



e-Mental Health and Health Informatics

Maritta Välimäki and Kirsi Hipp

Learning Objectives

The objectives of this chapter are to enable you to:

- Explore the meaning of concepts related to e-mental health.
- Discuss examples for complex health technology applications and explore how they are currently being used in mental health services.
- Recognize the opportunities, usage, and limitations of health technology applications in mental health services.
- Be motivated to implement and test the health technology application in mental health services as part of the role of an advanced practice mental health nurse.

1 Introduction

Mental health problems are common worldwide; one out of four people experience a mental health disorder at some point in their lifetime [1]. At least 10% of the global population is affected by a mental, neurological, or substance use disorder [2]. The impact of mental health disorders on individuals includes morbidity and mortality, low productivity, social unrest, poverty, inequality, dropout from education, and unemployment [1]. On a societal level, mental disorders contribute to

M. Välimäki (✉)

Xiangya School of Nursing and Xiangya Research Center of Evidence-Based Healthcare, Central South University, Changsha, China

Department of Nursing Science, University of Turku, Turku, Finland
e-mail: mava@utu.fi

K. Hipp

Department of Nursing Science, University of Turku, Turku, Finland
e-mail: kirsi.hipp@utu.fi

economic output losses of US \$2.5–8.5 trillion every year, and these costs are increasing [2].

The key hindrance to the progress of addressing mental illnesses lies in the structural imbalance between an inadequate capacity to extend support and the high growth rate of individuals requiring treatment. Despite research advances and a significant body of evidence, mental health services still lack both availability and quality, especially in low- and middle-income countries. Mental health conditions could be treated at relatively low costs, but effective treatment coverage has remained inadequate. According to the Organisation for Economic Co-operation and Development (OECD) [3], 80% of people with a common mental disorder and half of those with a severe mental disorder do not seek or receive treatment. As good mental health refers to a state of well-being in which an individual realizes their own abilities and is able to cope with the normal stresses of life, work productively, and contribute to society, it is important to make easy-to-use, low-threshold interventions available to everyone globally.

Various applications of mental health technologies have been developed and hold promise in addressing the different dimensions of global mental health challenges. To increase awareness of these technologies and to support the role of Advanced Practice Mental Health Nurses (APMHNs), in this chapter, we describe how different technologies are currently being used to respond to mental health challenges in a wide array of contexts. We first offer definitions for e-mental health. After that, we give some examples of e-mental health applications, as well as their opportunities, usage, limitations, and needs for further development. In addition, the role of the APMHN in supporting the usage of mental health technologies is discussed. This is particularly important because of the significant impact that digital technology currently has on societies, including its impact on the mental health and well-being of individuals, and the growing importance of digital technology in societies and, in particular, health services. The World Bank [4] has stated that a subset of challenges and barriers associated with the prevention and treatment of mental disorders could potentially be reduced through the application of select technologies. Therefore, every APMHN should be interested in this topic and prepare themselves to take a leading role in designing, implementing, and evaluating the impact of health technologies on the well-being of individuals and groups in mental health services.

2 Definitions Related to Health Informatics and e-Mental Health

In the literature, a variety of definitions are used to describe health informatics and e-mental health. Although the content, structure, and connotations may vary, these terms and concepts are closely related and indeed overlap.

Health informatics refers to the applications of computing methodology and technology in healthcare information systems. This concept integrates healthcare sciences, computer sciences, and cognitive sciences in the management of

healthcare information. The Royal College of Nursing in the United Kingdom [5] has specified that health informatics is a science that generates, records, classifies, stores, retrieves, processes, analyzes, and transmits health information.

e-Mental health refers to the information and digital technology that is used to promote, prevent, or assist in mental health recovery [6]. *e-Mental* health applications can also be used to deliver mental health information [7]. These technologies can be delivered via the Internet or other electronic communication technologies [8]. *e-Mental* health can be used as stand-alone self-help interventions, or it can be combined with conventional therapies.

According to the European Commission, *e-health* comprises the following four interrelated categories of applications: (1) clinical information systems; (2) telemedicine and home care, personalized health systems and services for remote patient monitoring, teleconsultation, telecare, telemedicine, and telerradiology; (3) integrated regional/national health information networks, distributed electronic health record systems, and associated services such as e-prescriptions or e-referrals; and (4) secondary usage of nonclinical systems, such as specialized systems for researchers, or support systems such as billing systems [9]. The WHO [10] has classified digital health interventions into those targeting clients, healthcare providers, health systems or resource managers, and data services.

