PROTECTING PATIENT WELL-BEING IN THE ADOPTION OF ARTIFICIAL INTELLIGENCE TO MENTAL HEALTH CARE

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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CLOSING THE MENTAL HEALTH CARE GAP

In the U.S. today, one in every five adults faces mental illness (Substance Abuse and Mental Health Services Administration, 2020, para. 14). As more people battle with their mental health, the demand for mental health professionals increases accordingly. The U.S. currently lacks enough mental health care providers to meet patient demand, leading to a mental health care gap (Chandrashekar, 2018, p. 4). Without more mental health professionals or an innovative treatment option, the gap continues to grow with each diagnosis of mental illness. To help close the mental health care gap, people facing mental illness need an affordable, accessible way to obtain mental health treatment.

While some Americans cannot easily reach traditional mental health treatment, access to the internet provides those facing mental health issues with an opportunity to use artificial intelligence (AI) as treatment. Luxton (2016) defines artificial intelligence as "machines that are capable of performing tasks that we define as requiring intelligence, such as reasoning, learning, planning, problem-solving, and perception" (p. 2). In the US, 90% of adults have access to the internet, allowing AI to become a widespread entry point to mental health care (Pew Research Center, 2019, para. 2). The internet can provide access to AI through technologies such as mobile mental health apps, digital phenotyping, and chatbots. These artificial intelligence technologies can monitor mental health patients, provide accurate diagnoses, and predict mental health incidents. If AI technology in mental health care becomes mainstream, it may be able to help close the gap between the number of mental health patients and the amount of available mental health care providers (Chandrashekar, 2018, p. 4; Luxton, 2016, p. 15).

While AI has the potential to bring many benefits to mental health care, it could also negatively affect patients. The STS research considers the ethical dilemma caused in adopting

artificial intelligence into mental health care given the possible adverse effects of AI on patients. The STS research then applies the Actor Network Theory (ANT) approach to examine how best to mitigate the negative effects of AI so that recommending the technology for patients becomes an ethical choice for doctors. Actor Network Theory by Law and Callon (1988) presents an approach to consider the "interconnected character of the social and technical" (p. 285). Therefore, the ANT approach grants a greater understanding of how artificial intelligence technology could affect patients' lives. ANT also investigates the way actors create roles to fulfil the needs generated by technology and other actors (Law & Callon, 1988, p. 285). Accordingly, the STS research uses ANT to understand how actors and their relationships might be structured to mitigate potential detrimental effects of bringing AI into mental health treatment.

The STS research must consider the implications of using AI in mental health care because the benefits of the technology indicate its eventual widespread acceptance. Artificial intelligence could improve and expand mental health care treatment, leading to many use cases for the technology, especially via smartphone apps. The technical project demonstrates a smartphone app that seeks to help adolescent patients facing depression better understand their illness through the development of a paired app and web portal. For the technical project, the smartphone application collects patient data and relays it to the web portal. The web portal then uses artificial intelligence to predict patients' depression levels and visualize trends in depression and behavior for patients. The tightly coupled technical and STS projects respectively seek to provide adolescents with insights regarding their mental illness and to examine the consequences of applying artificial intelligence to mental health care.

BENEFITS OF ARTIFICIAL INTELLIGENCE IN MENTAL HEALTH CARE

Numerous applications of artificial intelligence in mental health care already exist. Mobile mental health apps, such as Monsenso, monitor patient data via smartphone and provide predictions regarding patient mental states (Monsenso, 2017, pp. 1-2). Montag, Sinderman, & Baumeister (2020) note that digital phenotyping currently makes use of social media, smartphone, and Internet of Things data to gain insights into a patient's psychological traits (p. 19). D'Alfonso (2020), a digital mental health researcher, pointed out that natural language processing can use "internet technologies such as social media, online forums and instant messaging" to conduct mental health language analysis (p. 113). Additionally, chatbots can act as search assistants or recommendation systems to provide users with "relevant mental health information or therapy content after a basic and brief dialogical interaction" (D'Alfonso, 2020, p. 113).

