

# The Use of General Health Apps Among Users with Specific Conditions: Why College Women with Disordered Eating Adopt Food Diary Apps

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## Abstract

*There is a myriad of mobile health applications designed to address a variety of health conditions. While these apps hold significant promise for the management of these conditions, users sometimes turn to general health apps, rather than those designed with their specific condition in mind, which can lead to unmet needs and worsened conditions. We outline one example by focusing on college women with disordered eating behaviors and their use of general food diary apps, rather than eating disorder-specific apps. We investigate the types of health apps they use and how they choose them, focusing on the role of motivations and search behavior. We found their initial motivation informs their search process, which results in their selection of general food diary apps. Researchers should consider app adoption as influenced by user motivations and navigation behavior, particularly when determining how and why general apps are used and how clinicians can help.*

## Introduction

There are a variety of mobile health applications (apps) designed for general populations, while others are intended for individuals with specific conditions. Apps that are tailor-made for specific conditions, such as obesity, diabetes, and eating disorders, are often better suited to manage that condition than general apps. Despite the prevalence of these customized apps, individuals with specific conditions may opt to use general health apps instead. These general applications, however, do not always meet the needs of users with specific conditions<sup>1</sup> and their use may have dire consequences<sup>2,3</sup>. This is often attributed to intended versus unintended use: condition-specific apps are designed with the needs of those living with said condition in mind, while general health applications are not.

While there are numerous contexts in which individuals with specific conditions favor general health apps over those designed with them in mind, this particular study focuses on individuals with eating disorders and their choice of mobile health apps. Although eating disorders are increasing among boys and men<sup>4</sup>, girls and women are more likely to develop eating disorders<sup>5</sup>. While approximately 20 million girls and women in the United States have an eating disorder, many more have undiagnosed eating disorders, subclinical or subthreshold eating disorders, or disordered eating behaviors<sup>6,7</sup>. College women in particular are at an increased risk for developing eating disorders, and the number of college women who exhibit disordered eating behaviors is high<sup>8-12</sup>. In fact, some researchers have found that 13.5% of undergraduate women in the United States have positive screens for eating disorders<sup>12</sup>, and 40% to 49% of college women engage in disordered eating behaviors at least once a week<sup>11</sup>. Given their increased risk and prevalence of eating disorders (and disordered eating behaviors), as well as the high rates of health app use among this group<sup>8-12</sup>, this study focuses on college women with eating disorders and disordered eating behaviors.

In their 2015 publication, Fairburn and Rothwell<sup>13</sup> found over 800 apps when using eating disorder keywords to search in app stores. In spite of the numerous eating disorder-specific apps available, extant literature indicates that this population utilizes general health apps, such as food diary apps<sup>1</sup>, instead. This choice can be extraordinarily harmful and exacerbate eating disorder symptoms<sup>3</sup>. How and why are young women selecting generalized health apps instead of those that were specifically created with them in mind?

To begin answer these questions, we borrow from Gasser et al.'s<sup>14</sup> literature review surrounding youth and information behavior. The authors identify five main search behaviors and numerous variables that influence these behaviors. This study shifts from information behavior and applies these behaviors and variables to the context of health apps. In particular, we focus on the relationship between what the "purpose of search or motivation," which refers to the reasons or needs that drive a user's search, and what the authors label "navigation and reduction" behavior, which refers to the decisions users make about the results of their search queries. We selected two of these elements because they speak to the questions "why?" and "how?" While many studies explore users' motivations for and / or app

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<sup>1</sup> In this paper, food diary apps refer to any health app that allows users to track food, weight, and exercise but is not designed for a specific health condition (e.g., diabetes).

selection strategies<sup>15-19</sup>, this study specifically does so within the context of general versus condition-specific health apps. We can think about the concept of "selection" as an ongoing activity in the adoption process – beginning with an initial motivation, initial evaluation and selection, use and continuous evaluation, and a possible change or retirement of the app. In this paper, we focus on the use of general health apps, primarily food diary apps. This study explores what drives college women with eating disorders to search for health apps, as well as how they navigate (and select an app within) the search results. Therefore, we identified three primary research questions:

