

Appendix A: List of Reviewed Frameworks

PsyberGuide(1)(2), Mobile App Rating Scale (MARS)(3), AppScript Score(4), MindTech toolkit(5), NHS Digital Development Lab(6), Digital Assessment Questionnaire(7), PAS 277:2015(8), Cambridge Health Alliance(9), mHIMSS (10), NICE Behavior Change Guidance(11), AMA Principles for Safe Apps(12), Mindtools.io, ORCHA(13), Xcertia (14)(15), Guidelines for Mental Health App Evaluation Framework(16), mHealth Quality Label(17), Medical App Evaluation(18), Mobile Health Evaluation Framework(19), APPLICATIONS scoring system(20), Evaluating Sickle Cell Mobile App(21), mHealth App Evaluation for HIV(22), mHealth App Evaluation for HIV (23), mHealth App Evaluation for Pain Management(24), Evaluation of Mobile Clinical Applications(25), Quality of Experience (QoE) Survey(26), Concussion App Evaluation, Apps for Pain Management(27), Evaluation Tool for Healthcare Smartphone Applications(28), IMS: Patient Apps for Improved Healthcare(29), Mobile Apps for Asthma(30), Assessing Mobile Health App Quality(31), Certification Program for App Quality and Safety(32), Apps and Eating Disorders(33), Evidence-based Mobile Medical Applications in Diabetes(34), Diabetes Self-Management Applications(35), Framework for Evaluating Mobile Applications for Cardiac Rehabilitation(36), PIS: graphical classification tool for mHealth apps(37), Usability Evaluation of Mobile Applications for Diabetics(38), DiaDigital Apps(39), Applications of Mobile-Health in Iranian Health System(40), A Health Technology Assessment Module for Evaluating Mobile Medical Applications(41), Transparency4Trust(42), Graded Review of Dermatology Apps(43), What Makes a Good Health App?(44), Development a Guide for Mobile Health-Related Apps (45), Assessment Framework for COVID-19 Apps (46), Assessment of the Transparency and Reliability of Health Information Dissemination(47), Medical Mobile App Classification(48), Framework for Digital Support for the Autism Community (49), mHealth App Trustworthiness Checklist(50), THESIS(51), Framework for Evaluating Quality of mHealth Apps for Adolescent Users(52), ABACUS(53), Alberta Rating Index(54), Evaluation Framework for Digital Health Interventions(55), Mobile Applications Recommendations(56), Assessment Framework for Quality of Asthma Smartphone Applications (57), Global Digital Health Scorecard(58), NASS(59), Australian NSQDMH(60), Express Scripts Digital Health Formulary (61), Medical App Checker (62), Modernizing and Designing Evaluation Frameworks (63), Enlight (64), Improving the Quality of Apps for Patient Use(65), Assessment Framework for e-Mental Health in Canada(66), A Decision-Making Checklist to Support Technology Selection(67), Canadian Mental Health Commission (68), Trust4App(69), Evaluation Criteria (70), IDEAS(71)

Appendix B: Question-by-Question Analysis of MIND

Question	Frameworks with representative question
App Origin	26
Does it come from the government?	6
Does it come from a for-profit company or developer?	4

Does it come from a non-profit company?	3
Does it come from a trusted healthcare company?	6
Does it come from an academic institution?	3
App Functionality	42
Does it work on Apple(iOS)?	9
What is the Apple version?	0
What is the oldest iOS version supported?	0
What was the Apple release date?	1
When was the last Apple (IOS) update?	7
Has the apple version been updated in the last 180 days?	9
Number of reviews on Apple store?	9
Rating (number of stars) on Apple store?	9
App size on iOS?	2
Does it work on Android?	9
What is the Android version?	0
What is the oldest Android version supported?	0
What was the Google play store release date?	1
When was the last Android update?	7
Has the android version been updated in the last 180 days?	9
Number of reviews on google play store?	9
Rating (number of stars) on google play store?	9
App size on android?	2
Does the app work offline?	7
Does it have at least one accessibility feature (like adjust text size, text to voice, or colorblind color scheme adjuster)?	11
Does it have a web version?	5
Does it work with Spanish?	0
Does it work with a language other than English or Spanish?	5
Is the app totally free?	8
What is the cost up front?	16
Are there in-app purchases?	6
Is it a subscription (recurrent/monthly/annual)?	3
Inputs & Outputs	17
Input: surveys?	2

