

**ENHANCING E-COMMUNICATION AND COLLABORATION BETWEEN PRIMARY CARE
AND HOME CARE IN MULTIPLE CHRONIC CONDITION CARE: THE CASE OF AN
E-HEALTH APPLICATION IN MOROCCO**



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Abstract. The Moroccan population aged 65 and older living with multiple chronic conditions (MCC) is projected to increase by 30% in 2020. MCC is a clinical term that describes when multiple diseases coexist in a person at the same time. As such, multiple healthcare teams are often involved in MCC patients' care management, and meaningful communication and collaboration between healthcare settings (e.g.: acute care, primary care, home care) is highly desirable. The study focuses on the case of an existing home care e-Health application 'PocketDoc' being tested and deployed in Casablanca Morocco. 81% of PocketDoc users are home-dwelling patients with MCC. The app was originally developed for the home sector to enhance collaboration between home care providers, patients and their family caregivers. Primary care provider, however, were not engaged in the design process. The aim of this study is therefore to co-design an expansion of the app to include primary caregivers. For this purpose, the study identifies primary care user group requirements to create IT specifications for the design, development and implementation in real practice settings of an enhanced version of the app (PocketDoc 2.0) that connects home and primary caregivers. The identified requirements will also inform the development of future e-Health tools that can support patients with conditions other than MCC and who require care at home.

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INTRODUCTION

The aging population living with chronic conditions in Morocco is increasing. According to a 2018 report by the World Health Organization (WHO), chronic diseases cause more deaths than infectious ones, with an average 46% of worldwide total mortality due to chronic conditions such as diabetes, hypertension, and chronic kidney and pulmonary diseases. Among Moroccans aged 65 years and older, as many as three people out of four are at increased risk of mortality and poorer day-to-day functioning due to multiple chronic conditions. **Multiple chronic conditions (MCC)**, also referred to interchangeably as 'multimorbidity', are concurrent chronic conditions (two or more) that affect a person at the same time. This potentially complicates patient care management because different healthcare professionals must be involved in the care of each condition (e.g: heart specialist, kidney specialist). Care coordination is especially critical at **transition points**, which are times when patients are moved from one healthcare setting to another. A transition point for older adults could be a situation where the patient is discharged from acute care (e.g.: hospital) to a home care program.

Therefore, **meaningful collaboration** and **communication** among the different healthcare professionals and settings in charge of MCC patients, especially at transition points, is highly recommended. Strategies and tools must be developed to support two-way communication between home care and primary care involved in their care. Particularly, the literature on healthcare and chronic conditions management emphasize the role of **primary care** (e.g.: physicians). Although researchers fail to agree on a clear definition of primary health care, it is commonly referred to as 'the first point of contact for all healthcare enquiries (e.g.: hospital, emergency services)'. Yet, despite primary care being an important element in the healthcare system chain, studies report that primary care are not consistently provided with home care assessments, and 'rarely consulted in home care planning and decision-making'. Consistently, there is a gap in information sharing, real-time communication and proper collaboration between home and primary care teams. This study aims to find potential solutions to the identified gap, with a research focus on care management for home-cared MCC patients (aged 65 and older).

Progress in technological systems, like **electronic health (e-Health)**, could help solve these challenges of integration across home and primary care settings. E-Health concerns the use of Information and Communications Technology (ICT) to access in a well-organized way clinical and business processes related to the healthcare area, and ensure the quality of the medical care chain. As such, e-Health tools are designed to include information system solutions that support the management of health data, medical diagnosis, medical analysis and any other application 'app' handling health information. Morocco's e-Government has been developing a number of these apps in the public health sector. PocketDoc, a web-based app started in 2016, was designed specifically for older MCC patients in order to enhance communication in home circle of care. Although the inclusion of primary care was explored in the design stage of PocketDoc, co-founder Imad Chakri decided it was 'beyond their budget scope and time available to build the app within the initial funding model'. Therefore, the goal of this research is to identify primary care user requirements and create specifications for the design and implementation of an enhanced version of the app (Pocket 2.0) that integrates primary care into the PocketDoc circle of care, to support meaningful communication and integration between primary and home care teams.

