



Bioethics

ISSN: 2989-5448 (Online)

Publisher: Tomorrow's Research Publications (TRP)

An International Peer-Reviewed Open Access Journal

Review Article

Digital Phenotyping and Privacy in Mental Health Monitoring

Ines Rossi^{1*}, Lars Brenner² and Markus Wisniewski³¹Center for Medical Ethics and Law, Nordfjord University Center for Health Ethics, Norway²Institute for Health Policy and Ethics, Alpine Institute of Health Policy, Austria³Department of Public Health Ethics, Alpine Institute of Health Policy, Austria

ABSTRACT

Smartphones and wearables now continuously record behavioral data -- movement, communication patterns, sleep, screen use -- that psychiatry increasingly treats as clinically informative, a practice known as digital phenotyping.

This review examines how the ethical and legal literature has responded as passive sensing has moved from research protocols into commercial mental health apps and clinical workflows.

We survey four connected problems: the mismatch between one-time informed consent and continuous, purpose-evolving data collection; the gaps in data protection law that leave much of the consumer app market outside meaningful oversight; the error profile and accountability gaps of sensor-derived predictive tools used for relapse or suicide-risk detection; and the psychological effects of living under continuous behavioral observation.

Across these themes, the literature converges on a consistent finding: institutional safeguards that partially resolve these concerns in supervised research settings are frequently absent or weaker in commercial deployment.

We conclude that consent design, data governance, and algorithmic accountability need to be treated as core requirements of digital phenotyping tools rather than as compliance steps layered on afterward.

Keywords: digital phenotyping; mental health; privacy; informed consent; algorithmic prediction

Citation: Rossi I, Brenner L and Wisniewski M (2024) Digital Phenotyping and Privacy in Mental Health Monitoring. *Bioethics*. 1(1):01-05.

Corresponding Author: Ines Rossi

E-mail Address: i.rossi@nuche.no

Article History: Received 11 January 2024 | Accepted 05 April 2024 | Published 25 June 2024

Copyright: © 2024 Ines Rossi, et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (<https://creativecommons.org/licenses/by/4.0/>).

INTRODUCTION

A smartphone that never leaves a person's side records, without anyone touching it, a continuous trace of how that person moves through the world: how often they leave home, how quickly they type, how their

sleep and screen time shift week to week, who they call and for how long. Psychiatry has begun treating that trace as clinical data. The term "digital phenotyping" was coined to describe exactly this project -- the moment-by-moment quantification of the

individual, in situ, using data from personal digital devices, in particular smartphones [1]. The appeal to clinicians is obvious: mental illness is defined almost entirely by self-report and episodic observation, and passive sensor data promises something psychiatry has never had, an objective, continuous behavioral record that does not depend on a patient's ability or willingness to describe their own state accurately [2].

That promise has moved quickly from pilot studies to real products, and the ethical literature has had to catch up. Early enthusiasm framed digital phenotyping as a relatively low-risk extension of routine measurement -- more data, collected more often, about people already in care [3]. That framing undersells what is actually being collected. Behavioral sensor streams are not incidental byproducts of care; in aggregate, they are among the most intimate records that can be assembled about a person, capable of revealing information about mood, cognition, and social functioning that the person themselves may not have disclosed, or may not yet know [4]. This review examines how the ethical and legal literature on digital phenotyping has evolved as passive sensing has moved from research protocols into commercial mental health apps and clinical workflows, focusing on four connected problems: the fit between consent frameworks and continuous passive data collection, the adequacy (or inadequacy) of current data protection law, the use of sensor-derived predictions to make consequential clinical judgments, and the risk that constant behavioral monitoring itself changes what it means to live with, or recover from, mental illness.