Input: Diary?	1
Input: Geolocation?	0
Input: contact list?	0
Input: Camera?	0
Input: Microphone?	0
Input: step count?	0
Input: external devices (e.g. a wearable sending direct data)?	4
Input: social network?	1
Output: notifications?	6
Output: psychoeducational references/information?	0
Output: social network?	1
Output: reminders?	3
Output: graphs of data?	3
Output: summary of data (in text or numbers)?	3
Output: link to formal care/coaching?	2
Privacy & Security	43
Is there a privacy policy?	20
Does the app declare data use and purpose?	18
Does the app report security measures in place?	25
Is PHI shared?	9
Is de-identified data shared?	5
Is anonymized/aggregate data shared?	5
Can you opt out of data collection?	4
Can you delete your data?	3
Is the user data stored only on the device?	5
Is the user data stored on a server?	9
Does the app have a crisis management feature?	4
Does the app claim it meets HIPAA (or analogous national standard for patient/PHI privacy protection)	10
Reading level of the privacy policy (what grade reading level)?	4
Does the app use 3rd party vendors (i.e. google analytics, etc)?	4
Evidence & Clinical Foundation	57
Is the app content well-written, correct, and relevant?	25
Does the app appear to do what it claims to do?	18

Is the app patient facing?	28
How many feasibility/usability studies?	14
What is the highest feasibility impact factor?	1
How many evidence/efficacy studies?	27
What is the highest efficacy impact factor?	4
Can the app cause harm?	7
Does the app provide any warning for use?	11
Features & Engagement Style	29
Features: mood tracking?	4
Features: medication tracking?	2
Features: sleep tracking?	1
Features: physical exercise tracking?	1
Features: psychoeducation?	3
Features: journaling?	0
Features: picture gallery/hope board?	0
Features: mindfulness?	1
Features: deep breathing?	0
Features: iCBT or sleep therapy?	1
Features: CBT?	0
Features: ACT?	0
Features: DBT?	0
Features: peer support?	1
Features: connection to coach/therapist?	1
Features: biodata?	2
Features: goal setting/habits?	3
Features: physical health exercises?	2
Features: Chatbot interaction (like with virtual character)?	0
Features: Biofeedback with sense data (eeg, HRV, skin conductance, etc)?	2
Engagement style: user generated data?	4
Engagement style: chat/message based?	1
Engagement style: is it a screener/assessment?	3
Engagement style: real time response?	3
Engagement style: Asynchronous response?	0

Engagement style: gamification (points, badges)?	7
Engagement style: videos?	2
Engagement style: audio/music/scripts?	2
Engagement style: AI support?	0
Engagement style: peer support?	6
Engagement style: network support?	5
Engagement style: Collaborative with provider/other?	8
App Use	8
Is it a self-help/self-management tool?	6
Is it a reference app?	1
Is it intended for hybrid use with a clinician in conjunction with treatment plan?	3
Interoperability & Data Sharing	23
Do you own your data?	8
Can you email or export your data?	10
Can you send your data to a medical record?	5

