Apps for Coronary Heart Disease

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Mobile health applications (MHA) are discussed to contribute in overcoming this gap in treatment by fostering CHD management. First, MHA may support daily monitoring of activities and symptoms. Second, adherence to treatment and lifestyle changes can be increased by self-tracking, feedback, and reminder functions of MHA.

Keywords: coronary heart disease (CHD) ; apps ; mobile health ; eHealth ; systematic evaluation

1. Introduction

Cardiovascular diseases and especially coronary heart diseases (CHD) are one of the leading causes of death worldwide $^{[\underline{1}][\underline{2}]}$. According to the global burden of disease study 17.8 million people died from cardiovascular diseases in 2017 $^{[\underline{1}]}$. According to the heart disease and stroke statistics the prevalence of CHD in the US ranges from 5.3% for female adults to 7.4% for male adults $^{[\underline{3}]}$.

Disease management and behavior change including lifestyle changes are key aspects of CHD care but often not adequately and enduringly considered in care settings ^[4]. The large number of risk and lifestyle factors render the prevention and self-management of CHD extensive and complex for patients ^{[4][5]}. Therefore, means of promoting disease management and lifestyle changes as well as information are necessary to improve prevention and conventional treatment of CHD ^{[4][6][7]}. Mobile health applications (MHA) are discussed to contribute in overcoming this gap in treatment by fostering CHD management ^{[6][8]}. First, MHA may support daily monitoring of activities and symptoms ^[9]. Second, adherence to treatment and lifestyle changes can be increased by self-tracking, feedback, and reminder functions of MHA ^{[9][10]}. Third, MHA are accessible at all times and at relatively little costs ^[11] making MHA a scalable solution to provide general information about CHD, symptoms, and specific lifestyle modifications ^{[12][13]}. Fourth, MHA can increase patients' perception to play an active role in their own healthcare and hereby foster self-sufficiency, disease management, and **References**ny ^{[9][11][14]}.

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Delling, F.N.; Deo, R.; et al. Heart disease and stroke statistics-2018 update: A report from the American Heart **2**s**Research**la**Wethods**7, 67–492.

4. Hale, K.: Capra, S.; Bauer, J. A framework to assist health professionals in recommending high-guality apps for The identified MHA were examined for eligibility in a two-step procedure. In the first step, the title and app description supporting chronic disease self-management: Illustrative assessment of type 2 diabetes apps. JMIR mHealth uHealth. were screened and the inclusion criteria for the download of MHA were applied. Apps were downloaded if (a) in the app 2015, 3, 1–12. title or description the subject of coronary heart disease was stated, (b) the app was developed for patients with CHD, persons at hisk, ist. Jun Bringer affected in the work of type and the applied of the appl

6. Park, L.G.; Beatty, A.; Stafford, Z.; Whooley, M.A. Mobile phone interventions for the secondary prevention of In a second step, the identified apps were downloaded and the criteria for inclusion in the evaluation were examined cardiovascular disease. Prog. Cardiovasc. Dis. 2016, 58, 639–650. within the app. MHA were included if (a) CHD was focused, a CHD-specific section was included, or the app description statedings use for CHTB; (b) ho other specific chromation (c) and (c) how as the context of the second ary prevention after acute myocardial infarction: A call for action, Eur J. Prev, cardiol. 2016, 23, 1994–2006. malfunctions were tested on two devices.

 8. Frederix, I.; Vanhees, L.; Dendale, P.; Goetschalckx, K. A review of telerehabilitation for cardiac patients. J. Telemed. For this study is MARS elassification section was adapted to include the following general characteristics: (1) app name,
 (2) platform (Android, iOS), (3) affiliation, (4) price, (5) embedment in therapy, (6) user star rating, (7) number of user ratings, (8) app store category, (9) methods, (10) technical aspects, and (11) security and privacy.

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- 16. Athilingam, P.; Jenkins, B. Mobile phone approver support heart failure self cares management: Integrative review. JMIR Cardio 2018, 2.
- 17. Creber, R.M.M.; Maurer M.S.; Reading, M.; Hiraldo, G.; Hickey, K.T.; Iribarren S. Review and analysis of existing mobile phone apps to support heart failure symptom monitoring and self-care management using the mobile application rating scale (MARS). JMIR minipatin J health. 2016, 4.
 b) Not for patients (n = 40)
- 18. Ayyaswami, V.; Padmanabhan, D.L.; Criftälinearit, T.; Thelmo, F.; Pråbhör, Y.; Maghalin, J.W. Mobile health applications for atrial fibrillation: A readability and quality assessment in the sessment of the sessment of
- 19. Jamaladin, H.; van de Belt, T.H.; Luijpers, L.C.H.; de Graaff, F.R.; Bredie, S.J.H.; Roeleveld, N.; van Gelder, M.M.H.J. Mobile apps for blood pressure monitoring: Systematic search in app storescandie ontent analysis. JMIR mHealth uHealth. 2018, 6.
 e) Not for coronary heart disease or risk score only (n = 10, n = 6)
- 20. Zang, J.; Dummit, K.; Graves, J.; Lisker, P.; Sweeney, L. Who Knows What About Me & AiSurvey of Behind the Scenes Personal Data Sharing to Third Parties by Mobile Apps. Available online: https://techscience.org/a/2015103001/

 (accessed on 19 September 2021)
 Final sample N=38
 Technical malfunction

21. Nguyen, H.H.; Silva, J N_{A}^{2} . Use of smartphone technology in cardiology. Trends Cardiovasc. Med. 2016, 26, 376–386.

