


# Rethinking technology innovation for mental health: framework for multi-sectoral collaboration

Received: 14 June 2023

Accepted: 8 March 2024

Published online: 3 May 2024

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The impact of technology on mental health has become a core concern for researchers and practitioners from the clinical science, public health and technology sectors. One factor that influences this impact is the large gap between the silos of technologies explicitly designed as mental health support tools and the everyday technologies that inadvertently affect mental health. Here we ground our position on findings from a workshop that brought together over 60 experts and emphasize the importance of a multi-sectoral collaboration across these silos to address the complexities of technology's impact on mental health. Our specific recommendations include a push to align stakeholders, incentives and governance, adopting person-centered and proactive mental health evaluation, and empowering users and clinicians (and their interactions) through mental health and technology literacy. We highlight sector-specific adaptations that can support greater collaborations, toward a future in which users have consistently positive interactions between technology use and their mental health.

Mental health is a complex and multifaceted part of the human experience that is influenced by socio-ecological, environmental and biopsychosocial factors<sup>1</sup>. In recent years, technology has become increasingly intertwined with daily life. It is shaping experiences and affecting mental health in both positive ways and negative ways. The pervasive use of information and communication technologies (ICTs) has introduced digital stress<sup>2–4</sup>. The constant communication load has contributed to substantial mental health challenges, including depression, anxiety and burnout<sup>5–8</sup>. In young adults and adolescents, problematic use

of social media and technology can pose serious challenges, such as cyberbullying<sup>9–11</sup>, exposure to inappropriate content<sup>12</sup> and harassment<sup>13,14</sup>. It may also be associated with poor sleep quality<sup>15</sup>, addictive behaviors<sup>16</sup> and poor psychological symptoms, such as depression and anxiety<sup>17–21</sup>. Despite these challenges, technology, including social media, also harbors the potential for a positive impact. Technology has been shown to enhance social connections, the establishment of identity, opportunities for self-disclosure and learning skills<sup>11,16,22–24</sup>. Technology has also been leveraged to increase access to mental health

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resources. Some digital interventions show promise in supplementing traditional mental health treatments, but additional evidence regarding their effectiveness and generalizability is needed<sup>12,25–28</sup>.

Innovations in mental health and well-being technology are evolving rapidly<sup>29</sup>. Interdisciplinary research is steering this progress, focusing on improving mental health outcomes through the design, development, evaluation and implementation of technology-based interventions, services and systems<sup>30</sup>. However, rapid developments in technology also pose risks and challenges for mental health technology. Addressing these risks requires critical examinations on various fronts, such as ethics, quality, privacy, equity and accessibility. The lack of accountability in algorithm-driven mental health technologies (that is, the absence of a clear responsible party for the outcomes or consequences of these technologies) has raised both ethical and legal concerns, underscoring the need for ethical guidelines for their research, creation and deployment<sup>31–36</sup>. Despite the proliferation of ethical principles that guide the design and deployment of technologies, many mental health apps fail to reflect ethical values in their design<sup>37</sup>. Furthermore, technology developers may be tempted to shop for the set of ethical principles that best serve their interests<sup>34</sup>. Moreover, some issues are better addressed by careful design, rather than more technology. Over-indexing on techno-solutionism may result in the allocation of resources to technology development and away from addressing real issues<sup>38</sup>. Privacy and security concerns with web-based and mobile applications<sup>39</sup> are exacerbated by the lack of transparency in data security<sup>40</sup> and the potential mishandling of sensitive mental health data<sup>41</sup> and emotion data<sup>35,36</sup>. It is important to also consider the various responsibilities of the parties involved—the technology creators that develop the apps and the healthcare providers that deploy the apps and collect sensitive data<sup>35</sup>. More robust validation of these solutions is needed, especially in the current evolving consumer technology landscape<sup>42</sup>, using high-quality, evidence-based approaches, which are also frequently used to advertise such apps to users<sup>43</sup>. Special attention must be paid to populations that tend to get excluded<sup>29,44,45</sup>, including users who do not use or do not have access to such technologies (the so-called ‘digital divide’)<sup>46,47</sup>. Finally, in the midst of designing mental health apps that adhere to these ethical and quality standards, they must be engaging and meaningful for users<sup>48</sup>. These multidimensional challenges require a well-rounded approach to developing, evaluating and implementing technologies, ensuring that they are ethically sound, evidence-based, accessible, equitable and secure, while also fostering genuine user engagement. Here we argue for fundamental shifts in the way technology is innovated, in which a multi-sectoral approach is paramount to effectively address the complexity and interrelatedness of technology and mental health.

