


# The good, the bad, and the poorly designed: The mobile app stores are not a user-friendly experience for health and medical purposes

Digital Health  
Volume 8: 1–6  
© The Author(s) 2022  
Article reuse guidelines:  
sagepub.com/journals-permissions  
DOI: 10.1177/20552076221090038  
journals.sagepub.com/home/dhj  


Timothy Aungst , Sheila Seed, Nurisha Gobin and Rosa Jung

## Abstract

The utilization of mobile health applications to help manage health conditions have grown in utilization within the past decade. However, the application stores (i.e. Google and Apple) are not designed in a user-friendly manner that allows consumers to identify high-quality health and medical-related mobile applications. Researchers have been interested in identifying applications that may be recommended for patient care but have found the ability to quantify and assess these applications to be difficult due to the current layout and organization of applications. We explain here in this brief communication our own research experience in the identification of mobile health applications on the application stores, along with trends noted in other mobile health research, and make suggestions on how the application store experience could be improved for both patients and health professionals. These include collaboration between developers, medical professionals and organizations, and technology companies to facilitate a better means of categorizing health applications for patient use, alongside other current endeavors being pursued such as application review organizations and the creation of digital health formulary databases.

## Keywords

Digital health, mHealth, mobile app

Submission date: 13 November 2019; Acceptance date: 9 March 2022

## Introduction

With over 85% of US adults owning a smartphone and one-in-five using a health tracker (e.g. smart watch or fitness tracker) we are witnessing an ever-growing dependence on the internet and mobile health (mHealth) applications (apps) to gather and track health information.<sup>1–3</sup> The coronavirus disease 2019 (COVID-19) pandemic has seen a growth in the utilization of these health apps, and a 40% increase in the use of mental health-related apps representing the social need for health services that are not readily accessed in person.<sup>4</sup> While the benefit of digital health technology has been found to be beneficial and creates new modalities for care, the consumerization of digital health solutions allows for possible exploitation or confusion. With over 300,000 health-related apps across both the Apple App Store and Google Play Store and over 10,000 behavioral health apps as an example, the

ability for users to self-identify apps for utilization is overwhelming.<sup>5</sup>

Researchers and clinicians have, over the past decade, attempted to alleviate this problem by conducting research into apps within different medical specialties to identify and evaluate apps for patient care.<sup>6–19</sup> However, this work, while highly academic in nature, has revealed uncertainties in the mHealth space related to how to find quality mobile apps for health endeavors. To navigate these app stores and identify and appraise health apps is daunting and demonstrates the unfeasibility of providing an accessible repository for patients wishing to find apps on their own. We

---

Pharmacy Practice, MCPHS University, Worcester, MA, USA

### Corresponding author:

Timothy Aungst, Pharmacy Practice, MCPHS University, 19 Foster Street, Pharmacy Practice Suite, Worcester, Massachusetts, USA.  
Email: timothy.aungst@mcphs.edu



wish to bring this to attention, and this brief communication highlights our own experiences, and those of the larger medical community, and suggests a mechanism to help improve the app store experience.

### Issues with searching the mobile app stores: researcher experiences and patient limitations

The current iteration of the Apple App Store and Google Play Store presents a user interface that is predicated on users perusing apps at their own leisure or having a preidentified app to download, such as a link provided by a company website. The experience of navigating these stores is mixed, as there is no systemic means of indexing or finding apps on the store, aside from preset categories (e.g. games, entertainment, productivity) or using general search terms.

Our own experience has demonstrated the frustrating nature of trying to find medically related apps with the current store design. We have endeavored to identify and assess the number of mobile apps available on the Apple and Google app stores related to the area of Travel Medicine.<sup>20,21</sup> A previous investigation of ours evaluated the Apple App Store in 2015 and identified 897 apps with MeSH terms related to Travel Medicine (e.g. malaria, travel vaccinations).<sup>22</sup> Of those, only 44 apps were deemed relevant to travel medicine. Since that time, we expanded our search into the Google Play Store (2018), where we identified 3740 apps related to Travel Medicine. We examined each of the 3638 apps (after removing duplicates) to determine which were medically relevant, which proved to be a tedious process. In addition, we reevaluated the Apple App Store and found a change in the mechanism of how apps were organized in 3 years since our initial research. After analysis of the apps, we found a large percentage to be completely unrelated to the search term and had no medical relevance. For example, in one search, the MeSH term “Malaria *Plasmodium Vivax*” generated apps with no medical implication.