Applications of artificial intelligence could bring many benefits to health care providers and patients alike. AI has the potential to detect mental health concerns early, making it particularly useful for high-risk groups such as veterans (Fiske, Henningsen, & Buyx, 2019, p. 3). Artificial intelligence could also be used to reach patients who might be hesitant to use traditional mental health treatment. Fiske et al. (2019) explain that AI "might be preferable for some patients, reducing embarrassment when asking for specific information or services or feelings of shame when admitting noncompliance with a treatment plan" (p. 4). Furthermore, some patients may prefer "low-threshold interventions that can be conducted in the privacy of their homes" (Fiske et al., 2019, p. 4). Unlike human health care providers, AI has endless time and patience. With the inclusion of artificial intelligence in mental health treatment, health care

professionals may have more time to devote to severe cases or to take on new patients (Fiske et al., 2019, p. 4).

The expansion of mental health care services via AI provides the opportunity to reach underserved populations. Luxton (2016) points out that "nearly 80 million Americans reside in areas without a sufficient number of mental healthcare practitioners to meet the needs of those communities" (p. 15). Those living in resource-poor settings or remote communities with little access to mental health services may benefit from accessible artificial intelligence treatment (Fiske et al., 2019, p. 4). Knapp and Wong (2020) estimate that the cost of cognitive behavioral therapy for depression and other common mental disorders falls between $1,599 and $46,206 (p. 6). Artificial intelligences services accessed through the internet may provide a more affordable option for those without insurance or those unable to afford traditional mental health treatment (Fiske et al., 2019, p. 4).

Since artificial intelligence requires a wealth of patient data, adopting AI into mental health care will allow patients and doctors access to valuable information about patients. This information could consist of self-monitoring the frequency and duration of patient behaviors or of collecting data through passive sensing on smartphones (Harari et al., 2016, p. 839). Cornet and Holden (2017) define passive sensing as "the capture of data about a person without extra effort on their part" (p. 120). Passive sensing can collect smartphone data about a patient's sleep, exercise, location, calls, texts, and internet connection without disturbing the patient. Collecting such personal patient information will help give doctors a better understanding of their patients. Allen (2020) points out how data from AI allows doctors to "have more information about how their patients are doing than they currently get from seeing patients for 30 min every three to six months" (p. 4). Patients could also have access to their own data, giving them increased

autonomy and understanding of their mental illness. Luxton (2016) explains that, by helping patients and doctors better understand the manifestation of the illness, AI has "the potential to greatly improve health outcomes among care seekers by customizing their care" (p. 16).

COMPLICATIONS BROUGHT BY ARTIFICIAL INTELLIGENCE

Although artificial intelligence can bring numerous benefits to mental health care, society currently lacks proper legal and regulatory structure to guide its adoption. Both academic and popular sources promote using AI in mental health care; however, there remains a scarcity of guidelines on how best to apply AI to mental health treatment (Fiske et al., 2019, p. 4). The current legal and ethical frameworks do not provide regulatory guidance on the subject, and Fiske et al. (2019) fear "that the 'gaps' between application and ethical frameworks would only be addressed once harm had already occurred" (p. 4). When health care professionals bring any new technology into practice, there is potential to unintentionally harm patients in the process (Jacobson, 2004, p. 20). Patients risk further harm in the adoption of AI in mental health treatment if physicians do not have guidelines to follow.

Without proper regulatory structure, adopting AI into mental health treatment brings numerous concerns for patient well-being. Mental health interventions must be designed with ethical considerations in mind, specifically the inclusion of doctors. As Carr (2020) has noted, "scrutiny is needed at all times for AI, and it has been strongly argued that humans should not delegate decision making responsibility to 'machines alone'" (p. 126). Without the guidance of doctors, AI could have detrimental effects on patients. If patients perceive themselves as healthy but receive a substandard mental health assessment from AI, they could understandably feel discouraged (Carr, 2020, p. 126; Frost et al., 2013 p. 137). Additionally, doctors can help

distinguish genuine outcomes detected by AI from those caused by bias in algorithms, saving patients from potential false alarms (Carr, 2020, p. 126).