**RQ1:** *What health apps do college women with disordered eating behaviors use?*

**RQ2:** *How do they choose general food diary apps?*

**RQ2a:** *What is their purpose or motivation for searching for health apps?*

**RQ2b:** *After entering their search query, how do they navigate search results?*

**RQ3:** *If they change their motivation, how does this change relate to the “selection” process?*

This paper offers two main contributions. First, we provide insight into the app adoption process (particularly for apps that may be harmful for users) and offer a visualization to better understand app choice as a process that encompasses not only navigating search results, but also motivations behind this behavior. Second, we provide suggestions regarding how clinicians can support these users. By understanding the motivations that drive app searches and how users navigate search results to make a decision, we can determine when and what kinds of interventions may be most effective.

## **Methods**

### ***Recruitment***

This study includes 24 participants. Because anorexia nervosa, bulimia nervosa, and related disordered eating behaviors tend to affect college women<sup>12</sup> and food diary apps users tend to be popular with younger users<sup>20,21</sup>, we sought young women between the ages of 18 and 25 with disordered eating behaviors (symptoms related to anorexia and bulimia nervosa) who use or have used general food diary apps. Because some people do not meet the full criteria for a specific diagnosis and because many people never seek treatment for their eating disorder, we recruited both participants who were self-diagnosed and clinically-diagnosed. Participants were recruited from a large public university in State College, Pennsylvania. In order to recruit users with a history of eating disorders, we posted flyers across campus. Participants were compensated \$25 each for approximately 1.5 hours of their time.

### ***Data Collection***

We used three data collection methods: 1) surveys, 2) think-aloud exercises, and 3) semi-structured interviews. In total, four surveys were administered: a demographic survey to obtain information about participants' age, ethnicity, eating disorder status, and type of apps used, as well as three well-established surveys on Qualtrics to assess their eating disorder symptoms [similar to <sup>22</sup>] due to the inclusion of participants with both self-diagnosed and clinically-diagnosed eating disorders: the Eating Attitudes Test (EAT-26)<sup>23</sup>, the Eating Disorder Examination Questionnaire (EDE-Q 6.0)<sup>24</sup>, and the Clinical Impairment Assessment questionnaire (CIA 3.0)<sup>25,26</sup>.

The EAT-26 is a self-report questionnaire that assesses symptoms and concerns characteristic of eating disorders on a six-point scale, using behavioral questions<sup>23</sup>. It is comprised of three subscales: diet, bulimia and food preoccupation, and oral control that make up an overall score. For those who score over nineteen and/or qualify for one or more of the behavioral questions, the recommendation is to see a qualified professional because they are exhibiting symptoms characteristic of eating disorders. Even without the cut-off score, this measurement can be used as a continuous measure of disordered eating behaviors. Similar to the EAT-26, the EDE-Q 6.0 is a self-report questionnaire that measures frequency of disordered eating behaviors in the last twenty-eight days that reflect severity of aspects of the psychopathology of eating disorders<sup>24</sup>. A highly reliable and validated tool, EDE-Q is the most commonly used assessment for eating disorders<sup>22,27</sup>. It is comprised of four subscales: restraint, eating concern, shape concern, and weight concern, which make up the global score. Higher scores indicate greater levels of symptomatology. The CIA 3.0, on the other hand, measures the severity of psychosocial impairment due to eating disorder features in the last twenty-eight days on a four-point scale<sup>25,26</sup>. It is a sixteen-item measure that focuses on mood, self-perception, cognitive functioning, and work performance, which is intended to be taken after a measurement of current disordered eating behaviors (such as the EDE-Q). It then provides values to assess the severity of psychosocial impairment secondary to eating disorders. Higher scores indicate greater psychosocial impairment. Studies have found that a score of sixteen is best cut-point for predicting eating disorder case status.