It is crucial to recognize the existing silos between technologies explicitly designed for mental health purposes and everyday technologies that inadvertently impact mental health. On the one hand, the intersection of technology and mental health has spawned numerous innovative solutions aimed at enhancing mental health support across both clinical and consumer domains. In clinical settings, telepsychiatry<sup>49,50</sup> and digital psychotherapy (for example, IntelliCare<sup>51,52</sup>) have emerged as vital resources to increase accessibility to psychiatric care and psychotherapy. The burgeoning market of mental health apps targeting anxiety, depression, schizophrenia, self-harm and substance-use disorders provides users support with a limited evidence base for improving mental health outcomes<sup>43,53–56</sup>. Advancements in computing, particularly through artificial intelligence (AI) and machine learning (ML), are opening avenues for predictive and precise diagnosis and treatment<sup>57–60</sup>. Other therapeutic technologies include the use of virtual and augmented reality<sup>61,62</sup>, chatbots<sup>33,63,64</sup> and virtual humans<sup>65,66</sup>. In psychiatric settings, the deployment of surveillance technologies such as body-worn cameras and CCTV has been explored as a means to enhance safety and reduce incidents of aggression in psychiatric settings, with mixed results and ethical challenges<sup>67–70</sup>.

On the other hand, everyday technologies such as the Internet, search engines, social media platforms, productivity tools, commerce platforms, Internet-of-Things devices or gaming devices, which are not specifically focused on mental health, are even more widespread. However, there is a lack of emphasis on mental health considerations in their design. These everyday technologies are influential in life, leading to both positive effects and negative effects on mental health depending on access, demographics and usage behaviors. This impact is especially notable for adolescents and youth, as we have previously discussed.

Due to the pervasiveness of technologies, whether specifically aimed at mental health or not, mental health is a critical concern not just for digital mental health technology innovators, but also for the wider ecosystem encompassing designers, developers, regulators, users and researchers of all technologies. Governing bodies and policymakers have approached technology regulation from a broad perspective, often lagging behind rapid technology innovation or overlooking the nuances of mental health implications<sup>56</sup>. Clinicians, despite having minimal input into the design and development of such technologies, find themselves increasingly confronted with treating the consequences of technology use and misuse<sup>26</sup>. By acknowledging and addressing these silos—those between technologies explicitly designed for mental health and everyday technologies that affect mental health—stakeholders can work toward more cohesive and effective strategies. These strategies could either mitigate the negative impacts of technology on mental health or improve mental health outcomes.

We broadly categorize the stakeholders at the intersection of technology and mental health into four sector groups, based on the unique roles they play, their expertise and their influence on the subject matter:

1. **Technology creators and companies.** These drive innovation and shape the technological landscape of mental health by studying, designing and developing technologies that may impact mental health. Examples include private and public digital mental health and general technology companies (for example, Microsoft, Headspace and TalkLife), organizations (for example, the National Center for PTSD) and research disciplines (for example, computer science, human–computer interaction (HCI) and informatics).
2. **Healthcare providers.** These ensure that individuals receive appropriate mental healthcare, support and treatment based on clinical evidence and the best practices in various healthcare settings. This group ranges from specialists who are directly responsible for providing mental healthcare, such as psychiatrists, psychologists, mental health nurses and clinical social workers, to more general health practitioners who encounter people with mental health symptoms or co-morbidities, such as primary care physicians and other medical providers.
3. **Governing bodies and policymakers.** These are responsible for creating, implementing and enforcing regulations, guidelines and policies that shape the development, adoption and use of technologies and practices impacting mental health. They include not only formal governmental agencies (for example, the World Health Organization), but also non-governmental entities providing policy recommendations (for example, the American Psychiatric Association).
4. **Lived-experience stakeholders and advocates.** These have first-hand experiences with mental health challenges that position them as invaluable contributors, providing critical insights and perspectives that are often overlooked by other stakeholders in the innovation processes. This category encompasses both individuals with personal experience and organizations that advocate for and represent these individuals (for example, Mental Health America).

Incorporating a systems thinking framework, we created these categories based on the belief that navigating the complexities arising from the relationship between technology and mental health requires diverse perspectives and specialized expertise from each of these sector groups.

To facilitate a dialog between these diverse stakeholders and develop a collaborative approach to the challenges identified, we convened a virtual workshop hosted by Microsoft Research on 24 October 2022 (<https://www.microsoft.com/en-us/research/event/rethinking-technology-for-mental-health-andwellbeing-workshop/>). The workshop brought together over 60 experts from various fields related to technology and mental health, including consumer mental health companies, large technology companies, government organizations, legal scholars, educators, non-profit organizations and consumer advocates, as well as clinicians and academic researchers. Representing various sectors—from technology companies to academic researchers, legal scholars to consumer advocates—the workshop aimed to facilitate interdisciplinary dialog on critical aspects of technology's role in mental health, including its design, clinical applications, ethical concerns and equity implications. A subset of the workshop attendees distilled the discussions and co-authored this Perspective, identifying key themes and synthesizing them into a shared vision and a roadmap that advances the field of technology research and development that supports mental health. More details about the workshop and the analysis that informed this Perspective are provided in the Supplementary Information.

