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# Exploring Family Nurse Practitioners' Practices in Recommending mHealth Apps to Patients

Rebecca C. Mueller, PhD, RN, FNP-BC

Patients frequently download mHealth apps, which can be used to support health promotion. It remains unclear, however, if family nurse practitioners are recommending apps to patients. This study identified family nurse practitioners' current practices of recommending apps to patients and described their use and intent to use mHealth apps for health promotion with their patients. Nearly 70% of the 303 participants surveyed recommended mHealth apps to their patients, with the most common types comprising patient portal, diet and nutrition, and fitness apps. However, the frequency with which apps were recommended was low. Participants reported that apps complement patient care, enable health promotion behaviors, are easy to use, and improve clarity of patient data. These factors facilitated their intent to recommend mHealth apps to patients. Healthcare organizational support influenced participants' intent to recommend apps, and access to trustworthy apps and electronic health records compatibility increased usage. Barriers to recommending involved patient-specific characteristics and provider concerns about reliability, privacy, and efficacy of apps. Family nurse practitioners must be supported in guiding patients to use reliable, safe, and HIPAA-compliant apps. To help engage patients, clinicians should be educated on methods to evaluate mHealth apps and how to incorporate them into patient care.

**KEY WORDS:** Family nurse practitioners, Health promotion, mHealth, mHealth apps, UTAUT

Over the past decade, smartphone adoption has been rapid. According to the Pew Research Center, 95% of Americans own a cell phone, and 77% of those individuals own a smartphone.[1] Smartphones offer many functions, such as text messaging, interactive voice response, and mobile applications, making them ideal tools to address patients' health needs.[2] The increased uptake of smartphones corresponds with an increased availability of applications, or apps, for daily tasks, including 318 000 apps targeting health.[3] Many patients are using mobile health, or mHealth, apps to access health information,[4–6] and researchers and policy makers believe that this new technology offers many opportunities to deliver high-quality and cost-effective care.[2,7] What remains unknown are percentages of healthcare providers recommending mHealth apps to patients and the factors that influence recommendations. This article presents a study that identified family nurse practitioners' (FNPs') current practices of recommending apps to patients and described their use and intent to use mHealth apps for health promotion with their patients.

**Author Affiliation:** Division of Nursing and Health Sciences, Neumann University, Aston, PA.

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**Corresponding author:** Rebecca C. Mueller, PhD, RN, FNP-BC, Division of Nursing and Health Sciences, Neumann University, One Neumann Dr, Aston, PA 19014 (muellerr@neumann.edu).

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## BACKGROUND

Chronic diseases are a significant burden in our nation. Many chronic diseases are caused by modifiable lifestyle behaviors, and over the past decade, there has been increased emphasis on health promotion,[8] as a solution to the growing incidence and severity of chronic diseases in the United States. As such, clinicians are called upon to develop realistic measures to engage their patients in prevention and risk reduction activities.

Nurse practitioners (NPs), especially FNPs, are considered experts in health promotion. With their diverse skill set, they can tailor their roles and responsibilities to engage patients in achieving wellness,[9] provide patient education, enable informed and shared decision making with patients and their families, and utilize available resources.[10,11] As patient adherence is essential, tools that are easy to use and convenient and match a patient's preferred learning style are helpful in increasing patient engagement.[12] Mobile technologies, specifically mHealth apps, offer a convenient, patient-centered method for promoting healthy behaviors and can supplement the care provided by the FNP.[13]

### mHealth Apps for Patients and Consumers

Smartphone owners are using their devices to search for and track health information. Nearly half of all smartphone owners have downloaded at least one app specifically to track or manage their health.[4] The Health Information National Trends Survey 4 revealed that 60% of US adults who have an mHealth app have used it to achieve healthy lifestyle



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changes, and 34% use mHealth apps to help with medical decisions.[6] Significant health changes increase the likelihood that a patient will download an mHealth app.[14]

