

# A call for responsible innovation in mobile mental health: Findings from a content analysis and ethical review of the depression app marketplace

Dionne BOWIE-DABREO <sup>a, c, 1</sup>, Corina SAS <sup>b</sup>, Sandra ILONA-SUNRAM <sup>a</sup>, and Heather ILES-SMITH <sup>c</sup>

<sup>a</sup>*Department of Psychology, Lancaster University, Lancaster UK*

<sup>b</sup>*Department of Computing, Lancaster University, Lancaster UK*

<sup>c</sup>*Research and Innovation Centre, Leeds Teaching Hospitals NHS Trust, Leeds UK*

**Abstract.** Mobile mental health presents many ethical challenges in the wild. These ethical issues and associated values were explored through a content analysis and ethical review of the depression app marketplace. App search and data collection was performed in Google Play Store (UK) and Apple iTunes (UK) between October to November 2018. Iterative data extraction and coding of ethical variables and values were conducted prior to synthesis of issues and themes. Search found 353 unique apps for depression. Analysis uncovered a range of ethical issues including: limited evidence of intervention validity, fidelity, and outcomes; insufficient safeguarding and duty of care; non-multisector development teams; lack of independent certification and regulation; lack of information and transparency for informed user choices; and concerns with privacy, confidentiality, and user permissions. These findings highlighted the presence and absence of ethical values in apps for depression, with most apps failing to reflect many key values. Our findings suggest a need for greater ethical value sensitive design in mobile mental health. This is challenging given the field's multidisciplinary and value conflicts. We encourage designers to adopt a responsible innovation approach to creating technologies that meet these ethical demands.

**Keywords.** Mobile mental health, applications, depression, ethics, value sensitive design, responsible innovation, content analysis

## 1. Introduction

Mobile mental health has been lauded for its potential to remove barriers and increase access to care. Yet, many ethical concerns have been raised most commonly related to privacy and security, risks and safety, and benefits and evidence [1-9]. Examples of these issues were evident in content analyses and marketplace reviews of publicly available mental health applications, with apps for depression found to lack research evidence and information provided to potential users regarding the app, safety, and privacy [10-19].

---

<sup>1</sup> Corresponding Author, Dionne Bowie-DaBreo, Research and Innovation Centre, Leeds Teaching Hospitals NHS Trust, St James's Hospital, Leeds LS9 7TF; E-mail: dionne.bowie@nhs.net

Our research built on previous reviews and analyses to consider the ethical values and issues in mobile mental health with the aim of exploring solutions for greater ethical design and practice. Guided by principlism, professional ethics, and value sensitive design, we conducted a content analysis of the depression app marketplace to determine: (1) What ethical issues were evident in the depression app marketplace? and (2) How do these issues reflect ethical values in app design, development, and marketing?

## **2. Method**

App search and data collection was conducted between October to November 2018. Search was performed in Google Play Store (UK) and Apple iTunes (UK) for apps for depression according to the stipulated inclusion/exclusion criteria. Coding was done iteratively using a list of variables compiled prior to review and developed throughout as ethical issues emerged. Data was synthesized through group deliberation with all authors exploring how the identified ethical issues fit existing principles and values.

## **3. Results**

Search found 353 unique apps for depression. Analysis of these apps uncovered a range of ethical issues including: limited evidence of intervention validity, fidelity, and outcomes; insufficient safeguarding and duty of care; non-multisector development teams; lack of independent certification and regulation; lack of information and transparency for informed user choices; and concerns with privacy, confidentiality, and user permissions. Moreover, our analysis showed these issues to be complex, intertwined, and interrelated. These findings highlighted the presence and absence of ethical values in the design, development, and marketing of publicly available apps for depression, namely values of: (Beneficence) benefits, risk minimization; (Nonmaleficence) avoidance of harm, safety and welfare; (Duty) competence, responsibility, standards; (Integrity) transparency, credibility; (Autonomy) informed choice, privacy and confidentiality; (Justice) accessibility, fairness. Most apps for depression and the depression app marketplace failed to reflect many of these ethical values.

## **4. Conclusion**

Our analysis of the depression app marketplace reflected the complexity of ethical mobile mental health in the wild. Findings suggest an urgent need for greater ethical value sensitive design in mobile mental health and consideration of potential ethical dilemmas throughout the lifespan of mental health technologies. This is particularly challenging in mobile mental health given its multidisciplinary approach and the range of associated values. This research uniquely captures the complex ethical and value conflicts in mobile mental health in the wild, through the example of the depression app marketplace. When faced with moral overload, designers may prioritize some values over others, such as a focus on increasing accessibility at the expense of safety. We conclude by encouraging a responsible innovation approach to the design of new technologies and demonstrate how this will better meet ethical demands and practice.