After the surveys, we began the think-aloud exercises, which consisted of participants showing us the general food diary apps they use. The goal was to understand how they use these apps and for them to show us specific features and aspects of the app. After the think-alouds, we moved to the semi-structured interviews, which sought to answer why and how they chose specific food diary apps as well as what they know about eating disorder recovery apps. To begin to answer our research questions, we asked participants to name all health apps they use(d), and then, focusing on food diary apps, we asked them to explain their motivation for searching and how they decided to choose the app they did. They were also asked to describe their use over time – what emerged is that their use, perceptions, and motivations changed over time but their choice of app did not (as we also specifically asked about eating disorder recovery apps). We video recorded the think-aloud exercises and audio recorded the entire data collection session (both think-alouds and interviews together). All 24 participants completed the demographic survey and interview. Because some found general food diary apps triggering, 7 chose not to participate in the think-aloud exercise, and 5 declined to participate in the other three surveys. At approximately 14 interviews, we saw repetitive themes in the participant responses, and they converged into the same points (i.e., data saturation)<sup>28</sup>.

### ***Data Analysis***

In total, the think-aloud exercises and semi-structured interviews consisted of 21 hours and 36 minutes of audio for a total of 436 transcribed pages. We used the transcriptions from the think-alouds and semi-structured interviews, and then we used open coding to generate themes based on these research questions<sup>29</sup>. After becoming familiar with the data, we generated high-level themes based on our aims. For example, in order to answer RQ2, we first marked each transcript for discussions around how users chose general food diary apps. Then we iteratively labeled textual data based on participants' descriptions, which resulted in more specific categories. These codes were then grouped and refined to determine our final categories.

For the quantitative data from the questionnaires, we used Excel and SPSS. The EAT-26 and the CIA 3.0 only required mean computations, and therefore, Excel was used. For the EDE-Q 6.0, we used Excel to generate the means and standard deviations, but we also compared the means to norms. Therefore, using SPSS, we conducted an independent samples t-test comparing means. BMI for those 20 years old and older was computed using the United State National Institute of Health calculator<sup>2</sup>, and for those under 20 years old, BMI was calculated using the Centers for Disease Control and Prevention calculator<sup>3</sup>.

### ***Participants***

Our final participants were between the ages 18 to 23 with the mean being 20.63 years. The majority of participants identified as White (non-Hispanic) ( $n=18$ ) with one from Israel. Three identified as Asian, Asian American, or Pacific Islander, 2 identified as multi-racial, and 1 identified as Native American or American Indian. All participants were current university students. Most participants had not been professionally diagnosed with an eating disorder ( $n=17$ ), and most reported being in recovery or recovered ( $n=20$ ). Participants estimated they had an eating disorder anywhere from 2 months to 7 years (mean=34.93 months;  $SD=26.78$  months). Most ( $n=20$ ) felt their eating disorder began before using food diary apps ( $n=3$  felt their eating disorder began after using apps, and  $n=1$  is unsure when her eating disorder began).

Overall, 16 of 19 participants answered two or more of the questionnaires in a way that suggest they are exhibiting disordered eating behaviors. For the EAT-26, 15 of 19 participants exceeded the cut-off point, meaning they should see a qualified professional because they reported eating disorder symptoms. For the EDE-Q 6.0, 16 of 19 participants exceeded the norm for the global scale [see from Quick and Byrd-Bredbenner<sup>30</sup>]. In order to better understand the scores of the EDE-Q 6.0, we compared them to the norms of undergraduate women in the United States using an independent samples t-test comparing means from the present study ( $n=19$ ) to those from Quick and Byrd-Bredbenner<sup>30</sup> ( $n=1,533$ ). The global score for the present study is extremely significantly higher than the norms reported in Quick and Byrd-Bredbenner<sup>30</sup>,  $t(1550) = 3.5064$   $p = 0.0005$ . The restraint, eating concern, shape concern, and weight concern subscales were all either very significantly higher or extremely significantly higher than the norms,  $t(1550) = 2.7932$   $p = 0.0053$ ,  $t(1550) = 4.6036$   $p = 0.0001$ ,  $t(1550) = 2.6623$   $p = 0.0078$ , and  $t(1550) = 2.9262$   $p = 0.0035$ , respectively. This analysis suggests this sample of participants exhibit greater levels of symptomology than a general population. For the CIA 3.0, 9 of 19 participants exceeded the cut-off point. Together, these surveys show that

