LEVERAGING DIGITAL HEALTH TOOLS FOR BETTER MANAGEMENT AND CARE

Leveraging Digital Health Tools For Better Management and Care

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Lay Abstract

Chronic diseases pose a significant burden on patients, their informal caregivers, and healthcare systems. Patients with chronic diseases, such as heart failure (HF), diabetes, and cancer, can get involved in their health and practice self-care through the help of digital health tools (DHTs) while also improving access to care and patient outcomes.

Family physicians (FPs) are vital stakeholders when creating and implementing DHTs. However, their attitudes and needs are often overlooked.

To investigate this further, we conducted a rapid review to explore FP's attitudes and needs regarding DHTs for patients with chronic diseases. Supplementary to this, we also interviewed FPs in Ontario to gather their feedback and integrate it into a HF DHT, CorLibra.

The findings from both studies are crucial to better understanding the needs of FPs as they play a pivotal role in supporting patients with chronic diseases utilizing DHTs.

Abstract

Background

Patients with chronic diseases face many challenges in managing their health. In Canada, 44% of adults have at least 1 of the 10 most common chronic diseases such as diabetes, heart disease, and cancer. Research has shown that chronic diseases such as HF will soon cost Canada more than $1.8 billion a year, which is projected to grow. DHTs have the potential to improve access to care and health outcomes for patients with chronic diseases. The first point of contact for patients with any illness including chronic diseases is FPs and family practices who develop long-term relationships with their patients, offering comprehensive and personalized care. Integrating FP's feedback are a key stakeholder in designing an effective DHT that is feasible, integrates with usual care and aligns with best clinical practices.

Purpose

To better understand and explore FP's attitudes regarding DHTs for patients with chronic diseases and with a specific focus on HF.

Methods

For this rapid review, we conducted a literature search using academic databases in which 9 articles met the inclusion criteria. We followed the Cochrane methodological recommendations for the development of Rapid Reviews and the Preferred Reporting Items for Systematic Reviews

and Meta-Analyses for reporting. Two reviewers independently conducted study screening, selection, and data abstraction. The themes identified in the articles were extracted and presented narratively through a collaborative process. In our second study, we conducted semi-structured interviews using persona scenarios with Southwestern Ontario FPs to gather their feedback on a digital HF self-care tool, CorLibra.

Results

There were two major themes that emerged from our rapid review: physician-patient and physician-technology relationships. Within these, 7 subthemes were identified: increased physician workload, data capture and quality, evidence-based care, education and training, liability, patient interactions, and patient empowerment and suitability.

For our second study which consisted of interviews with FPs, we identified the following themes: availability of advice in more challenging situations, the importance of patient clinical data, digital health tool competencies, patient factors, general attitudes towards digital health technology and primary care climate.

Conclusion

To promote self-care for patients with chronic diseases, FPs' attitudes must be considered and integrated within DHTs. The themes described above are crucial to the design and implementation of DHTs as they have the potential to significantly improve patient outcomes and overall standard of care.

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List of Figures and Tables

Abbreviations

I.   HF-Heart Failure

II.   FPs-Family Physicians

III.   DHTs-Digital Health tools

IV.   SDDST-Standardized Diuretic Decision Support Tool

V.   HCPs-Health Care Professionals

VI.   EMR-Electronic Medical Record

VII.   HIREB-Hamilton Integrated Research Ethics Board

Declaration of Academic Achievement

The following is a declaration that the work presented in this thesis was completed by

Derya Demirci. Guidance at all stages of the research (study design, data collection, data

analysis) conducted for this thesis was provided by Drs. Catherine Demers, Derelie Mangin, Neil

Barr and Janusz Kaczorowski. Derya Demirci was responsible

for writing this manuscript. Drs. Catherine Demers, Derelie Mangin, Neil Barr and Janusz

Kaczorowski contributed to manuscript review and revisions.

Chapter 1

Thesis Structure

Chapter 1: Introduction

This chapter serves as an introduction to the research conducted, encompassing two studies aimed at in-depth exploration. It provides essential background information and outlines the research objective, setting the stage for the subsequent chapters.

Chapter 2: A Rapid Review of Family Physicians' Attitudes of Digital Health Tools for Managing Chronic Diseases

Chapter 2 focuses on the qualitative study conducted through a rapid review methodology. It involves the selection of relevant literature, data extraction, and analysis. The findings derived from the rapid review are discussed, revealing key themes, patterns, and insights from existing sources.

Chapter 3: Exploring How Family Physicians Can Support Patients with Heart Failure Utilizing Digital Health Tools: A Qualitative Study

Chapter 3 presents the methodology employed in collecting qualitative data from family physicians. It outlines the research design, participant recruitment process, data collection and analysis. The chapter includes the findings obtained from the qualitative data collection, offering insights into the perspectives, experiences, and challenges expressed by the participants.

Chapter 4: General Discussions and Implications

Chapter 4 encompasses general discussions and implications derived from both studies. It integrates the findings from the rapid review and qualitative data collection, examining the convergence or divergence between the two. The chapter explores implications, strengths and limitations of the research, and suggests future directions for further investigation in the field.

Background

Introduction

More than 50% of Canadian adults have one or more chronic diseases.[1] Chronic diseases are conditions that last 1 year or more and require ongoing medical attention.[2] These conditions lead to a substantial burden on healthcare systems. According to a report from Statistics Canada, chronic disease accounts for 89% of all deaths and costs the healthcare system more than $80 billions annually.[3] An example of a common chronic disease is HF, a condition where the heart cannot pump enough blood for the body's needs.[4]

Self-care is defined as the means to take action to improve mental, physical, and emotional health and wellness.[5] Patients with chronic diseases should engage in self-care to manage their health conditions to improve their quality of life. A systematic review which assessed 10 studies found that patient engagement, including self-care, improved health outcomes in patients with chronic diseases in all the studies analyzed.[6] All studies found improvements in self-reported patient health status and 5 of the 10 studies reported a significant reduction in clinical markers of a disease.[6] Self-care encompasses self-management, self-maintenance, and self-confidence. Self-management involves empowering patients to take control of aspects of their health.[7] More specifically, it is defined as tasks individuals with chronic diseases must take.[7] Engagement and self-management are a fundamental part of clinical care models for chronic diseases (e.g., Chronic care model).[8] Within the chronic care model, it includes self-management support, emphasising the important of the patient's central role in managing their health.[8] **Figure 1 below** depicts an overview of the Chronic care model. Lastly, self-maintenance is the process of caring for oneself and self-confidence is trust in one's skills and abilities[7,9].

Figure 1 The Chronic Care Model (Wagner et al. 1999)
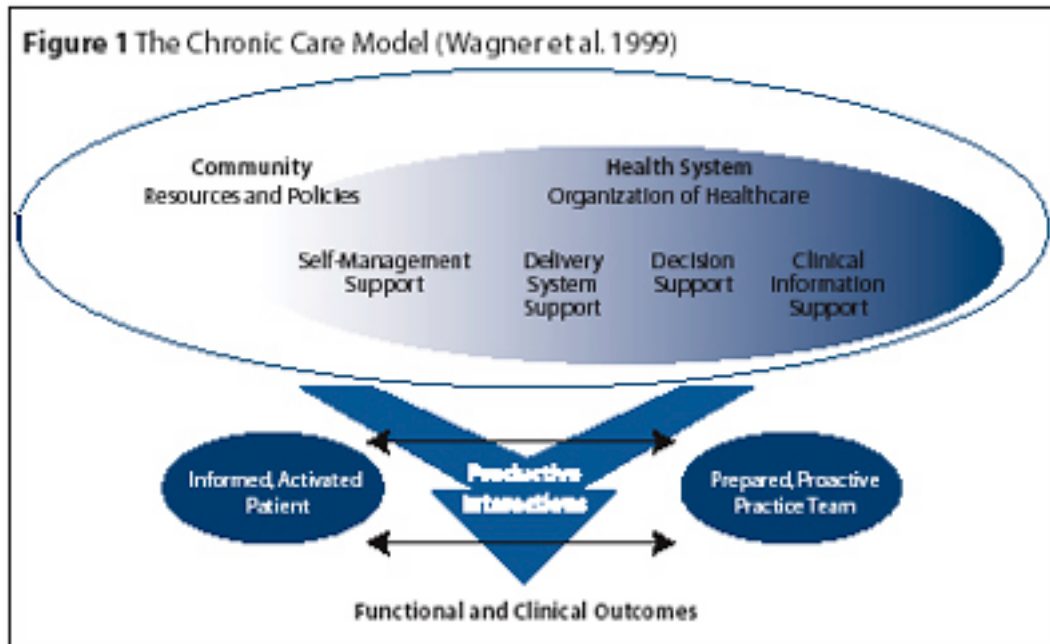
Digital health tools (DHTs) are crucial in promoting self-care for patients with chronic diseases.[10] Digital health is the use of information and communication technology in medicine to manage illness and promote wellness.[11] It is a multidisciplinary field constantly evolving due to the advancement of technology.[11] Digital health is an all-encompassing term which includes mobile health (mHealth) applications or apps, electronic health records (EHRs), wearable devices, telehealth, and telemedicine.[12] Essentially, DHTs use computing platforms, software and sensors for healthcare related uses.[13]

According to the WHO definition, primary care is a model of care that supports first-contact and coordinated person-focused care to optimize patient health and reduce population disparities.[14] There are 5 core functions of primary care which include the following: First contact accessibility, continuity, comprehensiveness, coordination and people centred.[14] Moreover, health promotion and disease prevention are critical roles played by FPs.[14] While many studies report effects on outcomes, as well as patient perspectives, many fail to report the attitudes and needs of

FPs[15]. Considering the attitudes of FPs is crucial. Previous studies have demonstrated that partnering within local health systems and having follow-up care provided by FPs familiar with the patient's health conditions within 14 days of hospital discharge can significantly improve clinical outcomes[16-17]. This relates to the importance of considering FPs attitudes as it emphasizes the significant role FPs play in improving patient outcomes. Unfortunately, the reality is that many studies fail to report the attitudes of PCPs [15]. This is the challenge as it crucial that FPs attitudes are being considered and integrate their feedback into DHTs. Our studies are crucial as they shed light on the needs of FPs to support patients utilizing DHTs for chronic disease management. Both studies involve FPs attitudes regarding DHTs and to implement best practices that can be integrated within DHTs.

Research Study Objectives

The research study objectives are:

1. To explore FP's attitudes regarding DHTs promoting self-care for patients living with chronic diseases.

2. To gather FP's feedback on a digital health self-care tool specifically designed for patients living with HF

Chapter 2

A Rapid Review of Family Physicians' Attitudes of Digital Health Tools for Managing Chronic Diseases

The results of this chapter have been submitted for publication to PLOS Journal-Digital Health.

Abstract

Background

DHTs can leverage technology to rapidly develop and disseminate interventions to promote self-care. Often, FPs are most directly involved in chronic disease patient care, yet their needs is often overlooked. To successfully develop DHTs for chronic disease management, FP's attitudes are critical to ensure improved patient adoption and care.

Objective

This rapid review aims to review the literature exploring FPs' attitudes regarding DHTs and to identify and summarize major themes from the literature. The themes will produce recommendations and best practices for DHTs creators encouraging them to integrate solutions that support both FPs and patients.

Methods

We conducted a rapid review of primary quantitative and qualitative research published between 2000-2022. Two reviewers independently conducted study screening, selection, and data abstraction. The data was analyzed using NVIVO12, a data analysis software. Braun and Clarke's deductive thematic analysis was used, and the themes identified were extracted and presented narratively.

Results

Our search identified potential 9 qualitative research studies which met the inclusion criteria. Themes were classified into two major categories: physician-patient relationship and physician-technology relationship. Within these, 7 subthemes were identified: 1) Increased Physician Workload, 2) Data Capture & Data Quality, 3) Evidence-Based Care, 4) Education and Training, 5) Liability, 6) Patient Interactions, and 7) Patient Empowerment and Suitability.

Conclusion

Digital health technologies need to consider how DHTs affect the patient-physician relationship and the physician-technology relationship, as this affects how FPs perceive DHTs. FPs' attitudes must be taken into consideration to promote self-care for patients with chronic diseases. Moreover, results from the study can be used to promote recommendations and best practices for key stakeholders and DHT developers/creators.

Introduction

The COVID-19 pandemic was a significant catalyst for change within the digital health field as the pandemic-imposed life-changing restrictions.[18] These restrictions limited direct in-person interactions between healthcare professionals (HCPs) and patients within clinics. It also accelerated the adoption and reliance on technology to provide care, impacting the culture surrounding technology-based healthcare for providers and patients.[18] The pandemic brought new unique opportunities and is the first global pandemic of the digital age.[19] In a short period, the pandemic brought about years of advances through DHTs due to the limited ability for in-person care.[19] Older individuals with chronic diseases such as HF represent a population particularly vulnerable to the complications of COVID-19 and were asked to restrict contact with others when possible.[20-21]

Patient engagement, including self-care, has been shown to improve health outcomes, more specifically in those with chronic conditions.[6] For example, weight monitoring is essential for HF self-care, but regular weighing is practiced by less than 10% of patients.[22] DHTs can support patients to safely promote self-care practices in the home setting.[6] A systematic review which included 54 reviews, reported that DHTs can empower patients to manage their conditions and improve their health.[23] It also illustrated improvement in health behaviors for patients, better clinical assessments being conducted, treatment compliance and enhance coordination of care.[23] Often, the most frequent contact with the healthcare system for patients with chronic diseases is through primary care.[14] Unfortunately,, many studies fail to report the attitudes of key clinical stakeholders, including FPs.[15]

This rapid review aims to investigate FPs' attitudes regarding DHTs and identify major themes from literature to develop recommendations and best practices for FPs and DHT

developers/creators. Ultimately, a new approach to patient care must be feasible to implement and consider FPs input as they are key stakeholders in providing care for patients with chronic diseases. The core attributes of primary care involved comprehensive, continuity, and person-focused care which requires engagement with DHTs to ensure that the primary care model is supported.[14]

Methods

A rapid review was undertaken to identify and analyze FPs' attitudes on that support patients with chronic diseases to promote self-care. Although previous review studies have investigated DHTs for chronic diseases, there has been no comprehensive review of FPs' attitudes and attitudes toward DHTs. This rapid review was guided by the Cochrane Rapid Review Methods Group and PRISMA guidelines in designing and reporting the study.[24] The PRISMA chart can be seen below in Figure 1. Rapid reviews provide information promptly compared to systematic reviews as they use systematic search strategies but limit particular aspects of the systematic review process.[25] For example, a rapid review typically takes less than 5 weeks and the sources are limited due to time constraint of searching compared to a systematic review which is much more comprehensive and extensive.[25] Typically, a rapid review involves a narrow, specific question as opposed to a complex research question. A rapid review is best designed for new or emerging research topics, updates of previous review, etc.[25] Ultimately, we conducted a rapid review because our research question is specific and lacks extensive literature.

Eligibility Criteria

We followed the PICO Framework in establishing eligibility criteria **(Table 1)**. We considered any primary qualitative research peer-reviewed articles that included FP's attitudes on

digital health interventions to support patients with chronic diseases, published between 2000 and 2022 to reflect the most up-to-date information available.

Table 1: Summary of PICO Eligibility Criteria for Research Studies

Table 1	
Population (P)	What are the attitudes of FPs on digital health tools for patients with chronic diseases?
Intervention (I)	What DHTs are being assessed for chronic disease management (i.e. Arthritis, diabetes, heart failure)?
Comparator (C)	There is no comparator
Outcomes (O)	What does the themes illustrate in terms of FPs attitudes in managing patients with chronic diseases utilizing DHTs?