The collection of patient data for artificial intelligence raises concerns over data rights and privacy. Gooding (2019) explains that digital data "raises the issue of a proliferation of copies, and an inability to delete or remove information" (p. 6). The proper storage and use of patient data are critical to maintaining patient privacy, a pressing ethical complication in the adoption of AI to mental health care. At present, the Health Insurance Portability and Accountability Act of 1996 (HIPAA) requires the security and privacy of patient medical records (U.S. Department of Health & Human Services Office for Civil Rights, n. d., para. 12). However, the lack of current regulations indicate that personal data collected for AI use by non-medical groups are not legally recognized as medical records, even if such data qualify as personal health information (U.S. Department of Health & Human Services, 2021, para. 4). Therefore, data collected by AI companies without doctor involvement are not protected by HIPAA, and such data may be compromised by companies looking to profit from patient data.

Flo Health, the developer of a menstrual and fertility tracking app, provides an example of a company unregulated by HIPAA that exposed personal health information. Earlier this year, Flo Health settled with the Federal Trade Commission for selling user data to other companies, including Facebook (McKinnon, 2021, p. 1). Although Flo Health promised it would not disclose its users' personal details to others, the Federal Trade Commission found that Flo Health's data sharing practices allowed third-party companies like Facebook to access user data for purposes such as advertising (Gupta & Singer, 2021, p. 1). Such misuse of patient data might dissuade potential patients from using AI technology, even if the technology would benefit their mental health. According to Gupta and Singer (2021), "deceptive data mining, misleading privacy

policies and other troubling practices" scare users out of relying on apps that collect personal data (p. 3).

Applications that expose patient information, such as Flo Health, have strong cause to frighten users. When sensitive patient information lands in the wrong hands, patients risk discrimination based on their data. For example, Gooding (2019) describes that patients may decide not to use mental health services "when this information may be sold, for example to insurance companies" (p. 7). Insurance companies could purchase data about consumers, then raise premiums for customers with certain health conditions. This intrusive practice would make health care less accessible to those with prior conditions, and it could be repeated in various fields by companies looking to learn more about customers to justify raising prices. Even if companies themselves do not sell patient data, hackers could launch cyber-attacks to steal patient data from companies and sell the data for their own gain. These examples indicate the need for strict regulations on protecting patient data.

Without proper regulatory structure in HIPAA to safeguard patients, patients must rely on their doctors and the companies producing AI to protect them. Figure 1 to the left displays the current system in which patients provide data to both doctors and AI, yet only doctors are regulated. The current system of AI in mental health care lacks regulations and has the potential to harm patients. This situation leads to the following
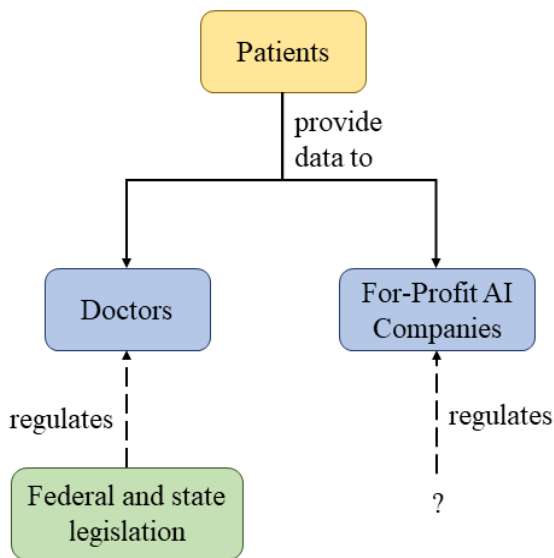

Figure 1: Lack of Artificial Intelligence Regulations in Mental Health Care: This figure depicts the current situation in which regulations hold doctors accountable, but technology companies handling patient data go unregulated. (Bonaquist, 2021).

question: How can we integrate artificial intelligence technology into mental health treatment while ensuring patient well-being?