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<sup>2</sup> [https://www.nhlbi.nih.gov/health/educational/lose\\_wt/BMI/bmicalc.htm](https://www.nhlbi.nih.gov/health/educational/lose_wt/BMI/bmicalc.htm)

<sup>3</sup> <https://nccd.cdc.gov/dnpabmi/calculator.aspx>

despite most participants not having been professionally diagnosed with a clinical eating disorder, many report disordered eating behaviors.

## Findings

### *Types of health apps used (RQ1)*

We use the term “health app” broadly because we asked participants to list all health apps they use or have used as part of the demographic survey (see Table 1). Therefore, participants listed and discussed a variety of apps that fit their understanding of what a health app is, including those that allow users to track their diet, exercise, and weight as well as mood tracking apps. Because the remainder of data collection (interviews and think-alouds) focused specifically on their use of food diary apps, these were the most commonly listed. It is important to note that participants were not recruited based on the use of a specific app, yet the majority of participants ( $n=21$ ) used MyFitnessPal as their primary choice. Other apps included Fitbit, Lose It!, Calorie Counter, Nike+ Run, and MapMyRun, although these were less common. Participants discussed more exercise-oriented apps as they often provide users with calorie expenditures and the ability to synchronize with other health apps.

**Table 1. Types of health apps used**

<b>Focus</b>	<b>Health App Name</b>	<b># of Participants<sup>4</sup></b>
<i>Food Diary / Weight Loss</i>	MyFitnessPal	21
	Lose It!	2
	Calorie Counter	2
	WeightWatchers	1
	Cronometer	1
	Weight Loss Coach	1
	MyPlate	1
<i>Exercise / Fitness</i>	Fitbit	4
	21 Day Fix by BeachBody	1
	Nike+ Run	2
	MapMyRun	2
	Steps	1
	Nike Training	1
	Charity Miles	1
	Spartan Race	1
	Fitness Reminder	1
<i>Eating Out / Cooking</i>	Healthy Out	1
	Eating Well	1
<i>Food and Exercise Betting</i>	Pact	1
<i>Mood Tracking / Well-being</i>	Moodnotes	1

### *How participants choose general food diary apps (RQ2)*

Participants’ app selection process includes activities that occur both before and during the search on app stores. Two related, yet distinct pieces emerged during data analysis: participants’ app choices were explained by their initial motivation for or goal behind searching for an app and how they navigate the search results within the app store to select a specific app.

*Initial motivation and purpose of search.* College women with disordered eating behaviors report two factors that influenced their decision to choose a general food diary app: losing weight and being more aware of their food consumption. When asked the objective or motivation behind using a food diary app, most participants mentioned losing weight ( $n=22$ ). For instance, when asked about the reason for using food diary apps, participants responded: “I

<sup>4</sup> Many participants reported using more than one app.

used to be just like naturally thin, and then I decided to lose 10 pounds 'cause I thought I should lose 10 pounds.” [U06] and “It was three years ago, and I wanted to lose weight. So I got the app, and then I went too overboard with it.” [U13].

While the majority of participants talked about weight loss, some also mentioned a desire to become more aware of what they were eating through tracking everything as a motivation for using a food diary app. For example, one participant stated, “It [the reason I chose a food diary app] was awareness. It was just to see what was going on.” [U24], and another simply said her objective was to “Track everything.” [U14]. Another participant explained her motivation was both weight loss and awareness: “I think a combination. So one of them [reasons] was to lose weight a little bit and also to be more aware of the nutrients.” [U12] While some participants wanted more understanding of what they were consuming, the majority’s primary driver was weight loss.

