**DIGITAL HEALTH**

# User testing to modify the MyHealthyGut digital health application for inflammatory bowel disease

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## Abstract

**Introduction:** Inflammatory bowel disease, characterized by chronic intestinal inflammation, can be subcategorized into Crohn's disease and ulcerative colitis. The treatment for these conditions is unique to each patient and may include lifestyle changes, pharmaceutical intervention, and surgery. Lifestyle changes, such as dietary intervention, are a cornerstone of inflammatory bowel disease symptom management. Given the daily burden of this disease, self-management is paramount in coping with and/or minimizing symptoms. The MyHealthyGut application, successfully proven to be a self-management tool for celiac disease, shows promise for use in an inflammatory bowel disease patient population.

**Objective:** To conduct user testing to gather valuable insights for the development of an IBD-focused version of the existing MyHealthyGut app.

**Methods:** Participants included inflammatory bowel disease patients and healthcare practitioners. Participants used the application for a 2-week period, followed by participation in a focus group or individual interview to provide feedback. Qualitative questionnaires were administered verbally and feedback was recorded. Thematic analysis techniques were used for data quantification and analysis.

**Results:** 15 participants were recruited and enrolled. Of these, 14 participants took part in the focus group and/or individual interviews. The feedback suggested changes related to clinical uses, food and symptom tracking, ease of use, and educational content. All (100%) participants reported that they would either use the application themselves or recommend it to patients, once their suggestions were implemented.

**Conclusion:** Through user testing and feedback collection, priorities for app modification were identified. Areas for modification in the app functions and features, ease of use, and content were identified. Once updated to meet the needs of inflammatory bowel disease patients, the MyHealthyGut app may be a useful tool for IBD self-management.

## Keywords

digital health, eHealth, gastroenterology, apps, self monitoring

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## Introduction

Inflammatory bowel disease (IBD) is characterized by chronic intestinal inflammation, broadly classified into two types, Crohn's disease (CD) and ulcerative colitis (UC). Typical IBD symptoms include diarrhea, abdominal pain, weight loss, and bloody stools. The etiology of IBD has not been fully elucidated however environmental factors, such as diet, have been under the spotlight in IBD development and management in recent decades.[1,2] Multiple studies have shown evidence that a diet high in fiber, fish, fruits, and vegetables has a protective effect against IBD.[3,4] Conversely, a typical western diet, characteristically rich in n-6 polyunsaturated fatty acids (PUFA) and low in fiber, is suggested to contribute to the onset of IBD. Moreover, the rise in IBD incidence in countries adopting westernized practices, such as those in Africa, Asia, and South America, further supports the potential impact of the western diet.[5]

Though IBD is seen globally, the prevalence of IBD was found to be the highest in highly industrialized countries, including those in North America, Australasia, and parts of Europe.[5] In Canada, the prevalence of IBD in 2018 is 0.7% and is forecasted to increase to 1.0% by 2030.[6] The IBD patient population grows in tandem with its financial burden on the healthcare system, predominantly through prescription drugs, biological therapies, and hospitalizations.[7] These direct healthcare costs, defined as the cost of medically necessary services for each IBD patient, were estimated in 2018 to be $14.6 billion (USD) and $1.29 billion (CAD) in the US and Canada, respectively.[7] In addition to direct healthcare costs, indirect costs include those related to patient time off work (absenteeism), decreased productivity, the mental health burden of living with a chronic disease, and premature and long-term disability.[7] One solution to the costs of both patients with IBD and the healthcare system is a greater emphasis and investment in self-management strategies.