In this Perspective we challenge the traditional silos that have inadvertently formed between stakeholders and between technologies explicitly designed for mental health purposes and everyday technologies that inadvertently impact mental health. We propose multi-sectoral collaborations that approach the intersection of technology and mental health, recognizing the interconnectedness of both types of technology. Our report is structured as follows. First, we present four recommendations for technology innovation for mental health. We outline the importance of aligning incentives and governance across stakeholders in mental health technology, including clinical, sub-clinical and general technology industries. We then emphasize the need for a renewed innovation design process that empowers users to voice their needs from the onset, provides clinicians and users with the means to express their mental health experiences related to technology, and promotes constant learning and iteration. Second, we present how each of the four sector groups can realize these recommendations. We argue that these recommendations must be built on a foundation of multi-sectoral collaboration and governance, offering practical considerations to advance technology that supports and does not negatively impact mental health. We delve into the distinct yet complementary approaches each sector group can adopt to collectively contribute to the recommendations outlined above and drive innovation, alignment and impact in the mental health technology landscape.

## Four areas for rethinking technology innovation for mental health

In light of the current challenges and opportunities at the intersection of technology and mental health, we highlight four key areas where focused efforts can begin to bridge the gap between stakeholders and between technologies that directly and indirectly impact mental health.

### Alignment of stakeholders, incentives and governance

Growing awareness of the potential negative mental health impacts of technology is leading to increased public attention and regulatory efforts<sup>71</sup>. However, discussions regarding these impacts often arise only after serious and irreversible harm has occurred<sup>72</sup>.

Efforts to understand the relationship between technology and mental health outcomes primarily occur within academia, healthcare and industries focused on mental health technologies. In contrast,

everyday technology industries, chasing conventional outcomes such as user engagement and profit, may overlook mental health impacts. Furthermore, regulation mainly targets high-risk medical devices, leaving many apps and everyday technologies unchecked<sup>56</sup>. This regulatory gap underscores the need for coordinated governance efforts in the technology landscape for mental health. All technology companies should acknowledge their role in users' mental health, fulfilling not only ethical obligations but also enhancing competitive advantage, public perception and corporate responsibility.

We propose a new governance paradigm involving multi-sectoral consensus on common agendas, value systems, incentives and governance models. Stakeholders should collaborate to define target mental health and product outcomes, establish incentives to drive investments in research and innovation, and develop strategies for monitoring and responding to mental health outcomes. They should clearly articulate a business case for mental health emphasis, aligning it with mental health-centered objectives and key results (OKRs). This will foster trust and responsibility among stakeholders, leading to beneficial outcomes such as responsible algorithmic engagement metrics and reduced technology-induced stress and addiction.

The lack of coordination between creators of mental health-focused technologies and everyday technologies leads to fragmented efforts and limited cross-sector knowledge sharing. For example, although general technology companies may excel in data security, mental health technology creators often better understand the sensitivity of mental health data. However, this fragmentation could jeopardize privacy and ethical standards<sup>32,38,73</sup>, especially for marginalized individuals (for example, those with mental health diagnoses, minoritized races/ethnicities and minoritized sexual orientations), with some organizations possibly compromising data for profitability<sup>71</sup>. Therefore, it is crucial to establish a collaborative governance approach, including technology companies, healthcare providers, policymakers, privacy experts and technology users, that oversees innovation design. In response to emerging and transformative technologies (for example, AI<sup>74</sup>) and usage patterns (for example, self-diagnosis on TikTok<sup>75</sup>), governance is critical in guiding responsible technology innovation and promoting necessary technology literacy. Establishing clear accountability mechanisms, drawing inspiration from established models such as the General Data Protection Regulation<sup>76</sup>, can ensure that all parties uphold their commitments, with a progressive strengthening of these mechanisms over time.

### Person-centered and proactive mental health measurement and monitoring

For mental health-focused technologies, the goals are usually reducing symptoms (as assessed by validated scales) or improving daily functioning. For everyday technologies, the assessment might focus on any negative mental health impacts from their use. Currently, there are no agreed-upon outcomes to measure, leading to inconsistent mental health monitoring across different types of technology. This variety in measurement approaches makes it difficult to establish shared best practices or compare how different technologies affect mental health, whether positively, in treatment and prevention, or negatively, by unintended harms.

The complex interplay between technology and mental health is further muddled by varying mental health-focused outcomes across organizations, products and contexts. These variations, though possibly necessary in their respective realms, add layers of complexity. For example, clinical mental health technologies often leverage established diagnostic criteria (for example, the *Diagnostic and Statistical Manual of Mental Disorders*, 5th edition (DSM-5)<sup>77</sup>) or validated scales (for example, Patient Health Questionnaire-9 (PHQ-9)<sup>78</sup> or Generalized Anxiety Disorder-7 (GAD-7)<sup>79</sup>) for outcome monitoring and evaluation. On the other hand, commercial technologies may use measurements focused on user experience (for example, 'Happiness' from



the Happiness, Engagement, Adoption, Retention, and Task success (HEART) framework<sup>80</sup>). Although a universal outcome measure may not be attainable, a concerted effort to develop suitable outcome measures that balance mental health and contextual goals is needed. For example, a communication app striving to promote social connectivity must also consider the mental health impacts of an ‘always-on’ culture, which would heighten stress or burnout<sup>81–83</sup>. The Hume Initiative (<https://thehumeinitiative.org/>) is moving in this direction by defining guidelines and mental health metrics for AI alignment.

