Title: Cybersecurity: A Critical Priority for Digital Mental Health

Author: Dr Becky Inkster

Affiliations: Department of Psychiatry, Cambridge University, UK; Finance and Economics Programme, The Alan Turing Institute, UK

Corresponding Author Details: becky@beckyinkster.com; Barton Road, Cambridge, United Kingdom, CB3 9BB

Competing Interests Statement: The author has no competing interests to declare.

Acknowledgements: None

Funding Statement: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Abstract

There has been a surge in the supply and demand of digital mental health support services in recent times. There have also been high profile cyberattacks specifically targeting mental health and behavioural services, along with a shift toward targeting vulnerable people directly. Cyberattacks involving personal health data, especially sensitive mental health data, could have devastating consequences to vulnerable people, those close to them, and many other stakeholders. This article calls for the immediate examination of the current state of cybersecurity in the digital mental healthcare industry to collectively identify risks and to protect user and provider vulnerabilities. This article points to the need to build a global cybersecurity culture within digital mental health while also working closely with other industries. The article concludes by making some preliminary recommendations to help support the creation of standards that will enhance the collective preparedness for future responses to cybersecurity threats and attacks.

Keywords: Cybersecurity; mental health; digital mental health; victim support; ransomware support groups; mental health data protection; vulnerabilities; data breach; privacy; security; security by design; vulnerability assessments; protective action; Security awareness; security strategy; parental monitoring; security compliance; cyber-victimisation; risk and attack perceptions; protective cybersecurity practices; protection motivation; cyberpsychology; API-based applications; API security; protected health information; personally identifiable information; trust; zero-trust security architecture; multi-factor authentication; attack surface; cyberhealth.

Introduction

I believe that cybersecurity in digital mental health is being overlooked as a critical priority. In a recent report by the World Economic Forum “Governance Toolkit for Digital Mental Health: Building Trust in Disruptive Technology for Mental Health” the word ‘cybersecurity’ is only mentioned once in 71 pages.¹ There is an immediate need to examine the current state of cybersecurity in digital mental healthcare to identify risks and to protect user and provider vulnerabilities. Data breaches involving mental health information can have widespread impacts, and this article highlights some of the ways in which vulnerable people and those close to them can be affected. It also highlights different ways in which providers and other stakeholders can become vulnerable. It then concludes with some preliminary recommendations for helping to cultivate a global cybersecurity culture within digital mental health, which would expediate the creation of standards to enhance collective preparedness to respond to future cybersecurity threats and attacks.

Personal health data is now the most valuable form of data on the dark web ², and cybersecurity breaches in the healthcare sector reached an all-time high in 2020.³ In January 2021 alone, a total of 878.17 million data records have been compromised worldwide, which is more than in all of 2017. ³ The pandemic has accelerated the global adoption of digital mental health services ⁴, but this growth in supply and demand could increase the exposure of sensitive data to cybersecurity threats and attacks. Several high-profile cyberattacks have already targeted mental health and behavioural services providers. For example, Finland's largest psychotherapy provider, Vastaamo, declared bankruptcy in 2021 after experiencing data breaches in which confidential therapy session notes, as well as other personal information, were stolen. ⁵ After the company refused to pay the ransom, the cyber criminals directly targeted victims, including minors. ⁶ This case is an example of how cybercrime has evolved beyond encrypting data to using blackmail and extortion aimed at already vulnerable people. ⁷ In another recent high-profile case, SalusCare, the largest provider of behavioural healthcare services in Southwest Florida, USA, filed a lawsuit against Amazon to force the release of allegedly stolen mental health data that was exfiltrated to an Amazon Web Services (AWS) storage account. ⁸⁻⁹ According to SalusCare, the stolen data contains extremely personal and sensitive records of patients' psychiatric and addiction counselling and treatment, as well as sensitive financial information. ⁸⁻⁹ In a cyberattack on the Behavioral Health Center, Bangor, Maine, USA, highly confidential psychotherapy records were stolen, which included evaluations, session notes, and records of sex offenders and sexual abuse victims. ¹⁰ This stolen data was listed on the dark web and has allegedly been sold to an unknown party for unknown purposes. ¹⁰

