Support seeking: 47% were either quite likely or very likely to use an online program. Higher psychological distress was associated with higher use of an online program.	5.5

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Table 1. Summary of Studies and Their Findings on the Use of e-Mental Health by University Students (Studies: *N*=24) *continued*

AUTHOR (YEAR OF PUBLICATION), COUNTRY	RESEARCH DESIGN	RESEARCH AIM	RECRUITMENT AND SAMPLING	DATA COLLECTION, ANALYSIS METHOD	KEY FINDINGS	MEAN QUALITY SCORE
Feng and Campbell (2011), Australia[24]	Quantitative Descriptive Cross-sectional	To determine personality types as predictors of knowledge and utilization of e-mental health resources; identify subject usage rates of specific e-mental health resources; and identify views on the efficacy of these resources.	176 (119 females); first year Health Science students; reporting mild psychoticism, high extraversion, and evenly distributed neuroticism; mean age 19.34 (SD 1.75). Voluntary participation (course credits in return) through advertisements and short verbal notifications in class.	Online survey (including EPQ-R) Descriptive statistics, correlations	Information seeking: The three most preferred online resources were text-based search engines, informational sites, and Facebook or Myspace profiles. 44% reported that they had used the internet to learn about personal feelings of anxiety, sadness, or confusion. Support seeking: 42% used text-based search engines for the purpose of coping with feelings, whereas 26% used informational sites and 22% used Facebook or Myspace profiles. For 59%, online resources that they had used "didn't make things better or worse." Use of e-mental health and extraversion and neuroticism were not associated.	6.5
Ruzek et al. (2011), USA[28]	Quantitative Descriptive Cross-sectional	To explore the methods that Asian American college students prefer when seeking help for psychological concerns.	584 (291 females) Asian American students; no particular mental health problems; no information about age, field, or year of study. Voluntary participation (course credits and small incentives in return) after contact via e-mail.	Online survey (including ARSMA-II; AVS-R; EAVSAA-R; DASS-42) Regression analyses	Support seeking: Classes on mental health topics were the first help seeking choice, followed by counseling at the Student Health Services, and accessing online website links.	4
Egan et al. (2013), USA[38]	Qualitative Descriptive	To determine students' views of mental health references seen in their peers' Facebook profiles.	34 (74% female) undergraduate students from all field of study; no particular mental health problems; aged 18–23 years. Voluntary participation (small incentives in return), convenience sample.	Focus groups Thematic analysis	Support seeking: Mental health status updates were believed to be calls for help. No gender differences in the severity of mental health status updates. Willingness to act on concerns tends to parallel offline relationships.	7

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Table 1. Summary of Studies and Their Findings on the Use of e-Mental Health by University Students (Studies: *N*=24) *continued*

AUTHOR (YEAR OF PUBLICATION), COUNTRY	RESEARCH DESIGN	RESEARCH AIM	RECRUITMENT AND SAMPLING	DATA COLLECTION, ANALYSIS METHOD	KEY FINDINGS	MEAN QUALITY SCORE
McKinley and Ruppel (2014), USA[36,a]	Quantitative Descriptive Cross-sectional	To explore how perceived threat and self-efficacy predicted college students' use and perceptions of online mental health resources.	443 (297 females) undergraduate students from all fields of study; no particular mental health problems; mean age 19.97 (SD 2.69). Voluntary participation (course credit in return).	Survey—not specified whether online or paper (including MHI-5; 10-item General Self-Efficacy Scale) Descriptive statistics, logistic regressions	Information seeking: 40.9% had previously visited some internet website to get information about a mental or emotional problem. Age, gender, and overall mental health significantly predicted visit to any internet website for mental health information. Perceived vulnerability independently predicted previous online searches. Support seeking: Perceived vulnerability independently predicted joining of online support groups. Self-efficacy was significantly associated with perceptions of online services, predicting greater perceived usefulness, and trust in online support groups. Greater perceived mental health severity was negatively associated with joining an online support group.	6.5
Farrer et al. (2015), Australia[25,b]	Qualitative Descriptive	To obtain input on potential functions and features of a university-specific virtual clinic for mental health.	19 (10 females) students from all fields of study; no particular mental health problems; aged 19–24 years. Voluntary participation after e-mail invitations and a snowball sampling technique.	Focus groups Thematic analysis	Information seeking: Strong need for mental health information, especially about general well-being, symptoms of mental disorders, how to help friends, and issues related to university students (homesickness and study stress). Support seeking: Virtual clinic was favorably seen as an additional option for the provision of mental health services for consolidating online mental health resources and providing help to students who might fear stigma. Concerns were expressed about the privacy of personal information and access to them. Clear desire for centralized information, access to professionals, and peer-to-peer support.	5.5