Full Framework Reference List

1. Neary M, Schueller SM. State of the Field of Mental Health Apps. *Cognitive and Behavioral Practice*. 2018 Nov 1;25(4):531–7.
2. About One Mind PsyberGuide [Internet]. One Mind PsyberGuide. [cited 2020 Oct 19]. Available from: <https://live-one-mind-psyberguide.pantheonsite.io/about-psyberguide/>
3. Stoyanov SR, Hides L, Kavanagh DJ, Zelenko O, Tjondronegoro D, Mani M. Mobile App Rating Scale: A New Tool for Assessing the Quality of Health Mobile Apps. *JMIR Mhealth Uhealth* [Internet]. 2015 Mar 11 [cited 2020 Oct 19];3(1). Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4376132/>
4. AppScript | Discover, Deliver & Track Digital Health [Internet]. [cited 2020 Oct 19]. Available from: <https://www.appscript.net/score-details>
5. Toolkit for Appraising Digital Mental Health Products - Technology theme - MindTech [Internet]. 2017 [cited 2020 Oct 19]. Available from: <https://web.archive.org/web/20170701091502/http://mindtech.org.uk/projects/71-digital-mental-health-tools-evaluation-criteria-technology-theme.html>
6. Betton V, Craven M, Davies B, Martin J, Nelissen N, Simons L. Framework for the effectiveness evaluation of mobile (mental) health tools. :42.
7. Digital-Assessment-Questions-V2.1-Beta-PDF.pdf [Internet]. [cited 2020 Oct 19]. Available from: <https://developer.nhs.uk/wp-content/uploads/2018/09/Digital-Assessment-Questions-V2.1-Beta-PDF.pdf>

8. British Standards Institution. Health and wellness apps: quality criteria across the life cycle : code of practice. 2015.
9. Hoffman L. Mobile App Technology Meets Collaborative Care [Internet]. Available from: http://app.ihl.org/FacultyDocuments/Events/Event-2930/Presentation-15621/Document-13034/Presentation_A1_B1_Mobile_App_Technology_benedetto.pdf
10. Selecting a Mobile App: Evaluating the Usability of Medical Applications. :32.
11. McMillan B, Hickey E, Patel MG, Mitchell C. Quality assessment of a sample of mobile app-based health behavior change interventions using a tool based on the National Institute of Health and Care Excellence behavior change guidance. *Patient Education and Counseling*. 2016 Mar;99(3):429–35.
12. AMA adopts principles to promote safe, effective mHealth applications [Internet]. American Medical Association. [cited 2020 Oct 19]. Available from: <https://www.ama-assn.org/press-center/press-releases/ama-adopts-principles-promote-safe-effective-mhealth-applications>
13. Ltd FS. ORCHA Review Process | Reviewing Health and Care Apps | ORCHA [Internet]. [cited 2020 Oct 19]. Available from: <https://www.orchaco.uk/our-solution/the-orcha-review/#0>
14. mHealthIntelligence. Amid a Flood of New mHealth Apps, Xcertia Looks to Set Standards [Internet]. mHealthIntelligence. 2018 [cited 2020 Oct 19]. Available from: <https://mhealthintelligence.com/news/amid-a-flood-of-new-mhealth-apps-xcertia-looks-to-set-standards>
15. Interoperability & Health Information Exchange Committee | HIMSS [Internet]. 2016 [cited 2020 Oct 19]. Available from: <https://www.himss.org/resources/interoperability-health-information-exchange-committee>
16. Chan S, Torous J, Hinton L, Yellowlees P. Towards a Framework for Evaluating Mobile Mental Health Apps. *Telemed J E Health*. 2015 Dec;21(12):1038–41.
17. Yasini M, Marchand G. Mobile Health Applications, in the Absence of an Authentic Regulation, Does the Usability Score Correlate with a Better Medical Reliability? *Stud Health Technol Inform*. 2015;216:127–31.
18. Walsworth DT. Medical Apps: Making Your Mobile Device a Medical Device. *FPM*. 2012 Jun;19(3):10–3.
19. Developing a Framework for Evaluating the Patient Engagement, Quality, and Safety of Mobile Health Applications | Commonwealth Fund [Internet]. [cited 2020 Oct 19]. Available from: <https://www.commonwealthfund.org/publications/issue-briefs/2016/feb/developing-framework-evaluating-patient-engagement-quality-and>
20. Shaia KL, Farag S, Chyjek K, Knopman J, Chen KT. An Evaluation of Mobile Applications for Reproductive Endocrinology and Infertility Providers. *Telemed J E Health*. 2017;23(3):254–8.
21. Shah N, Jonassaint J, De Castro L. Patients welcome the Sickle Cell Disease Mobile Application to Record Symptoms via Technology (SMART). *Hemoglobin*. 2014;38(2):99–103.
22. Schnall R, Mosley JP, Iribarren SJ, Bakken S, Carballo-Diéguez A, Brown Iii W. Comparison of a User-Centered Design, Self-Management App to Existing mHealth Apps for Persons Living With HIV. *JMIR Mhealth Uhealth*. 2015 Sep 18;3(3):e91.