AN ETHICAL DILEMMA

The benefits and complications of using AI in mental health treatment give rise to an ethical dilemma regarding whether doctors should recommend the technology to patients. Martin and Schinzinger (2009) define ethical dilemmas as "situations in which moral reasons come into conflict, or in which the applications of moral values are unclear, and it is not immediately obvious what should be done" (p. 27). AI in mental health care provides the benefits of expanding treatment and lowering costs, but it also risks exposing sensitive patient data and causing harm through incorrect diagnoses. In this situation, rights ethics, duty ethics, and utilitarianism ethics defend or oppose the use of AI in mental health care for different reasons. Since these three different ethical theories offer varying views on the situation, an ethical dilemma arises for doctors interested in treating patients with AI technology.

Rights ethics emphasize respect for an individual's autonomy (Martin & Schinzinger, 2009, p. 50). Martin and Schinzinger (2009) define autonomy as "having the capacity to govern one's life in accordance with moral duties" (p. 53). One of a doctor's most important rights is the right to help a patient recover. Furthermore, mental health patients have the right to seek treatment for their illness. From a rights ethics perspective, doctors and patients must be able to demonstrate their autonomy and make choices within their rights. Therefore, rights ethics give patients the right to decide to use AI in their mental health treatment given they understand the potential risks. Similarly, rights ethics give doctors the right to recommend AI treatment if they think it will help a patient on the path to recovery.

Duty ethics offer a different perspective and conclusion on the dilemma of using AI in mental health care. Martin and Schinzinger (2009) explain that "duty ethics say that right actions are those required by duties to respect the liberty or autonomy (self-determination) of individuals" (p. 52). A key duty of individuals is to avoid harming any other individual (Martin & Schinzinger, 2009, p. 52). In the case of doctors, this duty is explicitly stated in the Hippocratic Oath as "do no harm" to patients. Following this theory, AI should not be used in mental health care, as doctors cannot prevent the possibility of AI harming patients given the current lack of regulations. Additionally, the duty to avoid harming others reflects one of our society's virtues. The virtue ethics test opposes the use of AI in mental health care because it threatens this important virtue of our society.

Utilitarianism, another ethical theory, offers a different outlook from duty ethics. Utilitarianism provides only one general moral guideline: produce the most good for the most people, giving all people equal consideration (Martin & Schinzinger, 2009, p. 55). Unlike duty ethics, utilitarianism supports the expansion of AI in mental health care because the technology will help produce the most possible good. With the use of AI, all patients with internet access will be able to reach mental health treatment at any hour of the day. Although some people may be harmed by the introduction of AI, 90% of the United States can benefit from accessible mental health treatment via internet access (Pew Research Center, 2019, para. 2). Since far less than 90% of the U.S. population will be harmed through AI in mental health treatment, utilitarianism promotes the adoption of AI into mental health care.

These three ethical theories offer different perspectives on the moral dilemma for different reasons. Unlike rights ethics and utilitarianism, which recommend the use of AI technology in mental health care, duty ethics discourage this use of AI because it could cause

harm to some patients. If prescribing AI did not violate doctors' duty to not harm patients, duty ethics would not advocate against its adoption. To make the adoption of AI ethical from more perspectives, the potential harm caused to others must be diminished. Actor Network Theory can enlighten how to best mitigate harm from mental health patients using AI.

MAPPING ARTIFICIAL INTELLIGENCE IN MENTAL HEALTH CARE

STS concepts can be applied to technical problems to recognize different perspectives, analyze relationships, and understand causes and effects. The STS research applies Actor Network Theory to illuminate the dilemma brought on by adopting artificial intelligence technology into mental health care. ANT enables stepping back from specific people and roles to consider the entire system in its social context. Figure 2 below demonstrates the various social concerns engineers must consider while creating artificial intelligence technology for use as mental health treatment. In this system, understanding the integral implications is crucial to maintaining patient wellbeing.