The content of e-mental health applications varies. A systematic rapid review by Lal and Adair [11] identified e-mental health applications addressing four areas of mental health service delivery: (1) information provision; (2) screening, assessment, and monitoring; (3) intervention; and (4) social support. The Mental Health Commission of Canada [7] has listed and defined some examples of e-health technologies such as instant messaging, portal/electronic medical records, smartphones, social media, telehealth, virtual reality, and websites. Other examples of e-health solutions applications used in mental health are listed in Table 1.

Table 1 Examples of e-health solutions

Reference	<i>E-health</i> solutions
Mental Health Commission of Canada, 2014 [12]	Computerized interventions, resources, and applications; telehealth and telemedicine; wearable computing and monitoring; big data; virtual reality; peer support through social media and other technologies; robots; gaming
Mental Health Commission of Canada, 2018 [7]	Self-help tools: smartphone interventions, web-based management interventions, personalized monitoring/support, virtual online community Human-supported interventions: delivery of telemedicine-supported services, automated home messaging devices, access to mental health services
The Royal Australian College of General Practitioners, 2015 [8]	Instant messaging or video-based counselling services (also known as telehealth, telemedicine, or telepsychiatry); consumer information portals; online support groups, forums, and social networks; online assessment or diagnostic tools; blogs and podcasts; therapeutic gaming programs, robotic simulation, and virtual reality systems

3 e-Mental Health Technologies

In this section, we focus on e-mental health and describe some commonly used e-mental health applications. These include websites and portals, social media, apps and smartphones, chatbots, videoconferencing, wearable sensors, and virtual reality and gaming.

3.1 Websites and Portals

Websites and portals are e-mental health technologies that use the Internet to deliver mental health promotion and interventions [13]. Users can access web-based interventions via a computer, a laptop, or any other Internet-enabled device [14]. Web-based mental health interventions can be offered at healthcare organizations, in community settings, at schools, or in healthcare services [15].

Websites and portals have the potential to reduce the gap in mental health services as they can reach people who lack access to traditional mental health services [13]. Web-based interventions have been developed to improve mental health literacy [16], to promote mental health and prevent mental disorders [13, 17], and to provide mental health treatment [14]. Some web-based solutions are designed to manage physical conditions and healthy lifestyle, such as promoting physical activity and smoking cessation [14, 18]. Web-based interventions can be used to deliver treatment without a physical appointment [18]. Other benefits include convenience, privacy, and anonymity [17]. People can seek support without being stigmatized [14, 16]. Web-based interventions are stated to be cost-effective [13]; however, evidence of their economic benefits is still lacking [15].

Websites and portals have targeted the general population [16], young people [13], and university students [17]. They have also been developed specifically for persons experiencing depression [15, 18] and schizophrenia [19]. Other target groups include people with anxiety, social phobia, posttraumatic stress disorder, and binge eating disorder. Healthcare professionals have recommended the use of web-based therapies only for service users with low-risk diagnoses, strong motivation, the ability to use a computer, and a low need for tailored content [20].

Web-based interventions include a wide range of websites, portals, platforms, and apps. Websites can include text and multimedia such as images, animation, music, and videos [17]. There is also a wide variance in the contents of web-based interventions [15]. A review by Brijnath et al. [16] found interventions ranging from linear, statistic websites to highly interactive interventions.

Web-based intervention programs have different theoretical approaches guiding the content and structure of the intervention. Typically, interventions are based on cognitive behavioral therapy (CBT) [13, 17]. Several other approaches have also been reported, such as interpersonal psychotherapy, psychoeducation, and techniques to change health behavior [14].

The content of web-based interventions can be well structured with evidence-based material and can be designed to target the general population or specific

groups. Web-based interventions can also be tailored based on users' needs, and its interactivity can support experiential learning. Välimäki et al. [15] found in their review that interventions for young people included different tasks, like exercises, quizzes, and questionnaires. Web-based interventions can also be "stand-alone," with no human support and independent work by the user, or they can include human interaction with professionals, peer supporters in face-to-face contact, phone discussions, or email support [14]. Other interactive methods supporting interventions are chat rooms and videoconferences in small groups or privately between a mentor and a participant.