Understanding mental health issues is complex due to their subjective, dynamic and transdiagnostic nature<sup>84</sup>. Hence, we propose a person-centered approach to support individuals across the diagnostic and transdiagnostic mental health spectrum, aimed at monitoring mental health intricacies across technologies. Such monitoring can help individuals better understand their technology experiences and their impact on mental health. In clinical settings, this might mean expanding the evaluation panel and exploring the feasibility of data collection, alongside equipping clinicians to leverage data. This could lead to personalized care and well-informed treatment plans. In commercial settings, aligning mental health and business objectives may require designing systems with mental health measurement as a core consideration. Establishing feedback mechanisms between actions or features and monitoring their mental health impact can help identify and monitor their connections. Longitudinal research that incorporates mental health outcomes into product metrics, such as measuring life satisfaction or happiness against product usage, can enhance transparency and foster trust. This consistent, systematic and iterative measurement can continually refine mental health innovations using real-world data.

Developing technologies and monitoring capabilities that learn the relations between system actions and mental health outcomes is an innovative opportunity for statistics and ML. A/B testing and ML methods can be used, while considering ethical implications, to analyze variables and their relations to outcomes. In clinical settings, for example, therapy feedback systems that use natural language processing (NLP) algorithms on therapy recordings can identify crucial factors related to positive outcomes, helping care teams to continually improve their service. In commercial settings, retrospective analyses of user data can identify features linked to positive mental health outcomes, thus informing future product development.

### Technology innovation through co-design and iteration

The field of digital mental health solutions has been growing in response to the unprecedented demand for mental health support. However, the vast majority of research and innovation practices do not engage with the people with lived experiences as equal partners in the design process<sup>48,85,86</sup> and have often excluded communities of color and marginalized youth<sup>85</sup>. This approach leads to ‘one-size-fits-all’ solutions that do not account for the diversity and complexity of mental health needs<sup>87</sup>. Consequently, the potential neglect of users’ fundamental rights to privacy and safety might cause them to feel disconnected from the innovation.

We recommend co-design<sup>88,89</sup> as a promising approach to developing technologies and to understand their relevance and impact on mental health. Co-design aims to design technologies tailored to users’ needs by actively involving them in the full design process (that is, problem identification, solution ideation, product development and evaluation). Co-design should include users from diverse demographic backgrounds to ensure that the results can be applied across a range of cultural and social groups. This approach overcomes the imbalance of power, elevates different types of knowledge, minimizes dependence on assumptions and biases, and enables essential debate around literacy, privacy and ethics.

Co-design, when properly implemented, encourages a shift away from a diagnosis or psychotherapy-centric view to a person-centered

perspective of an individual’s digital mental health journey, effectively blurring the strict line between clinical mental health technologies and everyday technologies. Instead, it focuses on the person’s needs, encompassing all technology interactions and the social environment around them. With this approach, users’ unique situations may call for special interventions woven into their everyday technologies (for example, bite-sized<sup>90</sup> or single-session interventions<sup>91,92</sup> in social media, email clients, operating systems, wearables and messaging apps).

Embracing co-design can serve as a valuable complement to traditional clinical evaluation methods, leading to better mental health outcomes for both clinical and everyday technology products. Traditional randomized control trials (RCTs) are used for clinical evaluation, considering standard care as control and focusing on the heterogeneity and variability of users and contexts through precision medicine<sup>93</sup>. However, these approaches have historically left people of color out, causing interventions from a small homogeneous group to be applied to large heterogeneous groups<sup>94</sup>. In addition, applying RCTs to product development would be costly and infeasible due to the complex and dynamic nature of technology products and their user interactions.