CONSENT FOR DATA YOU CANNOT FULLY ANTICIPATE

Standard informed consent asks a participant to authorize a defined set of procedures for a defined purpose. Digital phenotyping breaks that model in a specific way: the data being collected is not a discrete measurement taken at a single visit but a continuous stream whose research and clinical uses are often not fully specified when collection begins, and whose interpretive value depends on inferences -- mood classifiers, relapse-risk scores -- that may not exist yet at the point a person agrees to be monitored [5]. A Delphi study surveying experts in digital phenotyping tool development found broad agreement that existing consent practices lag behind what the technology actually does, particularly around explaining to participants how raw sensor data (GPS traces, keystroke timing, call logs) gets transformed into clinical inferences they may not anticipate or welcome [6].

The population most often targeted by these tools compounds the problem. Digital phenotyping is frequently deployed with people experiencing acute psychiatric symptoms, cognitive impairment, or crises that can affect decision-making capacity at precisely

the moments when the tool is most likely to be actively monitoring them, which raises the question of whether consent obtained during a stable period remains valid once a person's capacity to understand ongoing monitoring has changed [7]. Proposals for a "consent-forward" model of digital mental health data collection argue for periodic re-consent, granular controls over which data streams are collected, and default settings that favor minimal collection rather than maximal data capture, explicitly rejecting the assumption that a single enrollment agreement can carry ethical weight indefinitely [8]. Others have proposed adapting model consent language developed for other areas of sensitive research, such as rare disease genetics, to the passive-sensing context, on the reasoning that both share the problem of participants authorizing future uses they cannot concretely picture [9].

DATA PROTECTION LAW WAS NOT BUILT FOR THIS DATA

Much of the commercial mental health app market sits outside the regulatory categories that were designed to protect sensitive health information. In the United States, an app that is not provided by a HIPAA-covered entity or its business associate can collect and monetize behavioral data that would be tightly restricted if it were held by a hospital, and consumer-facing mood-tracking and therapy apps routinely fall into this gap [10]. Investigations into popular therapy and mental wellness apps have repeatedly found third-party trackers embedded in software that markets itself as private and confidential, sharing behavioral and sometimes diagnostic information with advertising and analytics companies under terms most users never read [11]. The pattern is not new: a clinical appraisal of apps targeting eating disorders, published years before digital phenotyping became a formal research program, already warned that consumer wellness software marketed as therapeutic frequently lacked any clinical evidence base or credible privacy safeguard, a warning that current investigations into therapy apps largely confirm still holds [12].

Table 1 summarizes how four categories of digital phenotyping data are typically governed depending on where and how they are collected, and the gap is not confined to any one jurisdiction. Scoping work on the ethical, legal, and social implications of digital phenotyping has catalogued a recurring pattern across multiple legal systems: data protection frameworks written with discrete, purpose-limited data collection in mind struggle to regulate a technology whose entire clinical value comes from continuous, multi-purpose collection over long periods [13]. Commentary aimed at a human rights audience has gone further, characterizing some current and proposed uses of behavioral surveillance in psychiatric contexts, particularly compulsory monitoring tied to medication

adherence, as posing a direct threat to rights against non-consensual medical intervention and freedom from surveillance, not merely a privacy inconvenience to be balanced against clinical benefit [14]. Reviews of ethics oversight for big-data health research have separately argued that institutional review boards, built around a single-study, single-dataset model of harm, are poorly equipped to evaluate research where the risk comes from combining many small, individually low-risk data streams into a detailed behavioral profile [15]; a related review of ethics review reform for Big Data research reached much the same conclusion about the mismatch between existing oversight structures and continuous, longitudinal collection [16].

Table 1. Typical regulatory coverage of four digital phenotyping data categories, by collection context.