Data security

Patient privacy

Patient-doctor relationship

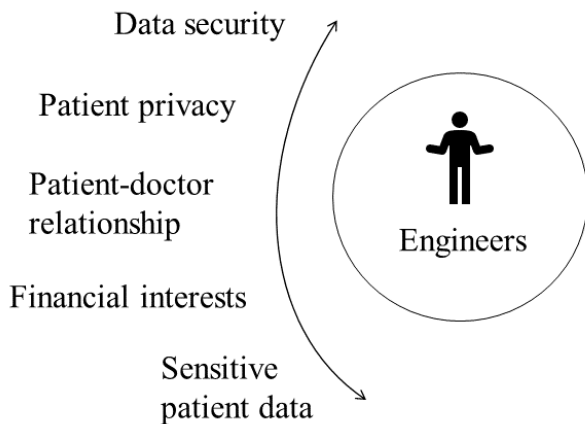Financial interests

Sensitive patient data

Engineers

Figure 2: Artificial Intelligence in Mental Health Care in Context: This figure shows the various social contexts that affect adopting artificial intelligence treatment into mental health care. (Adapted by Bonaquist, 2021 from Carlson 2009).

The first step in applying ANT is to identify the actants in the network. Actants are humans or objects characterized by having agency, meaning that actants can apply or experience parts of the network (Hurtado-de-Mendoza, Cabling, & Sheppard, 2015, p. 327) There are many actants in the network, including artificial intelligence technology, engineers, patients, health

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care providers, data management services, companies that create AI products, and businesses looking to buy personal digital consumer information. Figure 3 below displays the actants and denotes which interact with one another.
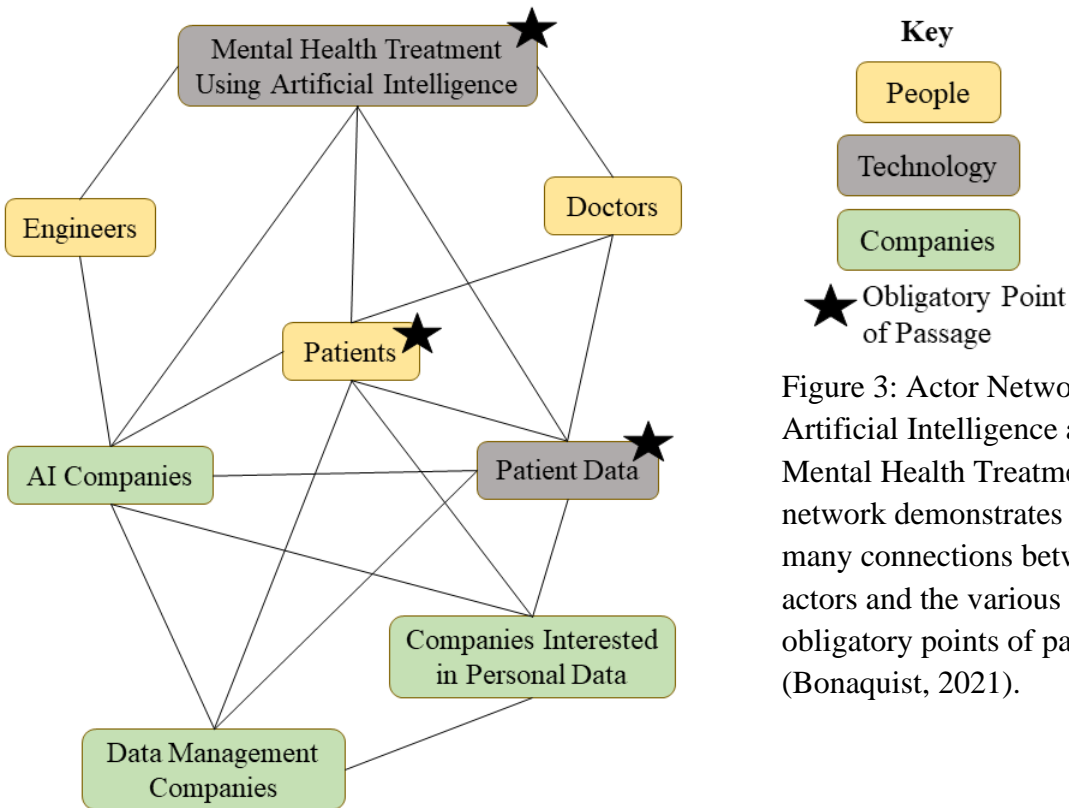

Figure 3: Actor Network for Artificial Intelligence as Mental Health Treatment: This network demonstrates the many connections between actors and the various obligatory points of passage. (Bonaquist, 2021).