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Table 1. Summary of Studies and Their Findings on the Use of e-Mental Health by University Students (Studies: $N=24$) *continued*

AUTHOR (YEAR OF PUBLICATION), COUNTRY	RESEARCH DESIGN	RESEARCH AIM	RECRUITMENT AND SAMPLING	DATA COLLECTION, ANALYSIS METHOD	KEY FINDINGS	MEAN QUALITY SCORE
Ruppel and McKinley (2015), USA[33,a]	Quantitative Descriptive Cross-sectional	To examine how social anxiety and social support were related to college students' use and perceptions of online mental health resources.	443 (297 females) undergraduate students; moderate mental health, social support, and social anxiety problems; mean age 19.97 (SD 2.69). Voluntary participation (course credit in return).	Online survey (including MHI-5; MSPSS) Descriptive statistics, multiple regressions	Support seeking: Participants with higher social support perceived websites and online support groups as more useful. Even if perceived as beneficial, online mental health resources are not used a lot.	5.5
Chan et al. (2016), Australia[21,b]	Qualitative Descriptive	To investigate the attitudes of university students on mental health help seeking on the internet.	19 (10 females) undergraduate students from all years and fields; no particular mental health problems; aged 19–24 years. Voluntary participation after e-mail invitations.	Focus groups Thematic analysis	Information seeking: Desire for centralized information and resources vs. information overload. Support seeking: Perceived concerns included privacy and confidentiality, difficulty communicating on the internet, and the quality of web-based resources. Potential benefits included anonymity/avoidance of stigma, and accessibility. Mixed views regarding the ability of people with similar mental health issues to interact on the internet.	5.5
Culjak et al. (2016), Australia[34]	Quantitative Longitudinal Prospective (three time points across each university semester, 2 years).	To explore university students' awareness, access, and use of internet self-help websites for depression and related problems.	2,146 (1,242 female) students mostly from information technology, science, and health sciences; no particular mental health problems; 90.61% aged 18–24 years. Voluntary participation after invitation during lectures.	Paper survey (including CES-D 10) Descriptive statistics	Support seeking: 10.30% students had visited a self-help website for emotional health. 21.48% considered the credibility of a self-help website, whereas only 3.03% said they never considered it. Self-help websites were rated as very useful (7.18%) or of little use (16.31%) or harmful (0.70%). User-friendliness, content and interactivity were considered as very important in the design of a self-help website.	8

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Table 1. Summary of Studies and Their Findings on the Use of e-Mental Health by University Students (Studies: *N* = 24) *continued*