23. Robustillo Cortés M de las A, Cantudo Cuenca MR, Morillo Verdugo R, Calvo Cidoncha E. High quantity but limited quality in healthcare applications intended for HIV-infected patients. *Telemed J E Health*. 2014 Aug;20(8):729–35.
24. Reynoldson C, Stones C, Allsop M, Gardner P, Bennett MI, Closs SJ, et al. Assessing the quality and usability of smartphone apps for pain self-management. *Pain Med*. 2014 Jun;15(6):898–909.
25. Murfin M. Know your apps: an evidence-based approach to evaluation of mobile clinical applications. *J Physician Assist Educ*. 2013;24(3):38–40.
26. Martínez-Pérez B, de la Torre-Díez I, Candelas-Plasencia S, López-Coronado M. Development and evaluation of tools for measuring the quality of experience (QoE) in mHealth applications. *J Med Syst*. 2013 Oct;37(5):9976.
27. Lalloo C, Jibb LA, Rivera J, Agarwal A, Stinson JN. “There’s a Pain App for That”: Review of Patient-targeted Smartphone Applications for Pain Management. *Clin J Pain*. 2015 Jun;31(6):557–63.
28. Jin M, Kim J. Development and Evaluation of an Evaluation Tool for Healthcare Smartphone Applications. *Telemed J E Health*. 2015 Oct;21(10):831–7.
29. patient-adoption-of-mhealth.pdf [Internet]. [cited 2020 Oct 19]. Available from: <https://www.iqvia.com/-/media/iqvia/pdfs/institute-reports/patient-adoption-of-mhealth.pdf>
30. Huckvale K, Morrison C, Ouyang J, Ghaghda A, Car J. The evolution of mobile apps for asthma: an updated systematic assessment of content and tools. *BMC Med*. 2015 Dec;13(1):58.
31. Grundy QH, Wang Z, Bero LA. Challenges in Assessing Mobile Health App Quality: A Systematic Review of Prevalent and Innovative Methods. *Am J Prev Med*. 2016;51(6):1051–9.
32. Álvarez-Rementería JF. QUALITY AND SAFETY STRATEGY FOR MOBILE HEALTH APPLICATIONS. :18.
33. Fairburn CG, Rothwell ER. Apps and eating disorders: A systematic clinical appraisal. *Int J Eat Disord*. 2015 Nov;48(7):1038–46.
34. Drincic A, Prahalad P, Greenwood D, Klonoff DC. Evidence-based Mobile Medical Applications in Diabetes. *Endocrinol Metab Clin North Am*. 2016 Dec;45(4):943–65.
35. Demidowich AP, Lu K, Tamler R, Bloomgarden Z. An evaluation of diabetes self-management applications for Android smartphones. *J Telemed Telecare*. 2012 Jun;18(4):235–8.
36. Beatty AL, Fukuoka Y, Whooley MA. Using mobile technology for cardiac rehabilitation: a review and framework for development and evaluation. *J Am Heart Assoc*. 2013 Nov 1;2(6):e000568.
37. Basilico A, Marceglia S, Bonacina S, Pincioli F. Advising patients on selecting trustful apps for diabetes self-care. *Computers in Biology and Medicine*. 2016 Apr 1;71:86–96.
38. Arnhold M, Quade M, Kirch W. Mobile Applications for Diabetics: A Systematic Review and Expert-Based Usability Evaluation Considering the Special Requirements of Diabetes Patients Age 50 Years or Older. *Journal of Medical Internet Research*. 2014;16(4):e104.
39. Kaltheuner M, Drossel D, Heinemann L. DiaDigital Apps: Evaluation of Smartphone Apps Using a Quality Rating Methodology for Use by Patients and Diabetologists in Germany. *J Diabetes Sci Technol*. 2018 Sep 28;13(4):756–62.

