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Asynchronous Technologies in Mental Health Care and Education

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Abstract

Purpose of review Patients, providers, and trainees should understand the current types of asynchronous technologies that can be used to enhance the delivery and accessibility of mental health care. Asynchronous telepsychiatry (ATP) removes the need for real time communication between the clinician and patient, which improves efficiency and enables quality specialty care. ATP can be applied as distinct consultative and supervisory models in *clinician-to-clinician*, *clinician-to-patient*, and *patient-to-mobile health* settings.

Recent findings This review is based on research literature and the authors' clinical and medical training, using experiences with asynchronous telepsychiatry from before, during, and after the COVID-19 pandemic. Our studies demonstrate that ATP provides positive outcomes in the *clinician-to-patient* model with demonstrated feasibility, outcomes and patient satisfaction. One author's medical education experience in the Philippines during COVID-19 highlights the potential to utilize asynchronous technology in areas with limitations to online learning. We emphasize the need to teach media skills literacy around mental health to students, coaches, therapists, and clinicians when advocating for mental well-being. Several studies have demonstrated the feasibility of incorporating asynchronous e-tools such as self-guided multimedia and artificial intelligence for data collection at the *clinician-to-clinician* and *patient-to-mobile health* level. In addition, we offer fresh perspectives on recent trends in asynchronous telehealth in wellness, applying concepts such as "tele-exercise" and "tele-yoga."

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Summary Asynchronous technologies continue to be integrated into mental health care services and research. Future research must ensure that the design and the usability of this technology puts the patient and provider first.

Introduction

Currently, over 28 million people in the USA have mental illnesses that remain untreated. According to the *State of Mental Health in America 2023 Report*, significant barriers include cost of care (42%), lack of resources to go get services (27%), beliefs that patients can handle their mental health without treatment (26%), a lack of time to seek treatment (19%), and finally that health insurance is not paying enough for mental health treatment (17%).

The ratio of US mental health providers [1] to individuals is 1:350. This proportion is exacerbated when considering the actual accessibility of these providers, which includes factors such as insurance acceptance, availability to accept new patients, and cultural and linguistic representation of their serving community. This shortage of mental health practitioners is intensified in rural regions [2], as the majority of practicing US psychiatrists are located in urban areas, as tabulated by the U.S. Bureau of Labor Statistics. Over 50% of counties in the USA lack even a single psychiatrist, further magnifying the problem in underserved areas.

Response to the COVID-19 pandemic

The COVID-19 pandemic accentuated the gaps in mental health services along with the desperate need to shift to virtual methods as infection control became of utmost importance. Social, community, and rehabilitation services for mental health care were limited or stopped altogether. Psychiatric units closed down to transform into emergency COVID-19 units. To address these challenges, mental health services began to rely largely on telehealth to continue care. Mental health services, however, were under-prepared to equip staff with best practices in delivering timely, flexible, and quality telepsychiatry solutions. Online prescriptions also became an integral, yet legally complex service to improve upon [3••]. In response, mental health leaders around the world explored trends [4] and innovative approaches [5•] to reach for accessible, high-quality care for all. Professionals additionally used therapy apps, social media, and messenger platforms to reach out to patients and the public.

The role of technology in mental health care

The 2022 World Mental Health Report by WHO highlights the important role of digital technologies in achieving universal, patient-focused mental health coverage [5•]. These technologies allow patients to access asynchronous telehealth, which allows communication between clinicians and patients without the need for real-time interaction. This differs from synchronous telehealth, which requires coordination of patient and clinician schedules,

ready availability of technology, and adequate staff for support. Advantages of *asynchronous telehealth* include better access to specialty care, improved efficiency for the patient and provider, and reduced cost of care. Disadvantages include limitations in physical exam and direct communication [6–8]. Asynchronous telehealth appears in distinct consultative and supervisory models. Telehealth can be categorized by interaction type: clinician-to-clinician, clinician-to-patient, and patient-to-mobile health technology [9].