While our difficulties may stem from the narrow field and availability of apps focused on Travel Medicine, it has been a trend noted in other studies identifying and evaluating apps in other therapeutic areas, as can be seen in Table 1. Researchers continue to search through hundreds to thousands of apps just to identify a small percentage worth evaluating. Examining the studies in Table 1, it was common for investigators to review hundreds of apps only to select a small sample to utilize in their assessment. While this is not an all-inclusive list of research in the medical app space, their methodology can be applied across any specialty. This entails spending time going through each store to evaluate apps based on using search terminology related to said medical specialty and evaluating in-store descriptions to determine relevance. While those

researchers have commented on the limitations and struggles of searching app stores and identification of apps, they do not list the labor and time that is dedicated for a team to conduct these searches. Even among our small team of researchers, the time invested has been significant, which includes factoring in time spent searching, collecting information, navigating developers’ websites, documenting app data, and finally screening them; and this does not even include the time dedicated to evaluating the individual apps screened for clinical utilization.

In comparison to the methodological dilemma facing researchers hoping to identify and review mobile health apps related to a therapeutic area, it can be extrapolated that the patient experience must be equally as problematic. Taking into account issues such as limited app descriptions, app costs, and medical literacy, it can be surmised to be a daunting experience for patients just to determine what app to download and try.<sup>15,23,24</sup> A limited number of studies have investigated such patient experiences and have found that while there is a high interest in using apps in their health, there remains a question on long-term utilization.<sup>25–29</sup> This may be best encapsulated by the fact that users of apps tend to stop using apps after only several days or weeks, which may represent the trialing period patients spend exploring an app before deciding to move onto another one. For patients to self-discover apps to manage their health and determine the best fit is a burden that has yet to be addressed and may be an impediment to large-scale adoption at this time.

### What can be done to improve the current mobile health app marketplace?

Currently, there is no gold standard in the best approach to guide patients on what health apps to use for their care. Researchers and clinicians have offered sporadic recommendations, though these are limited in scope and usability for the time period when their research was performed. Based upon the author’s knowledge, several approaches have been implemented or are under investigation, as outlined in Table 2, which may have a more scalable impact. These are not new ideas, and past endeavors have had their failures. These models may be a viable means due to the numerous apps available at this time.<sup>30–32</sup>

While the current emphasis has been placed on nonprofits or organizations to navigate the mobile app marketplace and identify and evaluate apps, we believe that other actions can be taken by tech companies and developers to amend some of the issues identified. An important point to make is that it is not feasible for these tech companies to recommend apps for patients for medical solutions, which is better left to a provider who knows their patient. As such, tech companies will likely remain the “host” for the repository of apps, but it should not exclude them from responsibility.

**Table 1.** Sample mobile app research investigations.

Author(s)	Year of publication	Therapeutic category	App stores evaluated	Apps identified	Apps selected
Fougerouse P, Yasini M, Marchand G, et al. <sup>6</sup>	2018	Mobile health	Google Play Store, Apple Store	Approximately 100,000 m-health apps have been added as of the beginning of 2015.	100 apps total in both iOS and Android 25 free and 25 paid in each operating system Three apps were excluded from the study due to their non-medical nature. One app was not selected due to its high price and two others were excluded because they were essentially a mini store of apps.
Yeung W, Dawes P, Pye A, et al. <sup>7</sup>	2019	Visual acuity	Google Online, Google Play, Apple Store	2185	42 Total (20 Google Online, 12 Google Play, 10 iOS Store)
Prado L, Carpentier C, Preau M, et al. <sup>8</sup>	2019	Chronic conditions i.e. cardiovascular diseases, cancers, respiratory diseases, and diabetes	Google Play Store	704	44
Knitza J, Tascilar K, Messner E, et al. <sup>9</sup>	2019	Rheumatology	Google Play store, Apple App store	Google Play Store: 128 Apple App Store: 63	28
Ayyaswami V, Padmanabhan DL, Crihalmeanu T, et al. <sup>10</sup>	2019	Atrial fibrillation	Apple App Store, Google Play Store	206	Apple App Store: 6 Google Play Store: 8
Larsen M, Huckvale K, Nicholas J, et al. <sup>11</sup>	2019	Mental health	Apple App Store, Google Play Store	1435	Android: 200, Apple App store: 150
Zhao P, Yoo I, Lancey R, et al. <sup>12</sup>	2019	Pain management	Apple App Store, Google Play Store	Apple App Store: 121 Google Play Store: 251	36 Android: 23* Apple App Store: 25*
Sleurs K, Seys S, Bousquet J, et al. <sup>13</sup>	2019	Chronic respiratory diseases	Apple App Store, Google Play Store	Apple App Store: 232 Google Play Store: 174	Apple App Store: 61 Google Play Store: 86
Richardson B, Dol J,	2019	Neonatal ICU care	Apple App Store	Apple App Store: 1939	Apple App Store: 12 Google Play Store: 6

(continued)

Table 1. Continued.