There are more than 318 000 mHealth apps available to patients,[3] offering information, instruction, health data tracking, guidance, reminders, and communication.[15] In 2017, of the mHealth apps available for download, 30% were fitness trackers; 19% involved lifestyle, stress management, and smoking cessation; and 12% pertained to diet and nutrition.[3] Other examples of mHealth apps for patients include apps for medication reminders, pregnancy and women's health, sleep tracking, patient portal access, and apps that target specific diseases like mental health, diabetes, heart disease, and musculoskeletal and neurological illnesses.[15] More than half of mHealth apps use data from biosensors, including activity monitors, and external sensors like glucometers or digital scales.[3] Patients can use mHealth apps to track biometric data, learn about disease processes, receive feedback on health behaviors, and communicate with clinicians or peers.

It has been suggested that mHealth apps can benefit patients by improving the monitoring, tracking, and communicating of their biometric data, which in turn promotes better disease management and engagement in their care.[7] Patient-provider communication, data tracking, and instructional feedback through an app may also reduce the need for ambulatory visits, thus reducing costs.[7] Biosensors can track real-time health data and send alerts to clinicians and caregivers.[3] Family NPs, who constitute 60% of the 248 000 NPs in the United States, play a vital role in the proliferation and support of healthcare initiatives utilizing mHealth apps.[13,16] Although there has been a steady increase in the number of studies exploring mHealth app acceptance and use among patients, no studies have identified FNPs' acceptance and use of these technologies for health-promoting purposes.

### Implementation and Innovation

There have been many frameworks developed to explain how and why people adopt technology. A cumulative model, the Unified Theory of Acceptance and Use of Technology (UTAUT), has been used by many research teams to explain the role of performance expectancy, effort expectancy, social influence, behavioral intent, and facilitating conditions in predicting the actual use of technology.[17]

According to Venkatesh et al,[17] FNPs' decisions about whether to recommend mHealth apps to patients can be influenced by various factors. One consideration is performance expectancy, or the degree to which the FNP believes that mHealth apps complement patient care and improve quality of work. Another influencing factor is effort expectancy, or the FNP's sense of ease associated with recommending mHealth apps to patients. This includes not only ease with the use of apps but also the time associated with recommending them, and the clarity apps provide in understanding patient data. Social influence, defined as the degree to which the FNP perceives encouragement from patients, peers, management, and hospital organizations to recommend mHealth apps to patients, is another important factor. The UTAUT posits that performance expectancy, effort expectancy, and social influence directly affect the FNP's behavioral intention to recommend mHealth apps.[17] In determining use behavior, defined as the FNP's performance of recommending mHealth apps to patients, two influences exist: facilitating conditions and behavioral intent. Facilitating conditions is defined as the degree to which the FNP believes that an organizational infrastructure exists to support mHealth app use with patients. In this study, facilitating conditions included FNPs' current knowledge of mHealth apps, available resources (smartphones, tablet computers, connectivity), app compatibility with electronic health record (EHR) systems, and whether the institution had compiled a list of recommended apps to use with patients. Behavioral intent is the degree to which the FNP had formulated plans to recommend apps within the next 6 months.

There is little research exploring clinicians' practices in recommending mHealth apps to patients, and RNs and advanced practice nurses have not been studied. Research involving physicians demonstrates that only a minority recommend apps to their patients.[18–21] Dietitians have been identified as a clinician group that recommends mHealth apps.[22–24] A cross-sectional survey of dietitians from five different countries, including the United States, revealed that nearly one-third recommended mHealth apps to patients[24]; in another study by Chen et al,[23] 84% of dietitians recommended apps to patients.

Several studies have identified various facilitators of and barriers to recommending mHealth apps to patients. Most clinicians agree that mHealth can improve health outcomes, costs, and patient engagement,[25] but the supporting body of evidence is limited.[15] Uncertainties regarding the privacy and security of apps,[7,21,25,26] accuracy of app content,[7,21,25,26] efficacy,[7,21,26] reimbursement,[7,25] and integration with current EHR technology systems[25] exist. As a result, there has been a call for an app certification process, beyond the US Food and Drug Administration limited oversight.[7] Specific to patients, concerns exist surrounding technology usability and health literacy, and the ability to reach vulnerable populations that are rural, elderly, and lower income.