Literature Search Strategy and Terms

We initially consulted a librarian within the Health Sciences department at McMaster University that assisted with the methodology of how to research and locate appropriate articles. Following this, three databases were searched: Ovid - MEDLINE, Scopus, and PubMed. We first brainstormed relevant keywords to use in our search, which were: "Digital Health", "Family Physicians", "Chronic disease management", "Perspectives" and "Self-management". We then replaced these terms with controlled vocabulary according to Medical Subject Heading (MeSH) shown in **Table 1**. We decided to adopt the search terms "Telemedicine", "Physicians, Primary Care", "Chronic Disease", "Attitudes", "eHealth", "Digital Health", "Self-Management", and

"General Practitioners" to increase our indexing results within the databases. To supplement our literature search, we used our search terms within Google Scholar to identify more publications related to our research question. We also reviewed the reference lists of the included articles to further expand our search.

The terms 'eHealth', 'telehealth', 'telemedicine', and 'digital health' are often used interchangeably, with all terms generally referring to the electronic means of receiving or giving care, such as the use of video conferences or digital imaging technology[13].

Screening

The screening process was conducted by 2 independent reviewers. The first reviewer was Derya Demirci and the second reviewer was Muhammad Minhas (MSc eHealth). We screened articles according to our eligibility criteria by cross-referencing the title and abstract. The key terms used in literature search are listed below in **Table 2.**

Table 2: Terms Used in Literature Search for Rapid Review

Table 2	
Term	**MeSH Term**
Ehealth, digital health	Telemedicine
Family physician	Physicians, Primary Care
Chronic Disease Management	Chronic Disease
Perspectives	Attitude

Self-Management	Self-Management
General Practitioners	General Practitioners

Eligibility Criteria

The article must have included perspectives of primary care and/or FPs, chronic diseases, and DHTs to be eligible for further screening. Each article that met this criteria (N=37) was entered into a standardized extraction form for full-text screening. After a full-text review, the resulting identified papers (N=9) were analyzed and extracted for major themes. The focus of the papers included a discussion about DHTs concerning FPs managing patients with chronic diseases; themes had to be relevant to FPs' attitudes and needs. We used Braun and Clarke's inductive thematic analysis approach to analyze, identify, and refine emerging themes[26.] The two reviewers (Derya Demirci and Muhammad Minhas) collaboratively reviewed the data and finalized the themes. Any discrepancies were resolved through discussion.

Figure 2 below displays a PRISMA chart to outline the rapid review process, an adapted PRISMA flow diagram of the study inclusion process.

Figure 2: PRISMA Flowchart summarizing the Rapid Review Process
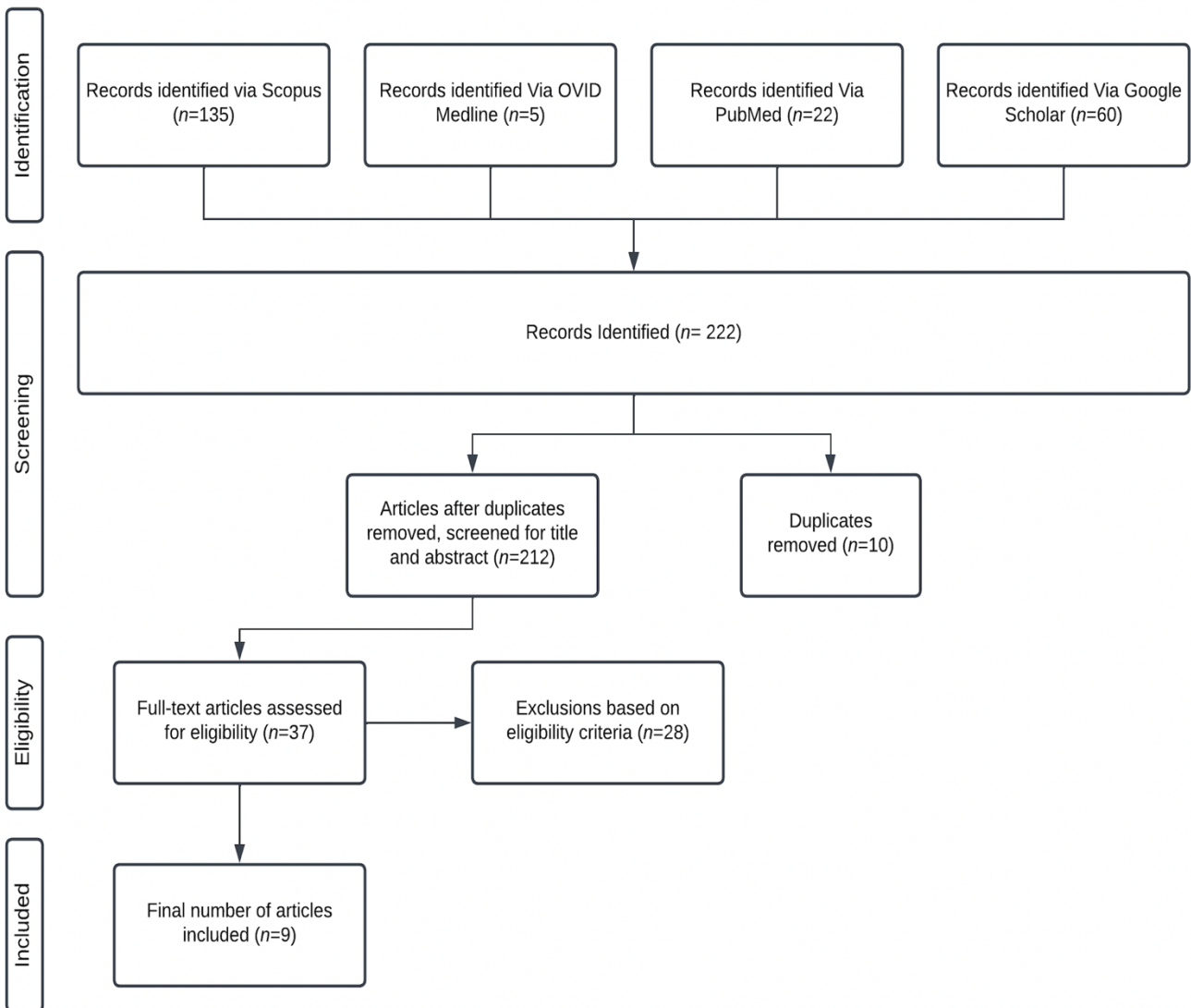
Data Abstraction

Studies were classified based on relevant criteria in relation to the objectives, including the type of intervention, geographic location, and type of study. The reviewers conducted thematic coding to organize and chart the data using inductive coding. We then collated the first-person attitudes of providers and identified prevalent themes from the article text, including direct quotations.

Results

We identified 9 articles that met our inclusion criteria. Based on the papers reviewed, we captured 2 major themes that we categorized as the Physician-Technology relationship or the Physician-Patient relationship category. The subthemes reported were the following: physician workload, data capturing & data quality, evidence-based care, education and training, liability, patient interactions and lastly, patient empowerment & suitability. A thematic overview of the results is shown in Figure 3 below:

Figure 3: Thematic overview of Rapid Review results
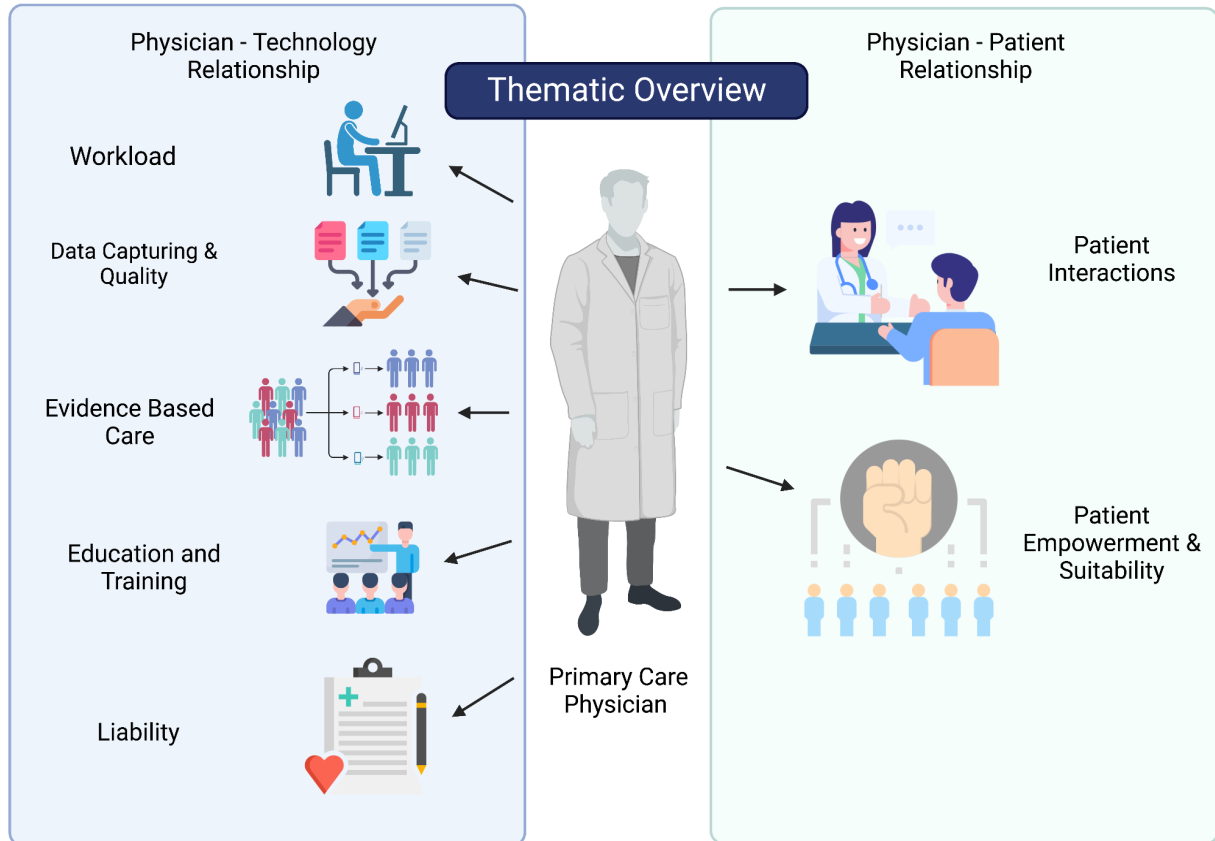
A table that outlines each paper, with the main themes identified, is shown below in **Table 3.**

Table 3: Rapid Review of the literature papers screened

Author (year)	Geographic Location	Type of Study	Sample size	Main themes
Ayre et al (2019)	Australia	Interview Study	$n=25$	- Increased physician workload: - FPs believe that workload will increase as they need to learn to use the app and provide care remotely - Concerns about lack of incentive if doing extra work - Workflow integration is crucial - Liability concerns - Monitoring of data outside work hours - Patient empowerment & suitability - Allow patients to take control and manage their health - Suitable for younger, more independent patients - Data capturing and quality - Provide a summary of the data - Enhanced documentation of patient data - Patient-physician relationships - Concerns that the tool would undermine the patient-physician relationship - Enhanced communication and stronger relationship - Education and training - Allow for key messages during consults to be retained by patients - Enhancing education for participants regarding their health is beneficial

Barber et al (2019)	Canada	Qualitative Study	$n=4$	- Increased physician workload - Educating patients on application function, setting up Wifi for clinic - Patient empowerment & suitability - Concerns about causing anxiety of older patients - Liability - Accountability capabilities for patients
Bhattarai et al (2020)	Australia	Qualitative Study	$n=17$	- Data quality - This might lead to data overload, physicians prefer data summaries beneficial - Physicians prefer a range of data points - Evidence-based care - Physicians require evidence to prove tool effectiveness and a regulatory body - Education and Training - Physicians want to be familiar with the tool - Patient empowerment & suitability - Concerns about age, and technology literacy for patients using DHTs - Empowered patients

Morrissey et al	Ireland	Qualitative Study	$n=10$	- Increased physician workload - Expanding duty of care for overworked physician through DHT - Data capturing - DHT provide accurate blood pressure readings - Easier to convey information through visualization of data - Patient empowerment & suitability - Suitable for patients who already tech-savy, independent,etc - Motivated patients to manage their health - Education & Training - FPs to know about the tool before recommending it - Patient-physician relationship - Power dynamic being disrupted - Liability - Concerns about monitoring data after hours
Slevin et al (2020)	Ireland	Qualitative Study	$n=32$	- Evidence-based care - Regulatory guidelines needed for DHT - Data quality - Concerns about lack of validation and calibration - Data reliability concerns - Workload - Resource constraints - Patient empowerment & suitability - Digital literacy concerns

Van de Vijver (2022)	Netherlands	Qualitative Study	$n=4$	- Patient empowerment & suitability - Not suitable for patients with hypochondria and those with low digital literacy - Patients having an active role in managing their health - Workload - Increase in work efficiency as the traditional model was seen no longer feasible - Also would increase workload due to administrative works, messaging features, etc.
Varsi et al., (2021)	Norway	Qualitative Study	$n=12$	- Patient empowerment & suitability - Barriers to usage: cognitive impairments, technological illiteracy, advanced age, cultural barriers, linguistic barriers, equipment that not everyone can afford
Grant et al., (2019)	United Kingdom	Qualitative Study	$n=11$	- Increase workload - Liability & Security - Patient confidentiality, especially when using sms texting - Patient-Physician interaction - Enhanced communication between patients and HCPS - Enhanced doctor-patient relationship - Data capturing and data quality - Useful clinical data that allows for more intense follow-ups - Easy access to patient data

Duineveld et al., (2016)	Netherlands	Qualitative Study	$n = 20$	- Patient empowerment & suitability - Not all patients wanted to be more in charge, for those young and educated - Patient empowerment - Relief for patients to be educated on their symptoms - Patient-physician interaction - The tool as a supplement to medical care and not as a replacement - Increase workload - Education & Training - Be knowledge on the tools content - Data capturing and data quality - Some expressed wanting to see results intensively and receive alerts when the status is critically low and some acted more as a consultant

Physician-Technology Relationship

Physician Workload

Our review indicates that most FPs (78%) expressed concerns about increased workloads due to DHTs [27-33]. With the emergence of the COVID-19 pandemic, many physicians' workloads, including FPs, have increased significantly, which poses an obstacle in adopting complex and time-consuming digital patient tools.[23] FPs described data management and logging into separate web portals as time-consuming.[32] Many FPs specifically expressed concerns about promoting the tool, providing patient training, investing additional resources within their clinic, monitoring patients outside of work hours, and integrating data within their EMR system. FPs perceive these resource and workload concerns as barriers to patient adoption of DHTs. FPs identified that app integration for older people will tax their time. They felt they had to download and familiarize themselves with the app before recommending it to their patients.[34] Adoption of DHTs is perceived to encourage expanding duty of care through longer working hours and increased communication/monitoring of patients. FPs also felt the need to invest resources for their clinics, such as WiFi capabilities.[28] Lastly, FPs stated their preferences for having data obtained from DHTs integrated into their existing EMR systems.[27] Otherwise, there were workload concerns about manually integrating patient data, which may add additional work for the care provider.[27]

Data Capturing and Quality

DHTs can capture immense data that may be valuable for FPs. DHTs allow patients to collect valuable data at home to help FPs make clinical decisions and empower patients to keep records of their health.[27,29-34] Increased data availability also allows for more intense follow-ups as there is more accessible access to clinical information.[32] Often, FPs face challenges when obtaining

clinical data such as blood pressure readings, as they provide a comprehensive view of patient data. However, allowing FPs access to clinical data across different times was deemed helpful.[29] Although there were many benefits to real-time data sharing, this might lead to data overload for FP. As a result, FPs preferred a summary of crucial patient data during consults to make clinical decisions instead of extensive reports.[34] Some concerns regarding data generated from DHT were that lack of calibration, validation, and reliability might lead to patient safety concerns.[30] For instance, data demonstrating inaccurate results may introduce patient health anxiety.[30] Overall, some FPs perceived digital health tool data as beneficial in guiding FP decision-making if presented in manageable chunks and not overwhelming, while others questioned data quality.