AUTHOR (YEAR OF PUBLICATION), COUNTRY	RESEARCH DESIGN	RESEARCH AIM	RECRUITMENT AND SAMPLING	DATA COLLECTION, ANALYSIS METHOD	KEY FINDINGS	MEAN QUALITY SCORE
Karwig and Chambers (2016), Ireland[35]	Mixed methods	To explore students' views of e-mental health and their likelihood of availing of e-mental health.	5,556 (61% female) students from all years and fields of study; no particular mental health problems; 60% aged 18–22 years. +33 (27 female) for the focus groups. Voluntary participation after invitation through links.	Online survey and focus groups Descriptive analyses, thematic analysis	Information seeking: For 54%, mental health information on the internet can be unreliable. For 81%, there can be harmful discussions about mental health in forums, social networking sites, or discussion boards. 85% avail of e-mental health by searching for online information about mental health and 81% by searching for information regarding supports and services. Support seeking: For 84%, using the internet for mental health information and support can allow for anonymity, privacy, and confidentiality. 63% would prefer to talk with someone in person. For 17%, online counseling from a professional can be as effective as face-to-face counseling. 26% would be more likely to use online than face-to-face supports. 30% use a mobile app related to mental health and well-being. Preference for seeking help from a more familiar source of support.	8.5
Lungu and Sun (2016), USA[29]	Quantitative Descriptive Cross-sectional	To evaluate college students' reported willingness to seek help for emotional distress through novel delivery mediums, to play computer games for learning emotional coping skills, and to disclose personal information online.	572 students (368 female), mostly Asian American, freshmen and having undecided majors; no particular mental health problems; mean age 18.78 (SD 1.19). Voluntary participation using advertisements through the psychology subject pool.	Online survey (including MHI) Descriptive statistics, multinomial logistic regressions	Support seeking: 75.3% endorsed willingness to seek help online for emotional problems than from a professional in a face-to-face setting. Facebook was the preferred approach for online help (35%), followed by Instant Messenger (29%) and online self-help apps (22%). 16.7% students would seek online psychotherapy. 35.7% are likely to disclose equal or more information online compared with face-to-face. 87.4% are interested in trying computer games for handling emotional difficulties.	8

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Table 1. Summary of Studies and Their Findings on the Use of e-Mental Health by University Students (Studies: *N*=24) *continued*

AUTHOR (YEAR OF PUBLICATION), COUNTRY	RESEARCH DESIGN	RESEARCH AIM	RECRUITMENT AND SAMPLING	DATA COLLECTION, ANALYSIS METHOD	KEY FINDINGS	MEAN QUALITY SCORE
Montagni et al. (2016), Spain[19,c]	Quantitative Descriptive Cross-sectional	To determine students' general use of the internet and their perceptions and trust in using this medium for mental health information.	687 (339 female) students of all 5 years of Law, Nursing, and Computer Science of the University of Cadiz; no particular mental health problems; 30.7% aged 18–19 years. Random recruitment during lectures.	Paper survey Descriptive statistics	Information seeking: 49.4% had looked for mental health information at least once in their lifetime. Females and Nursing students were more likely to look for mental health information. 30.2% entered key words into a search engine, portal, or internet service provider to look for mental health information. 33.8% never directly visited a health website or portal they already knew. 77.6% did not trust information found online. The top three advantages were: accessibility (68.8%), information availability (50.8%), and confidentiality (44.6%). The top three disadvantages were: unreliable information (74.4%), unknown sources (47.1%), and distrust (45.8%). Support seeking: 12.7% had used forums, online therapy supporting devices, or chat boards with experts in the field of mental health. The use of e-mental health was associated with consultations with mental health professionals.	8

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Table 1. Summary of Studies and Their Findings on the Use of e-Mental Health by University Students (Studies: *N* = 24) *continued*