*Navigation behavior.* With their initial motivations in mind, participants would then go to an app store and search for an app that aligned with these motivations. When navigating the search results, participants reported five main reasons for or heuristics used when choosing a specific food diary app: 1) recommendation, 2) popularity and name recognition, 3) top of search results, 4) high ratings and reviews, and 5) features and usability, which can be seen in Table 3.

**Table 3. App selection criteria during search result navigation**

<b>Reason</b>	<b># of Participants<sup>5</sup></b>
Recommendation	6
Popularity and name recognition	5
Top of results	4
High ratings and reviews	4
Features and usability	9

*Recommendation:* Participants often chose a specific food diary app because someone trusted recommended it. For example, a number of participants discussed how friends recommended food diary apps: “I gained 20lbs since I came here, and from this semester, I decided to lose my weight, and they, like my friends, recommended MyPlate, the app, for me, and I used it.” [U01] In addition to friends endorsing food diary apps, some participants talked specifically about learning about these types of apps through social media. One participant discussed how she saw others on social media using MyFitnessPal, which encouraged her to download it: “MyFitnessPal I’ve been using since 2012 when I started my first diet, and I just used that to track my food 'cause that’s what everyone said was like a good way to do it... I might have seen it on social media or something, like other people who were dieting were posting about it. That’s probably what it was.” [U06] Other participants mentioned how their followers used certain food diary apps and they saw this as a recommendation: “Because someone on YouTube that I like following said that they use it and that it’s pretty good.” [U12] One of the major reasons food diary apps were chosen was because they had been recommended.

*Popularity and name recognition:* Another thing that came into play when deciding what apps to use was the app’s popularity and name recognition. Participants tended to choose apps that they had hear about and viewed as common: “It’s just the one I heard the most about, I think. I think it’s pretty prevalent. Like I don’t really know of any other ones.” [U02] Similarly, another participant discussed how she only chose MyFitnessPal because it was well known: “I really didn’t even look at other ones [apps] just because I knew like MyFitnessPal was like well known.” [U07] One participant talked about how the app was the most popular, which is why she chose it: “At the time, it was the most popular.” [U04] The more popular food diary apps seemed, the more likely users reported choosing them.

*Top of results:* When participants searched for a generic term, such as “food diary app”, in one of the app stores, they selected one of the first ones in the list. For instance, when asked how she chose the app, one participant simply said: “I think it was just like the first one that popped up.” [U07] Similarly, another participant talked about how the app she decided to use was first on iTunes store: “I think I probably just typed it into the iTunes Store, and that was the first one that came up.” [U09] Another participant also explained how she selected the app that appeared first: “I

<sup>5</sup> Some participants discussed more than one reason for selecting a food diary app.

*think it was just the first one that came up.*" [U13] Participants more likely to choose apps that showed up early in the list of search results.

High ratings and reviews: Another reason participants selected particular food diary apps was due to their ratings and reviews. For example, one participant said she focused on the apps ratings, which led to her decision to use it: *"On the App Store, just looking at different options and that was the highest rating, so clicked that one."* [U17] Likewise, when asked why she chose the app she did, another participant said it was because of its rating: *"It had a high rating."* [U20] One participant also mentioned how the app she chose not only had good reviews but also had many reviews: *"Well, when I went to the app store to look at them, it was the most highly-rated or it had the most ratings."* [U15] Participants tended to select apps based on their reviews and ratings.

Features and usability: Lastly, a number of participants expressed the need for food diary apps to have certain features and be usable. For instance, some participants talked about how the app they ultimately selected was easy to use and user-friendly: *"It was basically easy to entry, like it wasn't, like the interface was like easy to deal with. So I was like, all right like I don't really have to, I don't feel the need to try out different ones."* [U07] Others discussed specific features, such as a food and exercise log, a thorough food database, and reminders. For example, one participant talked about how she liked that it focused on both food and exercise: *"I knew it could log food and exercise at the same time and calories was the biggest issue, so I was like, like that's the best of both worlds, so I'll just choose that one."* [U04] When asked why she picked her app, one participant talked about its extensive food log as well as a feature that shows if food entries are reliable: *"I like that it has almost every food option as soon as you click it, whether it's from a restaurant or the grocery store, it finds it, and it has a green check mark if it's verified that that's the contents, so I really trust it."* [U10] General usability and specific features were cited as important when deciding on a specific food diary app.