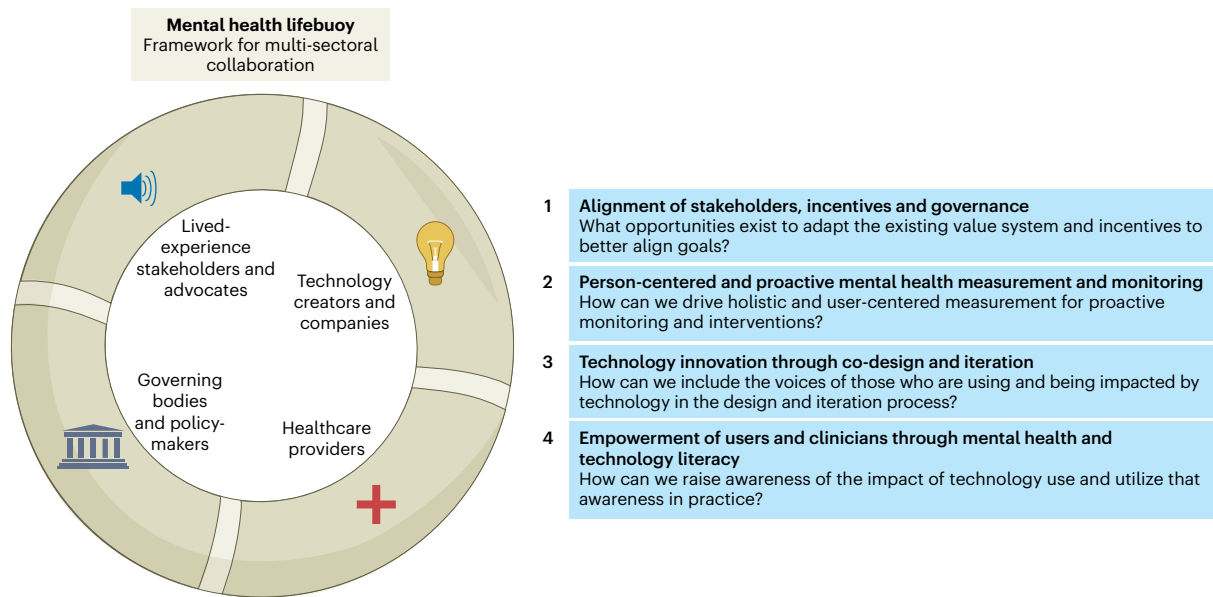
Incorporating iterative cycles of testing and refinement of technology in the co-design approach allows for continuous reshaping of what is seen as an ‘effective’ solution. This engenders trust, ownership and empowerment among users and stakeholders through proactive, transparent and inclusive dialogs about potential ethical, social and cultural issues. Although this philosophy of iterative development is more common in commercial products and HCI research, clinical domains can adopt alternate models such as the Learning Health Systems from the United States Agency for Healthcare Research and Quality<sup>95</sup>. By applying iterative co-design in both clinical and everyday technology contexts, the development process can better address the mental health needs of users across a wide range of situations and experiences.

### Empowering users, educators and clinicians through mental health and technology literacy

To better address potential risks associated with technology use before they reach a critical point, it is essential for technology companies, educators and clinicians to equip users with the necessary language and literacy to assess whether a technology platform is ‘good’ or not and discuss the potential benefits and harms to mental health related to technology use during the design process and use. This involves increasing awareness of technology’s role in mental health among users, for example, by providing information akin to warning labels or contraindications on potential mental health impacts, even for platforms not explicitly created for mental health support.

Educators have a crucial role in guiding the digital interactions of young individuals and protecting their well-being. Technology has become an integral part of the daily lives of young people<sup>96</sup>, and it is thus extremely important for educators to teach young people how to maintain their well-being online, particularly given the potential for distressing interactions or content. Educators can provide students with guidelines and best practices on using technology to bolster their digital education and online safety practices responsibly<sup>97</sup>. Educators can nurture non-technical skills centered around a holistic and comprehensive view of technology<sup>98</sup>. This includes educating youth about the potential pitfalls of technology, the implications of their digital footprint, and supporting their overall digital well-being while helping them avoid harmful online interactions<sup>23</sup>.

Given the important role technology plays in the daily lives of youth and beyond youth, it is crucial for mental health clinicians to understand how the use of different technologies (and their associated interfaces and algorithms) might influence mental health. Clinicians are becoming more aware of these impacts<sup>99</sup>, and some have already integrated them into their clinical approaches<sup>100</sup>. Despite the progress, clinical programs do not have standardized discussions about the use of technology. Emerging HCI research could enrich clinical



**Fig. 1 | Framework for multi-sectoral collaboration, serving as a reminder to address the unique contexts, challenges and strengths of each sector group.** To facilitate balanced and inclusive discussions, we encourage each of the four sector groups to consider distinct yet complementary approaches to collectively contribute toward the four recommendations outlined by this Perspective.

curricula by providing more information on how clinicians might address technology use.

However, merely raising clinicians' awareness of the mental health implications of technologies does not address the challenges faced by the average technology user, who often feels constrained by the inflexible designs of the platforms they use daily. We suggest that all technology platforms encourage users to report how engagements with technology impact their mental health, regardless of the platform's primary function. For example, although social media platforms are often associated with mental health implications<sup>101</sup>, even a language translation platform could potentially impact a user's mental health through inappropriate translations. Providing a channel for user feedback on mental health impacts across all technologies enables designers to offer more flexible user engagement options, paving the way for the development of mental health-friendly technology.

To empower users to effectively communicate the impact of their technology interactions on their mental health, designers need to clarify the connection between users' engagement and the design of the platform's interface. Recognizing the user as the expert of their own experience is necessary and should drive the creation of tools that facilitate user reflection on their feelings and allow customization of their interactions with the platform. HCI research has explored this, particularly concerning vulnerable groups re-entering society after psychiatric hospitalization<sup>102</sup>.