AUTHOR (YEAR OF PUBLICATION), COUNTRY	RESEARCH DESIGN	RESEARCH AIM	RECRUITMENT AND SAMPLING	DATA COLLECTION, ANALYSIS METHOD	KEY FINDINGS	MEAN QUALITY SCORE
Montagni et al. (2016), France, Ireland, Italy, and Spain[17,c]	Quantitative Descriptive Cross-sectional	To describe the socio-demographic variables associated with the use of the internet for mental health information seeking by European university students.	2,466 (1,395 female) students of all 5 years of Law, Nursing, and Computer Science; no particular mental health problems; mean age 21.6. Random recruitment during lectures.	Paper survey Descriptive statistics	Information seeking: 49.8% looked for mental health information and support on the internet with relevant differences across countries. The most searched topics were "stress" (29.7%), "depression" (24.1%), and "anxiety" (22.8%). 73.0% paid attention to the person and/or institution providing the information. Online mental health information was rated as either "quite so" (48.9%) or "not quite so" (43.0%) credible. Support seeking: 97.8% had never used online therapy, 95.6% had never accessed a specific chat room, and 91.8% had never used a forum or a discussion board. Good mental health status was significantly associated with a lower use of e-mental health.	8
El Morr et al. (2017), Canada[41]	Qualitative Descriptive	To elicit perspectives of students about their online activities and the development of an online mindfulness community.	72 (40 female) undergraduate students from all years and fields; no particular mental health problems; mean age 23.38 (SD 5.82). Voluntary participation after distribution of study flyers.	Focus groups Thematic analysis, descriptive statistics	Support seeking: Virtual community can help overcome stigma and social pressure. It could also reduce the need for costly one-to-one mental health consultations. Content should be flexible and personalized, and a culture of safety should be present and overseen by a moderator.	4
Johnson and Kalkbrenner (2017), USA[40]	Systematic review	To investigate the use of mobile health for communicating wellness-related resources and mental health interventions to college students.	13 articles: 12 at 4-year universities in the United States and 1 at a university in the United Kingdom; students from different disciplines; with or without mental health problems; aged 18–25 years. No specific information on recruitment strategy.	Systematic review PRISMA framework	Information/Support seeking: College students are open and willing to using m-health for accessing wellness-related resources and receiving text messages from educational institutions regarding their well-being.	8

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Table 1. Summary of Studies and Their Findings on the Use of e-Mental Health by University Students (Studies: *N* = 24) *continued*

AUTHOR (YEAR OF PUBLICATION), COUNTRY	RESEARCH DESIGN	RESEARCH AIM	RECRUITMENT AND SAMPLING	DATA COLLECTION, ANALYSIS METHOD	KEY FINDINGS	MEAN QUALITY SCORE
Levin et al. (2017), USA[23]	Quantitative Longitudinal (Baseline survey plus follow-up survey 4 weeks after)	To examine students' intentions and use of online mental health resources as compared with other support options.	389 (70% female) students mostly from psychology; 57% of the sample currently had clinically elevated scores on one or more sets of mental health problems; mean age 20.08 years (SD 3.48). Voluntary participation after invitation through a research platform with students' e-mail addresses.	Online survey (including CCAPS; GHSQ) Descriptive statistics	Support seeking: The highest intention was of informal supports (e.g., parents, friends), whereas the lowest was online self-help. 21% preferred online self-help resources than in-person therapy resources. Barriers for using mobile apps were stigma, credibility, and privacy. Students were not familiar with mental health mobile apps and had low interest in such apps. General intentions to use a mobile app if their therapist or a friend recommended it.	8.5
Berkout et al. (2018), USA[30]	Quantitative Descriptive Cross-sectional	To understand ethnic differences in students related to treatment barriers and willingness to use mobile health technology.	250 (76% female): 47.2% Latino and 32.8% non-Hispanic White; undergraduates; no particular mental health problems; unspecified age. Voluntary participation after invitation via psychology courses in class and e-mail announcements (course credits in return).	Both paper and online surveys (including BAPS; BASH; DASS-21; MAA) Descriptive statistics	Support seeking: No ethnic differences in willingness to use m-health technology, but willingness to use m-health was predicted by greater acculturation. Attitudinal variables and acculturation explained 13.5% of the variability in outcome after distress was controlled for.	4
Dunbar et al. (2018), USA[22]	Quantitative Descriptive Cross-sectional	To assess use of and attitudes toward online mental health services among community college students.	6,034 (54% female) university students; 91% undergraduates from all fields of study; 1,557 met study criteria for mental health treatment need; mean age 23 years. No specific information on recruitment strategy.	Online survey (including K6) Descriptive statistics	Support seeking: Among students with psychological distress, 3% reported online mental health services use. 60% reported willingness to use online services, but real utilization was low.	7
Gorczynski et al. (2018), United Kingdom[27]	Quantitative Descriptive Cross-sectional	To ascertain levels of mental health literacy in students and to examine whether mental health literacy is associated with better mental health outcomes and intentions to seek professional care.	380 (146 female) university students; mostly undergraduates; from all fields of study; 11.6% indicated a diagnosis of a previous mental health problem; mean age 20.94 years (SD 5.29). Voluntary participation after invitation through a web link.	Online survey (including K10; MHLS; WEMWBS) Analyses of variance, correlations	Information seeking: 69.2% declared being confident using the computer or telephone to seek information about mental illness. Support seeking: Online tools and family and friends were preferred sources rather than medical professionals such as general practitioners.	6