With the rise of mobile phone users worldwide, as well as the increased use of telemedicine due to the 2019 coronavirus (COVID-19) pandemic, the electronic health (eHealth) monitoring movement is at the forefront of disease prevention and self-management. The eHealth applications (app) developed for chronic disease management of diabetes, several types of cancer, and chronic obstructive pulmonary disease, have demonstrated efficacy through decreased hospitalization rates, healthcare costs, and increased patient sense of security, understanding of their condition, and convenience.[8] The established benefits of eHealth in chronic disease management show promise for use of a mobile app as a tool in IBD management. A focus group study conducted by Khan and colleagues (2016) highlighted IBD patients' need for a tool with better symptom tracking, disease control assessment, medication adherence, physician feedback, objective setting, and education.[9] While the validation of the IBD management mobile app HealthPROMISE, created based on Khan and colleagues study outcomes, revealed a reduction in hospitalization and increased understanding of IBD, no significant change in IBD quality indicators such as bowel symptoms, emotional health, social function, and overall quality of life were seen.[10] Given the importance of diet in IBD management and the lack of scientific-based nutrition advice and analysis features in current IBD management mobile apps, there is a need for a diet-centered app, providing dietary guidance and support to patients with IBD.

A recent review article published by Spartz et al. (2023) reviewed the use of mobile health tools, such as mobile apps and telemedicine, in the management of IBD. Potential benefits included symptom tracking, exchanging data, increasing communication between patients and care providers, and providing educational materials to patients.[11] Of the trials and studies they reviewed, they noted several positive outcomes in patients with IBD using mobile health tools including improvements in disease activity and quality of life, reduced costs to patients and healthcare, reduced use of long-term steroids, improvements in adherence to treatment, and reductions in hospitalizations. However, it should be noted that the benefits of using mobile apps to manage IBD are not fully understood as the majority of mobile apps are used in commercial rather than clinical settings. Several limitations in the use of mobile apps for the management of IBD were also reported in the review. The use of mobile health in general requires patients to have access to the internet or cellular data, a computer and/or smartphone, as well as general technical literacy to navigate these tools. This divide in access to technology is known as the "digital divide" and can disproportionately impact people of ethnic and racial minorities, those with mental or physical disabilities, rural populations, the elderly, and those of lower socioeconomic status, thus limiting access to potentially beneficial forms of healthcare. Additional limitations posed included data privacy and the amount of data that is collected. For example, a patient who does not input an adequate amount of information may not experience beneficial outcomes whereas a patient who inputs data too frequently may experience burnout.

MyHealthyGut (MHG) is a mobile app that was originally designed for celiac disease (CeD) self-management.[12,13] At present, the only treatment for CeD is a strict gluten-free (GF) diet.[14] The app was developed to provide guidance, diet and symptom tracking, and information related to the GF diet and CeD. Although CeD and IBD have key distinctions ( CeD is a gluten-induced, immune-mediated enteropathy), they may share similar risk association, etiology, and patient experience.[15,16] Given these similarities, we hypothesize that many of the functions and features of the

original MHG app, such as diet and symptom self-monitoring tools, may be transferable and beneficial to patients with IBD once tailored to the disease. The purpose of this study is to investigate the ways in which the original MHG app can be modified to meet the needs of patients with IBD and healthcare practitioners (HCPs) working in IBD care.

## Methods

### Recruitment

This project was completed between October 2021 and April 2022. We recruited participants using a flyer posted on social media (LinkedIn, Facebook, Twitter). Participants were recruited based on convenience sampling within IBD patient and HCP (i.e., registered dietitians [RD], physicians, and registered nurses [RN]) populations. After expressing interest, potential participants met with an RD. Following a review of the study background and protocol, participants provided written consent (e-signature).

### Ethics approval

The project was reviewed and approved by the Research Ethics Board of University of British Columbia (H21-02662).

### Study design

Following the consent process, a 15-min introductory meeting between participants and two RDs was conducted over Zoom. Participants were guided through the app setup, as well as the key functions and features of the app. Participants were instructed to test the app for a 2-week period and make note of what they liked or disliked about the app features and functions, as well as any ideas for improvement. Following the app testing period, the study RDs interviewed participants (grouped by type) in a 30–60 minute, one-time focus group or individual interview conducted over Zoom. The discussion was guided by questionnaires developed for the purposes of this study. Focus groups and interviews were video recorded for data analysis and the interviewers also completed field notes during this process. Within the recordings, participants were only identified by their participant IDs (videos remained off). Participants received a $25.00 CAD gift card to Amazon Canada as compensation for their participation in the study.