Evidence-based care

Our analysis reveals that FPs require evidence based DHTs or applications in order to provide their endorsement of the tool.[34] Evidence-based care is the integration of research-based evidence in the decision-making processes.[34] FPs want to see significant results that positively impact patient health. Supplemented with evidence-based care, an authority figure will also increase the likelihood that FPs will adopt and promote the utilization of DHTs for patients in their care.[30]

Education and Training

Education and training were also a major theme observed across many studies reviewed. FPs expressed a need to be educated and trained on the DHTs their patients are utilizing. FPs would ideally like to familiarize themselves with DHTs and receive primary education or training before promoting it to their patients.[29,33-34] Moreover, patients see DHTs as informative and valuable guides that promote education, and FPs can use them to facilitate information and instruction.[34]

Although FPs preferred face-to-face care over online care, they viewed the supplementation of an app during consultations positively.[27] FPs were interested in DHTs that would provide patients with brief educational materials, including key messages discussed during consultations.[27]

Liability

Although many FPs expressed the positive value DHTs can have for their patients, there were strong concerns about liability. Specifically, many physicians expressed liability concerns regarding the recommendation of DHTs and the responsibility of monitoring/receiving data after work hours.[29,33-34] FPs expressed that they felt liable if they were to recommend a DHT to patients and to view the data from these tools as part of their EMR systems.[33] They felt they would need to have enough information on the app before recommending it to their patients.[30] Reliability concerns were in combination with privacy concerns when DHTs incorporated SMS messaging features.[32-35] There is also the concern that if FPs receive alerts of patients' data, they will feel a sense of responsibility to act and respond if patient symptoms appear to be deteriorating.[30] As a result, they may be held liable. A study found that patient accountability capabilities would be attractive as it would shift the responsibility away solely from the physician and more to the patient.[35] There is also a confidentiality risk, mainly when using SMS texting to communicate with patients based on our data and is a genuine concern.[32]

Physician-Patient Relationship

Patient Interactions

Our review illustrated that DHTs could negatively and positively impact the FP/patient relationship. Family physicians expressed concerns about dehumanization and power-dynamic being disrupted.[27,29] There is also the issue that patients may rely on possible incorrect information

from DHTs and disregard their physician's professional opinion.[33] FPs have emphasized that DHT should supplement medical care and not replace it.[33] Moreover, DHTs can also positively impact patient-physician relationships as they facilitate difficult conversations regarding their health easier.[29,32] Having a tool also helped focus the conversation on patient goals and enhanced communication, promoting a positive patient-physician relationship.[27,32] DHTs were seen positively in this aspect.

Patient Empowerment, Suitability, & Factors

Many FPs believe DHTs can empower patients to manage their chronic disease. FPs believe that having access to visual health information will motivate patients to change their lifestyles and adhere to their medication.[29,33] However, FPs also believe DHTs are only readily adoptable by some patients. Some studies discuss that FPs feel that giving patients access to health data or too much information might result in unnecessary anxiety or concern.[29,36] Other studies have mentioned that patients who adopt these tools are younger, technologically savvy, and highly motivated about their health.[29,33,36] FPs expressed that patient factors such as age and digital literacy are important in determining suitability for DHTs. They expressed reluctance to recommend it to older populations as they question older individuals' technological ability and the impact these tools can have on individuals who need it the most.[25,29,31,33] However, FPs also described the positive impact DHTs have on empowering patients and motivating them to manage their health.

Discussion

Chronic diseases greatly burden patients who are affected by them. DHTs can lessen patients' burden through self-care.[6] The rapid development of the digital health field has made

many different tools available for consumers. FPs are the primary healthcare professionals in direct contact with patients managing chronic diseases. Therefore, their attitudes must be taken into consideration when developing DHTs for these patients. This rapid review aims to evaluate the attitudes of FPs on DHTs and outline guidelines to ensure DHTs are effective and preferred by FPs.

Our results demonstrated a key theme discussed widely in literature, **physician workload.** The goal of DHTs should be to decrease physician workload. The biggest barrier to DHTs is workload concerns as it may disrupt current processes.[37] A survey conducted in 10 countries found that since the pandemic, FPs have been experiencing a heavier workload, a significant backlog of patients, and increased time spent on administrative tasks.[38] The increase in workload can lessen the quality of care provided to patients.[38] Critical ways to reduce burnout are the following: provide training, reduce documentation & task time, expand care time and implement quality improvement initiatives.[39] Moving forward, we can reduce the barriers to DHTs, such as the lack of reimbursements, by creating incentive payments.[40] FPs should be acknowledged and incentivized for their work. The design and implementation of DHTs must take this into account, ensuring that FPs are compensated for their work as they are overburdened. Creating a simple DHT that can easily integrate into current systems utilized by FPs will help us ensure we do not increase their workload.

Another crucial aspect of a DHT is **data capturing and data quality.** Primary care consists of 4 functions: comprehensiveness, first contact, continuous longitudinal relationship and coordinated care.[41] FPs expressed patient data as beneficial, giving them a holistic overview of patients' clinical information and helping their clinical decision-making.[29] This provides them with important clinical data to positively enhance their decision-making. However, DHTs can present

data in ways that can be overbearing. Therefore, FPs prefer if patient data is reported in summaries and manageable chunks to help guide their consultations with patients.[34] A key enabler in improving the data captured is building trust between key stakeholders such as patients, clinicians and 3rd party data end-users. It is important to consider stakeholder engagement, transparency, robust data security, and protection factors to ease FPs' concerns.[42] A study found that a typical data architecture and nomenclature were necessary for data sharing across digital health systems; this would also help promote care.[43] Ultimately, reducing FPs' concerns is crucial to provide them with adequate support in managing patients, despite the importance of the data obtained from DHTs.

Moreover, FPs expressed the importance of **evidence-based care**. FPs expressed the needed validation to confirm the tool's effectiveness and positive impact on patients. Credibility and evidence-based are essential as this would likely encourage the adoption and promotion of DHTs by FPs.[31] Endorsements from respectable professional associations or colleges will enable FPs to further advocate and endorse the DHT to their patients.[44] They want to fully trust the tool because of concerns of potential liability if recommending it, emphasizing the importance of conductive scientific studies and research to support the tool's validity. DHTs must provide evidence-based recommendations based on current guidelines and quality measures.[43]

Concerning **liability**, having clinical guidelines in place would ensure set expectations between all parties involved, reducing any liability concerns that would be helpful for FPs. FPs expressed liability concerns in initially recommending a DHT and monitoring patient data.[27-29,32] Ideally, establishing accountability is critical to help reduce FPs' concerns, as it would relieve them of the expectation to monitor patients' data after hours.[28] Another solution is for patients to sign

consent forms enabling FPs to disclaim liability for after-hours of data monitoring.[45] A critical factor is ensuring clear expectations and guidelines are in place for patients while ensuring confidentiality & privacy measures are in place.

Nonetheless, DHTs must ensure that set guidelines and expectations are in place for all parties involved.

Education and training were also critical as many DHTs available in the market, making it challenging for FPs to remain up to date on every tool available. Ideally, DHTs should educate FPs about the capability and features in a simple, minimal manner. Moreover, FPs should know the risks and challenges, such as data sharing and confidentiality. Teaching material for DHTs should be reviewed and remain current with technology development.[46] Education and training could be a short video, webinars or a one-page pamphlet containing the necessary information for FPs.[47]

There is also the need to educate patients, FPs emphasized. For instance, DHTs could incorporate educational materials within their devices that would help FPs ensure that their patients are educated and knowledgeable about their condition.[27,33-34] Moreover, incorporating FPs' ability to facilitate information into a platform could be viewed positively, provided that other key factors such as physician workload and liability issues are addressed.

Patient-Interactions were also a critical theme identified based on our review. FPs voiced concerns that DHTs could disrupt their relationship with patients, given that patients may assign more importance to the information provided by DHTs than to their FPs'. Recommendations include setting expectations that DHT's role is to help support patients and not replace medical care and ensuring FPs remain responsible for significant clinical interventions.[48] On a positive note, FPs highlighted the impact of DHTs on communication, stating that it made difficult

conversations more manageable and that education on DHTs was helpful for both patients and FPs.[29] DHTs should ensure that patients are educated and empowered yet balance compliance and autonomy.[48]

Lastly, regarding **patient empowerment and suitability,** our review illustrated that many physicians believe that patient factors are important in determining digital health suitability for older patients. FPs have expressed that older populations are limited in DHTs due to technological capabilities restraints. However, older patients have expressed positive attitudes toward DHTs and the impact they could have on their health.[49] Yet according to our review, FPs often make assumptions about what their patient can or cannot do. FPs have expressed that they did not want to worry/challenge older patients with DHTs as they did not want to heighten their anxiety.[28,31] Another major barrier is multimorbidity for patients wanting to engage in eHealth. A study examining patient access and attitudes towards eHealth identified several significant factors that predict less interest in eHealth.[50] These factors include age, multimorbidity, home internet access, comfort using the internet, privacy concerns, and self-rated health.[50] Although many barriers exist, DHTs must consider these when catering to the older population. FPs should also make fewer assumptions about their patient's capabilities because if provided with the opportunity to increase their well-being, patients accept utilizing DHT to do so.[49] Overall, DHTs should consider diverse patient needs as FPs hesitate to utilize a technology tool for specific patient populations. FPs can be mindful and ensure that they make fewer assumptions about their patient's capabilities.

With chronic disease management, DHTs promoting self-care should consider the necessary themes when implementing a self-care DHT. This would make things easier for both the FPs and the patient and further promote adopting and utilizing a digital self-care tool.

Limitations

As part of the rapid review process, we omitted formal quality assessment of studies. Given the quick innovation of technology and the rapidly changing nature of DHTs, we felt this methodology was the most appropriate for timely dissemination in a swift-moving research area. We screened articles using our eligibility criteria and undertook a thematic analysis of healthcare provider attitudes s to synthesize and report on the current literature. The results were then collated, summarized, and reported.

Conclusion

This review systematically analysed FPs' attitudes on DHTs for patients with chronic diseases through rapid literature reviews. Findings revealed the impact on physician workload as a critical factor in whether FPs view the digital health tool positively or negatively. There are many aspects regarding the data that DHTs create, such as its validity and providing FPs with only crucial clinical information. Digital tools should supplement evidence-based, have clear clinical guidelines in place and provide education and training for FPs. FPs often consider patient digital literacy and the impact the digital health tool would have on their patient-physician relationship, ensuring that they advocate a tool that would be helpful for their patients while maintaining a positive patient-physician relationship. These factors will significantly impact whether FPs adopt and promote the tool to their patients and practice.

Chapter 3

Exploring How Family Physicians Can Support Patients with Heart Failure Utilizing Digital Health Tools: A Qualitative Study

Abstract

Background

Heart Failure (HF) impacts millions of individuals worldwide and is associated with a high hospital readmission rate. Patients with HF face potential challenges such as medication non-adherence, mild decline in memory and executive function, accessing timely healthcare, and limited knowledge of their condition. Patients can learn to manage their condition using validated self-care tools to prevent worsening HF symptoms. DHTs can promote self-care by developing user centred tools. Primary care FPs are well-positioned to support patients in managing their chronic diseases. When creating and implementing DHTs that support older patients with HF, it is crucial to consider the input of their family physicians. For FPs to support patients using digital health HF self-care applications, we must understand their needs and expectations.

Objective

Our study objective was to understand FPs attitudes and needs to feasibly and effectively support older patients with a self-care DHT tool. The existing self-care DHT is CorLibra, which promotes HF self-management in the home-setting by prompting the patients to monitor their weight on a daily basis and adjust their diuretics (water pill) accordingly. This medical device is specifically designed and adapted to older individuals needs based on extensive qualitative work.

Methods

This qualitative study follows an evidence-based, user-centred design (UCD) framework. The study format followed a semi-structured interview using persona-case scenarios to identify FP's needs. A persona is an invented person intended to represent a type of user. The scenario is the narrative that the persona interacts with. Participant (FPs) recruitment occurred (FPs) through a regional primary care practice. NVivo 12, a qualitative data analysis software, records and transcribes interviews verbatim. Braun and Clarke's inductive thematic analysis approach was used to analyze, identify, and refine emerging themes from the interviews. Two reviewers independently generated codes and themes. The coding and themes were identified through a collaborative process. The local Hamilton Integrated Research Ethics Board (HIREB) approved this study.

Results

Based on our analysis, 12 interviews were identified, and the following themes were identified: availability of advice in more challenging situations, patient clinical data, digital health tool competencies, patient factors, attitudes and preferences toward digital health technology, and the primary care setup.

Conclusions

This study provides a better understanding of FP's needs and expectations to support seniors with HF using a self-care digital health tool. FPs face many challenges when caring for seniors with chronic diseases. The themes identified in this study must be considered and integrated into HF

digital health platforms in order for them to be successful and adopted by key stakeholders such as FPs.

Introduction

Heart Failure (HF) is a chronic disease that affects an estimated 750,000 individuals in Canada alone.[51] Excess fluid accumulation in the body, which can lead to weight gain, fatigue, swelling in the legs and abdomen, and shortness of breath, are all common symptoms associated with HF.[52] Managing HF can be further complicated by other chronic diseases, which is the case for one-third of all patients diagnosed with this condition.[53]

HF is ubiquitous among the senior population, with more *than* half of hospitalizations occurring in adults aged 75 years or older.[54-57] Unfortunately, the healthcare system faces a significant burden as up to 35% of seniors are readmitted within 3 months after their initial hospitalization.[54-56] The expected healthcare costs associated with HF are projected to reach $70 billion annually in Canada and the United States by 2030.[58]

Self-care encompasses self-maintenance, self-management and self-confidence and involves behaviours that maintain physiological stability and response to symptoms when they occur. Patient engagement, including self-care, has been shown to improve health outcomes in patients with chronic diseases.[59] In patients with HF, self-care includes tasks such as measuring daily weight, symptom monitoring, and adjusting diuretics.[60] Systematic reviews found that self-care is effective in preventing hospital readmissions for patients with HF.[61-64] In addition, self-care improves patient satisfaction and quality of life.[66] However, complex medication regimens, management of co-morbidities, health literacy, and frailty can all lead to challenges in self-care.[65-68] A model of the HF self-care process can be seen below in Figure 4.