Data category	Hospital-based clinical monitoring	Research study (IRB-approved)	Consumer mental health app
Passive GPS/location traces	Covered by health-privacy law (e.g. HIPAA)	Covered by IRB consent and data-use agreement	Often outside health-privacy law; governed only by general privacy policy
Smartphone usage/keystroke metadata	Covered as part of medical record	Covered by IRB consent	Frequently shared with analytics/advertising third parties
Communication logs (call/text frequency)	Covered by health-privacy law	Covered by IRB consent, use-limited	Rarely addressed explicitly in app terms of service
Derived mood/relapse-risk scores	Part of clinical record; clinician-reviewed	Covered by IRB protocol; oversight varies	Largely unregulated; accuracy and use claims self-reported by vendor

PREDICTION, AUTOMATION, AND THE LIMITS OF SENSOR-DERIVED JUDGMENT

Digital phenotyping's clinical case rests heavily on prediction: the hope that changes in movement, sleep, or communication patterns can flag a psychiatric relapse or a suicidal crisis before it is visible any other way. A pilot study using passive smartphone sensing to predict relapse in schizophrenia did find measurable behavioral changes preceding relapse events, offering some evidence that the underlying signal is real [17], and subsequent work on digital biomarkers of mood has extended this to depression and OCD symptom tracking [18]. But translating a statistical association observed in a research cohort into a deployed clinical alert is a different undertaking, and the ethical literature has been considerably more cautious than the popular

framing of "AI that can detect a mental health crisis before it happens."

A widely discussed commentary on suicide-risk prediction models built from passive and electronic health record data argued that even models with respectable statistical performance produce enough false positives, in absolute terms, that acting on their output at scale risks subjecting large numbers of people to unwanted intervention, coercive check-ins, or involuntary hospitalization for a crisis that was never going to occur [19]. That argument generalizes beyond suicide prediction specifically: a review of automation and bias in medical AI observed that behavioral prediction models trained on convenience samples from clinical or research populations tend to perform worse, in ways that are hard to detect without deliberate testing, for demographic groups underrepresented in the training data [20]. In a psychiatric monitoring context, an under-performing model does not merely produce a wrong diagnosis; it can produce a false flag that triggers an unwanted clinical or even legal response, which is a materially different kind of error than a missed classification in most other AI applications, and reviews of legal and social issues in digital mental health technology have specifically flagged the absence of clear accountability rules for who bears responsibility when an algorithmic alert leads to a harmful intervention [21].

LIVING UNDER CONTINUOUS OBSERVATION

A separate strand of the literature asks a question that is harder to resolve empirically: what does it do to a person, clinically and psychologically, to know that their movement, communication, and sleep patterns are being continuously logged and interpreted by a system designed to detect signs of illness in them? Sociological work on digital phenotyping has argued that framing behavioral data as a diagnostic signal risks recasting ordinary variation in mood, routine, and sociability, the kind everyone experiences, as pathological data points requiring clinical attention, which can itself narrow a person's sense of what counts as a normal life while unwell [22]. Reviews of the broader digital psychiatry field have echoed a milder version of the same concern, noting that patient acceptance of passive monitoring drops sharply once people understand the granularity of what is actually being inferred from data they assumed was innocuous, such as GPS location or app-switching frequency [23].

This connects to an older concern in mental health ethics about surveillance and stigma: monitoring introduced with the intent of protecting a vulnerable person can, if it is not experienced as protective by that person, communicate distrust and reduce the sense of autonomy that recovery-oriented care is supposed to build. Design-focused proposals for precision mental health interventions have tried to

answer this by building in user-facing transparency about what is being collected and why, and by giving patients meaningful control over pausing or adjusting monitoring rather than treating continuous collection as a fixed condition of receiving care [24]. Whether that kind of participatory design actually survives commercial pressure to maximize data collection, once a tool moves from an academic pilot to a marketed product, remains an open and under-studied question, and it is precisely the gap that current oversight structures, discussed above, are least equipped to monitor [25].

Figure 1. Schematic comparison of unresolved ethical concern across four dimensions of digital phenotyping, contrasting research/clinical deployment with consumer mental health apps (illustrative synthesis of the reviewed literature, not derived from a single empirical study).