## Framework for harmonizing efforts

### Sector-specific adaptations toward a collaborative future

Building on the four key recommendation areas, workshop participants recognized the importance of aligning incentives and governance across stakeholders to establish shared mental health goals. These goals would strike a balance between conventional business incentives and positive mental health outcomes for all technology users. An established coalition of researchers, industry leaders, product makers, clinicians, policymakers, advocates and users can drive knowledge exchange, resource sharing, partnerships and funding opportunities while developing technology innovation guidelines, processes and success metrics grounded in research, practice, regulation and lived experiences. The coalition can organize multi-sectoral discussions

and establish standards and best practices based on publicly shared scientific research and real-world studies. It can also hold organizations accountable in relation to emerging mental health standards (for example, through ratings and certifications). Equitable and longitudinal research on person-centered mental health outcomes and the relationship between technology and mental health will be an essential focus of the coalition. This includes identifying which outcomes should be measured and investigating suitable measurement tools to monitor these outcomes, ensuring that findings can be translated into practice.

One proposed initiative to strengthen multi-sectoral governance and alignment is the development of a Digital Mental Health Bill of Rights, developed and maintained by the coalition. This bill aims to protect individuals' mental health, rights and interests by aligning efforts toward improved mental health outcomes. The Digital Mental Health Bill of Rights will serve as a framework to ensure that digital mental health research and innovation are performed, developed and implemented in a way that prioritizes and protects the interests of people, while enabling collaborators to advance meaningful and effective innovation.

As we strive toward a new paradigm in digital mental health, it is essential to recognize the unique roles and responsibilities of each sector in achieving a common goal. Although the overarching mission is shared, the strategies employed by different groups will differ so as to effectively address their specific contexts, challenges and strengths. We leverage the four sector groups defined in the introduction to delve into the distinct yet complementary approaches each sector group can adopt to collectively contribute toward the areas outlined above (Fig. 1). In the following, we outline these complementary approaches according to sector group.

### Technology creators and companies

Technology creators and companies must acknowledge that the impact of technology on mental health and well-being is a fundamental concern, regardless of whether it is designed specifically for mental health purposes. This recognition should serve as the cornerstone for defining business priorities, investment opportunities, development efforts and user experiences. Key actions include aligning mental health outcomes with business outcomes, with consultations from other sector groups,

## BOX 1

# Adaptations for technology creators and companies

### Alignment of stakeholders, incentives and governance

*What opportunities exist to adapt the existing value system and incentives to better align goals?*

- Recognize the impact of technology, whether it is designed specifically for mental health or not, on mental health and well-being.
- With consultation from other sector groups, identify best practices for aligning mental health outcomes with business outcomes and produce mental health centered with OKRs (such that they keep the best interests of those in distress in mind).
- Invest in multi-sectoral consortiums that provide guidance on responsible and mindful business practices.

### Person-centered and proactive mental health measurement and monitoring

*How can we drive holistic and user-centered measurement for proactive monitoring and interventions?*

- Recognize mental illness as transdiagnostic and consider the impact of product features and actions on mental health outcomes across clinical, sub-clinical and general contexts.
- Prioritize implementing mental health centered OKRs into business practice to continuously monitor the impact of products.
- Invest in longitudinal research that brings scientific rigor and an evidence base from clinical and research fields into the technology sector.
- Architect systems to collect such data in a compliant, privacy-preserving way with meaningful consent.
- Partner with other stakeholders to share and connect data and to understand causal relationships between product features, usage behaviors and mental health outcomes.
- Offer technical insights for large-scale analysis of multi-modal and multi-stream data relevant to mental health outcomes.

### Technology innovation through co-design and iteration

*How can we include the voices of those who are using and being impacted by technology in the design and iteration process?*

- Engage the voices of lived-experience stakeholders and advocates to understand the ethical, cultural and social barriers and boundaries surrounding where and how technology impacts mental health or addresses mental distress.
- Develop a pipeline that incorporates end-user perspectives and lived experiences into iterative development and continuous monitoring of product quality against mental health-centered OKRs.

### Empowerment of users, educators and clinicians through mental health and technology literacy

*How can we raise awareness of the impact of technology use and utilize that awareness in practice?*

- Give users the language to speak about any potential negative impact of technology use on mental health and psychological well-being.
- Give users some ability to customize their experience to avoid deleterious effects of products on mental health and psychological well-being.
- Clarify the connection between users' engagements and the design of the platform's interface and allow users to customize how their engagements influence the design.

## BOX 2

# Adaptations for healthcare providers

### Alignment of stakeholders, incentives and governance

*What opportunities exist to adapt the existing value system and incentives to better align goals?*

- Offer time and input to other sectors regarding clinician and patient needs.
- Beyond traditional diagnostic criteria and treatments, lead innovation and evaluation efforts, ensuring scientific and clinical rigor for technologies that address sub-clinical concerns and promote well-being.