### Questionnaire development

Three versions of an open-response qualitative interview-based questionnaire were developed, specific to each participant type (patient, physician, RD/RN), for feedback provision. Common validated mHealth evaluation questionnaires, including the Technology Acceptance Model (TAM), System Usability Scale (SUS), and the user version of the Mobile Application Rating Scale (uMARS), as well as questions used in previous MHG user testing, were adapted to be open-ended and therefore suitable for use in focus groups and interviews (Tables 1 to 3).[12,13,17]

### Data analysis

Recorded conversations were transcribed by the two interviewers, who then completed the thematic analysis. Thematic analyses were performed in accordance with the Kiger and Varpio (2020) "Thematic analysis of qualitative data: AMEE Guide No. 131", the basis of which is Braun and Clark's (2006) "Thematic analysis in psychology".[18,19]

The analysis was completed as follows:

Step (1) *Familiarize yourself with the data.* The interviewers actively reviewed all recordings (through completing the transcription process) and field notes in order to become re-familiarized with the data set.
Step (2) *Generating initial codes.* The interviewers began generating and defining codes to categorize the content of

**Table 1.** Patient version (11 questions).

| | Question |
|---|---|
| 1 | What was your first reaction to the app? |
| 2 | How easy was the app to use and what would make it easier? |
| 3 | Did anything about the app confuse you about the app? |
| 4 | What features did you like most about the app? |
| 5 | What features would you use least? |
| 6 | Are there any features you dislike? |
| 7 | What are the things that you would most like to improve about the app? |
| 8 | What other types of apps do you currently use to help you manage your health? |
| 9 | Do you currently have any favorite apps and/or features within an app that you'd like to see included in this one? |
| 10 | How likely are you to use the MyHealthyGut app to help you manage your IBD in the future and how often would you use it? |
| 11 | Would you feel comfortable using this app to capture information about your diet and health and share it with a research team and/or your HCPs? |

**Table 2.** Physician version (9 questions).

| | Question |
|---|---|
| 1 | How often do you see your average patient? |
| 2 | Do you have a series of questions you ask your patients in order to understand their disease state? |
| 3 | How beneficial are disease activity indices in your practice and would it be beneficial if an app collected all components of that algorithm regularly to produce a score? |
| 4 | What are the key areas of concern for your patients when it comes to managing their IBD? |
| 5 | What are some functionalities an app would need in order to be beneficial to your practice? |
| 6 | Would it be valuable for the app to flag a pattern or the frequency of specific symptoms and suggest the patient seek medical attention? |
| 7 | Are there any new innovations related to self-management of IBD that you would like to see in an app like this? |
| 8 | Do you recommend any apps to your patients or their families, related to IBD self-management? |
| 9 | Are there any specific resources you recommend to your patients or their families, and if so, which ones? |

**Table 3.** Rd/RN version (9 questions).

| | Question |
|---|---|
| 1 | What are the key areas of concern for your patients when it comes to managing their IBD? |
| 2 | Do you recommend any apps to your patients or their families, related to IBD self-management? |
| 3 | What features of the MyHealthyGut app did you like most and think your patients would use most? |
| 4 | Are there any features you disliked about the app, or think your patients would use the least? |
| 5 | Any improvements that you would suggest for the symptom tracker? (6) What kind of educational content would you like to see within the app? |
| 6 | What kind of educational content would you like to see within the app? |
| 7 | Are there any features you think would be important for your patients to have within an app for IBD self-management? |
| 8 | Would you recommend this app if it were tailored to IBD self-management? |
| 9 | Would you find it useful if patients could share information about their diet and health through the app ahead of appointments? |

each transcript. The codes were organized into a coding tree for each theme using the MIRO web application.