Author(s)	Year of publication	Therapeutic category	App stores evaluated	Apps identified	Apps selected
Rutledge K, et al. <sup>14</sup>			Google Play Store	Google Play Store: 4639	
Singh K, Diamantidis C, Ramani S, et al. <sup>15</sup>	2019	CKD	Apple App Store, Google Play Store	Apple App Store: 178 Google Play Store: 200	Apple App Store: 11 Google Play Store: 12 Dual-platform apps: 5
Bergeron D, Morin C, Bigder M, et al. <sup>16</sup>	2019	Neurosurgery	Apple App Store, Google Play Store	422	118 Total 95 iOS Apps and 52 Android Apps (29 Apps with both iOS and Android versions)*
Siddique A, Krebs M, Alvarez S, et al. <sup>17</sup>	2019	CKD	Apple App Store, Google Play Store	431	12**
Talwar D, Yeh Y, Chen W, et al. <sup>18</sup>	2019	Genomics	Apple App Store, Google Play Store	Apple App Store: 616 Google Play Store: 678	88 Total iPad 57, iPhone 52, Android 47*
Metelmann B, Metelmann C, Schuffert L, et al. <sup>19</sup>	2018	Cardiopulmonary resuscitation	Apple App Store, Google Play Store	Apple App Store: 744 Google Play Store: 3146	34**

CKD: chronic kidney disease; ICU: intensive care unit.

\*Apps crossed over on both platforms (iOS and Android).

\*\*Break down of apps and respective platforms are not indicated in this paper.

Imposing stricter filters and restrictions on apps generated from search terms could eliminate as much of the “junk” apps as possible. For example, an advanced search function would be beneficial for patients searching for specific apps within certain medical categories (e.g. heart disease, diabetes, mental health) or features (e.g. symptom tracker, telehealth feature). A tagging system for specialties or medical purposes could also be accomplished, similar to how the app store breaks down games into different types (e.g. sports, strategy). Lastly, a means to report potentially inappropriate medical apps may be a means to help the encumbered system and reduce the number of low-quality or dubious health apps available. This can help remove many junk apps and allow better curation. Lastly, transparency on how medical apps are reviewed or uploaded to the store may help foster a better process to avoid problematic apps from being available. This was seen in the COVID-19 pandemic where apps were removed from the store by Apple and Google based on concerns on the accuracy of information presented to the public, though the process may have

been nebulous and uncertain if this will continue in the future.<sup>33</sup>

We would recommend collaboration between app stores, developers, and medical organizations that may serve as a means to mitigate such issues and help improve the overall experience. In this way, we are ensuring that users not only have accurate information on hand but also it eliminates the difficulty of finding accurate information no matter what type of app store they are using. This becomes even more paramount that the app store evolves in this process, given the large push within digital health to foster the growth of the nascent digital medicine and digital therapeutics space.<sup>34</sup> Taking into consideration that many products are now undergoing clinical research to demonstrate their effectiveness in disease management and treatment, they stand above the current myriad apps focused on general health and wellness.<sup>35–37</sup> How then could a patient identify an app that may help with their sleep versus treat insomnia for instance? Factoring in those, providers are now prescribing such apps and payors are covering them for patient care, allowing an

**Table 2.** Frameworks to provide providers with high-quality mobile health apps.

Intervention	Description	Examples
Evaluation Websites	Online websites run by clinicians or related health professionals that review mobile health apps based on their internal editorial processes	iMedicalApps.com, Digital.Health
Digital Formulary	Organizations that select and review apps to disseminate to others. May be sponsored by medical organization or separate business entity. May work directly within an electronic health record (EHR) platform for “prescription” by a patient provider. Services often provided to outside organizations for a fee.	Express Scripts*, Orcha Health, App Script by IQVIA Xealth, Rx.Health
National Formulary	A national organization focused on identifying and evaluating apps for their providers to recommend.	NHS App Library
Formal Guidelines	Collaboration between medical societies and others to create a framework for best practices to review medical apps.	Xcertia
Nonprofit & Medical Organizations	Task forces part of medical or health organizations seeking to evaluate mobile medical apps within certain conditions or medical specialties.	World Health Organizations, American Psychiatric Association

\*Work still in process.

easier process of access to these apps is needed. If nothing less, tech companies that partner with other health organizations with a vested interest in digital health may allow some expertise to craft a means of delineating how to categorize apps for better patient access. If not, providers and patients will ultimately have to turn to other organizations to provide a means of determining app categorization and tools to navigate the app store. This in turn could be a fragmented approach with some companies or groups only covering certain areas (e.g. psychology, endocrinology) and thus pose a barrier to those patients with multiple co-morbidities.