At present, there is no study that investigates FNPs' practices in recommending mHealth apps to patients for health promotion. This is the first study that explores the facilitators of and barriers to FNPs' recommending mHealth apps to patients and FNPs' current habits in recommending apps to patients. The following research questions guided the study:



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1. What are the types and frequency of mHealth apps recommended to patients by FNPs?
2. What is the relationship of performance expectancy, effort expectancy, and social influence to FNPs' behavioral intent to recommend mHealth apps for health promotion?
3. What is the relationship of behavioral intent and facilitating conditions to FNPs' recommending mHealth apps for health promotion?

## METHODS

### Participants

This study was an anonymous, online survey of FNPs, conducted from January to March 2017. Subjects were recruited, using convenience sampling, through a closed, members-only FNP Facebook (Facebook, Inc, Palo Alto, CA) group with membership totaling 14 246 at the time of the study. Weekly postings were made inviting FNPs to participate. With each posting, subjects were also invited to share the instrument within their own professional networks to recruit additional FNPs. Email invitations were also distributed by NP state organizations in nine states, with reminder emails sent after 2 weeks. An a priori analysis was conducted to determine the acceptable sample size of 177. A total of 303 survey submissions were received.

### Data Collection

Data were collected using an electronic questionnaire specifically developed for this study using SurveyMonkey (SurveyMonkey Inc, San Mateo, CA). The 41-question instrument included three sections: UTAUT framework questions (19 items), demographic information (17 items), and mHealth app types and levels of frequency assessment (one-item scale). An open-ended comments question concluded the survey asking participants if they had anything else to add. Disqualifier items were added to the beginning of the survey to exclude those who were not FNPs, students, and participants in an earlier pilot study.

The UTAUT questions were modified to measure FNPs' mHealth app use with patients. "Use of mHealth apps with my patients" or "recommending mHealth applications" was entered into each item as the technology being studied. The instrument offered a definition of "mobile health applications" with examples to avoid confusion among the participants. Cronbach's $\alpha$'s for each of the five UTAUT subscales ranged from .61 to .98; the Cronbach's $\alpha$ of the UTAUT overall scale was .91. Demographic items examined age, gender, years in practice, practice location as defined by the United States Census (regions 1 through 9), type of community served (rural, urban, suburban, other), primary practice population (pediatrics, adult, gerontology, lifespan, other), practice setting, area of clinical focus, and EHR use. To assess participant acquaintance with mobile technology, items identifying app education in NP curriculum and personal use of mHealth apps were included. Participants were also asked about employment status in the past 12 months, involvement as a faculty member, and whether they integrated mHealth apps in their teaching.

The app type and frequency assessment questions were based on app categories defined by the IMS Institute of Healthcare Informatics[14]: fitness apps, diet and nutrition apps, lifestyle and stress management apps, medication reminder apps, pregnancy and women's health apps, disease-specific apps on mental health, diabetes, heart disease, musculoskeletal and nervous system illnesses, and healthcare provider–specific apps. Three additional types were included based on supportive findings from the pilot study: tobacco cessation, patient portal, and sleep tracking apps. Participants were asked to choose the frequency with which they recommended different types of apps to patients in a typical week.