Step (3) *Searching for themes.* Through completing steps 1 and 2, themes were identified from the data. Each interviewer independently identified a list of themes, which were later compared and consolidated into a final list of 12.

Step (4) *Reviewing themes.* The data was reviewed to ensure that each theme was supported by a series of codes. The interviewers reviewed the proposed themes and codes together with the data set.

Step (5) *Defining and naming themes.* A definition was created for each theme. The interviewers defined each theme together and verified the importance of each.

Step (6) *Producing the report/manuscript:* A report was created based on the analysis of the frequency of each theme arising in the discussion and specific ideas or pieces of feedback within each theme.

## Results

### Participants

Recruitment was completed on an ongoing basis and continued until data saturation was reached; based on the level of variety in participant responses.

A total of 15 participants (9 patients, 6 HCPs, including 2 MDs, 3 RDs, and 1 RN) were recruited to participate. Each was provided with a unique participant ID which was the only identifier connected to the collected data. 14 participants provided feedback, however, one patient participant's feedback was excluded, as it was related to the participant's personal use of supplements and was therefore entirely unrelated to the objective of the study.

### Themes

The data was grouped into 12 different themes, based on the type of comments and answers received: 1) clinical use, 2) symptom management, 3) nutrition, 4) medications/supplements, 5) parents/transitional phase, 6) customization, 7) resources/education, 8) functionality, 9) accessibility, 10) community, 11) wellness, and 12) research. Table 4 summarizes the frequency of theme occurrence. The frequency of each theme was based on the total number of times the theme was mentioned across all focus groups and interviews. Minor themes were categorized as those mentioned fewer than 20 times by the total participant population and major themes were identified as those mentioned more than 20 times. In summary, the MDs provided feedback most

**Table 4.** Frequency of theme discussion by participant type.

| Themes | MDs (n = 2) | RDs (n = 3) | RN (n = 1) | Patients (n = 8) | Total (n = 14) |
|---|---|---|---|---|---|
| Clinical use | 14 | 9 | 2 | 12 | 37 |
| Symptom Management | 5 | 23 | 4 | 26 | 58 |
| Nutrition | 2 | 31 | 12 | 29 | 74 |
| Medications/Supplements | 0 | 14 | 4 | 3 | 21 |
| Parents/Transitional Phase | 0 | 0 | 3 | 1 | 4 |
| Customization | 0 | 7 | 5 | 14 | 26 |
| Resources/Education | 0 | 27 | 17 | 24 | 68 |
| Functionality | 0 | 12 | 6 | 29 | 47 |
| Accessibility | 0 | 10 | 0 | 6 | 16 |
| Community | 0 | 3 | 0 | 8 | 11 |
| Wellness | 0 | 12 | 0 | 7 | 19 |
| Research | 0 | 1 | 0 | 6 | 7 |

frequently about the clinical use theme. The RDs provided feedback most frequently about the nutrition, symptom management, and resources/education themes. The RN provided feedback most frequently about the nutrition and resources/education themes. The patients provided feedback most frequently about nutrition, symptom management, resources/education, and the functionality/ease of use themes.

The 12 themes were defined as follows:

1. *Clinical Use:* The clinical use theme was a major theme that included any mention of how HCPs could use the app in their practice or to connect with their patients and other HCPs. The use of technology in healthcare is expanding rapidly and thus an interest in incorporating technology like mobile applications into patient care was expressed by both patients with IBD and HCPs. The codes related to the clinical use theme included 'sharing health information', 'laboratory work (e.g., blood work, stool sample analysis)', and 'physician intervention'.
   - "[To provide benefit to my practice,] it would be best if the results could be integrated into our Electronic Medical Record (EMR)."–Physician #1
   - "I would never delete the app if it had the function of communicating distressing symptoms to my gastroenterologist."–Patient with IBD #8