The "clinician-to-clinician" model can be seen in medical training, where videoconferencing systems are used for continuing medical education and student clinical evaluation. Reviews have discussed teaching models around teaching anxiety management via telehealth to US clerkship medical students, but the model largely focuses on synchronous aspects of a virtual visit [10]. Research should therefore expand into asynchronous opportunities to enhance the educational experience for both the clinical trainer and the trainee. Clinician-to-clinician telehealth is further described in the section on "Asynchronous technologies in education."

The "clinician-to-patient" and "patient-to-mobile health" models encompass the ways that an individual can interact with various technologies when receiving health care. Clinician-to-patient technologies support the patient-physician relationship while patient-to-mobile health technologies empower the patient in self-management to maintain and personalize their care. Examples within the patient-to-mobile health model allow patients to leverage self-directed multimedia to access resources without the direct need of a professional at hand. Both clinician-to-patient and patient-to-mobile health are further discussed in the section on "Asynchronous technologies in clinical care."

In this review, we reflect on current trends in asynchronous telehealth incorporating our experiences as medical professionals and trainees. We discuss recent use cases of asynchronous technologies from both educational and clinical perspectives, which are relevant to shaping the current and future standards of mental health care and training. We hope that this inspires the ongoing exploration of safe and practical implementation [11] of technologies in psychiatric care.

Asynchronous technologies in education

For the mental health trainee

Training in psychotherapy has already implemented asynchronous digital recordings of sessions, giving trainees the opportunity to improve and update their skillset. This is particularly beneficial to providers practicing in underserved communities, who have historically lacked evidence-based training in selected disorders across the age spectrum [12].

COVID-19 also shifted US psychiatry residency curriculum and training to include virtual options. In a cross-sectional online survey conducted between July and November 2020, 245 US psychiatry program directors were contacted with 22% of them completing the entire survey. Results showed that prior to

the pandemic, 82% reported that didactics were entirely in-person, whereas post-pandemic, 98% reported using real-time online didactics. Only 17% however utilized asynchronous methods of pre-recorded lectures to supplement real-time online lectures [13]. While more research is needed to evaluate the efficacy of virtually-conducted educational settings in medical training, these examples demonstrate a willingness and ability to explore hybrid models of learning. Future studies should focus on understanding best principles for active learning in psychiatric education [14, 15].

An interesting area of research that uses an asynchronous modality to provide clinical information is through social media which continues to be a valuable e-tool for mental health patients and providers [16]. As more mental health professionals engage in participatory medicine [17], the more important it becomes to promote media skills literacy around mental health to trainees [18]. This is crucial as social media utilization is the preferred platform for digital natives, namely medical students and residents [19, 20]. Media-related curricula for mental health issues have already been advocated for in psychiatry residency programs. Suggestions include 3 core domains to incorporate into basic media-related education: (1) effects of media coverage around mental health on public attitudes toward these topics, (2) clinical scenarios related to media that may arise during the practice of psychiatry, and (3) education for psychiatry residents around media participation [18].

For the medical student

COVID-19 accelerated the adoption of blended styles of learning in both developed [21] and developing countries like the Philippines [22•], Somalia [23], and Thailand [24]. As an example, we will highlight the asynchronous use cases of blended learning in the Philippines, based on this author's experience at University of the East Ramon Magsaysay Memorial Medical Center (UERMMMC) College of Medicine in Manila. Philippine medical schools were quick to innovate to prevent suspension of medical education across the country [25]. Despite facing severe challenges such as poor Internet connection, limited access to Internet-enabled devices, and lack of study space at home [22•], schools incorporated both synchronous and asynchronous teaching methods into a new reality of virtual medical training. Asynchronous technologies — such as watching pre-recorded lectures prior to attending synchronous sessions — were considerably used to make up for times when Internet connection and data were severely limited.

Despite the challenge in adopting a model of learning that was different from the traditional classroom-based in person teaching, the use of asynchronous teaching deepened the medical student's learning. Clinician presentations were shifted to an asynchronous model, which allowed synchronous sessions to become a time for clinicians to simulate clinical cases with students for better active learning. Asynchronous resources allowed students to access teaching modules when they could not attend synchronous sessions because of limited Internet connectivity. Students wanted collaborative learning in the online environment, where they could use asynchronous technologies such as e-mail, chat, discussion

boards, and social media to interact with peers. Not only did collaborative learning support their education, it also supported their mental health to be able to continue learning in solidarity with peers, despite it being remote [26].

