Gut and Gastroenterology

RESEARCH ARTICLE

The Practical Utility of Mobile Health Applications for Celiac Disease Patients

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Abstract

Objective: Celiac disease affects about 3 million people in the United States, and requires lifelong patient education and treatment. Advances in technology have led to the development of over 300,000 healthcare mobile applications. However, there is no regulation on the quality of these mobile health applications, which can impact patient care. We performed a qualitative analysis of mobile applications available for celiac disease patients.

Design: The terms "celiac" and "celiac disease" were used to identify mobile health applications related to CD on the Apple and Google Play Store. Only patient-oriented applications for disease self-management and education were included. Application quality was evaluated with Mobile Application Rating Scale (MARS), a reliable tool for rating the quality of mobile health applications. Health information in applications was evaluated using DISCERN, a validated tool to assess quality of written health information.

Results: Of the 294 applications on the Google Play Store and 106 apps on the Apple Store, 17 met our criteria. The mean MARS score was 3.24/5, indicating acceptable application quality. The mean DISCERN score was 2.74/5, signifying potentially important or serious shortcomings to the quality of health information. Apps developed by healthcare providers (HCP) had higher average MARS and DISCERN scores compared to those developed by non-HCP. "My Healthy Gut" scored highest with MARS of 4.28 and DISCERN 3.90.

Conclusion: Although tremendous potential for mobile health applications exists, the quality varies drastically. Applications created by HCPs appear to be superior. The quality of health information in applications remains an area for improvement. HCPs can serve a big role in shaping future applications, and we encourage further contribution to their ongoing developments.

Summary Box:

What is already known about this subject?

- In today's society, patients are commonly turning to technology for education and management of many chronic diseases, including celiac disease
- Over 300,000 healthcare applications have been developed, and applications are becoming increasingly popular
- There is no regulation on the quality of mobile health applications and the quality of the applications is unknown

What are the new findings?

- The quality of mobile health applications for celiac disease varies drastically
- The quality of health information in mobile applications remains an area for improvement.
- Applications created by HCPs were overall superior compared to those that were not.

How might it impact on clinical practice in the foreseeable future?

- HCPs can serve an instrumental role in shaping future applications which can improve patient care. Their contributions to ongoing developments can lead to significant improvement in long-term management of chronic diseases

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Introduction:

Celiac disease (CD) is one of the most common autoimmune disorders, and currently affects about 3 million people in the United States [1]. Due to its lifelong burden, ongoing patient education and treatment are essential. In today's society, patients are commonly turning to technology for education and management of many chronic diseases. Mobile health applications (apps) have quickly emerged to meet this demand, with over 300,000 healthcare applications developed [2]. With these developing health delivery tools, patients have the ability to obtain evidence-based knowledge and potentially improve the management of their disease from home. Technological advances have transformed the way chronic diseases are managed. As healthcare now focuses on a patient-centered approach, patients are increasingly playing active roles in their care by being more informed and involved in the decision-making process [3]. Unfortunately, there is no regulation on the quality of these mobile health applications, and this can potentially impact patient care [4]. We performed a qualitative analysis of mobile applications currently available for celiac disease patients.

Materials and Methods:

We utilized the Apple App Store and Google Play Store, which are currently the two most widely used mobile application stores throughout the world. The terms "celiac" and "celiac disease" were used to identify mobile health applications related to CD. We only included applications that were English language based and patient-oriented for disease education and self-management, which was determined by personally evaluating individual application contents (figure 1). Other various application contents were also characterized (table 1). The quality of each application was evaluated with Mobile Application Rating Scale (MARS), an objective and reliable tool developed for rating the quality of mobile health applications [5]. We also graded the health information in each application using the DISCERN instrument, a validated tool used to assess quality of written health information [6]. Each scoring system was used to assess various objective measures to generate scores between 1 and 5 (Table 2). Permission was obtained from the originator of both MARS and DISCERN, and study authors were all trained in using each scoring system.

Results:

Our search yielded a total of 294 applications on the Google Play Store and 106 applications on the Apple App Store. A total of 17 mobile applications met our criteria (Figure 1). Most were free of charge, and they all contained a patient education section. The quality of each application was evaluated using their engagement, functionality, aesthetics, and information with MARS. The mean rating for all apps was 3.24/5, which