2. *Symptom Management:* The symptom management theme was a major theme identified that included any feedback or commentary related to symptoms, the symptom tracker, and/or symptom management. This theme was discussed primarily by the patients with IBD to be able to track their symptoms in an organized fashion, identify specific symptom patterns, and then be able to intervene with management, either directed by their HCP team or by themselves. The codes related to the symptom management theme included 'bowel movements', 'time or onset of symptoms', 'symptoms during a flare-up', 'detecting patterns', and 'common triggers'.
   - "The app would be more beneficial in a flare, but good to track as well while in remission to see what remission looks like and so they can notice little changes, an easy way to track what foods trigger you and cause symptoms."—Patient with IBD #1
   - "[Key areas of concern for my patients include] knowing what to eat and identifying potential trigger foods for them. Depending on where they're at in their disease [i.e., flare vs remission], trying to pinpoint if food is a trigger for symptoms and if they can identify it."–RD #2

3. *Nutrition:* The nutrition theme was a major theme identified that included any feedback or commentary related to nutrition for IBD and/or the food tracker. The patients with IBD as well as many of the RDs

had feedback and ideas about how they would use the food tracker, recipes, and meal plan functions that are provided within the app to help manage their IBD in the case of patients or in providing nutrition-related education and suggestions to patients in the case of the RDs. The codes related to the nutrition theme included 'meal plans', caloric information', 'fiber', 'fluid intake', 'food tracking', 'FODMAPs', and 'therapeutic diet'.

- "[I liked] the therapeutic diets. [My patients would like this app] as they often ask for diet plans, recommendations, handouts, sample meal plans… [the app could provide] more tailored suggestions and there could be potential for some of the therapeutic diets and certain recipes [to be] generated specifically for the patient."–RD #2

- "I would probably use [the app] pretty regularly, especially when introducing new foods or trying a new diet, or moving to a different region with different food."–Patient with IBD #5

4. *Medications and Supplements:* The medication and supplement theme was a major theme primarily discussed by the patients with IBD and the RDs that included any feedback or commentary related to the use of medications or supplements for the prevention and treatment of symptoms of IBD and other related conditions. The codes related to the medications and supplements theme included 'reminders', 'tracking', 'interactions', and 'side effects'.

- "[I liked the] medication tracking… [it would also be helpful to have] medication interactions with foods [and] reminders for when your medication is due for a refill."–Patient with IBD #7

- "[I would like] the ability to have the [medication] alarm go off more than weekly [such as] monthly and to be able to track [biologic] infusions, where you are in the cycle, and compare that with symptoms."—Patient with IBD #8

5. *Parents/Transitional Phase:* The parental and transitional phase was a minor theme identified by the RN that included any feedback or commentary related to a parent or guardian using the app on behalf of their child or young adult with IBD. The codes related to the parental and transitional phase theme included 'social life', 'development', 'young adult', 'child', and 'parent'.

- "Paediatric patients in transition towards adult care [face] many issues such as trying to balance having a normal life and having a chronic disease in a time when they are teenagers. [They also struggle with] finding a balance between their condition and reaching developmental milestones."–RN #1

- "[I would recommend this app] to parents with children who have IBD [to help manage their disease] as many youth don't want to use apps on their phones because their phones are for social and happy reasons."–RN #1

6. *Customization:* The customization theme was a major theme identified and included any mention of the user ability to customize the app to meet their unique needs. This was primarily discussed by the patient participants, with topics related to the organization of the app interface or the storage of the individual's frequently consumed foods, recipes, medical history or medications. The codes related to customization included 'my food section', 'personal trigger foods', 'medical history', 'my recipes', and 'reducing repetition'.