In general, users' acceptance of web-based mental health programs is good [13, 17]. Still, some studies have reported high dropout rates and nonadherence among users [13, 14]. The reasons for this vary and may include participants lacking time or interest, psychiatric symptoms such as hallucinations or restlessness, technical problems, or participants perceiving the intervention to be unnecessary or noneffective. To promote adherence among participants, different solutions have been reported such as improving the quality, design, and usability of the interventions. Reminders and alerts or scheduled tracking have also been added to intervention platforms to increase more active participation [14]. Recently, gamification elements have been appearing more often in web-based interventions, meaning that interventions are using the elements of game design. Examples of gamification include playfulness, progress monitoring, increased challenges to maintain interest toward participation, automated feedback, and rewards, badges, or points with which participants can follow their own improvement [14].

Studies have found promising results using web-based mental health interventions for university students [17], adolescents with depressive symptoms [15], and adults with or without mental health problems [16]. However, the current evidence is vague due to their high risk of bias [13, 14, 17]. Reviews have also reported heterogeneity of the interventions and study methods [13], which make it difficult to compare the impact of different study results. In addition, evidence on the long-term effects of these interventions is lacking [15]. Healthcare professionals often have doubts about these types of interventions as they require extra training and organizational support. Healthcare staff also have concerns about confidentiality and security of client data in web-based interventions [17].

3.2 Social Media

Social media is defined as an application used to create and exchange user-generated contents [21]. Typically, social media in western countries refer to platforms such as Facebook, Instagram, Snapchat, and Twitter [22], but blogs, Wikipedia, and content communities such as YouTube are also included in the family of social media [21]. The opportunities for the utilization of social media are many. For example, it has been utilized to screen and identify individuals with mental health problems [21, 22]. For young people, social media is a natural tool to use to search for information about mental health and to seek support [23]. Its benefits are easy to access due to

its nearly unlimited availability. Social media can also reach individuals with whom are otherwise hard to engage [21]. It can easily connect people with the same agenda to offer peer support [22]. Typically, social media interventions have been found to be usable, engaging, and supportive for young people [23]. Various social media applications have been used for persons with symptoms of depression or anxiety [24] and young people with symptoms of depression or psychosis [23].

Based on a systematic review by Ridout and Campbell [23], mental health interventions in social media can be purpose-built games or social networking environments created around mental health issues. Interventions can also be conducted in a closed Facebook group where members can post educational material, hold discussions based on daily prompts, and communicate with each other. For example, social media sites have been developed for individuals with suicidal ideation to provide information, instant chat, and online forums [21]. The interventions can have scheduled discussions, or they can provide working material with which users can proceed at their own pace [23]. Social media can also be used as part of wider interventions [24]. Analysis of social media profiles can provide a way to detect depression [22] and prevent suicide attempts [21]. This is possible as some social media applications can use artificial intelligence to detect depression, provide information on treatment, and monitor the course of treatment [22].

Limitations related to social media applications include ethical and practical concerns [21, 23]. For example, automatic detection of social media profiles raises privacy concerns if persons are not fully aware of these activities. Detection may also involve screening errors, and a person's situation portrayed on social media can be more or less erroneous [22]. Other challenges reported include difficulties in controlling member participation and accurately assessing the emotional state of participants online, as well as the potential for technological problems [21]. Peer support may also lead to sharing misleading or unreliable information [23] or dissemination of hurtful comments [22, 23]. People can also share risky behaviors such as justifications of and means for suicide [21, 22]. Social media interventions have therefore used expert moderators with clinical experience, peer moderators, and auto-detect risk management systems to ensure safe and supportive environments [23]. However, the emotional burden on volunteers needs to be acknowledged [21]. There is also a risk that people use social media platforms instead of offline help, and this can result in marginalization from mainstream society [21]. In addition, the effectiveness of social media interventions should be studied further. For example, a systematic review and meta-analysis conducted in 2016 found numerous published reports, but only two randomized studies published on the effects of social media interventions for people with schizophrenia [24].