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Table 1. Summary of Studies and Their Findings on the Use of e-Mental Health by University Students (Studies: *N*=24) *continued*

AUTHOR (YEAR OF PUBLICATION), COUNTRY	RESEARCH DESIGN	RESEARCH AIM	RECRUITMENT AND SAMPLING	DATA COLLECTION, ANALYSIS METHOD	KEY FINDINGS	MEAN QUALITY SCORE
Levin et al. (2018), USA[31]	Quantitative Descriptive Cross-sectional	To examine whether self-help (books, websites, mobile apps) increases help seeking for mental health problems among college students.	200 (64.5% females) students with mental health problems; from all fields of study; no particular mental health problems; mean age 21.07 (SD 4.74). Recruitment from a larger cross-sectional survey study according to specific inclusion criteria.	Online survey (including CCAPS; SSOSH; SSRPH). Descriptive statistics, correlations, ANOVA	Support seeking: 48% reported intentions to use one or more self-help resources (website, app, and/or book). Students who do not see (or intend to see) a mental health professional are willing to use self-help. Students tended to have higher perceived injunctive norms supporting self-help (i.e., that people approve of self-help), and lower perceived stigma.	5.5
Wong et al. (2018), Malaysia[20]	Quantitative Descriptive Cross-sectional	To examine the potential of mental health online delivery as a way of increasing overall usage of mental health services among students.	409 (239 female) students from all years and fields of study; no particular mental health problems; median age 20 years. Random recruitment during lectures.	Online survey (including FFAS; OCAS) Descriptive statistics	Support seeking: Small, but statistically significant, preference for face-to-face services. 35% preferred online counseling and had a significantly higher likelihood of reporting that they would only utilize online counseling services.	4.5

[a–c]Same study, but different analyses and outcomes.

ARSMA-II, Acculturation Rating Scale for Mexican Americans adapted for Asian Americans; AVS-R, Asian Values Scale Revised; BAPS, Beliefs About Psychological Services; BASH, Brief Acculturation Scale for Hispanics; CCAPS, Counseling Center Assessment of Psychological Symptoms; CES-D 10, Center for Epidemiologic Studies Short Depression Scale; CSS, Cyberchondria Severity Scale; DASS-21 or 42, Depression Anxiety Stress Scales-21 or 42; EAVSAA-R, European American Values Scale for Asian Americans Revised; eHeals, eHealth literacy scale; EPQ-R, Eysenck Personality Questionnaire; FFAS, Face-to-Face Counseling Attitude Scale; GHSQ, General Help-Seeking Questionnaire; K6 or K10, Kessler Psychological Distress Scale 6 or 10 items; MAA, Mobile Application Acceptance; MHI or -5, Mental Health Inventory Scale or five items; MHLC, Multidimensional Health Locus of Control; MHLS, Mental Health Literacy Scale; MSPSS, Multidimensional Scale of Perceived Social Support; OCAS, Online Counseling Attitude Scale; PF-SOC, Problem-Focused Style of Coping; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement; SSOSH, Self-stigma of seeking help (SSOSH); SSRPH, Stigma scale for receiving psychological help; WEMWBS, Warwick-Edinburgh mental well-being scale.