Figure 4: Heart Failure (HF) Self-care Process Model[69]
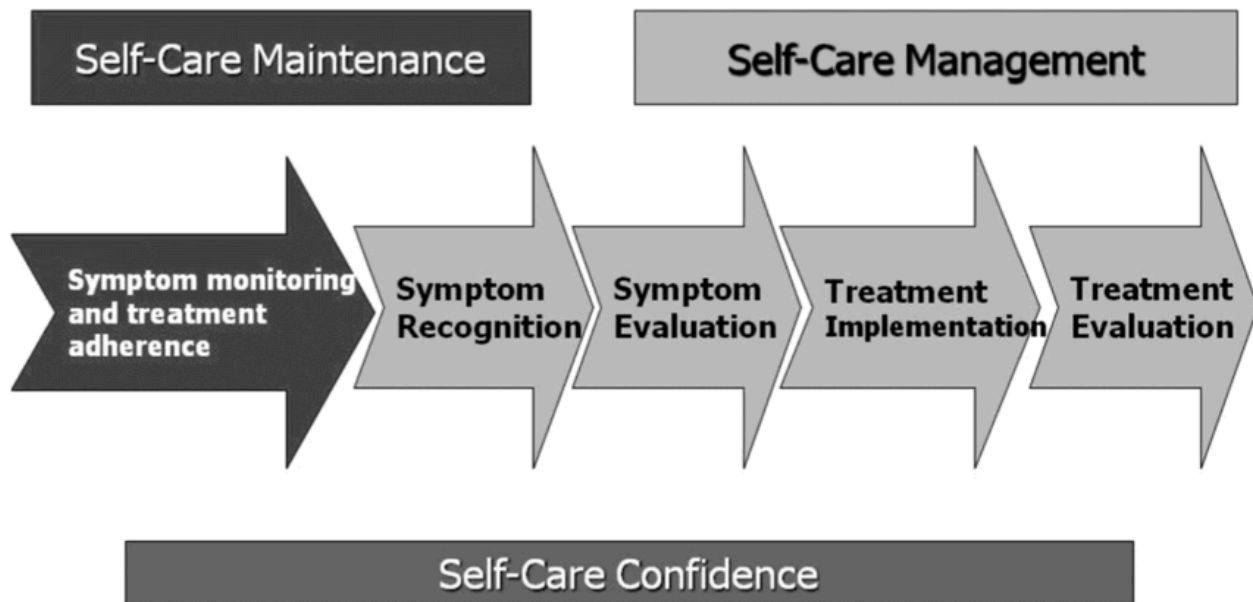
Currently, team-managed programs catered to patients with HF, such as the Ontario Telemonitoring Network's 6-month virtual care program, have limited ability to support many patients.[70] Furthermore, telemonitoring interventions can be costly because of the maintenance of large PHIPA-compliant patient databases and the costs of hiring qualified nurse practitioners.

Clinicians such as FPs play a critical role in helping patients with HF better understand and manage their health. Patients prefer to see their FPs with whom they have built a strong rapport over specialists.[71] However, many studies fail to report the attitudes of various stakeholders in managing patients with HF.[15] A study which included stakeholder attitudes, including FPs[15], cardiologists and other HCPs, found many challenges associated with HF care. A major finding was that FPs lacked knowledge and skills associated with HF care.[15] Therefore, further efforts are required to identify FPs' needs to support and manage patients with HF who utilize DHTs. The literature review found that FPs feel more comfortable managing patients with HF with other

healthcare professionals.[72] However, barriers such as the lack of sufficient exposure and education needed to manage patients with HF effectively were present.[72]

Research has also demonstrated the crucial role of diuretics (also known as water pills) in managing HF, as their use can reduce hospitalization rates among patients.[73] Yet, this is not a treatment adjustment that all FPs are comfortable making. A study found that FPs felt that cardiologists had unrealistic expectations for managing patients with HF, including making diuretic adjustments.[74] Involving FPs in the design of DHTs would also enable them to recommend DHTs to their patients, further promoting self-care.[75]

This present study particularly focuses on CorLibra, a digital HF self-care tool. CorLibra is a medical device designed to help seniors disproportionately affected by HF recognize and manage their symptoms. The key to controlling their condition is daily weight monitoring in order to recognize fluid retention, a reflection of worsening HF.[76] Weight loss and weight gain are associated with high hospital mortality with repeated hospitalization admissions.[76] Despite this, only 10% of seniors regularly weigh themselves at home.[22] CorLibra addresses this by providing a solution catered explicitly towards seniors, ensuring their journey of managing their condition is as easy as possible. Its design is based on the principles of user-centred design (UCD) principles and the Senior Technology Acceptance Model (STAM) framework.[77,78] UCD ensures that user needs based on factors such as gender and age are considered throughout all stages of the design life cycle.[77] The STAM promotes a participatory approach and posits that technology usage, specifically for seniors, is influenced by its perceived usefulness and ease of use.[78,79]

CorLibra supports seniors with different levels of cognitive function, technological abilities, caregiver support, socioeconomic status, and self-care abilities. It also addresses visual

and hearing impairments (e.g., engaging audio feedback, visual cues, large font size), empowering all seniors to take ownership of their HF management.

The medical device consists of a slip-proof Bluetooth weight scale linked to a dedicated Android tablet serving as a display screen with an embedded standardized diuretic/water pill decision support tool (SDDST). The SDDST assists seniors in adjusting their water pill dose depending on their daily weight. The paper-based version of the SDDST has been tested in a randomized clinical trial following hospitalization for heart failure (HF) in seniors and demonstrated improved self-management at 3 months following hospital discharge[80.] Figure 5 outlines the welcome screen for CorLibra, the tablet and the scale used (left-right). A clinical workflow of CorLibra can also be seen in figure 6.

Figure 5: CorLibra Product
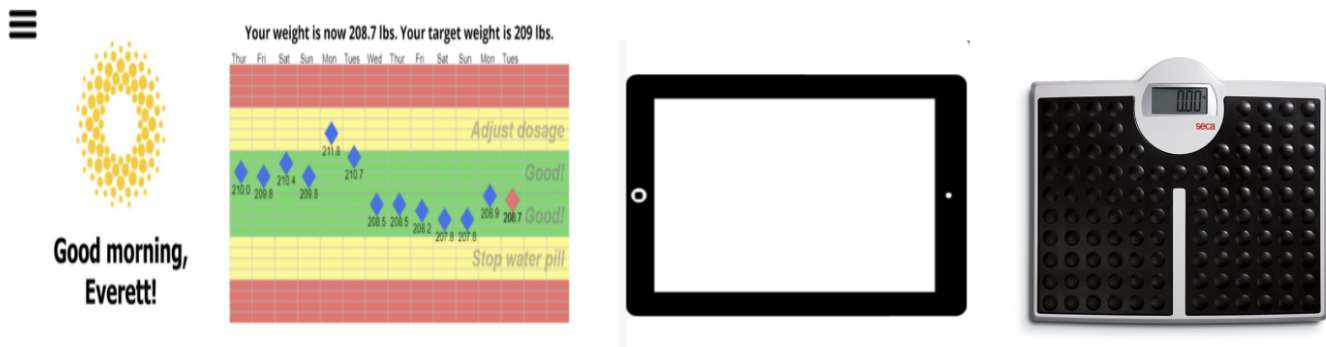
Figure 6: A clinical workflow of CorLibra
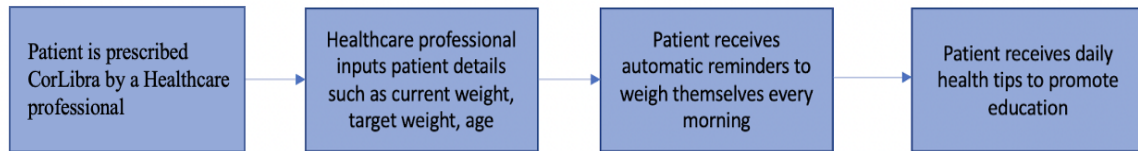
Study Hypothesis

We hypothesize that by understanding the attitudes of FPs on the support they need to manage patients with HF, it will allow us to better understand how to support FPs when managing patients utilizing digital HF self-care tools such as CorLibra.

Study Objective:

The objective of this study is to gather FP's feedback based on persona-case scenario discussions to identify themes and features to integrate into an HF self-care tool (CorLibra) that would be able to better help physicians support patients with HF. Feedback from FPs might include features that users perceive to be helpful and allow for thorough integration of the tool. Through physician feedback, we can better understand the needs of FPs on how they can better support seniors with HF using CorLibra.

Study Protocol

Study Design:

We conducted a qualitative observational study with an experience-based design. An experience-based design is a method which involves a user-focused design process and is often used as a healthcare quality improvement tool.[81] It involves patient, caregivers and stakeholders to identify how healthcare services can be enhanced to provide better care.[81] There are 4 main approaches involving this method which includes the following: participating action research, user centred design, learning theory and narrative-based approaches to change.[81] For our context, our participants worked with our staff (study team) to help make changes to improve care for patients with HF, focusing on CorLibra. Participants shared their experiences, their challenges, to develop a more effective solution. This allowed us to maximize patient support and enhance the development of CorLibra.

Population:

The study population included male and female FPs who will vary in age. Participants who are practicing FPs in Ontario will be considered eligible for participation. Purposeful sampling was done to get a range of FPs that would allow for information-rich discussions.

Inclusion Criteria:

Participants (FPs) with a minimum of 5 years of experience working in primary care were included in the study as it was a reasonable experience level that would ensure that physicians had the experience needed to share thoughtful attitudes. We also ensured that FPs were in non-academic practices as these physicians are not primary involved in outpatient HF care.

Exclusion Criteria:

Participants (FPs) with specialties such as sports medicine, palliative care or any other areas were not considered as the study wanted to focus entirely on FPs with the most direct contact with patients without specialty expertise. Participants (FPs) involved in any specialty practices were also not considered, as these family doctors are not primarily involved in outpatient HF care.

Methods

Braun and Clarke's inductive thematic analysis approach was used to analyze, identify, reflect and refine emerging themes from the discussion sessions.[26] Braun and Clarke's six-step method require coder (s) (Derya Demirci, MSc eHealth & Muhammad Hannan Minhas MSc eHealth) to familiarize themselves with the transcripts, and then generate initial codes into meaningful groups. Step three involved searching for the actual themes and identifying possible candidates. These candidate themes were reviewed and organized in step four. In step five the themes were defined, named and refined, and lastly there was a report generated for the fully worked-out themes. In addition, Malterud *et al's.* (2015) five components, 1) study aim, 2) sample specificity, 3) use of established theory, 4) quality of dialogue, 5) analysis strategy, and guideline on sample size was used as a baseline to determine the sample size for data saturation.[82] To gather feedback on the interview session, an informal feedback questionnaire was developed. The questionnaire, provided in Appendix F, aims to capture participants' thoughts and impressions regarding their experience.

This study had a relatively narrow objective of using FPs feedback for the further development of CorLibra, and the sample population included participants who had direct primary experience with patients with HF, thus, the sample specificity was also high. Therefore, due to the narrow study aim, dense sample specificity, intense dialogue and case analysis, it was estimated

that a large sample size (>30) was not needed to reach data saturation. Furthermore, previous studies indicate that our sample size will provide adequate saturation of coded themes when using structured interviews for qualitative research.[26,82] Thus, the projected sample size of 12 participants meets both the student researchers' capacities (i.e. workload) and data saturation.

We will ask FPs to participate in a persona-scenario discussion throughout this study. A persona is simply an invented person to help represent a type of individual or user. The scenario is then the story or narrative that the persona interacts with.[83] Together, these persona scenarios provide insight into FP's needs and expectations, which helps predict how they would potentially behave and assist patients with HF using self-care tools. The use of persona scenarios also helps individuals identify and connect with what a real person may need.[83] It allows them to draw information from another's experience and connect it to their own. Whether the persona scenario identifies challenges or benefits, it draws different conceptual ideas that may help situations that occur in real life.

We used the NVivo, Version 12 software for data analysis to code verbatim transcriptions of the discussion sessions. Dr. Catherine Demers purchased the license for this software and Derya Demirci (MSc eHealth) who was the primary student investigator identifying the codes, categories, and themes for the thematic analysis. The second student researcher was Muhammad Hannan Minhas (MSc eHealth) who collaboratively worked with Derya Demirci. Braun and Clarke's inductive thematic analysis approach was used to identify and finalize the themes. The 2 reviewers independently reviewed the data and coded general themes that were seen. Once the reviewers analyzed all of the data, they met to collaboratively go through each identified theme, further defining and refining the findings. It was evident that thematic saturation was reached once there were no longer new themes emerging. Moreover, to support each theme, illustrative verbatim

quotes were used to allow readers see the evidence underpinning the themes created based on the data analysis.

Results

Interviews were conducted with 12 FPs currently practicing in Ontario. The table below (**table 4**) outlines FPs sex, years of experience and practice location (urban vs. rural).

Table 4: Characteristics of Study Participants (FPs)

Characteristic	Participants (FPs) (N=12)
Sex	- Male=6 - Female=6
Years of Practice	- 5 years or less=3 - 6-10 years=7 - 10+ years=2
Location of Practice	- Rural areas=3 - Urban areas=9

Analysis of our results demonstrated the following major themes: availability of advice in more challenging situations, patient clinical data, digital health tool competencies, patient factors, attitudes and preferences towards digital health technology, and the primary care climate. In addition, saturation was reached as there was no further new themes or insights emerging from the data.

Availability of advice in more challenging situations

Most FPs expressed a general comfort level and positive attitude required to adjust patient diuretics. However, they discussed different aspects of support that would be useful to provide to enable them to access before doing so. Often, if it is a more complex case involving patients with multiple co-morbidities and clinically symptomatic, then FPs are cautious and would prefer to communicate with a specialist.

FP:

"If they do not have any renal issues or are a little more straightforward, then I would do the adjustment myself, but if it's a bit of a nuanced case, then I definitely want some specialist support". It is common to allocate numbers for the participants (e.g., "Participant 1")

FP*:*

"I am always worried about pushing a patient into renal failure. I usually I'm just like very conservative with it because I'm scared that I am just gonna make things worse"

Several FPs also expressed the benefits of having access to a cardiologist and having the opportunity to collaborate with them as helpful when providing care for patients with HF.

FP:

"I think follow-up with the cardiologist is always best in case they (referring to the patient) need more of a work-up. It depends on how acute the concern is"

FP:

"I have had very helpful cardiologists where I have instructions from them from their consult notes and I can kind of follow that some of the patients actually do know how to make adjustments because they have had very clear instructions".

Participants (FPs) have also expressed the need for clinical information such as whether the patient is expressing shortness of breath, their blood pressure, and how much fluid they have been taking before adjusting a patient's diuretics.

FP:

"Does the tool ask questions such as what their blood pressure is? How much fluid they've been taking in. Are they short of breath? Do they have chest pain? That needs to be done. I would want to know what the patient actually answered first".

Patient Clinical Data

FPs identified a significant advantage to patients utilizing DHT, which is the wealth of data that becomes available to them. In this aspect, FPs favoured the HF DHT as it would capture critical information to help manage patients with HF.

FP:

"When we are practicing in offices, we see the patients for five-ten minutes, I need to know how they function every day, what their ups and downs are. You cannot treat any human being without you know his lifestyles and this kind of tool will help us do that"

Digital Health Tool Competencies

FPs identified many factors regarding DHT such as the need to be educated and familiar with the DHTs their patients are using, liability concerns and the importance of having a credible tool supported by evidence-based care. Most FPs expressed a need to know whether their patient is utilizing a HF self-care tool and wanted to be familiar with and educated on how the tool operates. Many of the FPs viewed DHT's tools from their patients' attitudes and wanted to be familiar with them to support their patients best. FPs made suggestions that they wanted to be knowledgeable on the DHTs through medicine conferences, one-page handouts, links to access more detailed information, or short videos that outline key features. It was also critical for FPS to know their expectations and roles when their patients are utilizing a DHT.

FP:

"Knowing first of all that it (referring to the HF self-care tool) exists, how it works on the patient end, how it works on my end, and what the expectations are"

FP:

"I think the doctor needs to be aware of what's happening just in case you need to kind of check-in"

Regarding DHT's, FPs expressed a need to have data that highlights the outcomes and benefits such a tool would have for their patients. Providing studies that outline an improvement in patient outcome was deemed critical and also considering who is endorsing the tool.

FP:

"But if there was evidence that this tool reduced hospital admissions, mortality, improved quality of life then I think we're all more motivated to get on board with it because it's going to change outcomes"

FP:

"I feel, unfortunately, the way our healthcare is right now everybody wants to hear it from the specialist and they take it a lot more seriously than when it comes from a family physician"

Patient Factors

Many FPs were supportive of an HF self-care tool if it would help their patients manage their condition. However, they emphasized key factors to remember, such as the patient's age, access and attitude towards technology, and language barriers. However, these barriers were not significant in introducing and endorsing the tool to their patients as FPs expressed that regardless of patient factors, they would still recommend it because the patients may have a strong support system at home.