3.3 Apps and Smartphones

e-Health apps refer to software applications that provide tools, processes, and communications to support electronic healthcare; they have been used within healthcare systems, but apps today are mainly geared toward smartphone and tablet users. In a

survey conducted in 2015, the WHO identified 15,000 disease-specific mobile health apps, of which 29% focused on mental health [25].

A wide range of apps has already been developed in the field of mental health. In 2013, there were more than 3000 mental health apps for Android, Apple, and Microsoft freely available for download [26]. The development of mHealth apps was originally driven by commercial and economic rather than scientific research motivations. Since then, apps have been found to have the potential to overcome barriers in accessing treatment. Today, smartphone apps hold promises in monitoring health status and running interventions, such as cognitive behavioral therapy for social anxiety [27].

Typically, the development of mHealth apps has targeted either the general public or specific groups. Apps aimed at the general public have focused on issues such as stress, substance use, or quitting smoking [26]. Alyami et al. [27] found in their systematic review that over 95% (36/38) of apps focusing on anxiety targeted the general public, whereas only 2 apps out of 38 were directed at healthcare professionals. Apps are already designed for particular groups, for example, adults with anxiety [27].

The main purpose of apps have thus far been to offer psychoeducation, symptom management, treatment, self-assessment, or supportive resources. Apps can be used for treatment interventions, assessment, monitoring, self-management, social support, or as a platform for receiving positive feedback from a coach or peer supporters. Peers can share their lived experiences in apps that can help others navigate their daily life and solve issues that they may face during the course of illness. Users with depression have found that cognitive behavioral therapy (CBT) apps can play an active role in supporting their mental health. Ideally, apps should be evidence based; incorporate appropriate therapies (e.g., CBT); provide validated mental health information; have utility for real-time engagement, gamification, or reminders; and be easily found and accessed [28].

Typically, media used in apps includes text, audio, a combination of text and audio, or visual elements with text. To be effective, apps should combine evidence-based treatment options and support self-management skills to implement the intervention impact into practice [27]. However, not all apps are based on evidence or are validated treatment elements. It has been found that publicly available mental health apps for depression and anxiety ($n = 27$) often do not include empirically supported treatment and lack evidence-based content [29]. On the other hand, users may have different opinions on the impact of the evidence-based and non-evidence-based features. Qualitative analysis revealed that users may find non-evidence-based techniques incorporated into apps to be helpful if they distract the user from negative thoughts and feelings and help them to function by decreasing the disorder's symptoms in the moment. Still, the quality and content of apps are important as apps classified as non-evidence-based have found to have lower user ratings, and a larger percentage of users found these apps non-beneficial [30].

Various limitations have been found in existing mental health apps. For example, a great number of apps do not report their content sources. Apps are seldom found

to be robustly evidence based [29]. In one study, only 4% of the participants used the apps for more than 15 days, implying that users self-manage their condition in real-world settings in ways that differ from what the intervention developers intended [31]. In addition, the effectiveness of apps is seldom evaluated in published studies [27]. If it is assessed, it is only on a short-term basis. Therefore, based on the current evidence, sustainability of results regarding the effectiveness of these apps cannot yet be determined [26].

3.4 Chatbots

Chatbots are digital tools capable of holding conversation with natural language mimicking humanlike behavior. They can be software programs with artificial intelligence [32] or rule-based chatbots that offer responses to conversations based on predefined rules or decision trees [33].

In the area of mental health, interest in chatbots is growing. Chatbots are used as diagnostic tools for monitoring mental health conditions and treatment methods to relieve psychiatric symptoms, psychological distress, loneliness [32], and stress [33]. Chatbots can also be used to facilitate psychoeducation and self-management, therapies [32–34], and suicide prevention [34]. In addition, chatbots are used to offer social companionship [32].

Chatbots have been used to target persons with any kind of mental health disorder but also persons with specific disorders, such as anxiety, depression, and phobias [32, 33]. Chatbots have been found to be promising in reducing psychological distress and symptoms [34]. The strengths of using chatbots include accessibility, flexibility, and interactivity; they are not dependent on time, place, or duration. They also enable synchronous two-way communication without specific support from experts [32]. In addition, chatbots have been used in community and educational and clinical settings, and they are usable in anonymous social interaction for individuals who are not comfortable seeking help for mental health [33].