Asynchronous technologies in clinical care

Psychiatry supports collaborative models of care that promote multidisciplinary teams and the integration of digital technologies. Hybrid care uses both in-person and online methods to treat both individual patients and populations of patients [27, 28]. Although technology-supported models are now the standard of psychiatric care, there is still a need to improve the provider experience [29] when using technology. Despite this, provider attitudes continue to change as patients demand better access to providers and more choices in treatment. Providers in favor of hybrid models cite increased quality of life outside of medicine, including parenting, retirement, and preferring to work nontraditional hours to pursue other interests [12]. Telemedicine continues to improve, augment, and replace shortcomings in traditional in-person only care and counteract cognitive biases [30] such as anchoring, premature closure [31], or reliance on authority [32].

Asynchronous telepsychiatry (ATP) encourages *sustainable* integration of technology in the 3 core components of a traditional doctor-patient interaction: (1) the history and physical exam, (2) assessment and diagnosis, and (3) creation of a treatment plan. ATP, however, has received much less research attention than synchronous telepsychiatry (STP), and apart from some anecdotal reports focused on patient and provider satisfaction from our own studies, there are no other formal studies of patient or provider satisfaction with ATP. We have reported the clinical outcomes of a 2-year randomized controlled clinical trial of STP vs. ATP in primary care performed from 2014 to 2018, which showed positive outcomes for both groups, without major differences in efficacy [33••, 34•, 35, 36, 37•, 38]. We believe that this is the first such study examining the two telepsychiatry modalities from the perspective of both patients and providers. We found that patients expressed overall satisfaction with both STP and ATP, although ATP reported more concerns due to a slower feedback response than after an STP consultation [33••]. Patients have been more satisfied with the delivery of care [28] in addition to the ATP workflow, which allows for more flexible scheduling than STP for both patients and providers [35]. If ATP were to become a regular clinical service, clinician recommendations could go from a 2-week to a 24-h turn-around time [28]. Prior reviews have also consolidated the breadth and potential of asynchronous e-tools such as video games and e-therapy [16, 39].

Asynchronous e-tools for wellness

Evidence persists about the benefits of physical activity on mental health across diverse populations [40]. In the 2021 Worldwide Survey of Fitness Trends, online training has emerged as a top-ranked trend, surging from its

26th position in 2020. Online training leverages digital streaming technology to facilitate the dissemination of individual, group, or instructional exercise programs via the Internet, with the added advantage of being accessible 24/7, in the form of live sessions or pre-recorded modules [41].

Digital and remote physical activity programs with added social support have shown to help address the ongoing mental health needs of cancer survivors during and after the COVID-19 pandemic [42]. Both synchronous and asynchronous models of tele-exercise have been suggested, which have similar processes to synchronous and asynchronous telepsychiatry [43]. Asynchronous tele-exercise enables communication to take place without the need for real-time interaction, utilizing tools such as messaging, e-mail, video recording, and the electronic medical record. When used in conjunction with synchronous tele-exercise, this approach can aid in the control of training load, aiding in proper "prescription of exercise routines." This may help avoid inadequate levels of physical activity or excessive intensities that may result in injury. Existing research has shown that adherence to synchronous tele-exercise is higher compared to asynchronous tele-exercise [43]. Therefore, more research is needed to develop strategies to improve adherence to asynchronous tele-exercise programs.

This author's experience as a Registered Yoga Teacher (RYT-200) advocates for the potential for tele-yoga interventions in mental health care. Yoga practice is already known to be a feasible and well-accepted adjunct to clinical and nonclinical mental health care [44–47]. Yoga can be provided in populations with or without chronic conditions [48]. Studies have shown that yoga can increase psychological resilience in older adults [49–51], in trauma healing [52, 53•] for women's health [54] and Veterans [55, 56], and in individuals with opioid use disorder [57]. For example, Trauma Center Trauma-Sensitive Yoga (TCTSY) has shown to be a viable posttraumatic stress disorder (PTSD) treatment option with earlier symptom improvement, higher retention, and sustained effect over cognitively based psychotherapy (CPT) in Women Veterans with PTSD related to military sexual trauma (MST) [58].