### Data Analysis

Data were downloaded from SurveyMonkey into IBM SPSS Statistics version 24.0 (IBM, Inc, Armonk, NY) for analysis. Descriptive analysis methods were used to examine participant demographic information and the types and frequencies of mHealth apps recommended by participants. For the first question, participants chose the frequency with which they recommended different types of apps to patients in a typical week. The frequency scales ranged from none, less than 10%, 11% to 25%, and quartile increments ending with 76% to 100%. To analyze frequency of recommendation for each type of mHealth app, the rating averages or means were calculated based on the response scales. A response of "never" represented a score of 1, while 76% to 100% represented a rating score of 6. To further evaluate the types and frequency of recommendations, responses were coded dichotomously as "app recommenders" or "nonrecommenders" based on the app frequency response scales. Responses ranging from 11% to 100% for any type of mHealth app were considered mHealth app users or recommenders, while those who answered "none" or less than 10% for frequency items were considered nonrecommenders. Frequencies were calculated to determine the number of different types of apps recommended by participants.

Multiple regression was used to determine participants' behavioral intent to recommend mHealth apps, and beta weights from the regression model were used to determine the relative weights of each independent variable. Logistic regression was conducted to identify the determinants of participant usage or recommendation of mHealth apps to patients. Odds ratios and Wald statistics for each independent variable were used to describe the relative



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importance of each of the two predictors. For both of these regression analyses, frequencies of each scale were analyzed using descriptive statistics to determine the distribution of participant responses.

### Ethical Considerations

The study was approved by Villanova University's Institutional Review Board. All of the participants received an introductory email, which provided information about the study and a link to SurveyMonkey. At the start of the survey, participants signed an electronic informed consent and acknowledged that participation was voluntary and could be terminated at any time.

## RESULTS

The sample of 303 participants included a diverse group of FNPs. Participants' ages varied, with the majority evenly distributed into 30 to 39 years (n = 86, 28.6%), 40 to 49 years (n = 80, 26.6%), and 50 to 59 years (n = 87, 28.9%) age ranges. The majority of participants were female (n = 273, 91.0%) and were master's prepared (n = 232, 77.1%). Nearly half of the participants were new graduates in practice fewer than 5 years (n = 132, 44.1%) and were employed full-time (n = 238, 79.3%). Participants were from all regions of the United States, with the exception of New England. The largest group (n = 141) came from the South Atlantic region. Practice communities, populations, and settings varied markedly. Participants were employed in more than 20 different specialties, but primary care (n = 170, 56.9%) was the area of clinical focus for the majority.

Few participants received education on mHealth apps in their master's and doctoral education (n = 37, 12.2%), but a quarter utilized mHealth apps during FNP coursework (n = 75, 25.1%). Most participants were not faculty members (n = 235, 78.6%); among those who were educators, nearly half integrated mHealth apps into their curricula (n = 35, 47.3% vs n = 39, 52.7%). Electronic health record use (n = 281, 94.0%) was significant among participants, and the majority of participants reported using mHealth apps to benefit their own health (n = 214, 71.6%) (Table 1).

**Table 1.** Demographic Characteristics of Nurse Practitioners

| Variable | n | % |
|---|---|---|
| **Age** | | |
| <30 y | 15 | 5.0 |
| 30–39 y | 86 | 28.6 |
| 40–49 y | 80 | 26.6 |
| 50–59 y | 87 | 28.9 |
| 60–69 y | 31 | 10.3 |
| >70 y | 2 | 0.7 |
| **Level of education** | | |
| Master's | 232 | 77.1 |
| PhD | 11 | 3.7 |
| DNP | 49 | 16.3 |
| Other | 9 | 3.0 |
| **Years in practice as FNP** | | |
| <5 | 132 | 44.1 |
| 6–10 | 59 | 19.7 |
| 11–15 | 36 | 12.0 |
| 16–20 | 41 | 13.7 |
| 21–25 | 18 | 6.0 |
| 26–30 | 5 | 1.7 |
| >31 | 8 | 2.7 |
| **Practice community** | | |
| City or urban | 112 | 37.2 |
| Suburban | 106 | 35.2 |
| Rural | 75 | 24.9 |
| Other | 8 | 2.7 |
| **Primary practice population** | | |
| Pediatrics | 9 | 3.0 |
| Adult | 146 | 48.7 |
| Lifespan | 118 | 39.3 |
| Geriatric | 14 | 4.7 |
| Other | 13 | 4.3 |
| **Use mHealth apps for own health** | | |
| Yes | 214 | 71.6 |
| No | 67 | 22.4 |
| No, but I plan to | 18 | 6.0 |