Interventions using chatbot platforms vary in their content. They can be accessed through apps, computer programs, or virtual reality [32]. From the 12 studies included in a review by Abd-Alrazaq et al. [33], half of the chatbots were web-based and the other half stand-alone software where users communicated with chatbots using written, spoken, or visual language. A conversational agent can be embodied as a visual character such as a 3D avatar [33, 34]. Physical presence can also be offered using robots [32]. Studies on chatbots have reported user satisfaction [32]. They have been found helpful and easy to use [34]. Responses among chatbots can be structured to reply with pre-scripted statements and to replicate an empathetic response appropriate to the participants' inputted emotion or concern. For example, if the person has endorsed loneliness, the chatbot may reply "I am so sorry to hear that you are feeling lonely."

Despite the substantial development and achievements regarding chatbots, especially in the last decade, some concerns have also been raised. Users have found the content of chatbots repetitive. Voices of chatbots have been of poor quality, and their conversational skills have been limited [32]. On the other hand, contradictory

concerns have also been reported in their lack of empathetic and humanlike behavior [34], and relationships with chatbots have been reported to be shallow or superficial. Other limitations regarding chatbots are related to their usage. Participants have dropped out from chatbot interventions due to technical problems or their mental health status; they have felt a lack of engagement if the intervention period has been long or too demanding [32].

Concerns have also been raised about the possible risks of the use of conversational agents. For example, chatbots may produce inappropriate responses to users' suicidal ideation [32]. However, Vaidyam et al. [34] concluded that the risk of harm was low based on their study results as only 1 out of 759 participants expressed harm in the form of paranoid thoughts. On the other hand, safety issues in chatbot studies are rarely assessed. In addition, a systematic review and meta-analysis focusing on the effectiveness of chatbots found that the evidence on effectiveness is weak and the results were conflicting [33].

3.5 Videoconferencing

Videoconferencing is a technology that allows concurrent sharing of audio and video across geographical distances [35]. Videoconferencing is used to deliver different therapies to service users by connecting service providers and patients in different locations [36]. In the literature, videoconferencing has been included under the concepts of e-therapy [37] and telepsychiatry, which refers to remote provision of healthcare through the use of information technology [38]. In their review, Backhaus et al. [35] found 65 studies that focused on videoconferencing psychotherapy.

Videoconferencing interventions typically follow standard treatment procedure, but the delivery media is based on information technology between the service user and therapist [36]. Videoconferencing psychotherapy can be used for individual therapy as well as family and group therapy [35]. Videoconferencing has also been used to provide mental health services for refugees with a wide range of diagnosable mental health disorders [39]. Some service users may feel more comfortable using videoconferencing in their therapy, as they can participate from the comfort and privacy of their own home [38]. Videoconferencing has been used to conduct therapy for various mental health problems, such as eating disorders, mood disorders, anxiety disorders, addiction issues, and psychophysiological issues [35].

It has been found in the literature that therapeutic relationships and alliances can be achieved in e-therapies [37, 38]. Therapy conducted via videoconferencing has been found to be as effective as in-person therapy [35, 39]. Studies have also provided evidence of long-term effects of videoconferencing for posttraumatic stress disorder (PTSD). Videoconferencing has been found to be more cost-efficient than face-to-face therapies due to the reduced need for travel and accommodation, although the results of the economic analysis cannot be generalized to all settings [38]. Although videoconferencing requires professionals to conduct the therapy, it overcomes other problems such as access barriers like transportation, disabilities, or absence of available services [36]. These are important benefits for groups with

barriers to seeking treatment for their mental health issues, including time constraints; online therapies can be more easily accessible.

Videoconferencing has been found to be a feasible method of providing psychotherapy with high user satisfaction [35]. In contrast to, for example, phone or messaging, videoconferencing is synchronous, and verbal cues are not missed [37]. However, even though both users and providers have been satisfied with videoconferencing, they tend to still prefer face-to-face treatment [39].