This led to the following **research question**: 'what design features and factors need to be considered in the implementation of the enhanced app (PocketDoc 2.0) to improve communication and collaboration between home and primary care?'. **Persona-scenario** co-design methodology was used to gather primary care user requirements and create design specifications. 'Personas' are imaginary characters representing typical healthcare providers, while 'scenarios' are stories in which the created personas interact with the PocketDoc system in practice. Two persona-scenario sessions were held for **data collection**, and included a total participants of 5 primary caregivers from different healthcare practices. The first session included 3 nurses, the second session had 1 psychologist and 1 social worker, and participants in each group were asked to create personas and scenarios where their personas interacted with the PocketDoc system. Collected data was transcribed and ideas from the persona-scenario sessions extracted for **qualitative data analysis**. Each idea was examined, and ideas then grouped into themes or 'categories' for consideration in PocketDoc 2.0's development. Eight themes were identified in this data analysis process : (1) interprofessional team communication; (2) referral to community services and resources; (3) access to non-medical information; (4) patient-safety approach; (5) patient-centered care; (6) system integration; (7) clinic EMR as a tool; and (8) implementation considerations. For

each theme, the study identifies a list of **design features** required for PocketDoc 2.0 and its deployment in a real practice setting. **Implementation specifications**, such as hardware requirements, use policies, patient privacy, and training are also included in the final specification table available in Appendix IV.

The study is organized as follows: (1) background information on the context in Morocco, including the aging population, chronic condition management, and ongoing e-government projects in the healthcare sector. (2) The literature review then describes the identified gaps in home and primary care collaboration, interprofessional team communication, and continuity of care for elderly MCC patients. (3) The next sections detail the persona-scenario methodology, (4) the data collection procedure, as well as (5) findings and data analysis. (6) The sixth section consists of a discussion, where findings are reviewed in the literature for verification purposes. Lastly, (7) study limitations are detailed, followed by (8) future work recommendations and (9) study conclusions at the end of the thesis. The anticipated impact of this research is integrated and collaborative primary and home care services for elderly MCC patients, through the development of an enhanced version of PocketDoc. As such, diverse groups, including MCC sufferers, their primary care, home care and family caregivers, as well as healthcare software development teams could benefit from the insights and knowledge produced in this study. The identified requirements will also inform the development of future applications ‘apps’ that can support patients with other conditions who require care at home.

I. STUDY CONTEXT

1.1 Aging and chronic conditions in Morocco

In most countries, the elderly population continues to increase, with aging often connected to an increase in serious chronic conditions. Among Moroccans aged 65 and older, three out of four suffer from multiple chronic conditions (MCC), a clinical term that describes when multiple diseases coexist in the same person. As Morocco's MCC population is expected to rise by 30% by 2020, there are various medical and organizational challenges, as well as complex community needs associated with providing care for this category of patients. Managing chronic conditions is therefore a high-priority for the Moroccan healthcare system: according to the WHO, older adults with MCC often experience poorer quality of life and clinical outcomes. They also regularly consume multiple medications for different conditions at the same time, and face difficulties with treatment adherence. In addition, MCC patients are often in transition across a variety of care settings, including acute care, primary care and home care. This creates a challenge to coordinate care and communication between the multiple healthcare settings involved, and patients are likely to experience **fragmented care** from these settings. Fragmented care may negatively affect treatment process and rehabilitation outcomes. It is not surprising that the cost associated with MCC care is therefore very high, and costs Morocco 'about 3.8 million euros a year in healthcare expenses and lost economic output, including decreased productivity'.

1.2. The role of primary care and home care in chronic condition management in Morocco

Given the complex needs of MCC patients, an efficient Moroccan healthcare system must therefore develop a comprehensive strategy that integrates the multiple healthcare settings required in chronic care management. Particularly, primary and home care provide 90% of chronic care services in Morocco. Each of these healthcare settings is therefore an important element in the **continuum of care** and overall functioning of the healthcare system. **Primary health care** describes 'that level of the health services system that provides entry into the system for all new needs and enquiries, dispenses person-focused care overtime, and care for all but very uncommon or unusual conditions'. It is the first point of contact for all healthcare enquiries, and therefore the foundation of an efficient healthcare system.

Similarly, **home care** is considered an important care option, due to the numbers of patients being discharged from acute care settings who still require continuous care at home. Home care is defined by the Moroccan Health Association (MHA) as a broad range of healthcare services provided in the home setting, that integrate ‘medical services, preventive care, curative intervention, rehabilitation, end-of-life care, home support and maintenance, and social adaptation and support from informal caregivers (e.g.: family)’. Home care may also incorporate ‘the delivery of healthcare services in the home setting with community services’, such as transportation services or catering services (e.g.:Meals on Wheels). In Morocco, community-based teams not only supply medical care but also promote public health behaviours to mitigate risk factors for their patients.