Impact to victims and those close to them

Data breaches can harm victims in multiple ways, including: (a) Mental health harms (e.g., triggering or exacerbating issues such as anxiety, insomnia, trauma, paranoia, substance abuse, or even suicidal behaviours), (b) Interpersonal harms due to disclosures (e.g., when abusers are named in therapy sessions), (c) Financial harms that could exacerbate mental health issues (e.g., leaving victims exposed to fraud and identity theft, or financial hardship if the victim pays a ransom), and (d) Reputational harms, especially for high-profile victims, given that stigma about mental health still exists globally. Loved ones, and those who are close to the victim are also at risk from data breaches (e.g., when their details are listed as emergency contacts).

Targeting minors, who are already at a heightened exploitation risk, could lead to them being manipulated into carrying out illegal hacking activities, becoming ‘money mules’ to perform illegal online financial transactions, or being groomed by online predators to share age-inappropriate and often sexually explicit content; all of which can have implications for young people’s mental health and future outcomes.

Disruptions to services caused by data breaches could negatively impact not only victims of the crime, but all other service users who are no longer able to access the support they need, especially during moments of crisis and times of need (e.g., high suicidal risk, disruptions to medication delivery and/or medication adherence monitoring systems). Such issues raise questions about how individuals should be supported during and after such events. How do breaches and service disruptions impact psychological and other clinical outcomes? For example, one study assessing 3025 hospitals with 14297 unique hospital-year observations found that after a data breach had occurred clinical outcomes worsened with as many as 36 additional deaths per 10,000 heart attacks.¹¹ When victims have experienced identity theft what happens to their socioeconomic status? A data breach can also weaken or even destroy trust between service users and providers, and ill-prepared cybersecurity breach responses could add to the stigma around seeking and receiving mental health treatments (e.g., users might avoid or delay seeking treatment, or omit or give false information during assessments).

Digital mental health providers

Digital mental health providers offer critical and timely support to millions of people around the world (e.g., suicide safety planning), which can make them attractive targets for cybercriminals. When security-by-design is not a priority from the onset, providers risk hurting the people they are trying to help. Digital support can scale readily, but so too can disruption and devastation. There could be many immediate and long-lasting consequences to mental health services providers after being targeted by cyber threats and attacks. Employees and other stakeholders connected with the service could have their

data stolen. This can also be a stressful period for employees who continue to work with the provider while the breach is being investigated, especially if the breach involves an employee misstep (e.g., clicking on a phishing email). From a business perspective, data breaches could lead to serious impacts on revenue (e.g., slow operational recovery after a breach) as well as irreparable reputational damage. Cybercriminals are increasingly targeting small and medium-sized enterprises (SMEs)¹², which includes many digital mental health providers, and this could have a serious impact on their survival¹³, and in extreme cases lead to bankruptcy.⁵ Even security training for employees doesn't guarantee improvements in security awareness at the organizational level or in real-world attack situations.¹⁴ While cybersecurity insurance offers a mechanism to mitigate some risks to providers (e.g., underwriting ransomware payments to cybercriminals), it remains uncertain as to what extent providers will be able to shift cybersecurity risks to insurers in the future. For example, the global insurer, AXA, announced a landmark policy decision to stop reimbursements of ransomware payments in 2021 in France¹⁵, and some governments have started to inform companies that they should not pay ransomware.¹⁶ From a legal and regulatory perspective, digital mental health providers must be aware of any obligations and repercussions related to data breaches. For example, the US Department of Treasury's Office of Foreign Assets Control (OFAC) is warning that businesses could be in violation of USA law if they pay groups that are on the sanctions list.¹⁶ Other potential criminal penalties, such as prosecution, fine or imprisonment, could come from improperly disclosing a data breach (e.g., concealing the security failings). For example, Article 34 of the European General Data Protection Regulation (GDPR) states that data controllers must communicate a data breach to people impacted without undue delay.¹⁷