3.6 Wearable Sensors

Information about well-being has typically been collected with paper surveys or diaries. However, this information often lacks accuracy and depends on recall ability and willingness to share inner thoughts. Currently, unobtrusive monitoring using wearable technology to assess behavioral (i.e., sensors), physiological (i.e., biosensors), and cognitive/emotional outcomes (i.e., self-reports) is a usable method for providing new information about elusive psychological constructs under measurement.

Wearable technology has been used for diagnostic purposes due to the dynamic nature of mental states and various individual needs, and this technology has the ability to increase a more accurate diagnostic process. The benefits of using modern electronic devices compared to conventional data collection methods are that modern technology allows for the automation of data collection and prompting features, the combination of different features, less effort needed by the users, real-time data, and an increased self-management ability [40]. Wearable technology can also offer continuous monitoring of specific symptoms over time, and it can link the monitoring to specific interventions, predict short-term mood changes, detect the worsening of symptoms, and support continuous communication between clinicians and service users. Further, daily monitoring and symptom self-ratings could provide low-cost assessments, overcome recall bias, and capture the dynamics of human functioning in daily life that cannot be detected with traditional tools [40].

Various assessment approaches and interventions are being carried out with wearable technology. These include, for example, ecological momentary assessment (EMA) and ecological momentary intervention (EMI). The term *ecological* refers to the environment in which the data are collected, while *momentary* refers to the focus of the assessment [40]. Thus, EMA involves data collection on repeated occasions, in real time and in the context of daily life. EMA uses digital technologies with automated delivery and recording of data. These include smartphones for prompting and recording and passive capture of ambulatory physiological data using actigraphy to measure heart rate or sleep patterns [41]. EMA has been used, for example, to assess symptoms, identify and monitor signs of relapse, and monitor treatment effects for people with mood disorders, anxiety, and stress [40]. Fewer studies have been conducted on people with schizophrenia. However, Tahmasian et al. [42] reviewed and found 66 papers related to psychotic disorder. The authors concluded that actigraphy allowed the objective evaluation of sleep habits and circadian rhythm disorders among persons with schizophrenia. It also helped to clarify

and compare sleep and activity patterns in people with severe psychiatric disorders like schizophrenia.

EMI uses repeated prompting to provide treatment to people during their everyday lives in real time and in natural settings. The technology used in EMI includes palmtop computers, mobile phones, smartphone apps, or SMS text messages to deliver statements or instructions for promoting positive behaviors and coping when needed [42]. Other uses are illness self-management through momentary reminders or instructions for promoting medication adherence, management of symptoms and psychosocial impairments, daily living skills, and goal achievement [41].

The use of wearable technology has revealed similar limitations to other technology-oriented, repeated real-life interventions, such as poor rates of adherence among both consumers and practitioners [41]. Other limitations reported include a lack of standardization of the objective features collected, the assessment methodology, and the statistical methods applied [43]. In addition, there is a lack of standard and validated sets of items that have been developed for assessment, which raises the problem of context validity. Moreover, further research should be conducted to improve user compliance and reduce dropout rates.

3.7 Virtual Reality and Gaming

Virtual reality (VR) is a computerized real-time technology that uses graphics, sounds, and other sensory inputs to create an interactive computer-mediated world. Interactivity is enabled by sensors that track the user's position and orientation so that the user can respond to the VR environment. As virtual reality can include gaming features, in this section we discuss gaming and virtual reality together.

Virtual reality can represent social environments that trigger responses, reactions, and emotions in a person's mind that are equivalent to what a given context in the real world would create. Virtual persons (avatars) elicit reactions similar to those evoked in real life. Virtual reality can be categorized into four groups depending on what real and virtual objects are presented in the image: (1) reality, the real world; (2) augmented reality, in which computer-generated data are merged into a real-world image; (3) augmented virtuality, in which real-life data are merged into a computer-generated world; and (4) virtual reality, in which the world has been created entirely by a computer [44].

Typically, VR includes characters or any conversational agent (avatar, a virtual person), which is an image that is programmed to interact with the user. These characters were originally implemented as immersive two-dimensional figures on a flat screen. Currently, virtual reality can be a fully immersive computer-simulated experience consisting of the development of a three-dimensional virtual environment, around an individual through a head-mounted display (HMD). The environment allows the user to look around and move in any direction and to interact with the environment through inputs given via a controller or keyboard or, with the most advanced VR technology, through tactile gloves or body motion detection techniques. To offer the feeling of being immersed in a virtual space, the user's motions

are continuously detected to adjust the 3D environment accordingly. Modern VR kits are designed to be integrated with personal computers, gaming consoles, or smartphones.