### ***How a motivation change relates to this process (RQ3)***

Participants' motivations and goals are not stagnant; they reported a shift in motivation from weight loss initially to eating disorder recovery later. We sought to investigate how this change in motivation relates to the process around search and adoption – expecting that this shift in motivation might influence their navigation behavior. However, rather than going back to the app store and searching for a new app, participants modified their use of their current general app. In fact, 20 of 24 participants reported being in recovery or recovered at the time of data collection, yet none reported ever using eating disorder recovery apps (see Table 1). Therefore, we report some examples of how this change in motivation affects how they *use* general food diary apps.

In order to support recovery, participants reported changing their goals within general food diary apps to reflect their recovery focus. For example, one participant discussed how her increased calorie budget aligned with her recovery process: *"Yeah, [my goals are set towards recovery], so even my goal number... Whereas I showed you in, I think it's... in 2013, my goal was 1,200, very low; 2014, a little bit higher, 1,500; 2015, 1,750."* [U21]

In addition to calorie goals, participants also altered their weight goals within these apps. For instance, one participant changed her plan within the app from weight loss to weight gain: *"It [the app] did let me select weight gain. It says, 'What's your goal? To lose, gain, or maintain?' And MyFitnessPal also still does that. And this time I put 'gain'."* [U09] Similarly, another participant changed the number of her weight goal from 120 to something more realistic: *"When I saw the goal of 120, I'm like, 'I should probably change that' because if I say I'm so far from that, it's only going to discourage and probably prompt unhealthy behaviors... Changing the goal from what it might have been a year ago to how it is now, that's important for staying in recovery, I'd say."* [U10] When their goal changes, some repurpose the general food diary app with their recovery goals in mind rather than try to find a new app that aligns with their new motivation.

## **Discussion**

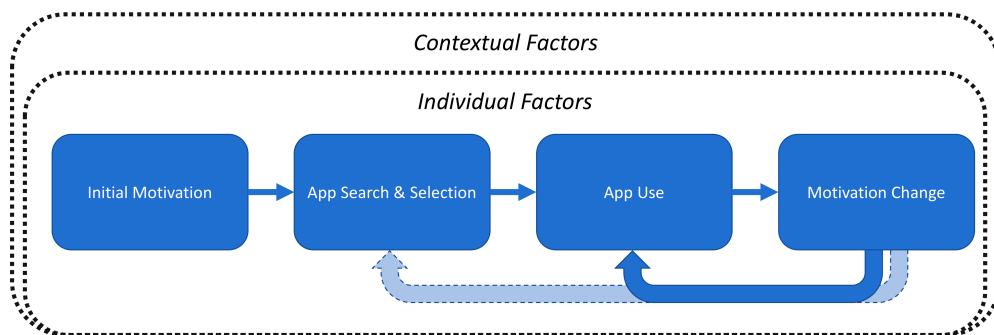
### ***App adoption as a process before and within the app store***

Search as a series of behaviors and actions based on perceived information need, and user behavior is shaped by this information need<sup>14</sup>. Our findings indicate that both users' initial motivations and the heuristics they use as part of navigating the search results within the app store influence what apps they end up downloading and using. There is literature on mobile health apps on motivations for search (i.e., what drives them to search) and how they navigate search results (what happens once they start to search)<sup>16-18</sup>, yet few studies outline the process of app adoption more broadly. However, literature surrounding other kinds of technologies, such as search engines, social media, etc., suggests that both motivations and navigation should be considered<sup>14</sup>. We argue the same should be applied to

understand app adoption, especially when studying health apps. By understanding the process around adoption as more than just how individuals choose an app in an app store, we can better understand how and why they choose general health apps versus specific condition apps.