Tele-yoga as an adjunct to in-person yoga continues to gain popularity worldwide [59] due to its convenience and opportunities to practice in a safe and familiar environment [60]. Tele-yoga shows another area that utilizes asynchronous e-tools to promote wider dissemination and adherence to the practice [61]. Studies have highlighted themes on the impact of asynchronous pre-recorded tele-yoga intervention such as increased well-being [46], improved self-compassion during stressful life events [53•], and better stress management [62]. Yoga modules for major depressive disorder [63] and generalized anxiety disorder [64] have taken blended approaches to tele-yoga using pre-recorded yoga sessions to empower individuals to continue their practice outside of guided sessions. One single-blind randomized controlled trial that investigated the feasibility and psychosocial effect of a remote yoga intervention via synchronous (live) sessions and asynchronous (self-guided) videos found that participants in the yoga intervention group had a statistically significant reduction in perceived stress and anxiety compared to the control group. Furthermore, this study facilitated autonomy, encouraged self-regulation, and improved ecological validity as participants could engage in the intervention within an area of their choosing rather than a tightly controlled lab [65].

Asynchronous e-tools for data collection

Digital phenotyping is the continuous monitoring of behavioral and mental states through user data tracking [66]. It provides objective measurements to improve disease classification, especially for trans-diagnostic symptoms. Currently, sensor technologies show positive results in the acute-setting [67] and in short-term situations [68].

A recent mixed methods study determining the feasibility of active and passive data collection in the treatment of depression followed 66 participants undergoing therapy for depression for 7 months. Continuous active (web-based surveys and a smartphone app "THING-it") and passive (wearable devices and smartphone sensors) data collection were taken before and after treatment. The study demonstrated low retention rates, although comparable to retention rates in psychological therapy. Higher baseline anxiety, length of treatment, and intensity of treatment were all associated with higher attrition suggesting that the higher the complexity of disorder, the fewer benefits there may be to long-term remote monitoring [68].

In a recent scoping review on use of sensors in acute detection of anxiety, of the 1087 studies initially identified, only 11 studies were ultimately included in the review with 5 randomized controlled trials (RCT) and 6 pilot studies. The role of the sensors in these studies was to "reduce, regulate, or manage anxiety" with physiologic sensor measures such as heart rate. While 4 of the RCT studies found significant improvements to measure anxiety, 1 actually concluded that sensors may impede efficacy when combined with an online intervention for stress, which was potentially due to technical issues. This review identified that wearable sensors can implement successful in-the-moment stress and anxiety management techniques such as diaphragmatic breathing [69].

Another study suggested that markers such as automated voice analysis, video behavior analysis, and physiological measures that include heart rate variability and electrodermal activity studies could aid in forming differential diagnoses for major depressive episodes. Although comparative studies are lacking, promising results were found in digital markers with physiological measures, such as heart rate variability, which showed significant differences in patients with bipolar depression compared to unipolar depression and more reactivity in patients with comorbid post-traumatic stress disorder in major depressive disorder when being reminded about a psychological trauma [66].

In a systematic review of smartphone-based passive sensing for health and well-being, 3246 citations were screened with 35 articles being included in the final review. The majority of these studies were not interventional, but used smartphone-based passive sensing across multiple domains of health, with the majority of representations falling under mental health and sleep. Examples of sensors used in these studies were accelerometers (most used), GPS, light sensors, and microphones (least used). The review concluded that passive sensing was more accurate and less intrusive compared to self-report measures. Smartphone-based passive sensing can promote minimally disruptive health care [70] in addition to supporting active patient tracking by facilitating or automating difficult tasks such as daily logging. The review highlighted the advantages of smartphones using several sensors that can be used simultaneously, but only if there is sufficient battery power.