40. Noee M, Baba akbari A, Olyacemanesh A, Mobinizadeh M. Prioritizing the Potential Applications of Mobile-Health in the Iranian Health System. *Journal of Research in Health Sciences*. 2020 Mar 7;20.
41. Moshi MR, Tooher R, Merlin T. Development of a health technology assessment module for evaluating mobile medical applications. *Int J Technol Assess Health Care*. 2020 Jun;36(3):252–61.
42. Wykes T, Schueller S. Why Reviewing Apps Is Not Enough: Transparency for Trust (T4T) Principles of Responsible Health App Marketplaces. *Journal of Medical Internet Research*. 2019;21(5):e12390.
43. Masud A, Shafi S, Rao BK. Mobile medical apps for patient education: a graded review of available dermatology apps. *Cutis*. 2018 Feb;101(2):141–4.
44. Dawson RM, Felder TM, Donevant SB, McDonnell KK, Card EB, King CC, et al. What makes a good health “app”? Identifying the strengths and limitations of existing mobile application evaluation tools. *Nurs Inq*. 2020;27(2):e12333.
45. Llorens-Vernet P, Miró J. Standards for Mobile Health–Related Apps: Systematic Review and Development of a Guide. *JMIR mHealth and uHealth*. 2020;8(3):e13057.
46. Vokinger KN, Nittas V, Witt CM, Fabrikant SI, von Wyl V. Digital health and the COVID-19 epidemic: an assessment framework for apps from an epidemiological and legal perspective. *Swiss Medical Weekly [Internet]*. 2020 May 17 [cited 2020 Oct 19];150(1920). Available from: <https://smw.ch/article/doi/smw.2020.20282>
47. Huang Z, Lum E, Car J. Medication Management Apps for Diabetes: Systematic Assessment of the Transparency and Reliability of Health Information Dissemination. *JMIR mHealth and uHealth*. 2020;8(2):e15364.
48. Nwe K, Larsen ME, Nelissen N, Wong DC-W. Medical Mobile App Classification Using the National Institute for Health and Care Excellence Evidence Standards Framework for Digital Health Technologies: Interrater Reliability Study. *Journal of Medical Internet Research*. 2020;22(6):e17457.
49. Zervogianni V, Fletcher-Watson S, Herrera G, Goodwin M, Pérez-Fuster P, Brosnan M, et al. A framework of evidence-based practice for digital support, co-developed with and for the autism community: Autism [Internet]. 2020 Feb 6 [cited 2020 Oct 19]; Available from: <https://journals.sagepub.com/eprint/4KEDZJ7YYCZAUHJ7B2NR/full>
50. van Haasteren A, Gille F, Fadda M, Vayena E. Development of the mHealth App Trustworthiness checklist. *DIGITAL HEALTH*. 2019 Jan 1;5:2055207619886463.
51. Levine DM, Co Z, Newmark LP, Groisser AR, Holmgren AJ, Haas JS, et al. Design and testing of a mobile health application rating tool. *npj Digital Medicine*. 2020 May 21;3(1):1–7.
52. Jeminiwa RN, Hohmann NS, Fox BI. Developing a Theoretical Framework for Evaluating the Quality of mHealth Apps for Adolescent Users: A Systematic Review. *J Pediatr Pharmacol Ther*. 2019;24(4):254–69.
53. McKay FH, Slykerman S, Dunn M. The App Behavior Change Scale: Creation of a Scale to Assess the Potential of Apps to Promote Behavior Change. *JMIR mHealth and uHealth*. 2019;7(1):e11130.
54. Azad-Khaneghah P, Neubauer N, Miguel Cruz A, Liu L. Mobile health app usability and quality rating scales: a systematic review. *Disability and Rehabilitation: Assistive Technology*. 2020 Jan 8;1–10.