Students reported trusting information provided by official and reliable institutions, including their university.[35]

Seeking mental health-related information on the internet was a relatively common behavior among all students, but especially among those with a need for help with psychological problems.[18,33,35,36]

On average, 1 university student out of 10 had accessed at least once a mental health support platform or mobile application for support seeking.[17,31,34] Facebook was among the most preferred e-mental health resources for support seeking. Specifically, social media were ranked higher than online support groups or discussion boards.[24] Support was sought mainly for managing academic stress, dealing with depression, and limiting anxiety symptoms.[22,23,26,37]

When asked about their intention to use online help, students' opinions differed. Some studies reported that young participants were very open to creative ways of receiving emotional help through digital tools (e.g., serious games, wearable devices, online education programs, Facebook), preferring the digital environment versus face-to-face professional help.[27,29,40] On the contrary, some other studies reported that students presenting a mental health problem would prefer to interact with a person, whether that be a professional, a friend, or a family member.[20,21,26,32,35] Current usage and willingness to use e-mental health were, in fact, associated to perceived vulnerability[36] and the presence of a psychological problem.[17,18,22,34] In other words, the need for help with mental health issues appeared to be a strong predictor of students' intention to use e-mental health for support seeking.[24,35] However, depressive symptoms were not significantly related to online help seeking in one study.[37]

Finally, some students considered e-mental health as an alternative help resource compared with traditional consultations, having the potential to attract students who might not be reached by traditional mental health services.[18,28,34] Some other students perceived e-mental health as a complementary tool to traditional care that cannot replace face-to-face consultations.[17,23,24]

ADVANTAGES OF MENTAL HEALTH-RELATED DIGITAL USE

The main advantages for using the internet for mental health information included the accessibility 24 h a day, the wealth of available online information, the promptness of free-of-charge information, and the fact that it was perceived as a confidential, private, and anonymous source for information.[17,29,35] Students felt free to ask their questions online, without the fear of judgment.[18,32]

All reviewed articles suggested that digital tools are seen as very useful by students since they can counteract two main barriers: lack of time and fear of being stigmatized.[21,23,25,29,34,41]

Consistently across studies, the main advantages for using the internet for mental health support seeking were: accessibility (at all times, from all places), anonymity, privacy, and confidentiality,[29,32] as well as the potential for providing cost-effective mental health interventions via web- or mobile-based platforms, thus addressing financial concerns related to treatment seeking and reducing mental health disparities among minorities.[21,29] Finally, students reported that e-mental health can also promote peer-to-peer support[25,35] favoring the connection of people experiencing similar issues (e.g., via forums).[21]

BARRIERS OF MENTAL HEALTH-RELATED DIGITAL USE

Reasons for not using e-mental health for information seeking included: lack of perceived need or interest, impossibility to identify the author of the information, distrust in the information in comparison with medical advice, and belief that the information would be unreliable.[17,32] Some students were particularly skeptical about the quality and accuracy of information found on mental health forums, social networking sites, or discussion boards.[21] Further, the quantity of information was perceived as overwhelming, scattered, and difficult to navigate for some students.[35]

The greatest barriers for using e-mental health for support seeking were related to students not being interested in using mental health-related digital tools, concerns on privacy of data collected, not enough guidance on which digital tools are credible and effective, the impersonal and distant nature of the digital environment, and concerns about the credibility of developers.[21,23,25,32] Students who reported that they would not use e-mental health for support predominantly cited that they would prefer to interact with a person, whether that be a professional, a friend, or a family member.[24] Finally, concerns were raised about not being understood or difficulties in communicating via text (i.e., accurately portray emotions through writing on the internet) when other nonverbal information is absent.[25]

Discussion

This systematic review consolidates the evidence that e-mental health is largely used and accepted by university students worldwide. Notwithstanding different cultural-specific perceptions of mental health and different organization of national health and prevention systems,[42] e-mental health appeared to be useful for university students from all countries of included studies.