- "Having the option to track certain things, for example having an exclamation mark beside the foods that you personally consider a trigger"–Patient with IBD #8

- "If the app could know your triggers and then filter through the recipes to not show you those ones"–Patient with IBD #1

7. *Resources/Education:* The resources/education theme was a major theme identified included any mention of using the app as a source of information. Both the patient and HCP participants identified many topics of interest and importance, as well as opportunities for learning (e.g., internal articles and links to external resources). The codes related to resources/education included 'overlapping conditions', 'external resources', 'nutrition and diet specific to IBD', 'IBD symptoms', 'special conditions (e.g., ostomies, short bowel syndrome, extraintestinal complications)', 'medication and supplement interactions', and 'treatment options'.

- "[I] would definitely use the app for educational resources because this is a trusted source of information compared to Googling for answers."–Patient with IBD #8

- "As far as educational content, we talk a lot with patients about managing symptoms. Things that as dietitians we can take for granted, such as eating small, frequent meals."–RD #2

8. *Functionality:* The functionality theme was a major theme identified and included any mention of app function and ease of use. The patient participants had many ideas related to how the user experience could be improved. The codes related to functionality included 'time burden', 'goal setting', 'analysis', 'ease of use', 'monitoring', 'reminders', 'automations', and 'exporting data'.

- "When I search for food [in the tracker], that's where I can imagine your typical day already being there. And then it could ask 'Was it a typical day?' [and you'd respond] 'yes' or 'no'."–Patient with IBD #8

- "The journey page [should] show you the foods associated with the symptoms."–Patient with IBD #4

9. *Accessibility:* The accessibility theme was a minor theme identified and included any mention of barriers to using the app. This was primarily a concern of the patient population, however, HCPs also noted that accessibility limitations would impact their likelihood of recommending the app. Topics included the subscription fee, operating system limitations, and effort burden. The codes related to accessibility included 'cost', 'web or android version', 'language', and 'frequency of use'.
   - "[There should be] marketing of the importance of an app like this"–Patient with IBD #9
   - "I would definitely recommend it if it was free, or free with a paid premium option"—RD #3

10. *Community:* The community theme was a minor theme identified and included any mention of ways in which users could connect with others for support. This theme was primarily mentioned by patient participants and included mention of chat rooms, support group links, and an 'upvoting' function. The codes related to community included 'networking', 'geographic location', 'ask an expert', 'upvoting/liking', 'forums', and 'public blogging'.
   - "[I'd like] a community component to find people around you with IBD. If you know people with IBD maybe you could just connect with particular people"–Patient with IBD #8
   - "Maybe users 'liking' [articles] or this article was read by users the most this week"–RD #2

11. *Wellness:* The wellness theme was a minor theme identified by the patients with IBD and the RDs that included any feedback or commentary related to wellness outside of 'clinical' IBD health such as mental wellness, physical activity, etc. The codes related to the wellness theme included 'mental health', 'physical activity', 'menstrual cycle', 'sleep', and 'weight monitoring'.
   - "[Areas of concern for my patients include] depression and anxiety, how their mood is affected, use of antidepressants…"–RD #3
   - "[I would like for the app to track] my fitness, weight, calories [intake], food, etc. and highlight certain things and determine whether or not they were out of the ordinary, [for example if my] diet, activity, or stress was out of the ordinary."–Patient with IBD #8

12. *Research:* The research theme was a minor theme identified and included any mention of current and upcoming research studies as well as advances in research. Many patient participants were interested in how they could find an opportunity to contribute to IBD research or shared ideas related to how they could envision the app contributing to research processes. The codes related to the research theme included 'IBD/clinical research use', 'research opportunities', and 'IBD care advancements'.
   - "[I'd like to see] research opportunities [in the app]"–RD #3
   - "[I'm] all for sharing any information [with researchers] if it will help others"–Patient with IBD #1

### Application usability

All participants (n = 14) said that they would be eager to use and/or recommend an IBD-focused self-management app if it came to fruition and reflected their suggestions.