In a previous review on automated tools [16], we briefly touched on early iterations of software used to detect dangerous messages, such as suicidal messages. A recent study has successfully stratified a person's level of psychological distress in real time through an examination of their vocal characteristics. This retrospective observational study took short segments of speech from callers to the Australian National Suicide Prevention Helpline and was able to classify groups of speech according to high vs. low psychological distress with high accuracy associating vocal characteristics pertaining to loudness and roughness with higher psychological distress. This modality should therefore be further researched in different ethnic groups who may more commonly present with softer/masked vocal characteristics when in psychological distress [67]. Furthermore, this niche in AI interpretation may be of interest to explore for minority groups with limited English proficiency [71].

Asynchronous e-tools for communication

Communication from providers using artificial intelligence is another compelling area of research. Chatbot-based text health care may offer ways to interweave management into daily life, increase intervention efficacy, and mitigate likelihood of relapse just as was seen in an 8-week intervention using a text-based health care chatbot for the self-management of chronic pain using painSELfMAnagement (SELMA). This was the first randomized controlled trial of a fully automated, unguided text-based conversational agent designed for patients with chronic pain [72]. Chatbots can be integrated into extensively used existing platforms like text SMS, Facebook Messenger, and WhatsApp. Chatbots make it feasible to access large and diverse populations; however, many studies currently are not representative of diverse geographies, cultures, and age groups thus hindering its generalizability [73].

A recent systematic review of chatbots in the promotion of health behavioral change identified 15 studies that demonstrated high efficacy of chatbots in promoting healthy lifestyles, smoking cessation, treatment adherence, and reduction in substance misuse. Although deployment of these chatbots was through typically scalable platforms like Facebook Messenger, it found mixed results on feasibility, acceptability, and usability. Studies set in developing countries were limited in this review, which prompts the need to understand its ability to scale to these areas where platforms such as Facebook Messenger are frequently used [73].

Lastly, one smaller sized formative study offered interesting design approaches to augment behavioral activation therapy through the use of asynchronous remote communities (ARCs). In short, ARCs are technology-mediated groups that use private online platforms to deliver weekly tasks to participants that have shown low burden and high adaptability among their participants. Here, they involved teens

and mental health clinicians in the design process by asking their experience of using the remote intervention for 10 weeks. Clinicians appreciated that chatbots gave teens additional information that they missed or had limited time to discuss during a quick appointment [74]. Numerous conclusions were drawn from this study, but the key was that there was a need for augmented human connection in therapy in addition to established boundaries between teens and clinicians around asynchronous communication. Best practices in establishing boundaries as a mental health provider in a hybrid model of care have been discussed extensively [28].

Conclusion

The potential for asynchronous technology in mental health care remains an active and exciting area of study, with asynchronous approaches clearly increasing substantially over the past decade, but further research is necessary. In this AI-driven world [75], we should not lose sight of the art of medicine [76] that appreciates the human connection between the patient and provider. We must continue to advance artificial intelligence in a way that is mindful of populations such as children, older adults, and patients of color who are more prone to mental health stigma. Digital health solutions in mental health must be created to help individuals identify personally meaningful values and create personalized approaches to combat both mental health stigma and racial and ethnic discrimination [77]. Research and development must focus on establishing practical infrastructures so that the ecosystem of health care providers, collaborating partners, and independent developers can design, provide, and reuse quality services within a reliable and secure environment [78]. Most importantly, the design of digital health software tools must use patient and clinician input regarding the role of technology in the care continuum [37•, 69, 79–81]. Several articles [82, 83] have discussed recent trends in changing attitudes of patients and clinicians in the use of technology for their health. As perspectives shift, we must find ways to provide useful technology-supported solutions for both digital natives and digital immigrants [19]. Technology will continue to play a vital part in the current standard of mental health care, and all stakeholders must understand the ways such technologies integrate into practice.

Author contribution

All authors contributed to this review article. The first draft of the manuscript was written by Pamela Gail D. Lagera, MD, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Declarations

Competing Interests
The authors declare no competing interests.

Human and Animal Rights and Informed Consent
This article does not contain any studies with human or animal subjects performed by any of the authors.

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