## Conclusion

Mobile app stores are now the primary means for patients to access digital health products and services. However, app stores are inherently designed poorly and limit the effectiveness of patients and clinicians to actively identify and utilize such apps without using outside resources. These limitations will continue to hamper digital health endeavors, especially as a push for evidence-based prescribable apps come to the fore. Alternative mechanisms for providers to recommend for patients will likely make large strides unless changes are made to the medical app environment. This can be rectified by better collaboration amongst multiple stakeholders to improve design and utilization for current and future patient needs.

**Guarantor:** TDA

**Author contributions:** TDA, NG, RJ, and SS contributed towards the development and writing of this brief communication and its revision after review.

**Declaration of conflicting interests:** The authors declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: DA is an advisor for the Digital Therapeutics Alliance and a previous editor for iMedicalApps.com and RankedHealth. The remaining authors have nothing to disclose.

**Funding:** The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the International Society of Travel Medicine to evaluate mobile medical apps in travel medicine.

**ORCID iD:** Timothy Aungst  <https://orcid.org/0000-0002-6914-0218>

## References

1. Mobile Fact Sheet. Pew research center. Last updated April 7, 2021. Available at <https://www.pewresearch.org/internet/fact-sheet/mobile/>. Accessed October 30, 2021.
2. Vogels EA. About one in five Americans use a smart watch or fitness tracker. *Pew Research Center*. Published January 9, 2020. Available at <https://www.pewresearch.org/fact-tank/2020/01/09/about-one-in-five-americans-use-a-smart-watch-or-fitness-tracker/>. Accessed October 30, 2021.