55. Kowatsch T, Otto L, Harperink S, Cotti A, Schlieter H. A design and evaluation framework for digital health interventions. *it - Information Technology*. 2019 Oct 25;61(5–6):253–63.
56. Jisha RC, Krishnan R, Vikraman V. Mobile Applications Recommendation Based on User Ratings and Permissions. In: 2018 International Conference on Advances in Computing, Communications and Informatics (ICACCI). 2018. p. 1000–5.
57. Guan Z, Sun L, Xiao Q, Wang Y. Constructing an assessment framework for the quality of asthma smartphone applications. *BMC Medical Informatics and Decision Making*. 2019 Oct 15;19(1):192.
58. Mathews SC, McShea MJ, Hanley CL, Ravitz A, Labrique AB, Cohen AB. Digital health: a path to validation. *npj Digital Medicine*. 2019 May 13;2(1):1–9.
59. Greenhalgh T, Wherton J, Papoutsi C, Lynch J, Hughes G, A’Court C, et al. Beyond Adoption: A New Framework for Theorizing and Evaluating Nonadoption, Abandonment, and Challenges to the Scale-Up, Spread, and Sustainability of Health and Care Technologies. *Journal of Medical Internet Research*. 2017;19(11):e367.
60. National Safety and Quality Digital Mental Health Standards | Australian Commission on Safety and Quality in Health Care [Internet]. [cited 2020 Oct 23]. Available from: <https://www.safetyandquality.gov.au/standards/national-safety-and-quality-digital-mental-health-standards>
61. Digital Health Formulary | Express Scripts [Internet]. [cited 2020 Oct 23]. Available from: <https://www.express-scripts.com/corporate/tag/digital-health-formulary>
62. Medical App Checker: a Guide to assessing Mobile Medical Apps [Internet]. [cited 2020 Oct 23]. Available from: <https://www.knmg.nl/actualiteit-opinie/nieuws/nieuwsbericht/medical-app-checker-a-guide-to-assessing-mobile-medical-apps.htm>
63. Coravos A, Doerr M, Goldsack J, Manta C, Shervey M, Woods B, et al. Modernizing and designing evaluation frameworks for connected sensor technologies in medicine. *npj Digital Medicine*. 2020 Mar 13;3(1):1–10.
64. Baumel A, Faber K, Mathur N, Kane JM, Muench F. Enlight: A Comprehensive Quality and Therapeutic Potential Evaluation Tool for Mobile and Web-Based eHealth Interventions. *Journal of Medical Internet Research*. 2017;19(3):e82.
65. Wyatt JC. How can clinicians, specialty societies and others evaluate and improve the quality of apps for patient use? *BMC Medicine*. 2018 Dec 3;16(1):225.
66. Zelmer J, Hoof K van, Notarianni M, Mierlo T van, Schellenberg M, Tannenbaum C. An Assessment Framework for e-Mental Health Apps in Canada: Results of a Modified Delphi Process. *JMIR mHealth and uHealth*. 2018;6(7):e10016.
67. Nebeker C, Bartlett Ellis RJ, Torous J. Development of a decision-making checklist tool to support technology selection in digital health research. *Transl Behav Med*. 2020 Oct 8;10(4):1004–15.
68. eMH_app_eng.pdf [Internet]. [cited 2020 Oct 23]. Available from: https://www.mentalhealthcommission.ca/sites/default/files/2018-01/eMH_app_eng.pdf
69. Habib SM, Alexopoulos N, Islam MM, Heider J, Marsh S, Muehlhaeuser M. Trust4App: Automating Trustworthiness Assessment of Mobile Applications. In: 2018 17th IEEE International Conference On Trust, Security And Privacy In Computing And Communications/ 12th IEEE International Conference On Big Data Science And Engineering (TrustCom/BigDataSE). 2018. p. 124–35.

70. Farnia T, Jaulent M-C, Steichen O. Evaluation Criteria of Noninvasive Telemonitoring for Patients With Heart Failure: Systematic Review. *Journal of Medical Internet Research*. 2018;20(1):e16.
71. Fedele DA, McConville A, Moon J, Thomas JG. Topical Review: Design Considerations When Creating Pediatric Mobile Health Interventions: Applying the IDEAS Framework. *J Pediatr Psychol*. 2019 Apr 1;44(3):343–8.