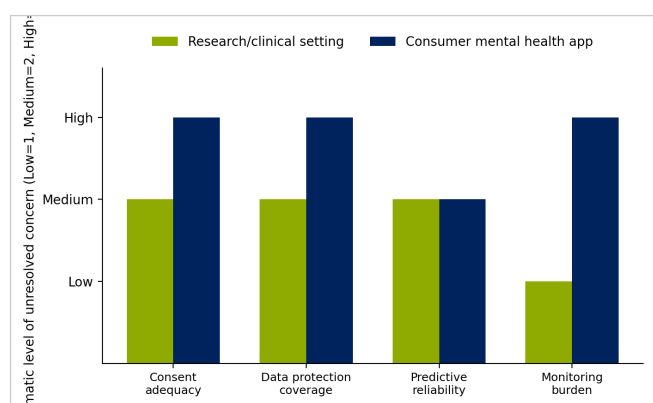


Figure 1 offers a schematic comparison, not derived from a single study, of how four commonly cited ethical concerns -- consent adequacy, data protection coverage, predictive reliability, and psychological burden of continuous monitoring -- appear to differ between digital phenotyping deployed in a research or closely supervised clinical setting versus a consumer-facing commercial mental health app. The pattern the literature converges on is that consumer deployment tends to carry higher unresolved concern on nearly every dimension, largely because the institutional safeguards (ethics review, data protection obligations, clinician oversight of alerts) that partially address these concerns in research settings are frequently absent or weaker outside them.

CONCLUSION

Digital phenotyping did not create the underlying tension between wanting better, more continuous information about a patient's mental state and wanting that patient's behavioral life to remain their own; it has simply made the tension unavoidable, because the technology's clinical value is inseparable from the density and duration of the data it collects. The literature reviewed here converges on a similar set of unresolved fault lines regardless of which angle it approaches from: consent models built for one-time authorization do not fit continuous, purpose-evolving collection; data protection law was largely written before this category of data existed and leaves much

of the consumer app market outside meaningful oversight; predictive tools built on passive sensor data carry error profiles whose consequences, unwanted intervention or a false alarm treated as fact, are not yet well matched by clinical or legal accountability structures; and the psychological experience of being continuously monitored, even with protective intent, has effects on autonomy and the meaning of recovery that the field has only begun to study empirically. None of this argues against digital phenotyping as a clinical tool. It argues for treating consent, data governance, and algorithmic accountability as central design requirements rather than as compliance steps addressed after a monitoring product already works, and for extending the more careful ethical infrastructure built around research use of these tools to the commercial and clinical settings where most of this data is now actually collected.

DECLARATIONS

Acknowledgements

The authors are grateful to colleagues in their respective bioethics and philosophy departments for helpful conversations that sharpened the focus of this review.

Funding

This review received no external funding.

Conflict of Interest

The authors declare no conflicts of interest relevant to this work.

Author Contributions

Ines Rossi conceived the review, coordinated the literature search, and drafted the introduction and conclusion. Lars Brenner wrote the sections on consent and on data protection law and coordinated revisions across the manuscript. Markus Wisniewski wrote the sections on predictive algorithms and continuous observation and prepared the table and figure. All authors read and approved the final manuscript.

Ethics Statement

As a literature review synthesizing previously published, publicly available research and commentary, this article did not involve new data collection from human participants and did not require institutional ethics committee approval.

Data Availability

No new data were generated or analyzed for this review. All sources discussed are cited in the reference list and are publicly available through their respective publishers.