These actants have varying relationships with each other. To begin with, companies hire engineers to develop AI for potential patients. These mental health patients rely on doctors for care and advice. Graham et al. (2019) describe how mental health care clinicians are "more hands-on and patient-centered in their clinical practice than most non-psychiatric practitioners, relying more on 'softer' skills, including forming relationships with patients and directly observing patient behaviors and emotions" (p. 2). This sensitive relationship must be considered by engineers developing AI, as shown in Figure 2 on page 10. Doctors connect patients to AI technology by suggesting that patients use the technology in their treatment. A typical use of AI technology is a smartphone application that passively collects data from the patient's smartphone

sensors, then uses the data to identify the behaviors associated with mental health state (Cornet &

Holden, 2017, pp. 121-127; Harari et al., 2016, p. 839).

Patient use of artificial intelligence technology creates a relationship between patients

and AI itself, as well as the company that produced the AI. Patients must rely on both actants to

protect their personal data, and engineers must enable this protection as seen in Figure 2 on page

10. Ideally, patients should have maximum control over their data to assure their privacy is

respected (Harari et al., 2016, p. 850). However, data management services likely control

patients' personal data. Gooding (2019) refers to data management services as "data

marketplaces", suggesting the likelihood of the sale of personal information (p. 7). However,

patients must also rely on the data management service to protect them. Data management

services and AI companies have the option to safeguard patient information or to sell it to

companies that purchase personal digital data. Such companies present the major challenge in the

network. According to Gooding (2019), "this category concerns corporations, companies and

data brokers that monetize the collection and sale of personal data, which could include 'personal

mental health information" (p. 7).

Actors encounter the obligatory point of passage into the network once they interact with

artificial intelligence technology used for mental health treatment, a mental health patient, or

patient data collected for artificial intelligence technology to use. Figure 3 on page 11 designates

these various entrances to the network, showing that different actors enroll in the network

through different entrances. Medical professionals can act as gatekeepers for patients, allowing

them to enter the network by suggesting using AI, or dissuading patients from using the

technology. Doctors can also serve as delegates for patients by projecting a positive or negative

view of AI on the patient. Companies enroll in the network by creating AI, buying personal data, or providing a resource that maintains personal data for an AI company.

Some aspects of the current network are highly irreversible. For example, once patient data is exposed by AI companies it cannot be retrieved and protected. The high degree of irreversibility on this important matter of patient privacy warrants caution for those involved in the network. Additionally, caution should be taken since the inscription, or specific policy, of the AI company actor group is to make money. AI companies that intend to make mental health products should align their inscription with that of doctors seeking to help mental health patients. The introduction of regulations ensures that companies seeking to profit through providing AI services do so in a supervised, ethical manner that better matches their goals with the goals of doctors. These regulations can serve as an agreement for all actors to use when interacting with other actors in the network.

PATIENTS AT RISK

Through the actor network analysis, it is evident that patients using AI in mental health treatment must rely on various actants for protection of their personal data. These actants include the artificial intelligence itself, doctors, data management services, and the company that produced the AI. All these actants must protect the patient, but not all of them are legally responsible to, as seen in Figure 1 on page 7. Doctors must follow legal regulations in their interactions with mental health patients, as HIPAA regulates doctors and prevents them from relaying patient information to others (U.S. Department of Health & Human Services Office for Civil Rights, n. d., para. 12). However, private companies that produce mental health apps are not mandated to follow similar regulations (U.S. Department of Health & Human Services, 2021, para. 4).