### Apps Recommended to Patients by Participants

Based on participants' responses, they recommended patient portal apps with greatest frequency (mean = 2.83, SD = 1.92), with 17% (n = 50) recommending these apps to 76% to 100% of their patients in a typical week. Diet and nutrition apps were recommended with the second highest frequency (mean = 2.74, SD = 1.51); in a typical week, 35 participants recommended these apps to more than half of their patients, while 13 recommended them to more than 75% of their patients. Fitness apps (mean = 2.49, SD = 1.37) were the third most common mHealth app type recommended by participants. Neurological disease apps and musculoskeletal disease apps were the least recommended (Table 2).

Participants were coded as "app recommenders" or "nonrecommenders" based on their responses to the app frequency response scales. Most participants (n = 210; 69.3%) reported recommending apps to patients; 93 participants (30.7%) were nonrecommenders. A mean score of 3.7 (SD = 3.9) showed that participants, on average, recommended three to four types of mHealth apps to patients on a weekly basis.



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**Table 2.** Descriptive Data of mHealth Apps Recommended by Participants

| | n | Mean | SD |
|---|---|---|---|
| Patient portal apps | 301 | 2.83 | 1.92 |
| Diet and nutrition apps | 302 | 2.74 | 1.51 |
| Fitness apps | 299 | 2.49 | 1.37 |
| Diabetes apps | 303 | 2.07 | 1.42 |
| Lifestyle and stress management apps | 302 | 2.06 | 1.32 |
| Tobacco cessation apps | 302 | 2.03 | 1.40 |
| Medication reminder apps | 301 | 2.00 | 1.35 |
| Healthcare provider-specific apps | 303 | 1.93 | 1.47 |
| Sleep tracking apps | 303 | 1.89 | 1.25 |
| Cardiovascular disease apps | 301 | 1.82 | 1.29 |
| Pregnancy and women's health apps | 303 | 1.82 | 1.28 |
| Mental health disease apps | 302 | 1.51 | 0.97 |
| Musculoskeletal disease apps | 302 | 1.48 | 0.99 |
| Neurological disease apps | 303 | 1.34 | 0.79 |

### Factors Affecting Participants' Intent to Recommend mHealth Apps to Patients

Performance expectancy had the most substantial impact ($\beta$ = .288, $P$ < .001) on participant intent to recommend mHealth apps for health promotion. This influence on behavioral intent was only slightly greater than that of effort expectancy ($\beta$ = .278, $P$ < .001) and social influence ($\beta$ = .205, $P$ < .001). The results suggested that participants with higher performance expectancy, effort expectancy, and social influence scores were expected to have behavioral intent to recommend mHealth apps for health promotion.

To analyze the distribution of participant responses, the frequencies of each scale were assessed. A response of "strongly disagree" was coded as 1, while "strongly agree" was coded as 5. The means for each scale were all greater than 3, representing mean responses that tend to support each construct. Effort expectancy (mean = 3.5) and performance expectancy (mean = 3.4) had the highest frequencies, as compared with social influence (mean = 3.1).

More than half of the participants agreed or strongly agreed that mHealth apps complement patient care (n = 176, 58.1%) and facilitate health-promoting activities (n = 186, 61.4%). Nearly 45% of participants agreed or strongly agreed that mHealth apps improve their patient outcomes. Half of the participants were undecided when asked if mHealth apps improved productivity. The effort expectancy scale had the strongest mean (mean = 3.5) of all three dependent variables, representing affirmative responses to the four effort expectancy survey items, whether mHealth apps were easy to use, improved clarity and understanding of health data, and were not time-consuming. Among the items assessing social influence, support from one's healthcare organization was the greatest influencing factor among participants (n = 129, 42.6%), as compared with peers (n = 82, 27.0%), patients (n = 66, 21.7%), and senior management (n = 41, 13.5%).