### Person-centered and proactive mental health measurement and monitoring

*How can we drive holistic and user-centered measurement for proactive monitoring and interventions?*

- Offer clinical insights for defining effective measurement and monitoring of mental health-centered OKRs in the clinical, sub-clinical and general contexts.
- Embrace a comprehensive approach to mental health measurement that considers transdiagnostic and dynamic perspectives as well as technology-based metrics (for example, engagement, digital health).

### Technology innovation through co-design and iteration

*How can we include the voices of those who are using and being impacted by technology in the design and iteration process?*

- Beyond traditional randomized control trial based evaluations that typically target clinical outcomes, embrace holistic outcomes, iterative design, and dynamic evaluation processes that emphasize real-world relevance and lived user experience along with clinical outcomes.
- Advocate for user needs surrounding the impact of technology use on mental health and facilitate knowledge exchange, especially around opportunities and adaptations to clinical practices relevant to technology innovation.
- Be open to the possibility that new technology may improve the administrative and clinical components of clinical practice and lead to improved clinical outcomes.

### Empowerment of users, educators and clinicians through mental health and technology literacy

*How can we raise awareness of the impact of technology use and utilize that awareness in practice?*

- Include research on psychological impacts of technology use in clinical curricula.
- Develop psychoeducation material about the impact of technology use on mental health and well-being, and train clinicians to integrate the material into standard clinical practice.
- Advocate for the Digital Mental Health Bill of Rights.

implementing mental health-centered OKRs, and investing in multi-sectoral consortiums that provide guidance on responsible practices. Additionally, companies should invest in privacy-preserving longitudinal research aimed at understanding causal relationships between product features, usage behaviors and mental health outcomes. Finally, companies should engage the voices of diverse lived-experience stakeholders, and they should empower users with the language to discuss

**BOX 3**

## Adaptations for governing bodies and policymakers

**Alignment of stakeholders, incentives and governance**

*What opportunities exist to adapt the existing value system and incentives to better align goals?*

- Listen to clinicians, lived-experience stakeholders and advocates, and technology creators to set standards around how mental health outcomes might be measured.
- Act as a neutral party to convene and facilitate collaborative exercise to define the common and context-dependent mental health outcomes that should be monitored.

**Person-centered and proactive mental health measurement and monitoring**

*How can we drive holistic and user-centered measurement for proactive monitoring and interventions?*

- Facilitate safe and secure data sharing and collaboration across sectors by developing guidelines and regulations.
- Allocate funding and resources to advance and inform evidence-based policy decisions.
- Promote public awareness about the relationship between technology and mental health.
- Anticipate emerging technologies and adapt measurement and monitoring guidelines for clinicians and technology creators.

**Technology innovation through co-design and iteration**

*How can we include the voices of those who are using and being impacted by technology in the design and iteration process?*

- Develop practice guidelines for technology creators and clinicians that incorporate the voices of people with lived experience.
- Incorporate the voices of lived-experience stakeholders and advocates to regularly evaluate the impact of existing policies and regulations on the use and protection of private health information in technologies.
- Foster collaboration to innovate and update policies and legislation in response to emerging technologies and their potential impacts on mental health, privacy and well-being.

**Empowerment of users, educators and clinicians through mental health and technology literacy**

*How can we raise awareness of the impact of technology use and utilize that awareness in practice?*

- Create standards for how designers and companies can avoid negative mental health and well-being impacts, and recourse if harm is caused.
- Create guidelines for how educators can incorporate healthy technology use into their teaching curriculum.
- Proactively reach out to multiple stakeholders to characterize and forecast gaps in technology and mental health literacy.

the potential negative impacts of technology on mental health and tools to customize their experience to mitigate any detrimental effects. Box 1 outlines adaptation opportunities for technology creators and companies across recommendation areas.

**Healthcare providers**

Healthcare providers must prioritize embracing the impact of technology on mental health in their training and practice. As an advocate for

**BOX 4**

## Adaptations for lived-experience stakeholders and advocates

**Alignment of stakeholders, incentives and governance**

*What opportunities exist to adapt the existing value system and incentives to better align goals?*

- Create a Digital Mental Health Bill of Rights that can be leveraged to guide alignment across sectors.
- Share stories of how misaligned value systems impact mental health and psychological well-being.
- Advocate for values grounded in lived experiences that are traditionally overlooked in clinical, technology and policy domains.

**Person-centered and proactive mental health measurement and monitoring**

*How can we drive holistic and user-centered measurement for proactive monitoring and interventions?*

- Engage in policy discussions on how to ethically and safely leverage personal health information and technology usage data for holistic and proactive public health monitoring.
- Share diverse needs and experiences of individuals that must be incorporated in any data science, ML and algorithm design used in measurement and monitoring.