Two key findings emerged: (1) students' high need for online mental health information and (2) their preparedness to use digital tools for psychological support. On the one hand, almost all students participating in reviewed studies declared being curious about mental health information, whether healthy or unhealthy, distressed or not. In other words, students' online mental health information seeking was unrelated to the presence of a diagnosed or suspected mental health problem. On the other hand, students were very interested in web- and mobile-based tools for their mental health and well-being and were confident about their ongoing development. However, according to reviewed studies, e-mental health is currently being used for support seeking almost exclusively by students experiencing a mental health problem or disorder. This result is consistent with studies on other young populations: In general, youth report seeking e-mental health care mostly in case of psychological difficulties or diagnosis of mental illnesses.[43]

These two findings reinforce the idea that the university setting represents a unique system of support services for students, and that digital tools developed by university staff have a potential to promote students' psychological well-being and prevent mental diseases.[44,45]

However, to increase mental health-related digital use for both information and support seeking among university students, some barriers still need to be overcome. These include concerns about credibility of online information and fear of confidentiality breaches, which is in line with the results of a systematic review on health-related internet use by children and adolescents conducted in 2018.[39] Students can feel overwhelmed when using e-mental health for information and support seeking, and, by consequence, demand centralized information and resources. A solution for this may be the combination of traditional mental health care with e-mental health tools, provided they are validated and recommended by therapists. Another barrier highlighted by this review was the potential side effects of untested digital interventions. Students reported the need for guidance on which digital tools are credible and effective to avoid the deterioration of their mental health. The risk of using these untested, inefficient applications was a point of vigilance often mentioned by students, who showed fear that for a sensitive subject such as mental health, uncontrolled or unaccompanied use risks was iatrogenic. Moreover, although online self-help is often assumed to overcome stigma related to seeking treatment, some students reported a common concern that others would see that they are using a mental health-related digital tool.[23] As a matter of fact, issues of anonymity and confidentiality were seen as controversial. Anonymity was considered a benefit when looking for information or at a primary prevention stage, whereas the lack of human contact was unanimously seen as a disadvantage in managing and treating a mental health problem or disease. As a solution, some students suggested to incorporate family and friends into online treatment platforms.[27]

An important final observation is that all studies in this review reported high prevalence of psychological distress among participants, thus reaffirming that university students are a high-risk population for mental health issues. The provision of technology-mediated universal prevention or early intervention measures is highly recommended. Digital options have great potential for reaching nontreatment seekers and as an adjunct for young adults who are already engaging in psychological therapy but need support and social connection outside of the usual therapy hours.

Our work has some limitations. First of all, one of the main difficulties in reviewing the literature regarding e-mental health is the absence of standard comparable survey tools to assess students' use of the internet and new technologies for mental health. Second, as we only included publications in English, language bias could not be ruled out. Third, the studies included were conducted during a time span of 10 years: In the digital age, practices and habits are constantly changing and results may be difficult to compare from 1 year to the other. Fourth, only four studies were conducted in non-English-speaking populations, thus not providing an exhausting picture of university students' mental health-related digital use worldwide. Finally, in all articles, female students were over-represented ($\sim$65%). Therefore, we cannot generalize our results to male students and gender specificities need to be explored further. Considering these limitations, future research should involve larger representative samples with special attention to hard-to-reach groups such as international students and male students. Findings will inform the design and development of attractive digital tools adapted to these specific audiences.

In conclusion, findings of this review have implications for university staff, health care professionals, and policymakers in relation to the design of digital mental health interventions targeting students. There already exist several web- and mobile-based tools for mental health aimed at young people at university.[8,9] Our review suggests that there is a need to not only continue developing tools but also improve existing ones to meet the needs and expectations of university students and optimize engagement. The systematic evaluation of such tools is essential. Taking into account the barriers identified by students, developers of these tools need to ensure that information on data and privacy protection is clearly available to

young people. Mental health-related digital tools should contain good quality content, be interactive, reliable, and user-friendly. Further, mental health websites or interventions should aim at consolidating and presenting resources in a navigable and accessible way. It is then recommended that health professionals and academic staff take leadership roles in producing and disseminating e-mental health tools within the university setting to guarantee the quality, reliability, and trustworthiness of the services provided.

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Supplementary Material

Supplementary Data

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