- 22. Martínez-Pérez, B.; de la Torre-Díez, I.; López-Coronado, M.; Herreros-González, J. Mobile apps in cardiology: Review. JMIR mHealth uHealth 2013, 1, e15.
- Figure 1. Flowchart of the app screening and inclusion process.

23. Treskes, R.W.; Wildbergh, T.X.; Schalij, M.J.; Scherptong, R.W.C. Expectations and perceived barriers to widespread Thereflamentations of the although and all expected in **Fabriers** from a approximate the difference of the although and solve the dames of the although and solve the dames of the although and solve the approximate the difference of the although and solve the dames of the although and solve the although and solve the although a solve the although and solve the although a solve the although

Table 1. General characteristics of included MHA for coronary heart disease.

	n (%)	M (SD)
Platform		
Android	30 (78.95%)	
iOS	7 (18.42%)	
Both	1 (2.63%)	
Affiliation		
Commercial company	20 (52.63%)	
NGO	2 (5.26%)	
University	2 (5.26%)	
Government	1 (2.63%)	
Unknown	13 (34.21%)	
Obligatory payment		
Google Play store	2 (5.26%)	2.84 (0.85)
Apple App store	2 (5.26%)	2.29 (1.20)

	n (%)	M (SD)
User ratings		
Google Play store	12 (31.58%)	4.26 (0.47)
Apple App store	1 (2.63%)	1.0 (0.00)
Technical aspects		
Internet required	19 (50.0%)	
App community	1 (2.63%)	
Methods		
Information and education	34 (89.47%)	
Tips and advice	25 (65.79%)	
Feedback	16 (42.11%)	
Alternative medicine	3 (7.89%)	
Bodily exercises	2 (5.26%)	
Security & privacy		
Privacy policy	26 (68.42%)	
Contact information	33 (86.84%)	
Informed consent	7 (18.42%)	
Login	6 (15.79%)	
Password	3 (7.89%)	

For 12 apps (31.58%) a user rating was available in the Google Play store and for one app (2.63%) in the Apple App store. The median user star rating in the Google Play store was 4.4 (M = 4.26, SD = 0.47) with five to 1276 ratings (M = 220.42, SD = 403.29) and the user star rating in the Apple App store was 1.0 with one rating (user ratings last updated on 4 April 2021). MHA were classified in eight app store categories: 'Health & Fitness' (n = 18, 47.37%), 'Medical' (n = 10, 26.32%), 'Education', 'Books & Reference' (n = 3, 7.89% each), 'Lifestyle', 'Food & Drink', 'Entertainment', and 'Social Networking' (n = 1, 2.63% each). In 19 apps (50.00%) internet was required for some or all functions and one app (2.63%) had an app community. Most common methods were information and education (n = 34, 89.47%), tips and advice (n = 25, 65.79%), and feedback (n = 16, 42.11%). For most apps a privacy policy (n = 26, 68.42%) and contact information (n = 33, 86.84%) was provided and in seven apps (18.42\%) active consent was required. Login was necessary in six apps (15.79\%) and a password protection in three apps (7.89\%).

The functions of the ten highest-rated apps are shown in **Table 2** and a full table depicting all employed functions per MHA is included in Appendix C . In general, many MHA had one (n = 17, 44.74%) or two functions (n = 14, 36.84%) and in seven apps (18.42%) three or more functions were employed. Of those MHA with three or more functions, five apps (71.43%) were among the ten highest-rated apps. A significant positive correlation with a large effect size was found between the MARS total score and the number of employed functions (r (36) = 0.66, p < 0.001).

	Provisi	ion of Inform	ation		Data Acqu	Data Acquisition, Processing and Evaluation					Calendar and Appointment- Related			Support		Other	
Name	News	Reference	Learning Material	Player/Viewer	Broker	Decision Support	Calculator	Meter	Monitor	Surveillance/Tracker	Diary	Reminder	Calendar	Utility/Aid	Coach	Health Manager	Communicator/Socia Network
CardiaCare	-	1		-			1	-	-		-	1		-	-	1	-
Love My Heart for Women		1				1	1	-		-		1	1	-	-	1	-
CardioVisual: Heart Health Built by Cardiologists		,			-		1										-
Heart Disease Yoga & Diet– Cardiovascular disease		1					1					1	1			1	-
My Heart Age		1	-	-		1	1		1			-		-			-
ASCVD Risk Estimator Plus		1	-			-	1	-				-	-	-	-	-	-
Texas Heart Institute		1	-	-		-	1	-				-		-	-	-	-
The Heart App ©		1					1	-		-		-			-		-

Table 2. Employed functions per included MHA for the ten highest-rated apps.

	Provisi	on of Informa	ition								Calendar and Appointment- Related			Support		Other	
Name	News	Reference	Learning Material	Player/Viewer	Broker	Decision Support	Calculator	Meter	Monitor	Surveillance/Tracker	Diary	Reminder	Calendar	Utility/Aid	Coach	Health Manager	Communicator/Social Network
Angina	-	1		-	-	-	-	-	-	-	-	-	-	-	-	-	1
Heart Disease 101 Audio Book	-	1		1				-	-		-		-				

4. Conclusions

This first systematic evaluation of MHA for CHD demonstrated an average overall quality of MHA (M = 3.38, SD = 0.36). The most common functions were information texts and risk score calculators. Only few MHA provide a set of multiple functions and incorporate behavior change techniques limiting the potential for lifestyle changes and support in disease management of users. Most MHA were not developed by a credible source and there is a considerable lack of scientific evidence for the usefulness and efficacy of the included MHA. Nevertheless, some potentially helpful MHA were identified.