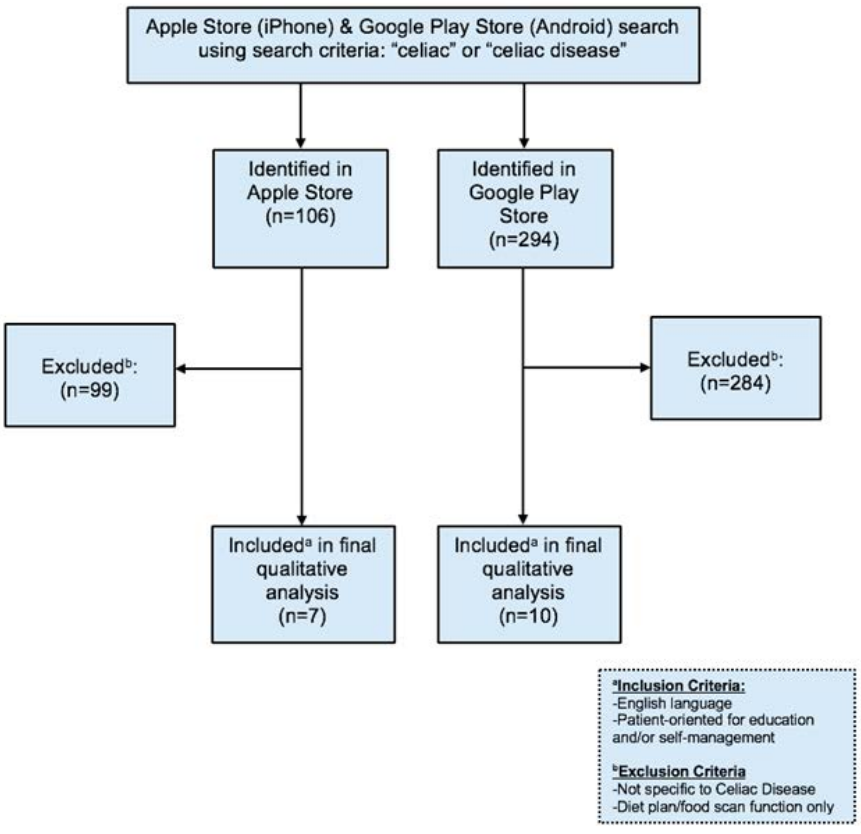

Figure 1: Flowchart of application identification, inclusion and exclusion

Table 1: Selected characteristics of mobile applications by store (Apple Store vs. Google Play Store)

Characteristics	Apple Store % (n=7)	Google Play Store % (n=10)
Category of Application in Store		
Medical	29% (2)	20% (2)
Education	-	10% (1)
Health & Fitness	57% (4)	70% (7)
Food & Drink	14% (1)	-
App Store Rating		
Less than 3	29% (2)	40% (4)
Between 3 and 5	71% (5)	60% (6)
Number of Raters		
Unavailable	100% (7)	40% (4)
Less than 100	-	50% (5)
100 – 500	-	10% (1)
Number of Downloads		
Unavailable	100% (7)	-
Less than 500	-	10% (1)
More than 500	-	90% (9)
Price		
Free	86% (6)	100% (10)
Paid	14% (1)	-
Needs Web Access to Function		
Yes	86% (6)	30% (3)
Login/Account Function		
Yes	43% (3)	10% (1)
App Designed to Use Independently		
Yes	86% (6)	100% (10)
Education Section		
Yes	100% (7)	100% (10)
Treatment Section		
Yes	57% (4)	30% (3)
Diet Plans		
Yes	71% (5)	70% (7)
Log/Diary Function		
Yes	29% (2)	10% (1)
In-App Purchases		
Yes	29% (2)	30% (3)
Networking Function		
Yes	0% (0)	10% (1)
Allows Sharing (Facebook, Twitter, etc)		
Yes	14% (1)	10% (1)
Link to Medical/Guideline Website		
Yes	43% (3)	20% (2)
App Developers		
Healthcare Provider	57% (4)	20% (2)
Non-Healthcare Provider	43% (3)	80% (8)

Table 2: Mean ratings for all 17 mobile phone applications

Quality of Mobile Applications[1]	Mean Rating (1-5)[3]
Overall Quality of All Apps	**3.24**
• Engagement *(entertainment, interest, customization, interactivity, target group)*	2.83
• Functionality *(performance, ease of use, navigation, gestural design)*	3.56
• Aesthetics *(layout, graphics, visual appeal)*	3.39
• Information *(accuracy of app description, goals, quality/quantity of information, visual information, credibility, evidence base)*	3.20
Overall Quality of HCP-developed Apps	**3.62**
Overall Quality of non-HCP-developed Apps	**2.91**
Quality of Health Information[2]	**Mean Rating (1-5)[4]**
Overall Quality of Health Information in All Apps	**2.74**
Is it reliable?	**2.78**
• Are the aims clear?	3.69
• Does it achieve its aims?	3.35
• Is it relevant?	3.35
• Is it clear what sources of information were used (other than the author or producer)?	2.04
• Is it clear when the information used or reported was produced?	1.78
• Is it balanced and unbiased?	3.02
• Does it provide details of additional sources of support and information?	2.27
How good is the quality of information on treatment choices?	**2.70**
• Does it describe how each treatment works?	3.31
• Does it describe the benefits of each treatment?	3.27
• Does it describe the risks of each treatment?	1.90
• Does it describe what would happen if no treatment is used?	2.78
• Does it describe how the treatment choices affect overall quality of life?	2.76
• Is it clear that there may be more than one possible treatment?	3.25
• Does it provide support for shared-decision making?	2.10
Overall Quality of Health Information in HCP-developed Apps	**3.10**
Overall Quality of Health Information in non-HCP-developed Apps	**2.49**