This app adoption process exists in a broader context and thus, includes contextual (e.g., society’s values, college environment, friends, etc.) as well as individual factors (e.g., age, gender, race, health history, etc.). For the purposes of this paper, we focused on the relationship between motivations, app search and selection (i.e., navigation), and app adoption and use. Figure 1 shows this process. Users initial motivations (in this case, weight loss) influence their search process. That is, they will choose keywords that yield general health apps that meet their initial goals and motivations. By highlighting users’ initial motivations, we see why they would yield food diary apps in their search and choose to use them. When they decide to adopt these apps, they are not thinking of themselves as disordered. This could be because they are unaware (i.e., symptoms have not yet emerged or they are unaware that these may be eating disorder symptoms) or because they are simply not thinking about their eating disorder history (i.e., they view this motivation [weight loss and/or awareness] as separate or more important than their health history). Then they use heuristics, such as recommendation, popularity and name recognition, top of search results, high ratings and reviews, and features and usability in order to navigate the search results and select a specific app among the search results<sup>6</sup>. It is important to note that while for instance, recommendations and popularity and name recognition play a role during their navigation behavior, these existed prior to navigation. In other words, users heard about health apps from friends, advertisements, and social media before they began their search on an app store. We know users’ goals and motivations play an important role in first deciding on an app. Thus, we would expect that once their goal changes, they would return to the search and selection process (see dotted-lined arrow). However, this is not the case.

While motivations play a key role in search in information seeking (e.g., using search engines) and in initially choosing a health app, motivations for this population do not result in users returning to the search and selection process. Rather than consider their new goal and try to find a new app that aligns with this goal, they continue to use food diary apps but try appropriate them for eating disorder recovery. This is problematic because the use of general food diary apps for recovery often leads to users falling back into unhealthy habits, thereby exacerbating their eating disorder, rather than supporting recovery<sup>3</sup>. Are there particular qualities of apps that lead to them repurposing rather than re-searching? For instance, users may feel invested in and comfortable with the app they have chosen. They may even like the app even if it does not completely match their needs. The process around finding a new one may be too big of a commitment for their new motivation to translate to searching and selecting a new app.



**Figure 1. Visualization of the app adoption as a process**

### *How clinicians can intervene*

Considering app selection as a more holistic process that exists beyond the actual act of searching is important in order to understand how we can positively impact health. For instance, if we only consider how users navigate search results and choose apps among a list, then we might be tempted to suggest that clinicians should recommend more eating disorder recovery apps, such as Recovery Record and Rise Up<sup>31</sup>. However, this would not be effective for those who decided to find an app with the goal of losing weight in mind (i.e., before their goal shifts to recovery). Thus, an eating disorder recovery app would not align with their initial motivation and would not be adopted by the user.

<sup>6</sup> It is important to note that app search and selection encompasses different and sometimes iterative steps not shown or described.

We know the app adoption process is influenced by users' motivations as well as the heuristics they use when navigating search results. Although clinicians are not able to affect how proprietary app stores display results and what apps are shown, understanding the process of app adoption can help us determine where clinicians can most effectively intervene. When users' motivation and goals change from weight loss to recovery, clinicians can play a key role in how they approach eating disorder recovery using general food diary apps by creating a dialogue around general food diary apps and acting as expert recommenders.

In particular, healthcare providers who interact with a large pool of college students – like those who work for campus health services – can be especially impactful if they carefully consider the unique factors of the population they serve. College can be a stressful time for students. During this transitional phase, many young women face new challenges, including unique social and academic stressors, which may increase the risk of developing eating disorders<sup>11</sup>. Not only do women experience a great deal of independence for the first time, but they also are thrust into a new environment with more opportunities to compare themselves to other women, which can increase body dissatisfaction, a risk factor for eating disorders<sup>32</sup>. This drastic life event can trigger eating disorders and disordered eating<sup>33</sup>. Keeping in mind eating disorders and disordered eating behaviors are more prevalent among women in college<sup>8-12</sup>, clinicians should have open conversations about body image and app use among their patients. This should be part of general clinical visits on campus due to the large numbers of women who do not seek a diagnosis or treatment for their eating disorder. While some researchers have urged clinicians, caregivers, researchers, and institutions to be aware of the existence and impact of technology in relation to eating disorders<sup>34,35</sup>, to what extent healthcare providers understand and assess technology use with their patients is not well known.