FP:

"I would recommend such a tool because I never know who's around in the family and whose their supporting them. But I would certainly consider that there would be frustration and barriers in using them and I would wait for them to let me know what works and what doesn't work for them"

FP:

"It would have to be something that's super easy to use because that's a population that struggles with that kind of thing"

Participants (FPs) also expressed features that can be integrated within the tool to ensure that it is adaptable to a diverse patient population. These include multiple language options, simple text and images, regulatory settings for patients with health anxiety and keeping in mind the older population.

FP:

"For me, the biggest thing would be a language barrier. So if the tool had lots of pictographs or very simple language that would be helpful"

FP:

"There are some patients that are just like super anxious and they'll follow their way to a point where it's unhealthy. For those patients, you'd want to be a little bit careful. Maybe there could be a way to regulate the amount that they're checking it in those cases".

Attitudes & Preferences Towards Digital Health Technology

Participants (FPs) expressed concern when asked whether they would benefit from having a messaging feature to communicate with patients. Many concerns were raised, especially concerning liability, such as monitoring patients in critical conditions after working hours. Therefore, FPs expressed a strong need to have clear guidelines and expectations put into place for patients.

FP:

"It becomes a question of what happens if something happens after hours or it's the weekend and the patient sends you a message and you're out of the office. I think there would have to be a clear expected time frame"

FP:

"A messaging system has a lot of problems associated with it. First of all, the patients get used to sending messages and they expect an answer back fairly shortly"

Overall, the majority of FPs had positive attitudes with regarding digital health technology and were particularly in favour of tools that would empower their patients.

FP:

"You have to embrace technologies that are useful".

FP:

"I'm all about empowering patients with knowledge about their healthcare so that they're more comfortable and they understand their medical condition"

In addition, when FPs were asked whether they would want to be informed if their patient is using an HF self-care tool, the majority were strongly in favour.

FP:

"If a patient is using a tool, I think it's important for the doctor to be aware in case a follow-up is needed"

Specific features that FPs deemed beneficial include items such as providing EMR integration, actionable items for patients, sections for FPs to read about what to do in certain scenarios, and access to patients' answers to symptom questionnaires.

FP:

"I would hope that there's going to be built-in parameters letting us know the alerts we might get and what a standard way to approach it would be"

FP:

"If a patient is using a tool and they're kind of bringing information to me, it would be nice if the information they're bringing in is directly actionable"

FP:

"It would be good if there's educational material that the tool can point to, to be like hey this is what's going on. Here's the research behind it. Here's the data behind it, and here's who's using it. It's been validated this, this and this".

Overall, FPs strongly emphasized the need for education on managing HF patients utilizing DHTs.

Primary Care Climate

This was also a key subtheme seen which referred to the burnout FPs face and the current climate being overwhelmed. Many FPs expressed concerns regarding their workload and that many FPs are leaving the field due to burnout and being overworked. Participants (FPs) expressed the

complexity of managing patients with HF and expressed a need to be acknowledged and properly compensated for additional work.

Many FPs expressed concerns regarding their workload and that many FPs are leaving the field due to burnout and being overworked. Participants (FPs) expressed the complexity of managing patients with HF and expressed a need to be acknowledged and properly compensated for additional work.

FP:

"I am overwhelmed, if this device has a messaging feature that came to me, I would not be using it. I am so already overwhelmed with patient volume that I just can't handle it anymore, especially on a topic (referring to heart failure) that I'm not going to have the answer and I'm going to have to spend time researching or still calling the patient or setting up a visit because I'm not comfortable enough"

FP:

"What would get family physicians to be more active in managing heart failure patients is probably if it was more financially compensated because it's so complicated"

Discussion

Globally, HF impacts millions of individuals.[84] It is the number one cause of hospital stay in Canada for people over age 65, accounting for 2 percent of healthcare expenditures.[79] The most common symptoms of HF are weight gain, shortness of breath, fatigue and swelling in the legs,

ankles and feet.[85] Weight gain significantly reflects the worsening of HF. Individuals with HF often struggle to recognize and manage their symptoms. Standard treatment for HF is diuretics, commonly used to relieve symptoms of congestion.[86]

Within primary care, FPs are vital in managing patients with chronic diseases such as HF. We must obtain their input to create DHTs to promote self-care for patients with HF. To our knowledge, no study has assessed FPs' attitudes regarding diuretic adjustments.

Our study found that FPs generally all expressed positive attitudes in adjusting patient diuretics for simple cases. However, with more complex patients, most FPs prefer to consult with a cardiologist or specialist. This also may be because they would like access to advice to be part of the implementation context. Areas for improvement in HF management in primary settings involve adopting collaborative strategies amongst HCPs such as FPs, specialists and nurses.[72] Collaboration between FPs and specialists has been found to be more efficient in reducing mortality than primary care alone.[72] This emphasizes the importance of establishing strong communication between FPs and specialists to ensure patients receive high-quality care.

DHTs provide important clinical data deemed beneficial by FPs, allowing them to view comprehensive patient data. Early detection of sudden weight gain or weight loss for HF is key to preventing hospital admission and increased mortality.[87-88] Regular daily weights are crucial to detect worsening symptoms in patients with HF. Patients using a DHT such as CorLibra will be able to weigh themselves daily, and FPs will be able to view weight trends and important clinical data[89], which was seen positively by FPs. However, obtaining large amounts of data may overwhelm PCPs and lead to poorer care.[75] In order to mitigate this challenge, the DHT should clearly outline actional tasks related to data changes for FPs to reduce complexity and ambiguity.[90]

While FPs exhibited favorable attitudes towards DHTs, it is crucial to consider various factors, including HF knowledge, liability, and the need for evidence-based tools and recommendations. The majority of FPs expressed the need to be supported by DHTs to enhance their knowledge, which would allow for better care. There were mixed views about the level of support required. Some expressed thorough support that outlines all the features present within DHTs. Others stated that a general understanding of the DHT would suffice. Many FPs in our study expressed limited knowledge and experience managing HF patients. A study found that providing guidelines or clinical suggestions would help FPs in patient management[91]. Supplementary to digital health competencies are liability concerns. Liability concerns are often seen in the majority of DHTs. FPs expressed concerns if patient data or messages were sent during after-hours. This concern can be mitigated by setting time restrictions and training patients on their responsibilities and expectations when using DHTs.[92] Patients should be advised to seek medical attention immediately if their symptoms appear to be deteriorating to reduce FPs' liability concerns. Another possibility is to relay critical patient alerts to a hospital after working hours.[92] Ensuring that responsibilities and roles are clearly outlined will help reduce liability concerns expressed by FPs. Lastly, FPs seek DHTs evidence-based supported DHTs that have been shown to improve patient outcomes.[92] Therefore, it is crucial for any tool seeking support from FPs to have strong scientific backing to ensure its adoption and integration into medical practice.[93]

The majority of the FPs viewed DHTs positively if they improved patient outcomes. Although concerns such as digital literacy, access to technology and patients' age and cognitive function were still present. Despite the potential challenges, endorsing/recommending a DHT was still seen as feasible by FPs, who believed that patients could rely on their support systems to navigate the process. Nonetheless, it was essential to FPs for DHTs to be simple and catered to

diverse population needs. A study which assessed seniors' perceptions of technology and barriers found that seniors often faced challenges when not provided with guidance/instruction and if the technology was too complex.[94] Similar concerns were expressed by FPs in our study hence the emphasis on creating DHTs that are simple, intuitive, and adaptable to seniors.

Health equity was also raised as a concern, with some FPs noting that their patients may face challenges in utilizing DHTs due to insufficient access to technology or language barriers. A solution may be incorporating a validated framework to address health equity concerns. A framework for digital health equity can be seen in Figure 6 below, which can be incorporated within DHTs.[66] According to the framework, there are 4 key determinants: individual, interpersonal, community and society.[89] Individual determinants refer to digital literacy, access to technology and general attitudes toward technology.[95] Interpersonal level determinants include implicit technology bias.[95] Implicit technology biases refer to the unconscious perceptions that an individual may have towards DHTs, technology and their clinician.[95] Disparity populations were seen as less likely to be invited by their clinicians to set up portal accounts due to clinician biases of selecting patients more likely to utilize successfully.[95] The FPs in our study demonstrated similar biases in expressing that some patients may succeed more than others when using DHTs. Community-level determinants include community infrastructure, healthy infrastructure, community technology norms and community partners.[95] Community infrastructure refers to patients who may not have access to DHTs due to limited internet access. Lastly, societal-level determinants include technology policy, data and design standards.[95] These involve federal and local policies to support healthcare technology adoption. Each determinant discussed should be applied to support FPs to ensure they can properly support their patients to utilize DHTs that would improve their conditions. Figure 7 below provides a further-in depth overview of the framework.

Figure 7: Research Framework for Digital Health Equity[95]

Levels of Influence*				
	Individual	**Interpersonal**	**Community**	**Societal**
Biological	Biological Vulnerability and Mechanisms	Caregiver–Child Interaction Family Microbiome	Community Illness Exposure Herd Immunity	Sanitation Immunization Pathogen Exposure
Behavioral	Health Behaviors Coping Strategies	Family Functioning School/Work Functioning	Community Functioning	Policies and Laws
Physical/Built Environment	Personal Environment	Household Environment School/Work Environment	Community Environment Community Resources	Societal Structure
Digital Environment	Digital Literacy, Digital Self-Efficacy, Technology Access, Attitudes Towards Use	Implicit Tech Bias, Interdependence (e.g. shared devices), Patient-Tech-Clinician Relationship	Community Infrastructure, Healthcare Infrastructure, Community Tech Norms, Community Partners	Tech Policy, Data Standards, Design Standards, Social Norms & Ideologies, Algorithmic Bias
Sociocultural Environment	Sociodemographics Limited English Cultural Identity Response to Discrimination	Social Networks Family/Peer Norms Interpersonal Discrimination	Community Norms Local Structural Discrimination	Social Norms Societal Structural Discrimination
Health Care System	Insurance Coverage Health Literacy Treatment Preferences	Patient–Clinician Relationship Medical Decision-Making	Availability of Services Safety Net Services	Quality of Care Health Care Policies
Health Outcomes	Individual Health	Family/ Organizational Health	Community Health	Population Health

Domains of Influence (Over the Lifecourse)

Lastly, the primary care climate is a significant theme. The family medicine climate in Ontario and across Canada is overburdened and overwhelmed. According to the Ontario Medical Association, 72.9% of physicians stated some level of burnout in 2021 which increased by 66% in 2020.[96] Many of the FPs in our study were cautious about supporting DHTs which could increase their workload. They demonstrated a need to be fairly compensated for their efforts and for the tool to be seamlessly integrated into their workflow was essential such as electronic medical record (EMR) integration. Evidently, due to the current climate, PCPs are unable to take on additional responsibilities. Implementing an infrastructure is put into place that supports coordinate and integrated primary care is crucial, while also ensuring that the appropriate training, supporting and retention efforts are put into place in human resources.[97] Overall, features expressed by FPs in our study highly involved and incorporated educational materials. Some FPs need to gain extensive experience managing HF patients, and limited knowledge may heighten their worries about DHTs. Therefore, DHTs must empower both patients and FPs.

Limitations

Due to the primary care climate, it was a challenge to recruit a high number of FPs. The original study design was to gain an equal number of FPs who practice in either rural or urban areas. However, due to recruitment limitation this was not possible.

Conclusion

Our study provided a better understanding of FP's needs to successfully implement support for patients with HF using a self-care DHT. There are many challenges FPs face may face when providing care for patients with HF. The themes described in this study must be integrated into

HF digital health platforms for them to be successful and adopted by key stakeholders such as FPs.

Chapter 4

General Discussion

Summary of Findings

The urgency of the COVID-19 pandemic has rapidly expanded the digital health field, as patient needs were being met remotely. There are many DHTs available globally, yet there are still numerous barriers and challenges to adoption by key stakeholders like FPs. Creating DHTs with little to no input from FPs can make it challenging for tools to have positive outcomes and feasible, as support from FPs is vital in a patient's treatment journey. Digital solutions should supplement medical care, not replace it, which is why it is crucial to engage FPs. We conducted this research because there needs to be more work done in the field that assesses FPs' needs and attitudes regarding DHTs specific to chronic diseases such as HF. FPs are intrinsically involved in the patient's management, particularly for chronic diseases.

In our rapid review, we extensively searched the literature to better understand FPs' needs and attitudes toward patients with chronic diseases utilizing DHTs. Some DHTs have built-in prompts that suggest patients reach out to their primary care without properly educating or engaging FPs or providing them with the proper support so that, in return, they can provide better care for their patients. Our review illustrated key themes that every DHT creator should consider if they want to create a successful tool that would contribute to positive patient outcomes while

also not introducing new challenges and barriers for FPs. A common theme within our rapid review and qualitative study with FPs was that physicians were against any tool that would add to their workload. Compared to other specialists, FPs suffer higher rates of burnout.[98] Both our rapid review and interviews with FPs found similar themes, such as liability concerns, having positive views on capturing clinical data, the need to be educated on DHTs, and supporting evidence-based tools that have demonstrated an improvement in patient outcomes.

Our qualitative study focused on HF as it was an in-depth study on managing patients with HF using a digital self-care tool. This involved understanding FPs' attitudes regarding different aspects, such as making diuretic adjustments, preferences on integrating messaging features and different elements that could be integrated within the tool. The results from this study will be implemented into a current HF self-care tool to support FPs.

Strengths & Limitations

Both studies in this thesis provide valuable key information in the form of themes for DHTs, specific to chronic diseases, especially HF. These papers outline novel findings concerning the understanding of FP's attitudes which are often overlooked within the field of digital health. As DHTs rapidly evolve and become increasingly integrated within our current and future healthcare systems, our research offers valuable insights regarding key stakeholders and FPs. FPs provide pertinent information, as they are uniquely positioned within our healthcare system to be in most contact with patients with chronic diseases. A key barrier for FPs supporting DHTs is a lack of trust and need for a clear evidence base. However, involving FPs in the design process and working collaboratively with these key players can lead to more trust and the creation of a tool that can benefit all parties involved.

One of the limitations of our rapid review was the limited number of articles that met all of our inclusion criteria. This was due to our narrow research question and the lack of studies available. As a result, our findings are primarily based on a small number of articles (N=9). We found a very limited number of articles that assessed FP's attitudes.

Additionally, a similar challenge was faced when recruiting FPs in Ontario for our qualitative study. Due to the shortage of FPs in Ontario and an overburdening amount of work for FPs, it was challenging to recruit a high number of FPs willing to participate in our study. Due to the limited sample size (N=12), the results may not be generalizable to a time outside the COVID-19 pandemic when stress levels and the burden of care are lower.

Next Steps

Patients with chronic diseases require support to help manage their condition. DHTs help patients in their daily management of symptoms without needing constant monitoring from HCPs. Moreover, for patients in rural and remote areas, DHTs can reduce barriers, allowing increased access to care which is a significant gap for indigenous populations.[99] Further work must be done within indigenous populations as the consensus amongst physicians is that digital solutions such as telemedicine are underutilized.[99] Reasons include lack of knowledge and resistance to change; similar themes were seen in our studies.[99] Significant opportunities exist within these areas and populations.

However, many factors need to be considered to implement an effective and efficient DHT for all. Factors such as adaptability, complexity, costs, and key stakeholders' early involvement need to be considered.[100] There is great opportunity to improve the designs of DHTs to make them better suited for patients and integration within the healthcare system.[101]

Our studies focused on shedding light on ensuring that DHTs have been created that address FP's needs.

Further work would need to be conducted better to understand the value and input of informal caregivers. Informal caregivers refer to the individuals such as family members or friends that provide care.[96] A study that interviewed informal caregivers found that almost half of the participants reported no specific knowledge about the patients they were supporting, and more than half reported no knowledge about how to provide care in general.[102] Although our study focused on FPs, informal caregivers are also key stakeholders to consider when creating DHTs.