The pandemic is shifting boundaries for mental health support and expanding and the evolving cyber threat attack surface for cybercriminals

The pandemic has brought a profound shift toward the digital provision of mental health support⁴, albeit with some exceptions (e.g., it was ruled illegal to section someone under the Mental Health Act using remote video consultations in the UK).¹⁸⁻¹⁹ In April 2020, an FDA regulatory change allowed digital mental health providers to bypass certain processes.²⁰ While the FDA still requires that products meet the same level of cybersecurity protections (e.g., undergo and demonstrate software verification, validation and hazard analysis), this has still increased the gap between 'time to market and the time to security' as stated by the World Economic Forum, inferring that digital mental health services providers could be introducing new vulnerabilities faster than they can be secured.

21

The pandemic also increased opportunities for adversaries to find vulnerabilities and infiltrate networks (i.e., 'expanding the attack surface'). This was in part due to the shift towards remote working, increased connectivity, and dependency on digital

infrastructures from possibly unprotected or unknown networks. For example, ransomware attacks have increased by 62% globally, and by 158% in North America.²² This increase in cybercrime can have a serious impact on the mental health of cybersecurity workers. A survey by OneLogin called IAMokay Mental Health Survey polled 250 technology leaders worldwide and found that over three-quarters believed the pandemic has increased workplace stress, 86% reported an increase in workload, and almost a quarter of respondents said they used alcohol, narcotics or prescription medication to manage their stress.²³ Nearly three-quarters of respondents believed their organization cares about their mental health, and nearly half (49%) said their employer has provided access to mental health services.²³

There are many ways that providers can experience cyber threats and attacks (e.g., brute force and distributed denial-of-service (DDoS), credential stuffing, person-in-the-middle etc.) and be made vulnerable in different ways (e.g., via interactions with clients and supplier third party software vulnerabilities).²⁴⁻²⁵ There are also factors such as human error and social engineering that play a role (e.g., sophisticated spear phishing attacks that exploit cognitive biases and target disgruntled or vulnerable staff members to help cybercriminals steal information or use disguises to enter premises).²⁴⁻²⁷ While cybercrime is often driven by financial incentives, ‘hactivist’ groups might have additional motivations, such as causing disruptions to clinical operations for social purposes (e.g., a hacktivist group in the USA had opposing views about how a hospital was managing a patient’s case and targeted the hospital with a DDoS attack²⁸).

Other tactics used by cybercriminals include exploiting web services and Application Programming Interfaces (APIs). APIs define how apps can communicate with other apps and systems, and this form of communication now accounts for more than 83% of all internet traffic.²⁹ Malicious API traffic is growing faster than non-malicious API calls (e.g., Salt Security customer data showed that API calls grew 51% whereas malicious traffic grew 211%³⁰) and it has been predicted that by 2022 API attacks will become the most frequent attack vector for application breaches.³¹ Many high-profile companies have experienced API-related cybersecurity problems (e.g., Peloton Equifax, Instagram, Facebook, Amazon and Paypal), and a report by Salt Security found that 91% of companies had API-related security problems.³² As the pandemic accelerated the use of mobile healthcare apps, this increased the exposure of health data through API vulnerabilities used by mobile health applications. For example, in the largest unveiling of vulnerabilities in telemedicine APIs, a recent report called “All That We Let In” by ethical hacker Alissa Knight and Approov found that all 30 mobile health apps investigated were vulnerable to API attacks, which collectively exposed 23 million mobile health users.³³⁻³⁴ While APIs play a crucial role in supporting health IT interoperability (i.e., allowing multiple data sources to become transferable) and help providers give better care³⁵, much more research is needed, especially as to the security of Fast Healthcare Interoperability

Resources (FHIR) standards and compliant applications, and potential FHIR API vulnerabilities.³⁶⁻³⁸

Recommendations: What are some of the steps that should be taken to remediate and respond to threats and attacks?