### Factors Affecting Participant Recommendations of (Use Behavior) mHealth Apps to Patients

Behavioral intent, the strongest predictor of use behavior, had an odds ratio of 2.4 and a Wald statistic of 24.9 ($P$ < .001). The mean for the behavioral intent scale (mean = 3.6) demonstrated participants' conscious plans to recommend apps within the next 6 months. Facilitating conditions was also a significant predictor of use behavior; it had an odds ratio of 2.3 and a Wald statistic of 12.2 ($P$ < .001). A mean for the facilitating conditions scale of 2.6 demonstrated that participants lacked current knowledge of mHealth apps, app compatibility with EHR systems, and an institutional list of recommended apps to use with patients.

### Comments Related to Participants' mHealth App Use With Patients

Further information on participant attitudes about recommending mHealth apps to patients was captured through free text comments at the end of the survey. Thirty-eight participants (12.5%) offered comments that provided additional facilitators of and barriers to mHealth app use. Several participants (n = 14) did not recommend apps because they cared for vulnerable populations (eg, individuals who were elderly, disabled, lived in rural areas, had low health literacy, and had limited access to Internet and mobile devices). Ten participants showed new interest in mHealth apps and inquired about a list of recommended apps to use with patients. Four reported recommending specific apps, such as those for diet and fitness, sleep tracking, and sports injuries to patients. One participant reported that mHealth apps interfered with time management, while five voiced concerns about the reliability, accuracy, and privacy of mHealth apps and their usefulness in providing long-term health changes, as outcomes-based research using mHealth apps is lacking.

## DISCUSSION

The aim of this study was to explore facilitators of and barriers to FNPs' recommending mHealth apps to patients and their current habits in recommending apps to patients. While nearly 70% of the participants recommended some type of mHealth app, the overall findings demonstrated that participants did not regularly recommend them to patients. Although limited research exists identifying clinicians' habits in recommending mHealth apps, a study by Jospe et al[24] exhibited similar findings, as only 32% of dietitians recommended apps to their patients. Research involving physicians revealed similar findings.[18,20] In this study, the UTAUT



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framework was validated in determining factors that affect FNPs' use and acceptance of recommending mHealth apps to patients, and these factors present many implications for practice.

Among apps recommended by participants, patient portal apps were the most common; participants recommended these apps to 11% to 25% of their patients each week. This supports the notion that FNPs recommend mHealth apps that are HIPAA-compliant and trustworthy and those that may synchronize with their EHR system.[27] Unfortunately, most consumer-based apps that track or monitor health data are not HIPAA-compliant; HIPAA compliance is only required among apps that transmit identifiable patient health information to a clinician or an EHR.[28] Patient portal apps offer patients convenient access to their health records while promoting clinician efficiency by integrating patient-recorded data and messages into the EHR.[3] Studies have identified increased patient engagement, decreased hospital utilization, and improved biometric data among patients with regular patient portal usage.[29,30] Family NPs' recommendations of patient portal apps demonstrate the need for more apps that guarantee HIPAA compliance, privacy, and integration with EHRs.[31]

Diet and nutrition apps were also commonly recommended by participants. Primary and tertiary prevention for patients often comprises lifestyle changes, such as diet modification and increased exercise. mHealth apps can support these interventions, and it is not surprising that diet and nutrition and fitness apps are among the most recommended. MyFitnessPal is the most frequently recommended diet and nutrition app among dietitians,[23,24] who recommend apps to provide patients with education, tracking, decision-making tools, motivation, and support.[23] Common diet and nutrition apps, such as MyFitnessPal and LoseIt!, have demonstrated modest improvements in health promotion and promote patient engagement in tracking health data.[32,33] These apps assist in mitigating risk factors, and FNPs can feel comfortable recommending these given their low perceived risks to patient safety.[3]