Future of Digital Health & The Transformation of Healthcare

From a larger lens, the digital health sector is valued at $16.8 billion and $211 billion in Canada and the United States, respectively.[103-104] Moreover, there is a rising prevalence of chronic diseases. Based on a survey conducted in 2018, more than half of Canadians reported having one or more chronic diseases.[1] DHTs have great potential to help patients manage their conditions and promote self-care.

Current trends in the digital health sector involve telemedicine, wearable technologies, artificial intelligence, and personalized medicine. One of the most rapidly evolving and impactful fields is Artificial intelligence (AI). AI is a field of computer science that focuses on developing machines that can simulate human intelligence which can improve efficiency using information processing and decision-making.[105] AI can make disease detection quicker, allowing for early intervention and better patient outcomes.[105] Overall, there are many directions the future of digital health may take, with many competing technologies and trends. However, AI is present in many aspects of our everyday lives and will continue to advance. AI is currently in the early stages

concerning DHTs, with the potential to transform this space soon. DHTs can offer benefits such as reducing workload, costs, and streamlining clinical care.[87]

Primary care is an important field within medicine helps prevent illnesses and death with a distinguish feature of patient centredness and shared decision making.[14,106] The benefits that primary care provides is immense. This includes greater access to needed services, better quality of care, greater focus on prevention and early management of health problems. Secondary care is specialist care provided on an ambulatory or inpatient basis.[107] It is then crucial to understand how to integrate primary and secondary care as this has proven to be a challenge.[108] A scoping review aimed to establish priority areas to improve integration between primary and secondary care and access to healthcare.[108] The results demonstrated that integrating primary and secondary can enhance clinical outcomes and is effective for patients with chronic diseases. However, there was still inconclusive evidence to the success of the different intervention types across the studies examined, demonstrating that more research is required to determine best practices for primary and secondary care integration.[108]

Overall, the healthcare system is rapidly changing, and FPs are responsible for advocating and guiding their patients in managing their conditions. DHTs are proven to impact patients positively. However, with the support of their FP, the effects may reach their full potential. It is also crucial to consider many different factors when designing and implementing DHTs. Ultimately, by ensuring that feedback and valuable insights from FPs are being considered and integrated, significant barriers discussed can be reduced. The results shared within this thesis shed light on what FPs need to better support and manage patients utilizing DHTs for chronic disease

and for HF-specific self-care. FP's vast knowledge and relevant experience can significantly improve the overall quality, usability, and adoption of DHTs to improve patient outcomes.

References

1. Montague, T, et al. (n.d.). *Chronic Diseases in Canada: Contemporary Burden and Management*. Health Care in Canada Survey. Retrieved April 17, 2023, from https://www.mcgill.ca/hcic-sssc/

2. Centers for Disease Control and Prevention. (2022, July 21). *About chronic diseases*. Centers for Disease Control and Prevention. Retrieved April 17, 2023, from https://www.cdc.gov/chronicdisease/about/index.htm

3. Statistics Canada. Canadian Survey on Disability, 2017. Ottawa (ON): Statistics Canada; 2020 Jan 29 [cited 2023 Apr 17]. Available from: https://www150.statcan.gc.ca/n1/pub/82-003-x/82-003-x2020010-eng.htm

4. National Heart, Lung, and Blood Institute. Heart Failure [Internet]. Bethesda (MD): National Institutes of Health; [updated 2021 Apr 9; cited 2023 Apr 17]. Available from: https://www.nhlbi.nih.gov/health/heart-failure

5. U.S. Department of Health and Human Services. (n.d.). *Caring for your mental health*. National Institute of Mental Health. https://www.nimh.nih.gov/health/topics/caring-for-your-mental-health#:~:text=Self%2Dcare%20means%20taking%20the,illness%2C%20and%20increase%20your%20energy.

6. Simmons, L.A., Wolever, R, Q., Bechard, E.M., Snyderman, R. (2014). Patient engagement as a risk factor in personalized health care: A systematic review of the literature on chronic disease. Genome Med 6:16

7. Institute of Medicine (US) Committee on the Crossing the Quality Chasm: Next Steps Toward a New Health Care System; Adams K, Greiner AC, Corrigan JM, editors. The 1st Annual Crossing the Quality Chasm Summit: A Focus on Communities. Washington (DC): National Academies Press (US); 2004. Chapter 5, Patient Self-Management Support. Available from: https://www.ncbi.nlm.nih.gov/books/NBK215507/

8. Barr, V. J., Robinson, S., Marin-Link, B., Underhill, L., Dotts, A., Ravensdale, D., & Salivaras, S. (2003). The expanded Chronic Care Model: an integration of concepts and strategies from population health promotion and the Chronic Care Model. *Hospital quarterly*, *7*(1), 73–82. https://doi.org/10.12927/hcq.2003.16763

9. "Self-Maintenance." Merriam-Webster.com Dictionary, Merriam-Webster, https://www.merriam-webster.com/dictionary/self-maintenance. Accessed April 17, 2023

10. Seixas, A. A., Olaye, I. M., Wall, S. P., & Dunn, P. (2021). Optimizing Healthcare Through Digital Health and Wellness Solutions to Meet the Needs of Patients With Chronic Disease During the COVID-19 Era. *Frontiers in public health*, *9*, 667654. https://doi.org/10.3389/fpubh.2021.667654

11. Ronquillo Y, Meyers A, Korvek SJ. Digital Health. [Updated 2022 May 8]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK470260/

12. "Digital Health." SearchHealthIT, TechTarget, https://www.techtarget.com/searchhealthit/definition/digital-health-digital-healthcare#:~:text=Under%20its%20umbrella%2C%20digital%20health,as%20well%20as%20personalized%20medicine. Accessed April 17,2023

13. Center for Devices and Radiological Health. (n.d.). *What is Digital Health?*. U.S. Food and Drug Administration. https://www.fda.gov/medical-devices/digital-health-center-excellence/what-digital-health#:~:text=Digital%20health%20technologies%20use%20computing,applications%20as%20a%20medical%20device.

14. World Health Organization. (n.d.). *Primary care*. World Health Organization. https://www.who.int/teams/integrated-health-services/clinical-services-and-systems/primary-care#:~:text=Primary%20care%20is%20a%20model,have%20equal%20access%20to%20services.

15. Hayes, S., Peloquin, S., Howlett, J.G. et al. A qualitative study of the current state of heart failure community care in Canada: what can we learn for the future?. BMC Health Serv

16. McAlister, F.A., Youngson, E., Mmath, PK; Kaul, P.,Ezekowitz,J.A.,(2016). Early follow-up after a heart failure exacerbation: The importance of continuity. Circ Heart Fail, 9(9). Pii: e003194. doi: 10.1161.

17. Bradley, E H., et al., (2013). Hospital strategies associated with 30-day readmission rates for patients with heart failure Circ Cardiovasc Qual Outcomes, 6(4): 444–450. doi:10.1161/CIRCOUTCOMES.111.000101

18. Ahmed, A., Charate, R., Pothineni, N. V. K., Aedma, S. K., Gopinathannair, R., & Lakkireddy, D. (2022). Role of Digital Health During Coronavirus Disease 2019 Pandemic and Future Perspectives. *Cardiac electrophysiology clinics*, *14*(1), 115–123. https://doi.org/10.1016/j.ccep.2021.10.013

19. Lee P, Abernethy A, Shaywitz D, et al. Digital Health COVID-19 Impact Assessment: Lessons Learned and Compelling Needs. *NAM Perspect*. 2022;2022:10.31478/202201c. Published 2022 Jan 18. doi:10.31478/202201c

20. Levin S N et al., (2014). Cognitive status in patients hospitalized with acute decompensated heart failure Am Heart J, 168(6): 917–923. doi: 10.1016/j.ahj.2014.08.008

21. Virani, S.A.et al., (2020). Optimizing Access to Heart Failure Care in Canada During the COVID-19 Pandemic. Canadian Journal of Cardiology, Volume 36, Issue 7, 1148 – 1151

22. Seid, M. A., Abdela, O. A., & Zeleke, E. G. (2019). Adherence to self-care recommendations and associated factors among adult heart failure patients. From the patients' point of view. PloS one, 14(2), e0211768. https://doi.org/10.1371/journal.pone.0211768

23. Ibrahim MS, Mohamed Yusoff H, Abu Bakar YI, Thwe Aung MM, Abas MI, Ramli RA. Digital health for quality healthcare: A systematic mapping of review studies. *Digit Health*. 2022;8:20552076221085810. Published 2022 Mar 18. doi:10.1177/20552076221085810

24. Garritty CGG, Kamel C, King VJ. Cochrane rapid reviews. In: CRR, ed. Interim guidance from the Cochrane rapid reviews methods group. Cochrane Collaboration, 2020.

25. Research guides: Systematic reviews & other review types: What is a rapid review? What is a Rapid Review? - Systematic Reviews & Other Review Types - Research Guides at Temple University. https://guides.temple.edu/c.php?g=78618&p=4156608. Accessed January 9, 2023.

26. Braun V and Clarke V. Using thematic analysis in psychology. *Qualitative Research in Psychology*. 2006; 3 (2): 77-101

27. Ayre J, Bonner C, Bramwell S, McClelland S, Jayaballa R, Maberly G, McCaffery K. Factors for Supporting Primary Care Physician Engagement With Patient Apps for Type 2 Diabetes Self-Management That Link to Primary Care: Interview Study. JMIR Mhealth Uhealth 2019;7(1):e1188

28. Barber, T., Sharif, B., Teare, S., Miller, J., Shewchuk, B., Green, L. A., ... & Marshall, D. A. (2019). Qualitative study to elicit patients' and primary care physicians' perspectives on the use of a self-management mobile health application for knee osteoarthritis. BMJ open, 9(1), e024016.

29. Eimear C Morrissey, Liam G Glynn, Monica Casey, Jane C Walsh, Gerard J Molloy, New self-management technologies for the treatment of hypertension: general practitioners' perspectives, Family Practice, Volume 35, Issue 3, June 2018, Pages 318–322, https://doi-org.libaccess.lib.mcmaster.ca/10.1093/fampra/cmx100

30. Slevin, P., Kessie, T., Cullen, J., Butler, M. W., Donnelly, S. C., & Caulfield, B. (2020). Exploring the barriers and facilitators for the use of digital health technologies for the management of COPD: a qualitative study of clinician perceptions. QJM: An International Journal of Medicine, 113(3), 163-172.

31. van de Vijver, S., Hummel, D., van Dijk, A. H., Cox, J., van Dijk, O., Van den Broek, N., & Metting, E. (2022). Evaluation of a Digital Self-management Platform for Patients With Chronic Illness in Primary Care: Qualitative Study of Stakeholders' Perspectives. JMIR formative research, 6(8), e38424.

32. Grant S, Hodgkinson J, Schwartz C, et al. Using mHealth for the management of hypertension in UK primary care: an embedded qualitative study of the TASMINH4 randomised controlled trial. *Br J Gen Pract*. 2019;69(686):e612-e620. Published 2019 Aug 29. doi:10.3399/bjgp19X704585

33. Duineveld LA, Wieldraaijer T, Wind J, Verdonck-de Leeuw IM, van Weert HC, van Uden-Kraan CF. Primary care-led survivorship care for patients with colon cancer and the use of eHealth: a qualitative study on perspectives of general practitioners. *BMJ Open*. 2016;6(4):e010777. Published 2016 Apr 28. doi:10.1136/bmjopen-2015-010777

34. Bhattarai P, Newton-John T, Phillips JL. Apps for Older People's Pain Self-Management: Perspectives of Primary Care and Allied Health Clinicians. *Pain Med*. 2020;21(4):686-694. doi:10.1093/pm/pnz218

35. Holtz, B., Vasold, K., Cotten, S., Mackert, M., & Zhang, M. (2019). Health care provider perceptions of consumer-grade devices and apps for tracking health: a pilot study. JMIR mHealth and uHealth, 7(1), e9929

36. Varsi C, Ledel Solem IK, Eide H, et al. Health care providers' experiences of pain management and attitudes towards digitally supported self-management interventions for chronic pain: a qualitative study. *BMC Health Serv Res*. 2021;21(1):275. Published 2021 Mar 25. doi:10.1186/s12913-021-06278-7

37. Ingela Henoch, Susann Strang, Charlotte Larnebratt & Jonas Hermansson (2020) Digital health support – a good thing, but not for me. Experiences of family caregivers and healthcare staff, British Journal of Guidance & Counselling, DOI: 10.1080/03069885.2020.1826030

38. Stressed out and burned out: The global primary care crisis. Stressed Out Burned Out: 2022 Intl Survey Primary Care Physicians | Commonwealth Fund. https://www.commonwealthfund.org/publications/issue-briefs/2022/nov/stressed-out-burned-out-2022-international-survey-primary-care-physicians. Published November 17, 2022. Accessed January 19, 2023.

39. Thomas Craig KJ, Willis VC, Gruen D, Rhee K, Jackson GP. The burden of the digital environment: a systematic review on organization-directed workplace interventions to mitigate physician burnout. *J Am Med Inform Assoc*. 2021;28(5):985-997. doi:10.1093/jamia/ocaa301

40. Mesko B, Győrffy Z. The Rise of the Empowered Physician in the Digital Health Era: Viewpoint. *J Med Internet Res*. 2019;21(3):e12490. Published 2019 Mar 26. doi:10.2196/12490

41. Alex H Krist, Robert Phillips, Luci Leykum, Benjamin Olmedo, Digital health needs for implementing high-quality primary care: recommendations from the National Academies of Sciences, Engineering, and Medicine, *Journal of the American Medical Informatics Association*, Volume 28, Issue 12, December 2021, Pages 2738–2742, https://doi.org/10.1093/jamia/ocab190

42. Canaway, R., Boyle, D., Manski-Nankervis, JA. *et al.* Identifying primary care datasets and perspectives on their secondary use: a survey of Australian data users and custodians. *BMC Med Inform Decis Mak* 22, 94 (2022). https://doi.org/10.1186/s12911-022-01830-9

43. National Academies of Sciences, Engineering, and Medicine; Health and Medicine Division; Board on Health Care Services; Committee on Implementing High-Quality Primary Care; Robinson SK, Meisnere M, Phillips RL Jr., et al., editors. Implementing

High-Quality Primary Care: Rebuilding the Foundation of Health Care. Washington (DC): National Academies Press (US); 2021 May 4. 7, Digital Health and Primary Care. Available from: https://www.ncbi.nlm.nih.gov/books/NBK571817/

44. Nguyen, A. D., Frensham, L. J., Baysari, M. T., Carland, J. E., & Day, R. O. (2019). Patients' use of mobile health applications: what general practitioners think. Family practice, 36(2), 214-218.

45. Rowland, S.P., Fitzgerald, J.E., Lungren, M. *et al.* Digital health technology-specific risks for medical malpractice liability. *npj Digit. Med.* 5, 157 (2022). https://doi.org/10.1038/s41746-022-00698-3

46. Neve G, Fyfe M, Hayhoe B, Kumar S. Digital health in primary care: risks and recommendations. *Br J Gen Pract*. 2020;70(701):609-610. Published 2020 Nov 26. doi:10.3399/bjgp20X713837

47. Bhyat R, Hagens S, Bryski K, Kohlmaier JF. Digital Health Value Realization through active change efforts. Frontiers. https://www.frontiersin.org/articles/10.3389/fpubh.2021.741424/full. Published September 13, 2021. Accessed January 19, 2023.