To ensure patient safety, companies that produce AI must be held accountable for protecting patients and their data. To protect patients, companies need a safe data management schema. They must also allow users to access their data and delete inaccurate data according to preestablished guidelines agreed upon by both parties. Even if the data collected for AI use are not currently covered by HIPAA, responsible companies will act accordingly with HIPAA to ensure patient safety. The company must enact security measures to protect patient data, and the company must also refrain from providing personal information to businesses interested in purchasing it. Lastly, patients should only use AI technology in treatment with doctor supervision to reduce misdiagnoses and sustain patient safety (Carr, 2020, p. 126).

Adding safety measures may be time consuming and expensive for companies; therefore, companies will likely not respect patient safety until the law requires them to do so. Senator Amy Klobuchar introduced the Protecting Personal Health Data Act, but the bill died on the floor of Congress (Protecting Personal Health Data Act, S. 1842, 116th Congress, 2019). However, some governing bodies have made leeway on protecting patient privacy, demonstrated by California's Consumer Privacy Act and the UK's Data Protection Act. In 2018, the Data Protection Act gave UK citizens the right to know how their personal data was used, stop the collection of that data, and delete their data (Data Protection Act, 2018). Similarly, the California Consumer Privacy Act allows Californians to find out what personal data businesses collect about them and to opt out of the sale of that information (Myrow, 2019, para. 4).

STEPS TO TAKE UNTIL REGULATIONS EXIST

Despite the need for regulations to protect patients immediately, it will take time for legislation to guide the use of AI in mental health treatment. Doctors should not recommend that patients use AI technology until proper regulations exist to ensure patient privacy and safety.

Without these regulations, patient privacy in AI services cannot be protected unless the AI company agrees not to release patient information or not to collect identifiable patient data. Doctors should not encourage the use of any AI application that cannot ensure patient privacy.

The issue of patient safety requires a more complicated solution than patient privacy. For the technology to be safe, users must understand, to a degree, how the AI works and what the AI output means. Schönberger (2019) describes how AI systems appear "opaque" since end users usually could not explain how algorithms classified a particular input (p. 177). AI algorithms constitute a punctuated part of the network as their output has been given a positive spin by companies to deflect from the potential harm they inflict on the patient. Involving doctors in decisions made by AI can prevent harmful AI algorithms from stabilizing into the network.

Another aspect of safety is that users will not receive inaccurate or detrimental information. This presents a difficult task, as Carr (2020) points out that data from monitoring devices such as smartphones "excludes the contextual information needed to assess mental health such as the interpersonal, cultural, social, economic and environmental influences" (p. 126). The collection of data that imperfectly represents a patient could result in unnecessary or incorrect mental health interventions. To help avoid harming patients, regulations should require that patients only use AI technology as treatment in conjunction with their doctors' reviewal. Luxton (2016) expresses that he intends the technology presented in his book on artificial intelligence in mental health care to assist doctors in treating patients, not replace them (p. 18).

UPDATING THE HEALTH INSURANCE PORTABILITY AND ACCOUNTABILITY ACT OF 1996

Before the network stabilizes, changes must be made to HIPAA to ensure personal mental health data collected by AI is protected (Bari & O'Neill, 2019, p. 1). HIPAA was passed

almost 25 years ago, before masses of patient data were collected in a digital manner. Without updated legislation to protect patient privacy, digital mental health applications will not be safe for patients to use, despite the benefits that AI can bring. Bari and O'Neill (2019) point out that various medical apps "collect health data that can be shared for advertising purposes and appended to medical records and other consumer information" (p. 1). To prevent such practices from occurring, several changes can be proposed to update HIPAA, helping protect patient data.