In this study, participants agreed that mHealth apps complement patient care and facilitate health-promoting activities, while nearly half agreed that mHealth apps improve their patient outcomes. These factors increased participant intent to recommend apps to patients. This is the first study to investigate FNPs' attitudes toward recommending mHealth apps for health promotion, supporting findings by Milt[34] that more than two-thirds of clinicians believe apps can facilitate patient engagement in health promotion. Participants also agreed that mHealth apps are easy to use and improve clarity and understanding of patients' health data and thus facilitated their inclination to recommend apps to patients. Data recorded in an app can improve FNPs' understanding of patient health[35] and may assist FNPs in mitigating disease exacerbations in patients with chronic diseases. By offering a convenient patient care method, they can be used to address gaps in care.[36]

Participants in this study were undecided about mHealth apps' impact on productivity, which is an important consideration for FNPs. In surveys of physicians and other healthcare providers, nearly half believed apps improved their efficiency.[16,34] Apps that transmit data to clinicians prior to an office visit may save time during the visit to cover other pertinent issues[37] and may allow FNPs to spend less time on education and more on supporting behavior change.[38] However, few apps allow data sharing of records with clinicians.[15,23] In a pilot study of physicians, Segui et al[35] found that recommending apps was not an easy task, as it increased the length of the visit; most dietitians report reviewing app data with patients verbally during an office visit, instead of viewing app records.[23] Participants in this study felt that recommending apps to patients did not take a lot of time. Regardless, to streamline the process of recommending apps, educational support for both clinicians and patients is essential. Adequate technical support to assist patients with downloading and using apps, as well as ongoing education for clinicians, must be considered to facilitate usage.[35] Further research must target mHealth apps' impact on clinician productivity and perhaps reimbursement for time spent using mHealth apps and reviewing patient data, as these may present potential barriers to their adoption.[15]

The results indicated that participants required support from employers and healthcare organizations to recommend mHealth apps to patients. Organizational support consisted of education on how to integrate apps into patient care, what apps to recommend, and connectivity resources such as smartphones, tablet computers, and wireless technology, as well as the availability of apps that were compatible with EHRs. Participants lacked these resources, which presented a barrier to recommending apps. These findings are supported by similar research on dietitians[23] and physical and occupational therapists,[26] who lacked connectivity resources and knowledge and awareness of the best apps to recommend to patients and often sought app recommendations from their colleagues or institutions.[23,26] Nurse practitioners are required to be competent in mHealth app implementation, including how and when an app can be recommended.[13] Healthcare organizations should develop lists of mHealth apps that are approved, as well as organizational policies on mHealth utilization in patient care.[2,13] Further, organizations can establish committees to review mHealth apps or develop their own evidence-based apps.

Free text responses elicited issues that were not captured using the UTAUT framework, but limit mHealth app usage. Participants were concerned that recommending apps with



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inaccurate content could have serious consequences. While diabetes apps were the most recommended disease-specific apps, other apps for chronic disease management were not commonly recommended. This may be due to the fact that evidence-based disease management apps are scarce in contrast to the thousands that are not based on credible sources.[39,40] Other barriers to recommending apps involve privacy and security[21]; a study of 71 popular mHealth apps found that 86% had at least two security vulnerabilities.[41] Physicians surveyed by the American Medical Association reported coverage by malpractice insurance and data privacy and security assurances as important requirements before recommending apps.[25] mHealth app developers must be urged to uphold privacy and security. The United Kingdom's National Health Service has developed a formulary of approved apps and has published criteria for app developers to ensure these safeguards.[3] Nurse practitioners and other clinicians are cautioned to seek out mHealth app appraisal methods to identify the best apps to recommend.