All digital mental health providers are vulnerable to cyber threats and attacks. How can we be individually and collectively more responsive and resilient in the face of those attacks so that the consequences are minimised? While improving the security of systems is vital, there are other factors to address, such as creating standards for victim support after breaches, and building an evidence base to evaluate the impact of data breaches on clinical and psychological outcomes. I think these goals will be best achieved by working collaboratively, and I make the following preliminary recommendations:

- 1. Develop a Global Cybersecurity Culture in Digital Mental Health:** Providers must navigate a growing number and increasingly complex system of regulations and rules (e.g., GDPR, the California Consumer Privacy Act, the Cybersecurity Law of the People's Republic of China and many others worldwide), making it harder to keep up with cyber criminals who do not comply with such regulations. Therefore, providers must work together, as they have shown they can do⁴, to make safety a universal and non-competitive issue. The digital mental health community needs to develop cybersecurity governance that ensures that security-by-design is built into digital services from the onset. By creating a global cybersecurity network within digital mental health, we can learn from every breach and improve our responses to future attacks.
- 2. Assess the Current and Future Landscape:** As a global community for digital mental health we need to assess the current state of the cybersecurity landscape (e.g., how have digital mental health security programs been developed to date? What are the common themes of struggle across this industry?). We need to think about assessing future risks (e.g., what are the risks and consequences if a cybercriminal hacks into a VR headset used for mental health and wellbeing support). What new security challenges for digital mental health may arise (e.g., as records are moved to patients to enhance autonomy, as patient payments become more digital etc.)? There has been a drive towards gamifying mental health treatment, but how secure is the information being gathered and stored, especially when a lot of games and apps link with virtual/social media profiles?
- 3. Set Standards for Victim Support (e.g., breach responses and continuity of care procedures):** While many solutions for breach responses exist from technical and

operational perspectives³⁹, we need standards to manage disruptions to care and for implementing victim support services.

4. **Incident Monitoring & Central Repository to Archive Incidents:** Cybersecurity incidents involving mental health information should be recorded, analysed, and shared to help the whole community respond to potential vulnerabilities.
5. **More Research and Better Budgeting: Support for Ethical Hackers, and Studies Evaluating Outcomes of Data Breaches:** Cybercrime is predicted to cost \$6 trillion in 2021.⁴⁰ By 2025, it is predicted that over \$1 trillion dollars will be spent on information security.⁴¹ More digital mental health providers should be running breach and attack simulations⁴⁰⁻⁴¹ performed by ethical hackers and they should be sharing the outcomes of these efforts. We also need to better understand the immediate and long-term risks of cyber-attacks and data breaches on users and investigate the impact of interruptions to service provision on psychological outcomes. Providers must ensure there is an adequate budget for employing or consulting with cybersecurity experts (e.g., having a cybersecurity officer, and/or a cybersecurity expert on their advisory board). There should also be a budget set aside for costs associated with breach responses (e.g., for the costs associated with offering victim support, or compensation) and other aspects.

References

1. <https://www.weforum.org/whitepapers/43c36293-05fa-4101-9abf-a5916a490a58>
2. <https://knightinkmedia.com>
3. <https://www.computerweekly.com/news/252501400/More-data-stolen-in-January-2021-than-in-all-of-2017-says-report>
4. Inkster B, Digital Mental Health Data Insights Group (DMHDIG). “Early Warning Signs of a Mental Health Tsunami: A Coordinated Response to Gather Initial Data Insights From Multiple Digital Services Providers” Front. Digit. Health, 10 February 2021 <https://doi.org/10.3389/fdgth.2020.578902>
5. <https://www.helsinkitimes.fi/finland/finland-news/domestic/18704-hacked-finnish-psychotherapy-service-provider-declared-bankrupt.html>
6. <https://searchsecurity.techtarget.com/news/252496977/Vastaamo-breach-bankruptcy-indicate-troubling-trend>
7. <https://www.f-secure.com/en/about-us/livewebcast/attackers-get-personal>
8. <https://www.infosecurity-magazine.com/news/saluscare-takes-legal-action/>
9. <https://healthitsecurity.com/news/amazon-sued-for-hosting-stolen-health-data-to-compel-its-release>
10. <https://www.databreaches.net/highly-confidential-psychotherapy-records-from-maine-center-listed-on-the-dark-web/>
11. Sung J. Choi, Eric Johnson, Christoph U. Lehmann. “Data breach remediation efforts and their implications for hospital quality” Health Services Research, 10