Active games are considered game modalities combining technology and physical activity that have been developed for children to improve their mental health. They seem to be suitable for persons in a wide range of ages because they combine a fun use of technology with the benefits of physical exercise and psychological elements [45]. Active games have recently gained an important role in increasing physical activity and promoting physical and mental health [45].

Virtual reality has been used in the treatment of various participant groups, including persons with posttraumatic stress disorder, anxiety, flying phobia, arachnophobia, agoraphobia, and schizophrenia [44]. Brown et al. [14] reviewed the interventions using gamification for common mental disorders and found 82 randomized controlled trials. These interventions were most frequently designed to treat depression ($n = 30$). Virtual reality with gaming elements is also potentially beneficial for elderly people with cognitive deficits in supporting their physical activity at home [45].

Although virtual reality with avatars has become popular with users, only a few studies have been carried out on the topic. A Cochrane review [46] described the effectiveness of avatar therapy compared to treatment as usual and was supported by three short-term studies ($n = 195$). The authors found that the evidence from the trials was not high quality. Although some positive effects were found, the results included considerable risk of bias. The authors were also worried that there was just as much risk of avatar therapy causing problems to people as there was a chance of it being beneficial. Therefore, information is not conclusive and more studies in this area are needed.

Horigome et al. [47] concluded, based on their systematic review, that the quality of virtual reality studies is not high. This technology might be suitable for persons with anxiety due to the opportunity to tailor specific features based on participants' needs. The dropout rate is also low, and participants can control their reality (e.g., the number of participants in the audience when practicing a speech). In addition, VR can create a real feeling of presence, which is missing in many other technology-based interventions. On the other hand, optimal dose amounts to increase positive results are not clear as structures and content of VR interventions vary. It is also unknown whether VR increases participants' anxiety levels. Therefore, more studies in this area are still needed.

Especially in Asian countries, an effort has been made to understand the prevalence and negative effects of gaming and Internet addictions. The reason might be that the prevalence rates of gaming disorders appear to be higher in Southeast Asia than in other world regions [48]. It has also been found that Internet addiction is associated with increased suicidality, even after adjusting for potential confounding variables including depression. Therefore, family members in Asian countries do not always favor gaming interventions as part of mental health services [49]. To better understand long-term impacts of gaming and Internet use related to mental health, prospective studies are necessary.

4 The Future Developmental Needs

4.1 The Future Developmental Needs of e-Mental Health

Despite the wide variety of target groups using e-mental health, older adults still seem to be underrepresented in the literature. More studies in this area are needed as global healthcare challenge is common especially in aging population. Many e-mental health programs are conducted in high-income Western countries. At the same time, the biggest gap in mental health services is in low- and middle-income countries. Future studies could therefore examine whether the results of previous studies are generalized for different cultures and contexts and establish new e-mental health solutions in these areas.

Current literature on the topic describes the importance of *how* e-mental health technologies are implemented in daily practices. Contrary to general assumption, the use of health technology itself does not automatically make the work of healthcare professionals easier, less time-consuming, safer, less costly, more productive, or more effective. It is therefore very important to understand, first, which treatment processes are to be replaced, changed, or left out due to new technological solutions. By doing this, it might be possible to avoid overwhelming extra workloads due to implementation of new technological solutions without changing old work processes. It is also essential to ensure that the technology does not increase staff's workload and burden.

The literature describes how some of the e-mental health products were originally developed for commercial use. Therefore, the public should be educated on how to identify evidence-based mental health technologies out of all of the non-evidence-based content. Another area that needs to be taken into account when using new e-health technologies is safety. One important future step should be to establish guidance and regulation for conversational agent interventions. It is also important to further discuss the ethical and safe use of different mental health applications and their relationship with clinical mental health services [44]. To address the needs of users, greater collaboration is needed between professionals in computer science, mental health services, and end users.