**Technology innovation through co-design and iteration**

*How can we include the voices of those who are using and being impacted by technology in the design and iteration process?*

- Actively participate in the co-design process by sharing personal experiences and real-world requirements. Take a primary role in technology design.
- Advocate for inclusivity of diverse perspectives, backgrounds and experiences.
- Critique existing and emerging technologies while providing alternate designs that protect the Digital Mental Health Bill of Rights.

**Empowerment of users, educators and clinicians through mental health and technology literacy**

*How can we raise awareness of the impact of technology use and utilize that awareness in practice?*

- Take time to notice and reflect on the impact of technology on the daily mental health and well-being of yourself and those you represent and mentor.
- Offer time and input about the impact of technology on mental health to designers and researchers.

the Digital Mental Health Bill of Rights, they would guide other sectors with expertise in patient needs and clinical rigor. Key actions include providing clinical insights for defining effective mental health-centered OKRs in clinical, sub-clinical and general contexts. Additionally, clinical research should adopt iterative design and dynamic evaluation processes that can be leveraged to respond to the fast-paced technology landscape. Integrating training for mental health professionals will help them to adapt and prepare for the ever-evolving mental health technology landscape. Box 2 outlines adaptation opportunities for clinicians across recommendation areas.



## Governing bodies and policymakers

Governing bodies and policymakers must act as neutral parties, convening and coordinating efforts across sectors to improve mental health outcomes. Key actions include setting standards for measuring mental health outcomes, facilitating data sharing and collaboration, allocating resources for evidence-based policy decisions, and promoting public awareness about the relationship between technology and mental health. In anticipation of emerging technologies, they must provide guidelines for clinicians, educators and technology creators to mitigate the negative impacts of technology on mental health. Finally, they should proactively engage stakeholders to address gaps in technology and mental health literacy, incorporating lived-experience stakeholders' voices. Box 3 outlines adaptation opportunities for governing bodies and policymakers across recommendation areas.

## Lived-experience stakeholders and advocates

Lived-experience stakeholders and advocates should take an active role in developing and advocating for a Digital Mental Health Bill of Rights. They can share stories of misaligned value systems across sectors and promote values grounded in lived experiences. Key actions include engaging in policy discussions on the ethical and safe use of personal health information, sharing diverse needs and experiences for data science and algorithm design, and actively participating in the co-design process by advocating for inclusivity and critiquing emerging technologies. Furthermore, stakeholders should reflect on the impact of technology on their mental health and offer valuable insights to designers and researchers, ensuring that real-world requirements are incorporated into technological solutions. Box 4 outlines adaptation opportunities for lived-experience stakeholders and advocates across recommendation areas.

## Conclusion

Addressing the complex intersection of technology and mental health requires a fundamental shift in approaches in innovation, collaboration and focus. Breaking traditional silos and fostering multi-sectoral partnerships can ensure that technology serves as a force for good in mental health. However, this new approach requires each sector group to accommodate and adapt to ways of working to harmonize efforts toward a common goal. Key paradigm shifts include tight coupling of mental health outcomes and business incentives, embracing transdiagnostic and dynamic perspectives in mental health measurement, driving innovation through co-design and iterative design processes, and empowering users to voice their needs. Our proposed framework promotes constant learning and iteration, paving the way for a future where technology companies, clinicians and governing bodies work together to foster mental well-being and provide support to individuals in both clinical and everyday contexts.

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## Acknowledgements

We acknowledge all of the workshop organizers and attendees for their invaluable contributions and discussions, as well as the Microsoft Research Summit organizers for facilitating the event and providing funding for the event. The workshop was funded by the Microsoft Research Summit program. The discussions and findings presented were shaped through a collaborative process involving diverse stakeholders, and do not necessarily reflect the views of any specific organization or company, including the workshop's

funding body. The funding organization did not have any role in the interpretation of data or writing of the report, nor in the decision to submit the paper for publication.

### Author contributions

J. Suh, S.R.P., R.L., E.H., K.S. and E.O. wrote the drafts of the manuscript. J. Suh, S.R.P. and E.H. prepared the boxes. J.A. and G.R. prepared the figure, which was later revised by the editorial office. J. Suh, S.R.P., R.L., E.H., J.A., G.R., J. Shen, J.B., A.S., P.P., L.F., C.J., Y.B., D.C.O., S.S., T.A. and M.C. participated in the thematic analysis of the workshop discussions. All authors edited, reviewed and refined all versions of the manuscript.

### Competing interests

The authors declare no competing interests.

### Ethics

All workshop attendees were given prior notice regarding the recording of discussions during the workshop registration process. Attendees were made aware of the intention to analyze the discussions for publication and were offered the opportunity to participate in the manuscript writing process.

### Additional information

**Supplementary information** The online version contains supplementary material available at <https://doi.org/10.1038/s44220-024-00232-2>.

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**Peer review information** *Nature Mental Health* thanks the anonymous reviewers for their contribution to the peer review of this work.

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