When deciding which apps to search for, users rely on recommendations and perceived popularity of apps. In particular, when apps are recommended by someone trusted, such as a friend, individuals search app stores to find that specific app. This is consistent with literature on perceived credibility of mobile health apps<sup>36</sup>. For example, Peng et al.<sup>36</sup> found that friend recommendations were viewed as highly trustworthy and therefore influenced which apps were downloaded. However, this becomes an issue when users' friends may have similar weight loss goals and thus recommend apps that match these goals without paying attention to broader health concerns. Clinicians can act as an important information source about general health apps, particularly since extant literature suggests that young people are typically more satisfied with the health information they receive from doctors and nurses than they are with what they find online or in school health classes<sup>37</sup>. Although we cannot change the popularity of general health apps, clinicians can help change the conversation around these apps so that they are not seen as appropriate for every individual for every type of motivation or goal. Therefore, clinicians can act as expert recommenders – in this case, recommending against the use of general food diary apps like MyFitnessPal for certain populations, such as college women with a history of eating disorders, especially those whose motivation is recovery.

There is growing interest in the role of prescribing health apps to patients<sup>38</sup>. These range from condition-specific apps to general health apps, such as food diary apps<sup>1</sup>. Healthcare providers should discuss both the benefits and drawbacks of general food diary apps, paying particularly close attention to the negative effects of these apps. It seems the pervasive narrative around general health apps is how they can lead to increased exercise and healthier eating. While there are positive aspects of these apps, they can also impact users in negative ways<sup>3,39,40</sup>. For instance, college students reported feeling guilt, avoidance, shame, and stress as a result of using health and fitness apps<sup>39</sup>. College women with disordered eating report similar negative feelings leading to extreme calorie and food restriction, compensatory behaviors, and obsession with food diary apps<sup>3</sup>.

Therefore, clinicians need to be careful when recommending general health apps to patients because the use of these apps may impact different groups and individuals in different ways. Especially in the college environment, healthcare providers should consider contextual and individual factors that may influence the effects of apps. For instance, a patient may find a general food diary positively impacts their health, but during finals week or after receiving a bad exam grade, this same individual may experience negative effects from using the app. A general food diary app may be a good tool for an individual with positive body image who wants to track foods as part of managing diabetes, but a track star who is of healthy weight but is being pressured to lose weight to perform better may not be a good candidate for a general food diary app, such as MyFitnessPal.

### **Limitations and Future Work**

How college women with disordered eating behaviors choose food diary apps emerged out of a larger study on their use and perceptions of food diary apps. Because of this, we were not seeking to evaluate their search; therefore, it is possible we are missing some aspects of their search process beyond navigation and motivation. However, we aim to



address this in future studies. We have identified a process around search and shown where clinicians can play a key role, but we do not address how to reach people before they get to the point of wanting to recover (i.e., users' goal switching from weight loss to recovery). Additionally, we know these users repurpose general food diary apps once their goals change, rather than search for and select a new app; however, we do not know why. Future research aims to address these limitations and investigate the use and lack of use of eating disorder recovery apps.

## Conclusion

While there are numerous studies that explore app adoption in terms of motivation and selection strategies, this study provides insight into motivation and selection within the context of users with specific health conditions favoring general health applications over those specifically designed for their unique conditions. This is particularly important, given the evidence that these decisions may worsen health outcomes for these users. Focusing on eating disorders as a specific condition, this study suggests that clinicians and healthcare providers can play an important role in the discussion around potential dangers of general health applications.

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