## References

- [1] Bowie, D., Sünram-Lea, S.I., Sas, C., & Iles-Smith H. (2018, December). A systemic ethical framework for mobile mental health: From design to implementation. *NIHR MindTech MIC*. Poster session presented at NIHR MindTech MIC National Symposium 2018: Improving Lives with Digital Mental Healthcare; 2018 December 5; London, UK. Archived at: [https://eprints.lancs.ac.uk/id/eprint/131847/1/A\\_systemic\\_ethical\\_framework\\_for\\_mobile\\_mental\\_health\\_From\\_design\\_to\\_implementation.pdf](https://eprints.lancs.ac.uk/id/eprint/131847/1/A_systemic_ethical_framework_for_mobile_mental_health_From_design_to_implementation.pdf)
- [2] Bowie-DaBreo, D., Sünram-Lea, S.I., Sas, C., & Iles-Smith, H. (2019, May). A content analysis and ethical review of mobile applications for depression: Exploring the app marketplace. *CHI 2019*. Poster session presented at CHI 2019 Symposium: Computing and Mental Health. 4th Symposium on Computing and Mental Health; 2019 May 5; Glasgow, UK. Archived at: [https://eprints.lancs.ac.uk/id/eprint/132009/1/CMH\\_2019\\_Symposium\\_Poster\\_Dionne\\_Bowie.pdf](https://eprints.lancs.ac.uk/id/eprint/132009/1/CMH_2019_Symposium_Poster_Dionne_Bowie.pdf)
- [3] Capon, H., Hall, W., Fry, C., & Carter, A. (2016). Realising the technological promise of smartphones in addiction research and treatment: an ethical review. *Int J Drug Policy*, 36, 47-57. <https://doi.org/10.1016/j.drugpo.2016.05.013>
- [4] Jones, N. & Moffitt, M. (2016). Ethical guidelines for mobile app development within health and mental health fields. *Prof Psychol Res Pr*, 47(2), 155-162. <https://doi.org/10.1037/pro0000069>
- [5] Karcher, N.R. & Presser, N.R. (2018). Ethical and legal issues addressing the use of mobile health (mHealth) as an adjunct to psychotherapy. *Ethics Behav*, 28(1), 1-22. <https://doi.org/10.1080/10508422.2016.1229187>
- [6] Lustgarten, S.D. & Elhai, J.D. (2018). Technology use in mental health practice and research: Legal and ethical risks. *Clin Psychol Sci Pract*, 25:e12234. <https://doi.org/10.1111/cpsp.12234>
- [7] Sanches, P., Janson, A., Karpashevich, P., Nadal, C., Chengcheng, Q., Dauden Roquet, C., ..., Sas, C. (2019). HCI and Affective Health: Taking stock of a decade of studies and charting future research directions. *Proc SIGCHI Conf Hum Factor Comput Syst*, Paper 245. <https://doi.org/10.1145/3290605.3300475>
- [8] Torous, J. & Roberts, L.W. (2017). The ethical use of mobile health technology in clinical psychiatry. *J Nerv Ment Dis*, 205(1):4-8. <https://doi.org/10.1097/NMD.0000000000000596>
- [9] Wykes, T., Lipshitz, J., & Schueller, S.M. (2019). Towards the design of ethical standards related to digital mental health and all its applications. *Curr Treat Options Psychiatry*, 6, 232-242. <https://doi.org/10.1007/s40501-019-00180-0>
- [10] Huckvale, K., Torous, J., & Larsen, M.E. (2019). Assessment of the data sharing and privacy practices of smartphone apps for depression and smoking cessation. *JAMA Netw Open*, 2(4):e192542. <https://doi.org/10.1001/jamanetworkopen.2019.2542>
- [11] Huguet, A., Rao, S., McGrath, P.J., Wozney, L., Weaton, M., Conrod, J., & Rozario, S. (2016). A systematic review of cognitive behavioral therapy and behavioral activation apps for depression. *PLoS One*, 11(5):e0154248. <https://doi.org/10.1371/journal.pone.0154248>
- [12] Kumar, S. & Mehrotra, S. (2017). Free mobile apps on depression for Indian users: A brief overview and critique. *Asian J Psychiatr*, 28, 124-130. <https://doi.org/10.1016/j.ajp.2017.03.031>
- [13] Larsen, M.E., Huckvale, K., Nicholas, J., Torous, J., Birrell, L. Li, E., & Reda, B. (2019). Using science to sell apps: Evaluation of mental health app store quality claims. *NPJ Digit Med*, 2:18. <https://doi.org/10.1038/s41746-019-0093-1>
- [14] O'Loughlin, K., Neary, M., Adkins, E.C., & Schueller, S.M. (2018). Reviewing the data security and privacy policies of mobile apps for depression. *Internet Interv*, 15, 110-115. <https://doi.org/10.1016/j.invent.2018.12.001>
- [15] Qu, C., Sas, C., Daudén Roquet, C., & Doherty, G. (2020). Functionality of top-rated mobile apps for depression: Systematic search and evaluation. *JMIR Mental Health*. 7(1):e15321. <https://doi.org/10.2196/15321>
- [16] Radovic, A., Vona, P.L., Santostefano, A.M., Ciaravino, S., Miller, E., & Stein, B.D. (2016). Smartphone applications for mental health. *Cyberpsychol Behav Soc Netw*, 19(7), 465-470. <https://doi.org/10.1089/cyber.2015.0619>
- [17] Shen, N., Levitan, M., Johnson, A., Bender, J.L., Hamilton-Page, M., Jadad, A.A., & Wiljer, D. (2015). Finding a depression app: A review and content analysis of the depression app marketplace. *JMIR Mhealth Uhealth*, 3(1):e16. <https://doi.org/10.2196/mhealth.3713>
- [18] Stawarz, K., Priest, C., Tallon, D., Wiles, N., & Coyle, D. (2018). User experience of cognitive behavioral therapy apps for depression: An analysis of app functionality and user reviews. *J Med Internet Res*, 20(6):e10120. <https://doi.org/10.2196/10120>
- [19] Sunyaev, A., Dehling, T., Taylor, P.L., & Mandl, K.D. (2015). Availability and quality of mobile health app privacy policies. *J Am Med Inform Assoc*, 22(e1):e28-e33. <https://doi.org/10.1136/amiajnl-2013-002605>