4.2 The Future Developmental Needs for e-Mental Health Research

Our introduction of e-mental health technology is mostly based on systematic reviews, and the amount of research knowledge in this area is enormous. Although the number of research results related to e-mental health applications are numerous, there is still space for future studies. First, the quality of the current evidence is low, or the results are contradictory, which makes any recommendation of the technology use difficult. Second, the content of the intervention including e-mental technology varies depending on target group, length of the interventions, structure, different components, follow-up times, etc. A variety of these elements make it difficult to combine the results

to show evidence of the effectiveness of each intervention. In addition, if the intervention is very complex and requires wide preparatory training and reorganization of work, it is hard to draw conclusions about which ingredient affected the outcomes. Therefore, researchers should use more time to describe carefully the intervention elements, which might make the comparison of the studies easier.

Third, the use of most e-mental technologies is limited due to low user engagement in developing the interventions. Perhaps, therefore, e-mental health technologies do not fully fulfill users' needs. Even though satisfaction studies have given positive feedback on e-mental technology, neither the participants nor the healthcare staff have been eager to use them in real-life environments. Dropout rates are also high in all of these interventions due to a variety of reasons. More insight should be offered on how interventions are used (or not used) and why. In addition, future studies should ensure healthcare staff's attitudes and competence regarding their use of new technology-based interventions and explore how interventions may best be integrated into routine practice. Although there are a great number of studies focusing on healthcare staff's attitudes and competence regarding their use of information technology, the best methods to support staff's use of e-mental technology has not yet been determined.

4.3 The Future Developmental Needs for the Role of APMHNs

e-Health technology can offer several opportunities for APMHNs to deepen their knowledge and skills about the need for new treatment and educational approaches in their daily practices. Web-based interventions include a wide range of websites, portals, platforms, and apps. At the same time, APMHNs need to have a variety of new skills so that they can offer the best possible clinical and technological support to e-health users. In addition, various therapies, such as cognitive behavioral therapy [13, 17], interpersonal psychotherapy, and psychoeducation, as well as techniques to change health behavior [14], can be offered using technological application. Therefore, APMHNs can widen their expertise in how to flexibly use technological tools in the application of different mental health interventions.

Using new technology-based interventions may also be challenging for advanced nurse practitioners. Communication between patients and nurses has traditionally been conducted face-to-face. Current web-based interventions can include discussions between peer supporters, phone discussions, email support, chat rooms, or videoconferences in small groups. Therefore, APMHNs need to be able to manage different communication methods for supporting and engaging participants in online interventions. As technological interventions may not suit everyone, APMHNs need also be able to recognize those who might benefit from using e-health and those to whom technology use may cause harm (e.g., persons with a gaming disorder). Nurses need new skills to assess accurately the emotional state of participants online, as well as the potential for technological problems. New questions regarding privacy, confidentiality, and nurse responsibilities need to be taken into consideration. Thus, APMHNs should be aware of ethical codes and national legislation related to health technology use in healthcare settings.

The role of the APMHN aims to meet service users' individual and complex mental and physical health needs holistically [50]. This role needs to lead the development of new requirements for the structure and content of university curricula, to ensure that APMHNs have the skills needed to manage in work contexts that are more complex and unpredictable and that require new strategic approaches. By taking these requirements into consideration in the learning objectives, APMHNs can more effectively take responsibility for contributing to professional knowledge and mental health practice in the future. Therefore, every APMHN should be interested in the topic of e-health technology in mental health and prepare themselves to take a leading role in designing, implementing, and evaluating the impact of health technologies on the well-being of individuals and groups in mental health services.

5 Conclusion

We can conclude that e-mental health applications are already widely developed and used for various purposes, target groups, settings, and environments. Definitions of e-mental health technologies vary. Some commonalities between technologies can be found, while some features overlap. Still, the overall purposes of the e-mental health applications are to support health and mental well-being by assessing, monitoring, supporting, offering treatment, and evaluating treatment outcomes. e-mental health technologies have been used for many purposes in various target groups with different ages, backgrounds, environments, and countries. This has developed new challenges and also opportunities for the role of APMHNs in the field of mental health.

Reflective Questions

- Based on your experiences or attitudes, what are the main pros and cons of using e-health technologies in mental health?
- What new knowledge might you need to enable you to facilitate technology-based interventions in mental health services?
- Which factors could support the use of e-mental health in your daily practice?

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