Currently, HIPAA only protects individually identifiable medical information when it is held by certain groups, such as doctors (Gupta & Singer, 2021, p. 2). To assure patient privacy, all individually identifiable medical data should be protected, regardless of who holds it (Bari & O'Neill, 2019, p. 1). Protecting patient data means that individuals have the right to access such data, to edit incorrect data, and to delete their data (Bari & O'Neill, 2019, p. 1). It also means that those holding it cannot use the data without the patient's permission (Bari & O'Neill, 2019, p. 2). HIPAA must clearly define what companies are permitted to use patient data for, and it must require explicit and ongoing consent from patients for each permitted use (Bari & O'Neill, 2019, p. 2). Additionally, HIPAA must explain clearly how patients are able to revoke their consent if they no longer want their data to be used (Bari & O'Neill, 2019, p. 2). Figure 4 to the left shows the ideal situation where patients are protected via regulations once such amendments are made to HIPAA. In this
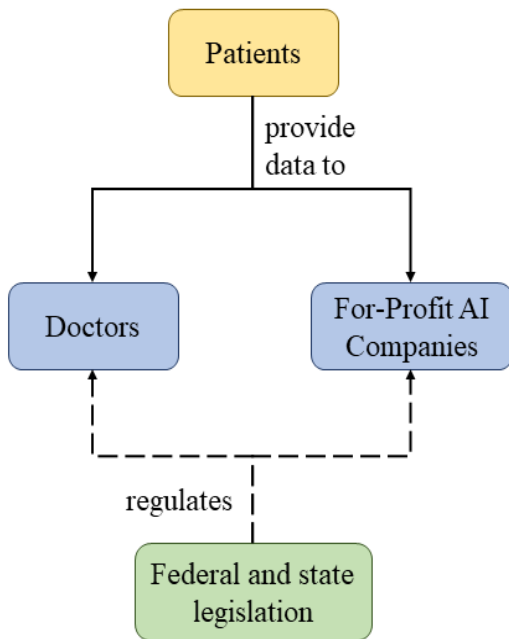

Figure 4: Accountability of All Actors: This figure shows how all actors that are responsible for protecting patient safety and privacy should be subjected to regulation. (Bonaquist, 2021).

case, patients are protected since companies cannot harm them or sell their data, showing an improvement for patient safety compared to Figure 1 on page 7.

SAFE MENTAL HEALTH TREATMENT WITH ARTIFICIAL INTELLIGENCE

With the addition of federal and state regulations, patient privacy and safety can be ensured. Once amendments to HIPAA create more patient privacy regulations, patients may benefit from artificial intelligence technology in mental health treatment without fearing that their data will be exploited. Safety regulations will ensure that patients understand in plain terms how AI technology operates and its basis for recommendations. Additionally, regulations that require a physician to manage patient AI use will establish patient safety on a psychological level. These various regulations will allow mental health patients to benefit from artificial intelligence treatment without sacrificing their safety or privacy.

The STS analysis presented key implications in implementing artificial intelligence technology in mental health treatment. The application of ethical theories to the moral dilemma of bringing AI into mental health care demonstrated that minimizing harm to patients would make doctors' recommendation of AI treatment to patients more ethical. The Actor Network Theory approach revealed methods to reduce harm to patients through updating HIPAA, introducing regulations that demand patients to understand the origin of the technology they use for treatment, and requiring patients' doctors to review patients' AI outcomes.

The insights from the STS research have contributed to recommendations for the technical project. First, the applications built for the technical project were designed to be used in conjunction with a doctor to maximize patient safety. The patient's doctor must recommend that the patient use the technology and must monitor the patient's results while the patient receives treatment. Additionally, the technical project ensured safety of patients' personal data through

secure databases where only patients and their doctors have access to patient data. However, patient data must be transmitted from the patient's smartphone to the web application's server, leaving a small chance for data interference.

In the future, the ethical implications of transmitting user data for artificial intelligence should be considered. Dhar et al. (2020) have explained that "transmission of user data is open to interference and capture, and stored data leaves open the possibility of unauthorized access" (p. 3). When companies transfer and store data, they risk harming patients. However, these tasks are essential in conducting artificial intelligence processes. The role of AI companies in minimizing opportunities for interference with sensitive patient data presents yet another interesting moral dilemma.

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