48. Jongsma KR, Bekker MN, Haitjema S, Bredenoord AL. How digital health affects the patient-physician relationship: An empirical-ethics study into the perspectives and experiences in obstetric care. *Pregnancy Hypertens*. 2021;25:81-86. doi:10.1016/j.preghy.2021.05.017

49. Ienca, M., Schneble, C., Kressig, R.W. *et al.* Digital health interventions for healthy ageing: a qualitative user evaluation and ethical assessment. *BMC Geriatr* 21, 412 (2021). https://doi.org/10.1186/s12877-021-02338-z

50. Mangin, D., Parascandalo, J., Khudoyarova, O., Agarwal, G., Bismah, V., & Orr, S. (2019). Multimorbidity, eHealth and implications for equity: a cross-sectional survey of patient perspectives on eHealth. *BMJ open*, *9*(2), e023731. https://doi.org/10.1136/bmjopen-2018-023731

51. Heart & Stroke. (2019, February 4). Heart failure in Canada: Complex, incurable and on the rise. Retrieved from https://www.heartandstroke.ca/what-we-do/media-centre/news-releases/heart-failure-in-canada-complex-incurable-and-on-the-

rise#:~:text=In%20Canada%20there%20are%20750%2C000,family%20member%20or%20close%20friend.

52. Mayo Foundation for Medical Education and Research. (2021, December 10). *Heart failure*. Mayo Clinic. Retrieved February 8, 2023, from https://www.mayoclinic.org/diseases-conditions/heart-failure/symptoms-causes/syc-20373142

53. *Roadmap for improving integrated heart failure care in Ontario*. (n.d.). Retrieved February 9, 2023, from https://www.corhealthontario.ca/Roadmap-for-Improving-Integrated-HF-Care-May-2019.pdf

54. Blais, C. et al. (2014). Assessing the burden of hospitalized and community-care heart failure in Canada. Can J Cardiology, 30(3), 352-8.

55. Tran D.C. et al., (2016). The current and future financial burden of hospital admissions for heart failure in Canada: A cost analysis. CMAJ Open 2016. DOI:10.9778/cmajo.20150130

56. Chun S., et al. (2012). Lifetime analysis of hospitalizations and survival of patients newly admitted with heart failure. Circ Heart Fail, 5(4): 414–21.

57. Feltner C et al., (2014). Transitional care interventions to prevent readmissions for persons with heart failure: a systematic review and meta-analysis. Ann Intern Med, 2014 Jun 3;160 (11):774-84. doi: 10.7326/M14-0083. Urbich M, Globe G, Pantiri K et al: A systemic review of medical costs associated with heart failure in USA. PharmacoEconomics (2020) 38:1219–1236.https://doi.org/10.1007/s40273-020-00952-0

58. Centers for Disease Control and Prevention. (2023, January 5). *Heart failure*. Centers for Disease Control and Prevention. Retrieved February 8, 2023, from https://www.cdc.gov/heartdisease/heart_failure.htm

59. Clark, A.M., Freydberg, C.N., McAlister, F.A., Tsuyuki, R.T., Armstrong, P.W., and Strain, L.A. (2009). Patient and informal caregivers' knowledge of heart failure: necessary but insufficient for effective self-care. European Journal of Heart Failure, 11: 617–621. doi:10.1093/eurjhf/hfp058.

60. Mlynarska, A., Golba, K.S., Mlynarski, R. (2018). Capability for self-care of patients with heart failure. Clinical Interventions in Aging, 13: 1919–1927.

61. Shively, M.J., et al (2013). Effect of Patient Activation on Self-Management in Patients with Heart Failure. Journal of Cardiovascular Nursing, 28(1): 20-34.

62. Fabbri M, Roger VL. Health literacy and outcomes among patients with heart failure. J Am Coll Cardiol HF 2020;8(6):451-60.

63. Piano MR, Prasun MA, Stamos T, Groo V. Flexible diuretic titration in chronic heart failure: where is the evidence?J Card Fail2011; 17: 944– 954.

64. Abraham WT, Stevenson LW, Bourge RC, Lindenfeld JA, Bauman JG, Adamson PB. Sustained efficacy of pulmonary artery pressure to guide adjustment of chronic heart failure therapy: complete follow-up results from the CHAMPION randomised trial. Lancet2016; 387: 453– 461.

65. DeWalt, D.A., et al. (2012). Multisite randomized trial of a single-session versus multisession literacy-sensitive self-care intervention for patients with heart failure. Circulation, 125: 2854-62.

66. Demers, C., et al. (2014). A simple multi-component intervention improves self-management in heart failure. Canadian Journal of Cardiology, 30: S201.

67. Howlett, J. G., et al., (2016). The Canadian Cardiovascular Society Heart Failure Companion: Bridging Guidelines to Your Practice. Canadian Journal Cardiology, 32 (3): 296-310.

68. Canon JA, Moffitt P, Perez-Moreno AC, Walters MR, Broomfield NM, McMurray JJV, Quinn TJ. (2017). Cognitive impairment and heart failure: systematic review and meta analysis. Journal of Cardiology Failure, 23(6): 464-475.

69. Riegel, B., Dickson, V. V., & Faulkner, K. M. (2016). The Situation-Specific Theory of Heart Failure Self-Care: Revised and Updated. *The Journal of cardiovascular nursing*, *31*(3), 226–235. https://doi.org/10.1097/JCN.0000000000000244

70. *Telehomecare for COPD & heart failure: Remote care management*. OTN.ca. (n.d.). Retrieved February 8, 2023, from https://otn.ca/providers/telehomecare/

71. Griffiths, Sarah et al. “"She knows me best": a qualitative study of patient and caregiver views on the role of the primary care physician follow-up post-hospital discharge in individuals admitted with chronic obstructive pulmonary disease or congestive heart failure." *BMC family practice* vol. 22,1 176. 7 Sep. 2021, doi:10.1186/s12875-021-01524-7

72. Boa Sorte Silva, N.C., Pulford, R.W., Lee, D.S. *et al.* Heart failure management insights from primary care physicians and allied health care providers in Southwestern Ontario. *BMC Fam Pract* **21,** 8 (2020). https://doi.org/10.1186/s12875-020-1080-y

73. Jones CD, Holmes GM, Dewalt DA, et al. Is adherence to weight monitoring or weight-based diuretic self-adjustment associated with fewer heart failure-related emergency department visits or hospitalizations? Journal of Cardiac Failure. 2012 Jul;18(7):576-584. DOI: 10.1016/j.cardfail.2012.05.004. PMID: 22748492; PMCID: PMC3389375.

74. Hossain, M. Z., Chew-Graham, C. A., Sowden, E., Blakeman, T., Wellwood, I., Tierney, S., & Deaton, C. (2021). Challenges in the management of people with heart failure with preserved ejection fraction (HFpEF) in primary care: A qualitative study of general practitioner perspectives. *Chronic illness*, 1742395320983871. Advance online publication. https://doi.org/10.1177/1742395320983871

75. Keshavjee, K., Johnston-Jewell, D., Lee, B., & Kyba, R. (2021, November 30). *Designing disease-specific mHealth apps for clinical value*. IntechOpen. Retrieved January 23, 2022, from https://www.intechopen.com/chapters/78498

76. Konishi, M., Kaneko, H., Itoh, H., Matsuoka, S., Okada, A., Kamiya, K., Sugimoto, T., Fujiu, K., Michihata, N., Jo, T., Takeda, N., Morita, H., Tamura, K., Yasunaga, H., & Komuro, I. (2023). Association of weight change and in-hospital mortality in patients with repeated hospitalization for heart failure. *Journal of cachexia, sarcopenia and muscle*, *14*(1), 642–652. https://doi.org/10.1002/jcsm.13170

77. Interaction Design Foundation. (2023, April 14). *What is user centered design?*. The Interaction Design Foundation. https://www.interaction-design.org/literature/topics/user-centered-design

78. Chen, K., Chan, A. (2014). Gerontechnology acceptance by elderly Hong Kong Chinese: a senior technology acceptance model (STAM). Ergonomics, 57(5): 635-652.

79. Cajita, M.I, Hodgson, N.A., Lam, K.W., Yoo, S., Han, H.R. (2018). Facilitators of andbarriers to mHealth adoption in older adults with heart failure. Comput Inform Nurs, 36 (8): 376-382.

80. *Caregiver enhanced assistance and support for the elderly heart failure patient at hospital discharge (cease-HF) - full text view*. Caregiver Enhanced Assistance and Support for the

Elderly Heart Failure Patient at Hospital Discharge (CEASE-HF) - Full Text View - ClinicalTrials.gov. (n.d.). https://clinicaltrials.gov/ct2/show/NCT01886534

81. Fylan, B., Tomlinson, J., Raynor, D. K., & Silcock, J. (2021). Using experience-based co-design with patients, carers and healthcare professionals to develop theory-based interventions for safer medicines use. *Research in social & administrative pharmacy : RSAP*, *17*(12), 2127–2135. https://doi.org/10.1016/j.sapharm.2021.06.004

82. Malterud K, Siersma VD, Guassora AD. Sample Size in Qualitative Interview Studies: Guided by Information Power. Qual Health Res. 2016 Nov;26(13):1753-1760. doi: 10.1177/1049732315617444. Epub 2016 Jul 10. PMID: 26613970.

83. LeRouge C, Ma J, Sneha S, Tolle K. User profiles and personas in the design and development of consumer health technologies. *Int J Med Inform.* 2013; 82(11):e251-e268. doi:10.1016/j.ijmedinf.2011.03.006.

84. Savarese, G., Becher, P. M., Lund, L. H., Seferovic, P., Rosano, G. M. C., & Coats, A. J. S. (2023). Global burden of heart failure: a comprehensive and updated review of epidemiology. *Cardiovascular research*, *118*(17), 3272–3287. https://doi.org/10.1093/cvr/cvac013

85. Heart and Stroke Foundation. (2016). Report on the health of Canadians: The burden of heart failure. Retrieved on Aug 15, 2017, from http://www.heartandstroke.ca/-/media/pdffiles/canada/2017-heart-month/heartandstroke-reportonhealth-2016.ashx?la=en

86. Casu, G., & Merella, P. (2015). Diuretic Therapy in Heart Failure - Current Approaches. *European cardiology*, *10*(1), 42–47. https://doi.org/10.15420/ecr.2015.10.01.42

87. Ambrosy, A.P., Cerbin, L.P., Armstrong PW, Butler J, Coles A, DeVore AD, DunlapME, Ezekowitz JA,Felker GM, Fudim M, Greene SJ, Hernandez AF, O'Connor CM, Schulte P, Starling RC, Teerlink JR,Voors AA, Mentz RJ. (2017). Body weight change during and after hospitalization for acute heart failure: patient characteristics, markers of congestion, and outcomes: Findings from the ASCEND-HF trial. J Am Coll Cardiol HF,5:1–13.

88. Blair, J., Khan, S., Konstam, M., Swedberg, K., Zannad, F., Burnett, J. et al. (2009). Weight changes after hospitalization for worsening heart failure and subsequent re-hospitalization and mortality in the EVEREST trial. Eur Heart J, 30(13): 1666-1673.

89. Lyngå, P., Persson, H., Hägg-Martinell, A., Hägglund, E., Hagerman, I., Langius-Eklöf, A., & Rosenqvist, M. (2012). Weight monitoring in patients with severe heart failure (WISH). A randomized controlled trial. *European journal of heart failure*, *14*(4), 438–444. https://doi.org/10.1093/eurjhf/hfs023

90. Farwati, M., Riaz, H., & Tang, W. H. W. (2021). Digital Health Applications in Heart Failure: a Critical Appraisal of Literature. *Current treatment options in cardiovascular medicine*, *23*(2), 12. https://doi.org/10.1007/s11936-020-00885-z

91. Lobelo, F., & de Quevedo, I. G. (2016). The Evidence in Support of Physicians and Health Care Providers as Physical Activity Role Models. *American journal of lifestyle medicine*, *10*(1), 36–52. https://doi.org/10.1177/1559827613520120

92. Liu, X., Sutton, P. R., McKenna, R., Sinanan, M. N., Fellner, B. J., Leu, M. G., & Ewell, C. (2019). Evaluation of Secure Messaging Applications for a Health Care System: A Case Study. *Applied clinical informatics*, *10*(1), 140–150. https://doi.org/10.1055/s-0039-1678607

93. Bhyat, R., Hagens, S., Bryski, K., & Kohlmaier, J. F. (2021). Digital Health Value Realization Through Active Change Efforts. *Frontiers in public health*, *9*, 741424. https://doi.org/10.3389/fpubh.2021.741424

94. Vaportzis, E., Clausen, M. G., & Gow, A. J. (2017). Older Adults Perceptions of Technology and Barriers to Interacting with Tablet Computers: A Focus Group Study. *Frontiers in psychology*, *8*, 1687. https://doi.org/10.3389/fpsyg.2017.01687

95. Richardson, S., Lawrence, K., Schoenthaler, A. M., & Mann, D. (2022). A framework for digital health equity. *NPJ digital medicine*, *5*(1), 119. https://doi.org/10.1038/s41746-022-00663-0

96. Ontario Medical Association. (2021, August 16). Ontario's doctors report increased burnout, propose five solutions. Retrieved from https://www.oma.org/newsroom/news/2021/aug/ontarios-doctors-report-increased-burnout-propose-five-solutions/

97. Mangin D, Premji K, Bayoumi I, et al. Brief on Primary Care Part 2: Factors affecting primary care capacity in Ontario for pandemic response and recovery. Science Briefs of the Ontario COVID-19 Science Advisory Table. 2022;3(68). https://doi.org/10.47326/ocsat.2022.03.68.1.0

98. American Academy of Family Physicians. Family Physician Burnout, Well-Being, and Professional Satisfaction (Position Paper). American Academy of Family Physicians. 2019 [accessed 2023 Apr 17];92(10):online. Available from: https://www.aafp.org/about/policies/all/family-physician-burnout.html

99. Jong, M., Mendez, I., & Jong, R. (2019). Enhancing access to care in northern rural communities via telehealth. International journal of circumpolar health, 78(2), 1554174. https://doi.org/10.1080/22423982.2018.1554174

100. Ross, J., Stevenson, F., Lau, R. *et al.* Factors that influence the implementation of e-health: a systematic review of systematic reviews (an update). *Implementation Sci* 11, 146 (2016). https://doi.org/10.1186/s13012-016-0510-7

101. Persson, J., & Rydenfält, C. (2021). Why Are Digital Health Care Systems Still Poorly Designed, and Why Is Health Care Practice Not Asking for More? Three Paths Toward a Sustainable Digital Work Environment. Journal of medical Internet research, 23(6), e26694. https://doi.org/10.2196/26694

102. Biliunaite, I., Kazlauskas, E., Sanderman, R., & Andersson, G. (2022). Informal caregiver support needs and burden: a survey in Lithuania. *BMJ open*, *12*(1), e054607. https://doi.org/10.1136/bmjopen-2021-054607

103. Insights10. Canada Digital Health Market Analysis. Insights10. [place unknown]: Insights10; 2021 [accessed 2023 Apr 17]. Available from: https://www.insights10.com/report/canada-digital-health-market-analysis/#:~:text=Market%20Executive%20Summary-The%20Canada%20digital%20market%20size%20was%20valued%20at%20%2416.88%20Bn,largest%20nations%20overall%20is%20Canada.

104. Grand View Research. Digital Health Market Size, Share & Trends Analysis Report By Technology (Tele-healthcare, mHealth), By Component, By Region, And Segment Forecasts, 2021 - 2028. Grand View Research. [place unknown]: Grand View Research; 2021 [accessed 2023 Apr 17]. Available from: https://www.grandviewresearch.com/industry-analysis/digital-health-market#:~:text=The%20global%20digital%20health%20market,18.6%25%20from%202023%20to%202030.

105.   Canada Health Infoway. Artificial Intelligence. Canada Health Infoway. Toronto, ON: Canada Health Infoway; [accessed 2023 Apr 17]. Available from: https://www.infoway-inforoute.ca/en/digital-health-initiatives/innovative-technologies/artificial-intelligence#:~:text=Building%20Smart%20Machines&text=Some%20applications%20of%20AI%20in,Automating%20repetitive%20processes.