- September 2019 <https://onlinelibrary.wiley.com/doi/abs/10.1111/1475-6773.13203>
12. <https://www.itpro.co.uk/security/cyber-security/358682/experts-blast-smbs-head-in-the-sand-approach-to-cyber-security>
 13. <https://www.weforum.org/reports/incentivizing-responsible-and-secure-innovation-a-framework-for-entrepreneurs-and-investors>
 14. <https://www.helpnetsecurity.com/2021/05/12/solve-human-risk/>
 15. <https://www.insurancejournal.com/news/international/2021/05/09/613255.htm>
 16. <https://www.darkreading.com/risk/cyber-insurance-firms-start-tapping-out-as-ransomware-continues-to-rise/d/d-id/1341109>
 17. <https://www.wired.co.uk/article/finland-mental-health-data-breach-vastaamo>
 18. <https://www.rlb-law.com/briefings/mental-health-law/court-says-video-assessments-unlawful-2/>
 19. <https://www.theguardian.com/society/2021/jan/30/nhs-drops-virtual-assessments-used-to-section-patients>
 20. <https://www.mobihealthnews.com/news/fda-devs-can-release-digital-products-psychiatric-disorders-without-510k-submission-during>
 21. <https://www.weforum.org/reports/incentivizing-responsible-and-secure-innovation-a-framework-for-entrepreneurs-and-investors>
 22. <https://www.securitymagazine.com/articles/94831-ransomware-soars-with-62-increase-since-2019>
 23. <https://www.infosecurity-magazine.com/news/quarter-cisos-it-selfmedicate/>
 24. <https://www.youtube.com/watch?v=jx22DjKsCT4>
 25. <https://hbr.org/2021/05/is-third-party-software-leaving-you-vulnerable-to-cyberattacks>
 26. <https://www.youtube.com/watch?v=fKP9aIs34wM>
 27. <https://venturebeat.com/2021/05/12/phishing-attacks-exploit-cognitive-biases-research-finds/>
 28. <https://www.healthcareitnews.com/node/529886>
 29. <https://blogs.akamai.com/2020/10/api-discovery-and-profiling-visibility-to-protection.html>
 30. <https://www.csoonline.com/article/3618569/how-api-attacks-work-and-how-to-identify-and-prevent-them.html>
 31. <https://www.gartner.com/en/documents/3956746/api-security-what-you-need-to-do-to-protect-your-apis>
 32. <https://salt.security/api-security-trends>
 33. <https://approov.io/mhealth/hacking/>
 34. <https://techwireasia.com/2021/04/how-api-attacks-are-hamstringing-mobile-healthcare-apps/>
 35. <https://www.healthcareitnews.com/news/what-you-need-know-about-healthcare-apis-and-interoperability>

36. <https://blog.approov.io/standing-outside-the-fhir>
37. <https://blog.approov.io/guest-blog-alissa-knight-on-fhir-walker-authentication-and-authorization-in-fhir-apis>
38. <https://securityboulevard.com/2021/06/guest-blog-alissa-knight-on-playing-with-fhir/>
39. <https://www.csoonline.com/article/3617910/minimizing-damage-from-a-data-breach.html>
40. <https://www.thesslstore.com/blog/breach-and-attack-simulations-how-to-find-the-gaps-in-your-cyber-defenses/>
41. <https://techcrunch.com/2021/05/05/cymulate-nabs-45m-to-test-and-improve-cybersecurity-defenses-via-attack-simulations/>