## Discussion

### Principal results (priorities)

The most frequently mentioned theme sub-topics were identified and summarized, with the intention of providing guidance for prioritization in the MHG app modification phase that will follow from this study. Identified priorities were divided into two groups: technical priorities and content development priorities. Technical priorities included automation, customization, food tracker improvements, symptom tracker improvements, and tracking medications. Content development priorities included the development of various resources for education, improving the language in the app, and creating recipes specific to common IBD trigger foods.

### Strengths/limitations

A notable strength of this study was the enrollment of participants who either had IBD or currently worked full-time as an HCP in the IBD field. From this, we were able to collect feedback that was very specific to the goal end user of the app. We were also able to capture two different perspectives, the very specific perspective of the patient and the more general and widely applicable perspective of the practitioner. This strategy will allow us to develop the IBD version of the app with a specific user-focused design.

A limitation of the study is the small sample size (n = 15). Recruitment was completed only through social media posting and word of mouth, due to financial limitations. With greater funding allocated to recruitment, more resources could have been put towards the strategy used, which could have elicited a larger sample size. Another factor was participation being limited to individuals with access to an Apple product, as the current app is only available on the iOS platform. Unfortunately, the limited sample in this study affects the generalizability of the results. Another limitation was the use of a CeD based app in an IBD population. When trialing the app, some of the features and functions were irrelevant to this study population. Therefore, participants' experience of the app was not as thorough as it would have been with IBD-tailored features. Another significant limitation arises due to the absence of validation carried out during both the data collection and

analysis processes. Despite employing aspects of validated questionnaires, our questionnaire as a whole lacked validation. Regarding the analysis process specifically, the practice of intercoder reliability (ICR) was not utilized to validate the coding process. The chosen methodology not only did not advise or support the incorporation of ICR but also did not deem this additional step as appropriate or obligatory. Though this omission might be perceived as a limitation, ICR remains a controversial practice due to its potential to disrupt the inherently interpretive nature of qualitative analysis.[20]

Finally, the study was undertaken during the COVID-19 pandemic, which impacted almost all aspects of everyday life, on a global scale. This may have affected recruitment, as well as the level of participant dedication.

### Comparison with prior work

To our knowledge, this is the first study to user test a mobile app for modification as a nutrition therapy app for patients with IBD. There are several eHealth platforms focusing on IBD patient education, diagnostic support, and symptom management for clinical purposes, yet the outcomes for each study reveal inconsistent effects on IBD quality indicators.[21] The MyHealthyGut app diet tracking feature along with the IBD symptom diary provides users with personalized diet associated patterns linking their food intake and symptoms, which provides an opportunity for more targeted treatment with improved efficacy.

A study by Villinger and colleagues (2019) demonstrated the poor long-term user adhesion to eHealth platforms, impacting prolonged beneficial outcomes.[22] App usability has been identified as the barrier to long-term user engagement of nutrition app and food database tools in previous studies.[23] To address this, the present study questionnaires elicited feedback on the usability of the app and priority changes for a more user-friendly design were identified.

Finally, previous eHealth platforms designed for IBD management have been assessed by IBD patient satisfaction and healthcare activities in isolation, which excludes the view of the healthcare team.[24] In this project, the HCPs in the IBD field were included as part of the assessment process and were also able to provide feedback for further app development.

### Future directions

Our future directions are to implement the identified priority changes to the existing MHG app. Once the new IBD version of MHG exists, the usability may be evaluated with the administration of validated questionnaires, such as SUS. We also intend to validate the food and symptom trackers so that they may be utilized in scientific research and clinical practice. Finally, there is potential for future

variations of the app to exist for a multitude of other disease states.

## Conclusion

With modifications to functionality and capabilities of the app, as well as the focus of the educational content, the current app is transferable to an IBD population. Responses from focus groups and interviews will be used to inform future modifications in the app. The proposed IBD self-management app would be of value to, and used or recommended by, both IBD patients and HCPs specializing in IBD.

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