REFERENCES

1. Insel TR (2018) Digital phenotyping: technology for

- a new science of behavior. JAMA, PMID:29049452.
2. Onnela JP, Rauch SL (2016) Harnessing smartphone-based digital phenotyping to enhance behavioral and mental health. *Neuropsychopharmacology*, PMID:27577438.
3. Glenn T, Monteith S (2014) New measures of mental state and behavior based on data collected from sensors, smartphones, and the Internet. *Current Psychiatry Reports*, PMID:25073598.
4. Martinez-Martin N, Insel TR, Dagum P, Greely HT, Cho MK (2018) Data mining for health: staking out the ethical territory of digital phenotyping. *npj Digital Medicine*, PMID:31211249.
5. Huckvale K, Venkatesh S, Christensen H (2019) Toward clinical digital phenotyping: a timely opportunity to consider purpose, quality, and safety. *npj Digital Medicine*, PMID:31304351.
6. Ethical Development of Digital Phenotyping Tools for Mental Health Applications: Delphi Study (2021) *JMIR mHealth and uHealth*, PMID:34255677.
7. Martinez-Martin N, Kreitmair K (2018) Ethical issues for direct-to-consumer digital psychiatry. *JMIR Mental Health*, PMID:29685866.
8. Advancing a Consent-Forward Paradigm for Digital Mental Health Data (2024) *arXiv*.
9. Parker LS, Karlychuk T (2019) Model consent clauses for rare disease research. *Journal of Bioethical Inquiry*, PMID:30675656.
10. Health Data at Your Fingertips: Legal and Ethical Issues With Mental Health Apps (2020) *Georgetown Law Technology Review*.
11. How to Navigate Mental Health Apps That May Share Your Data (2023) *American Civil Liberties Union*.
12. Fairburn CG, Rothwell ER (2015) Apps and eating disorders: a systematic clinical appraisal. *International Journal of Eating Disorders*, PMID:26315874.
13. Ethical, Legal and Social Issues of Digital Phenotyping as a Future Solution for Present-Day Challenges: A Scoping Review (2021) *JMIR Mental Health*, PMID:34898454.
14. Digital Phenotyping and Digital Psychotropic Drugs: Mental Health Surveillance Tools That Threaten Human Rights (2020) *Health and Human Rights Journal*.
15. Ienca M, Ferretti A, Hurst S, Puhan M, Lovis C, Vayena E (2018) Considerations for ethics review of big data health research: a scoping review. *PLOS ONE*, PMID:29799871.
16. Ferretti A, Ienca M, Sheehan M, et al. (2021) Ethics review of Big Data research: what should stay and what should be reformed? *BMC Medical Ethics*, PMID:33468110.
17. Barnett I, Torous J, Staples P, Sandoval L, Keshavan M, Onnela JP (2018) Relapse prediction in schizophrenia through digital phenotyping: a pilot study. *Neuropsychopharmacology*, PMID:29154366.
18. Jacobson NC, Weingarden H, Wilhelm S (2019) Digital biomarkers of mood disorders and symptom change. *npj Digital Medicine*, PMID:31304394.
19. Passive data doesn't save lives; ethical decisions made from it might (2021) *The Bulletin (British Psychological Society blog)*.
20. Straw I (2020) The automation of bias in medical Artificial Intelligence (AI): decoding the past to create a better future. *Artificial Intelligence in Medicine*, PMID:32828441.
21. Gooding P (2019) Mapping the rise of digital mental health technologies: Emerging issues for law and society. *International Journal of Law and Psychiatry*, PMID:30926130.
22. Birk RH, Samuel G (2020) Can digital data diagnose mental health problems? A sociological exploration of "digital phenotyping". *Sociology of Health & Illness*, PMID:32869344.
23. Torous J, Bucci S, Bell IH, et al. (2021) The growing field of digital psychiatry: current evidence and the future of apps, social media, chatbots, and virtual reality. *World Psychiatry*, PMID:33026219.
24. Bidargaddi N, Schrader G, Klasnja P, Licinio J, Murphy S (2020) Designing m-Health interventions for precision mental health support. *Translational Psychiatry*, PMID:32587248.
25. Mohr DC, Zhang M, Schueller SM (2017) Personal sensing: understanding mental health using ubiquitous sensors and machine learning. *Annual Review of Clinical Psychology*, PMID:28375728.