3. Bach RL and Wenz A. Studying health-related internet and mobile device use using web logs and smartphone records. *PLoS One* 2020 Jun 12; 15: e0234663.
4. COVID-19: Digital Health Trends & Opportunities for 2021. Orcha. Available at [https://www.orchac.co.uk/media/1746/covid\\_report\\_jan\\_2021\\_final-version.pdf](https://www.orchac.co.uk/media/1746/covid_report_jan_2021_final-version.pdf). Accessed October 30, 2021.
5. Carlo AD, Hosseini Ghomi R, Renn BN, et al. By the numbers: ratings and utilization of behavioral health mobile applications. *NPJ Digit Med* 2019 Jun 17; 2: 54.
6. Fougerouse PA, Yasini M, Marchand G, et al. A cross-sectional study of prominent US Mobile health applications: evaluating the current landscape. *AMIA Annu Symp Proc* 2017; 2017: 715–723.
7. Yeung WK, Dawes P, Pye A, et al. Ehealth tools for the self-testing of visual acuity: a scoping review. *NPJ Digit Med* 2019; 2: 82.
8. Siqueira do prado L, Carpentier C, Preau M, et al. Behavior change content, understandability, and actionability of chronic condition self-management apps available in France: systematic search and evaluation. *JMIR Mhealth Uhealth* 2019; 7: e13494.
9. Knitza J, Tascilar K, Messner EM, et al. German Mobile apps in rheumatology: review and analysis using the Mobile application rating scale (MARS). *JMIR Mhealth Uhealth* 2019; 7: e14991.
10. Ayyaswami V, Padmanabhan DL, Crihalmeanu T, et al. Mobile health applications for atrial fibrillation: a readability and quality assessment. *Int J Cardiol* 2019; 293: 288–293.
11. Larsen ME, Huckvale K, Nicholas J, et al. Using science to sell apps: evaluation of mental health app store quality claims. *NPJ Digit Med* 2019; 2: 18.
12. Zhao P, Yoo I, Lancey R, et al. Mobile applications for pain management: an app analysis for clinical usage. *BMC Med Inform Decis Mak* 2019; 19: 106.
13. Sleurs K, Seys SF, Bousquet J, et al. Mobile health tools for the management of chronic respiratory diseases. *Allergy* 2019; 74: 1292–1306.
14. Richardson B, Dol J, Rutledge K, et al. Evaluation of Mobile apps targeted to parents of infants in the neonatal intensive care unit: systematic app review. *JMIR Mhealth Uhealth* 2019; 7: e11620.
15. Singh K, Diamantidis CJ, Ramani S, et al. Patients' and Nephrologists' evaluation of patient-facing smartphone apps for CKD. *Clin J Am Soc Nephrol* 2019; 14: 523–529.
16. Bergeron D, Iorio-morin C, Bigder M, et al. Mobile applications in neurosurgery: a systematic review, quality audit, and survey of Canadian neurosurgery residents. *World Neurosurg* 2019; 127: e1026–e1038.
17. Siddique AB, Krebs M, Alvarez S, et al. Mobile apps for the care management of chronic kidney and End-stage renal diseases: systematic search in app stores and evaluation. *JMIR Mhealth Uhealth* 2019; 7: e12604.
18. Talwar D, Yeh YL, Chen WJ, et al. Characteristics and quality of genetics and genomics mobile apps: a systematic review. *Eur J Hum Genet* 2019; 27: 833–840.
19. Metelmann B, Metelmann C, Schuffert L, et al. Medical correctness and user friendliness of available apps for cardiopulmonary resuscitation: systematic search combined with guideline adherence and usability evaluation. *JMIR Mhealth Uhealth* 2018; 6: e190.
20. Aw B, et al. Travel medicine: what's Involved? When to refer? *Can Fam Physician* 2014 Dec; 60: 1091–1103.
21. International Society of Travel Medicine. <https://www.istm.org/>
22. Seed SM, Khov SL, Binguad FS, et al. Identification and review of mobile applications for travel medicine practitioners and patients. *J Travel Med* 2016 Apr; 23(4): taw034
23. Rogers D. Patient perspective of smartphone-based apps for CKD self-care. *Clin J Am Soc Nephrol* 2019; 14: 483–484.
24. Torbjørnsen A, Ribu L, Rønnevig M, et al. Users' acceptability of a mobile application for persons with type 2 diabetes: a qualitative study. *BMC Health Serv Res* 2019; 19: 641.
25. Lipschitz J, Miller CJ, Hogan TP, et al. Adoption of Mobile apps for depression and anxiety: cross-sectional survey study on patient interest and barriers to engagement. *JMIR Ment Health* 2019; 6: e11334.
26. Chen J, Loeffers J, Bauman A, et al. The use of smartphone health apps and other mobile health (mHealth) technologies in dietetic practice: a three country study. *J Hum Nutr Diet* 2017; 30: 439–452.
27. Han M and Lee E. Effectiveness of Mobile health application use to improve health behavior changes: a systematic review of randomized controlled trials. *Healthc Inform Res* 2018; 24: 207–226.
28. Tarricone R, Cucciniello M, Armeni P, et al. Mobile health divide between clinicians and patients in cancer care: results from a cross-sectional international survey. *JMIR Mhealth Uhealth* 2019; 7: e13584.
29. Lee K, Kwon H, Lee B, et al. Effect of self-monitoring on long-term patient engagement with mobile health applications. *PLoS ONE* 2018; 13: e0201166.
30. Dan L. The rise and fall of happtique, mHealth's First app prescribing platform. *HIStalk Connect*. December 10, 2014. Available at <https://histalkmobile.com/the-rise-and-fall-of-happtique-mhealths-first-app-prescribing-platform/>. Accessed November 10, 2019.
31. Hoeksma J. Un'appy times – the challenges facing the NHS app. *Digitalhealth*. February 5, 2019. Available at <https://www.digitalhealth.net/2019/02/unappy-times-the-challenges-facing-the-nhs-app/>. Accessed November 10, 2019.
32. 2018–19 Annual Report and Accounts. NHS Digital. Available at [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/815360/NHS\\_Digital\\_annual\\_accounts\\_and\\_report\\_2018-19.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/815360/NHS_Digital_annual_accounts_and_report_2018-19.pdf). Accessed November 10, 2019.
33. Leswing K. "Apple is rejecting coronavirus apps that aren't from health organizations, app makers say." *CNBC*. March 5, 2020. Available at <https://www.cnn.com/2020/03/05/apple-rejects-coronavirus-apps-that-arent-from-health-organizations.html>. Accessed May 1, 2020.
34. The Digital Therapeutics Alliance. Available at <https://www.dtxalliance.org/>. Accessed November 1, 2021.
35. Parcher B and Coder M. Decision makers need an approach to determine digital therapeutic product quality, access, and appropriate use. *J Manag Care Spec Pharm* 2021 Apr; 27: 536–538.
36. Yan K, Balijepalli C and Druyts E. The impact of digital therapeutics on current health technology assessment frameworks. *Front Digit Health* 2021 Jun 9; 3: 667016.
37. Ramakrishnan P, Yan K, Balijepalli C, et al. Changing face of healthcare: digital therapeutics in the management of diabetes. *Curr Med Res Opin* 2021; 37(12): 2089–2091.