106.   Starfield, B., Shi, L., & Macinko, J. (2005). Contribution of primary care to health systems and health. *The Milbank quarterly*, *83*(3), 457–502. https://doi.org/10.1111/j.1468-0009.2005.00409.x

107.   World Health Organization. (n.d.-a). *Indicator metadata registry details*. World Health Organization. https://www.who.int/data/gho/indicator-metadata-registry/imr-details/5063

108.   Murtagh, S., McCombe, G., Broughan, J., Carroll, Á., Casey, M., Harrold, Á., Dennehy, T., Fawsitt, R., & Cullen, W. (2021). Integrating Primary and Secondary Care to Enhance Chronic Disease Management: A Scoping Review. *International journal of integrated care*, *21*(1), 4. https://doi.org/10.5334/ijic.5508

Appendices

Appendix A: Recruitment Script

Hello (Participant name),

My name is Derya Demirci. I am a student researcher working with Dr. Catherine Demers at the Hamilton General Hospital. I am calling to invite you to participate in our research study to better understand how family physicians can best support patients with Heart Failure using self-management tools. We will be conducting persona-case scenario discussions where participants will be able to analyze the persona and share their inputs and experiences. We want to know your opinion on how we could further promote care for patients with heart failure and allow this information to be incorporated into the future development of self-management tools.

During the discussion session you will be evaluating the persona and sharing your experiences as a practicing family physician. You will be given guiding questions to facilitate discussions. The sessions will be recorded to conduct verbatim thematic analysis and stored confidentially. Feedback and suggestions will then be presented and a final feedback review will be done at the end of the session.

The session will take place online via Zoom and a link will be provided to you via email if you would like to participate in the study. The session is expected to last 1-2 hours. We will pay for your time and will provide you with a gift certificate ($100.00/person) if you participate in this study.

If you have any questions or comments regarding the study, please do not hesitate to contact Derya Demirci at demircid@mcmaster.ca or Dr. Catherine Demers at 905-521-2100 extension 73324 or at demers@hhsc.ca

Thank you.

Appendix B: Participant Consent Form

Heart Smart Scale App (now known as CorLibra)

Investigators:

Local Principal Investigator:	**Student Investigator:**
Dr. Catherine Demers	Ms. Derya Demirci
Department of Medicine	Department of Medicine
McMaster University	McMaster University
Hamilton, ON, Canada	Hamilton, ON, Canada
(905) 521- 2100 ext. 73324	

Purpose of the Study

The purpose of this study is to provide family physicians an opportunity to share their perspectives and needs on how they can best support Patients with HF, specifically on making diuretic adjustments.

You are a qualified, practicing family physician in Ontario who has a minimum of 5 years' experience and are working with patients in non-academic settings.

You are invited to participate in a research study to evaluate your needs and attitudes on how a new tool that we are developing could best help you manage your Patients with HF. This tool, CorLibra, is an application tool that helps collect patient information on their weight at home. It also helps their caregivers and family physicians such as yourself to adjust water pills for their heart failure.

Our goal is to find out what your needs are in order to best support Patients with HF using this tool, specifically with making diuretic adjustments.

Procedures involved in the Research

If you agree to participate in this study, you will be asked to attend **one** discussion session that will take place on Zoom where a secure link will be sent to you via email and the session will be expected to last 1-2 hours. This study will use the Zoom platform to collect data, which is an externally hosted cloud-based service. A link to their privacy policy is available here (https://explore.zoom.us/en/privacy/). While the Hamilton Integrated Research Ethics Board has approved using the platform to collect data for this study, there is a small risk of a privacy breach for data collected on external servers.

If you are concerned about this, we would be happy to make alternative arrangements for you to participate, perhaps via telephone. Please talk to the researcher if you have any concerns. Also, do not make any unauthorized recording of the session.

A detailed explanation of the CorLibra device will be given at the beginning of the session.

You will be going over **one** of the provided pretend stories about an individual who is a family physician such as yourself. After reviewing the story, you will then be asked to provide feedback on how CorLibra can or cannot help family physicians manage Heart Failure patients.

After this, we will ask you to come up with ideas on how **you** would use the tool and whether there are *specific feature*s you would want added or removed.

Potential Harms, Risks or Discomforts:

The risks involved in participating in this study are minimal. You may feel uncomfortable sharing any experiences you might have had as a family physician. However, we will be working hard to make sure that all participants are welcomed into an open environment.

You do not need to answer questions that you do not want to answer or that make you feel uncomfortable. If you need to stop to take a break you are always free to do so. You are also always given the option to leave the study at any time.

Potential Benefits

Your participation will give us a better understanding of how family physicians, like you, need to better support Patients with HF and to make diuretic adjustments. As a result, this study will provide us with information on how to help patients better care for their heart failure, as well as help guide future self-care programs.

Payment or Reimbursement

The interview will take place at online via Zoom. A gift certificate of ($100.00) will be provided if you take part in this study via email.

Confidentiality

Every effort will be made to protect your information and privacy. As soon as data is collected, we will remove any identifiable information (for example, your name), and then transfer the data onto a computer file that is protected. There will be an audio file collected from each participant during the study that will be used for thematic analysis using the NVivo software. As soon as all the data collection is completed and transcribed for a participant, we will de-identify data and save into a secure file. The identified data will be disposed following completion of transcription and the de-identified data will be deleted following the completion of the student assistant's thesis, April 2023. Direct quotes may be used but no identifiers will be included. We will also be collected some demographic information from you such as the size and location of your practice.

For the purposes of ensuring the proper monitoring of the research study, it is possible that a member of the Hamilton Integrated Research Ethics Board may consult your research data. By signing this consent form, you authorize such access. All our information will be stored in a secure

manner to respect privacy and confidentiality. As this information is identifiable we will de-identify it to maintain patient privacy and confidentiality. Information may still be used for analysis, but it will only used for research purposes. The recording file will be transcribed, and direct quotes may be used, however, it will not be identifiable. Your name will not be used on any report generated from this study.

Participation and Withdrawal

You are free to refuse to participate or withdraw from the study at any time without any penalty. You may contact the researcher verbally during the meeting or by phone call to withdraw from the study. We request that all conducted discussions during the session to remain confidential.

You will also be provided with a copy of the consent and are able to participate in any other studies without it impacting your role in this study.

By participating in this study, you do not waive any rights to which you may be entitled under the law.

Information about the Study Results

We expect to have this study completed by August 2022. We will provide you with a brief summary of the results once the study has been completed.

Questions about the Study

If you have questions or need more information about the study itself, please contact Dr. Demers' office at (905) 521- 2100 ext. 73324.

CONSENT

I have read the information presented in the information letter about a study being conducted by Dr. Catherine Demers and Derya Demirci of McMaster University.

I have had the opportunity to ask questions about my involvement in this study and to receive additional details I requested.

I understand that if I agree to participate in this study, I may withdraw from the study at any time. I have been given a signed copy of this form. I agree to participate in the study.

_____   _____   _____

Name of Participant (Printed)   Signature   Date

_____   _____   _____

Name of Person Obtaining   Signature   Date

Consent (Printed)

Appendix C: HIREB Ethics Approval

HiREB

Hamilton Integrated Research Ethics Board

May-12-2022

Project Number: 14735

Project Title: Qualitative Data Collection on how Family Physicians can Best Support Heart Failure Patients using Self-Management Tools

Student Principal Investigator:

Local Principal Investigator: Dr Catherine Demers

We have completed our review of your study and are pleased to issue our final approval. You may now begin your study.

The following documents have been approved on both ethical and scientific grounds:

Document Name	Document Date	Document Version
Personas	Mar-14-2022	1
Study Screening	Apr-12-2022	2
Recruitment final version 3	May-04-2022	3
Revision Consent final version 3	May-04-2022	3
Data collection form final	Apr-12-2022	2
Informational Script	May-04-2022	1
Revision HIREB version 3 final	May-04-2022	3

The following documents have been acknowledged:

Document Name	Document Date	Document Version
GCP training June 2020 Novartis Demers	Jun-30-2020	NA
Cover Letter final version2	May-01-2022	2

In light of the current COVID-19 pandemic, while HiREB has reviewed and approved this application, the research must be conducted in accordance with institutional and/or public health requirements.

Any changes to this study must be submitted with an Amendment Request Form before they can be implemented.

This approval is effective for 12 months from the date of this letter. Upon completion of your study please submit a **Study Completion Form**.

If you require more time to complete your study, you must request an extension in writing before this approval expires. Please submit an **Annual Review Form** with your request.

PLEASE QUOTE THE ABOVE REFERENCED PROJECT NUMBER ON ALL FUTURE CORRESPONDENCE

Good luck with your research,

Kristina Trim, PhD, RSW
Chair, HiREB Student Research Committee
McMaster University

Page 1 of 2

Appendix D: Persona Development and Discussion Guide

This study will be conducting an assessment on the perspectives of family physicians for the support they need to manage Heart Failure (HF) patients after hospital discharge. It involves patients using CorLibra to collect patient monitoring data, help educate patients/caregivers, and help patients self-manage their diuretic dosage.

This activity aims to get your feedback as a primary care family physician on managing patients with HF.

CorLibra has four components:

1   Online HF Self-Management Support System: HF App is an online tablet-based system that allows patients to store and access monitored data about their weight, and support their involvement in self-managing their health. Patients are able to share this information with whomever they choose, including health care providers, family members or other selected individuals, for viewing or updating information with their consent.

2   Electronic support tools: A digital tablet with a Standardized Diuretic Decision Support Tool (SDDST) decision aid and automatic weight scales will be provided to patients to assist them in monitoring their weight. The SDDST will also include a tool that helps patients to self-adjust their diuretic dose. In addition, patients will be able to access the Internet and communicate with family and friends in order to combat social isolation. In case their weight gets out of a predetermined safe zone for the patient, she/he will be urged to contact their family physicians and make office appointments to get help. In case of emergencies, patients will be urged to contact EMS immediately.

3   Trained primary health care volunteers: The program includes trained primary healthcare volunteers as one part of its intervention. These volunteers will visit patients with HF at home and help to train them in the use of their online digital tablets to view information about trends in their weights, and educational information about HF. Volunteers may also

inform patients about community-based events that they might wish to attend.

4   CCAC Rapid Response Teams for patients with HF: This program aims to help us understand how HF App can be used effectively to meet the needs of patients with HF and comorbidities. This will be done, by combining the use of technology, social interactions with friends and family, home nursing and volunteer support.

Note: Your evaluations may involve all or some of these four components.

Based on your knowledge and experience as a family physician, evaluate the following family physician personas and the "scenarios" for each "persona".

STEP 1: Evaluate the Persona (20 minutes)

Questions to Consider:

1. Does the self-care program help the patient's and/or family physicians' situation?
2. Is the self-care program practical for the family physicians' scenario(s)?
3. Does the family physician feel comfortable interacting with the Patients with HF?
4. What information does the family physicians needs to better help manage Patients with HF and making diuretics adjustments?
5. How do family physicians interact with the patients seeking their advice?
6. How do family physicians interact/view the CorLibra?
7. What are your thoughts on integrating a messaging feature within CorLibra?
8. Would you be comfortable with your patient utilizing a DHT without your knowledge?
9. What are your general thoughts on DHTs?
10. What happens after the interaction?
11. What are the results/outcomes of this interaction?
12. Are there any important areas that have been overlooked/not incorporated into CorLibra?
13. What features can be incorporated that would better help physicians manage patients with HF?

STEP 2. Come up with ideas on how to improve family physician interactions with patients with HF (20 minutes)

Note: This will be recorded for later review.

STEP 3. Present a summary of your persona evaluation and feedback. (5-10 minutes).

Note: This will be recorded for later review.

Appendix E: Persona-scenarios

Sarah Evinson

Age: 42
Work: Family Physician
Family: Married
Location: Brantford, ON

Biography

Dr. Evinson completed her MD training at McMaster University and has been a practicing family physician for 5 years.

She currently works in a clinic with 2 other family physicians.

Attitude
- Does not always feel comfortable answering diuretic adjustment/Heart Failure (HF) specific questions

Goals
- Be more confident in her ability to support patients with HF for basic assessment
- Be more knowledgeable on making diuretic adjustments and other guideline directed medical therapy changes

Frustrations
- Occasionally feels insecure supporting patients with HF
- Wishes to increase her experience/knowledge

Scenario	Needs	Behavior
Dr. Evinson is with a 67-year-old patient who was diagnosed with HF 4 years ago. The patient has been in the yellow zone for more than 5 days. Dr. Evinson is expected to adjust diuretics but is not comfortable in doing so.	She lacks experience and knowledge regarding diuretic adjustments and would prefer that the cardiologist handles diuretic adjustments and any HF specific symptoms.	She tells the patient to follow what the Heart Smart Scale tool has been instructing her to do and recommends that she sees a cardiologist.

Ben Scott

Age: 54
Work: Family Physician
Family: Married with 3 children
Location: Paris, ON

Biography

Dr. Scott completed his MD training at Western University, and he worked in a clinic with other family physicians for a few years before opening his own clinic.

Since then, he has been fairly exposed to patients with HF. Also, because he is living in a smaller community, he has built a closer relationship with his patients.

Attitude

- Prefers his patients to use digital health tools that would manage their symptoms

Goals

- Ensure patients are able to self-manage their symptoms

Frustrations

- Has to trust his expertise on HF related questions that he feels less confident about

Scenario	Needs	Behavior
Dr. Scott is with a 54-year-old patient who was recently diagnosed with HF. His patient often complains that they lack frequent interaction with him. The patient is using the Heart Smart Scale tool but shares that they wish they were able to message Dr. Scott through the device.	Dr. Scott feels overwhelmed, he is busy seeing other patients due to limited availability of physicians in his region and does not need extra work.	He expresses to the patient that he understands his concerns and that if in the future the Heart Smart Scale tool incorporated a messaging feature, he would possibly be open to his patients accessing that feature.

Melissa Stewart
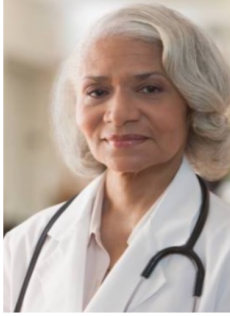
Age: 63
Work: Family Physician
Family: Married with 2 children
Location: St. Catharines, ON

Biography

Dr. Stewart completed her MD training at University of Toronto. She has been a family physician for 30 years and owns her own clinic.

Recently, her clinic transitioned to EHR's and she faced challenges due to her limited technological capabilities.

Attitude
- Sometimes feels inexperienced with regard to digital health tools

Goals
- Learn more about digital health tools
- Embed technology within her practice to enhance HF care

Frustrations
- Limited knowledge on digital health tools aimed for patients with HF
- Lack of technological experience; occasionally feels insecure about using new technology in her practice

Scenario	Needs	Behavior
Dr. Stewart has a high-risk patient who is 45 years-old and was diagnosed with HF 2 years ago. The patient recently started using the Heart Smart Scale tool. Dr. Stewart saw the patient for a follow-up and found out that they have been using the Heart Smart Scale tool.	She wants to be up-to-date on what tools the patient is using as they are a high-risk and feels a sense of liability.	She is upset that she was not aware that the patient was using the Heart Smart Scale tool and informs them that next time she would appreciate it if they got her input on it before using a digital health device.

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Appendix F: Informal Feedback Questionnaire

1. What did you like about the discussion today?

2. What didn't you like about the discussion today?

3. Was it easy to complete the study?

4. Is there any way that you would want us to improve on the discussion style?

6. Overall, did you find the HF App useful?

7. If you could change anything with the HF App, what would you change?

8. Is there anything else you would like to share about your experience today?