Findings of this study support the significant need for research testing mHealth app efficacy to identify how these enhance optimal wellness. McClure et al[31] found that nearly 90% of clinicians would recommend mHealth apps if they were empirically tested. The body of evidence surrounding app efficacy has increased significantly over the past decade, but still necessitates further studies. According to the IQVIA Institute for Human Data Science,[3] strong evidence exists for use of mHealth apps in diabetes, depression, and anxiety management. As of 2017, no clinical guidelines have endorsed mHealth apps, but this is expected to change in the future.[3]

With accelerating app usage among consumers, it is obvious that this technology is here to stay, and consumer demand is significant.[42] Although NPs are in a prime position to support and recommend mHealth apps,[13] fewer than 25% of participants in this study reported that patients encouraged them to recommend mHealth apps. This finding is less than expected. A study involving Swedish physicians found that 59% of physicians had patients inquire about mHealth apps,[20] and 72% of dietitians reported patients regularly asked for mHealth app recommendations.[23]

Patients are more willing to use mHealth apps if their clinicians recommend them,[43] and the trust that patients have in their providers places emphasis on FNPs' need to recommend apps to patients. mHealth apps cannot replace human empathy and counseling needed to facilitate behavior change, and they should not be utilized as a sole intervention for health promotion,[23,26] but high-quality apps can complement health promotion[23] and provide intensive care between office visits.[26] Studies involving mHealth apps demonstrated behavioral change and improved outcomes if they were combined with frequent consultations or communication follow-up by a clinician.[33,44]

It is important to point out that mHealth apps are not meant for every patient, and patients' health and technology literacy, access to technology, age, and type and severity of illness affect the appropriateness of recommending an app. As FNPs may differ from other clinicians in considering the use of mHealth apps and the applicability to patient populations, replicating this study with other clinician groups may demonstrate differing results. Additionally, the types of mHealth apps assessed in this study may not represent all types of available apps as this technology is rapidly evolving.

Limitations of this study involved bias and threats to external validity, as the survey was administered to a convenience sample on a social media platform and through email communication. Arguably, those FNPs well acquainted with social media or email and who were members of the Facebook networking group and state NP groups were more likely to utilize technology and mHealth apps. Representativeness of the sample may have been negatively affected since the Facebook sampling method may have excluded more seasoned, older FNPs who do not use social media. This study's population consisted of younger FNPs who are newer to practice, but older FNPs may be even less likely to recommend mHealth apps.

The UTAUT was the theoretical framework for this study. For the questionnaire, effort expectancy and facilitating conditions had Cronbach's $\alpha$'s of .662 and .60, respectively. This UTAUT tool was pilot-tested and results were statistically significant in predicting the outcome variables for the pilot study data. For these reasons, the researcher considered the Cronbach's $\alpha$ for each construct acceptable. The UTAUT did not assess specific concerns with mHealth app use, such as privacy and security, evidence base and accuracy of app content, efficacy, integration with current EHR technology systems, technology usability and health literacy, and the ability to reach vulnerable populations that are rural, elderly, and lower income. The researcher included an option for comments at the end of the survey where FNPs could enumerate these issues, and demographic questions addressing these issues were omitted to avoid confounding additional data with the UTAUT framework variables. However, this delimitation leaves opportunity for future research to identify NPs' specific concerns with mHealth app use.

## CONCLUSION

mHealth apps are ubiquitous and can promote patient-centered care. By embracing this technology to support preventive care, FNPs may improve patient outcomes and engagement. Apps most recommended by FNPs are HIPAA-compliant contain trustworthy content, and integrate with EHRs. Support from healthcare organizations will help further promote this practice, and it is important that FNPs are supported in guiding patients to use the most reliable and safe apps. To help engage patients, FNPs and other clinicians should be



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educated on methods to evaluate mHealth apps and how to incorporate them into patient care. While the evidence base for app efficacy continues to expand, FNPs and other clinicians should review scholarly journals and engage in conversations with colleagues to learn about empirically tested and trustworthy mHealth apps to recommend to patients. Clinicians can also download and assess apps using one of the available appraisal tools before recommending them to patients. The NP practice model emphasizes patient- and family-centered care, health promotion and the engagement of patients in self-care,[45] and mHealth apps can support these constructs and may improve FNPs' efficiency.

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