[1]From MARS[2]From DISCERN instrument[3](1-Inadequate, 2-Poor, 3-Acceptable, 4-Good, 5-Excellent)[4](1-Serious or extensive shortcomings, 3-Potentially important but not serious shortcomings, 5-Minimal shortcomings)

indicates overall acceptable app quality. App functionality was the best quality measured, with a mean score of 3.56/5. App engagement scores were the lowest measured with a mean of 2.83/5, indicating overall poor quality. In regards to the quality of the written health information in each application, the mean DISCERN score was 2.74/5, signifying potentially important or serious shortcomings to the quality of health information provided. Applications that were developed by healthcare providers (HCP) had a higher average MARS score of 3.62/5, compared to 2.91/5 in those developed by non-HCP. The DISCERN score in HCP-developed apps was also higher at 3.10/5, compared to 2.49/5 in non-HCP apps. "My Healthy Gut", an application developed by HCPs, had the highest quality scores of all mobile applications studied, with a MARS of 4.28/5 and DISCERN of 3.90/5.

Discussion:

There is tremendous potential for mobile health applications to contribute to the management of chronic diseases. Given that most applications in our study were free of charge, contained a patient education section, were designed to use independently and even contained dietary plans for patients (Table 1), mobile health applications can be very appealing and effective digital tools for patients with Celiac disease. As the use of mobile health applications becomes more prevalent, we must endeavor to understand their overall benefits and limitations. Although advancements in technology today can potentially improve patient education and aid in self-management of chronic diseases, mobile applications remain largely unregulated. To the best of our knowledge, this is the first study performed to qualitatively assess mobile applications for Celiac disease. Our study demonstrates that both the quality of mobile health applications and the medical information presented in them can vary drastically. As a result, their reliability remains an ongoing concern.

In our study, applications that were created by HCP were overall superior compared to those that were not. We found that "My Healthy Gut", an application developed by HCP for celiac disease, was the highest quality app in our study. Most applications available however were not developed by HCP, which can be a potential explanation for some of the deficiencies noted in those applications. Furthermore, most applications did not contain resources for patients to access up-to-date medical guidelines and recommendations, which can hinder patients from obtaining reliable and evidence-based recommendations. As evidenced by the low DISCERN scores, the quality of the health information in most applications also remains a significant area for improvement. We believe that HCPs can serve an instrumental role in shaping future applications which can improve patient care, and we encourage further contributions to their ongoing developments.

Contribution of each author:

Sunny Sandhu: Conception and design, analysis and interpretation of the data, drafting of the article, critical revision of the article for important intellectual content

Dhuha Alhankawi: Conception and design, analysis and interpretation of the data, drafting of the article, critical revision of the article for important intellectual content

Amitpaul Gill: Analysis and interpretation of the data, drafting of the article

Aalam Sohal: Analysis and interpretation of the data

Marina Roytman: Conception and design, critical revision of the article for important intellectual content; final approval of the article.

Thimmaiah Theethira: Conception and design, analysis and interpretation of the data, critical revision of the article for important intellectual content, final approval of the article.

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Conflict of Interest

We have no conflicts of interest to disclose.

References

1. Meize-Grochowski R (2005) Celiac disease: a multisystem autoimmune disorder. *Gastroenterol Nurs* 28:394-404. [View Article]
2. Levine DM, Co Z, Newmark LP, et al. (2020) Design and testing of a mobile health application rating tool. *npj Digit Med* 3: 74. [View Article]
3. Demiris G, Afrin LB, Speedie S, et al. (2008) Patient-centered applications: use of information technology to promote disease management and wellness. A white paper by the AMIA knowledge in motion working group. *J Am Med Inform Assoc* 15:8-13. [View Article]
4. Kao CK, Liebovitz DM (2017) Consumer Mobile Health Apps: Current State, Barriers, and Future Directions. *PM R* 9:S106-S115. [View Article]
5. Stoyanov SR, Hides L, Kavanagh DJ, Zelenko O, Tjondronegoro D, et al. (2015) Mobile app rating scale: a new tool for assessing the quality of health mobile apps. *JMIR Mhealth Uhealth* 3:e27. [View Article]
6. Charnock D, Shepperd S, Needham G, Gann R (1999) DISCERN: an instrument for judging the quality of written consumer health information on treatment choices. *J Epidemiol Community Health*. 53:105-111. [View Article]

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