Therefore, both primary and home care are indispensable in chronic condition prevention and management. While the majority of chronic conditions can be sufficiently managed at the primary care level (e.g.: generalist practitioners, pharmacists), home care plays an equally important role in supporting patients to live in the comfort of their own home (e.g.: end-of-life care). As such, increased **team-collaboration** between primary and home care in dispensing and coordinating clinical care for a variety of patients with different needs and/or conditions, is highly emphasized in Moroccan healthcare discourse.

1.3. Team-based healthcare in Morocco: legislation n° 1-59-380

In Morocco, there has already been a significant shift from a solo-physician practice model towards a **team-based healthcare** model that integrates a wide range of professionals and services. Morocco’s latest public health legislation n° 1-59-380 (March 2010) intends to increase team-based models of care and make them accessible to half Moroccans by 2024. Team-based healthcare is described as ‘two or more healthcare professionals working collaboratively to provide care services’, and is very useful ‘for ensuring continuous care for patients with multiple clinical issues who require a diverse network of specialists’. In these team-based models, care is mostly provided by primary care. Physicians can stay focused on medical issues, while other professionals deliver **supporting care services** (e.g.: diet, nursing, physiotherapy) and **patient education** to help patients effectively manage their conditions and enhance health behaviours. Cohort studies conducted at Mohamed V hospital across 120 patients aged 65 and older found that team-based care is an effective method for caring for chronically-ill adults, with long-term positive impact on health and

overall quality of life. After the enactment of legislation n° 1-59-380 which increased team-based models, patients with access to coordinated and continuous team care were also 'twice as likely to have better health compared to those who did not'. More generally, as of 2018 team-based care and the services offered by these teams have been received positively by over 76% of older adults in Morocco.

In our encounter with Morocco's Ministry of Health, Mr. Anas Doukkali further discussed legislation n° 1-59-380, team-based care and the positive outcomes for MCC care management. First, interprofessional teams 'tend to have the **right combination of expertise** in diverse clinical issues and extra-general training to serve the different needs of patients'. The **lean management** structure also allows immediate caregivers 'to solve problems themselves without getting multiple approvals from team members and superiors', which shortens the amount of time required to complete care activities in emergency situations. Lastly, 'in terms of role structuring (...) a team-based model creates a **comprehensive responsibility matrix**, where accountability gets clearly defined so misunderstandings and conflicts do not arise'. More generally, Mr. Doukkali's conclusions were that 'the appropriate **team structure** (e.g.: roles structuring) matters as much as physician expertise in chronic disease management', and that 'continuity of care cannot be achieved unless coordination exists between all stakeholders, who must act as a unified team'. Accordingly, the Moroccan Health Charter (recently updated to reflect legislation n° 1-59-380) identifies seven interconnected components for team-based Chronic Care Model (CCM) :

- (1) **sharing** vision, values and responsibilities in care planning and decision-making.
- (2) **partnership** defined by open communication and trust in one another.
- (3) **interdependency** of professionals for achieving patients' goals and needs.
- (4) **power sharing** between team members based on experience and knowledge.
- (5) **multidisciplinary** expertise and training.
- (6) clinical information sharing.
- (7) delivery system redesign.

Many e-Health care services have been designed based on this Chronic Care Model (CCM), including PockeDoc, a web-based app that connects home and specialty care interfaces in Morocco. Since PocketDoc is the main focus of this thesis, it therefore felt important in the context of the study to first understand Morocco's team-based chronic care

model before attempting to define requirements for the design of PocketDoc 2.0. For instance, the CCM model could serve as a reference for best chronic care practices on which PocketDoc 2.0 specifications could be based. The study also considers the e-context in Morocco, which is the topic of the next section.

1.4. Morocco's home care e-Health (r) evolution : PocketDoc app

The e-Morocco 2024 strategy, which began in 2002, aims to promote an 'information society' in Morocco. The strategy covers 180 targeted projects for which the government has budgeted over 2.5 billion Moroccan Dirham (0.21 billion euros) between 2002 and 2024. Morocco's prime minister clearly outlined ICT objectives as: (1) reinforce communication to optimize decision-making, (2) better transparency in administrative management and (3) improve the services provided to citizens and companies in terms of quality and proximity. In these matters of e-governance, some apps have been developed in various Moroccan sectors including healthcare. An example is PocketDoc, a web-based app created in 2016 by a team in the Community Health Research Unit (CHRU) at Cheikh Khalifa Hospital. The app targets elderly patients with MCC and their home care team in order to enhance communication and planning between those in the patient's home care circle. The specific objective for designing the app was to overcome barriers in community-based care.

PocketDoc was designed based on focus groups and interviews with home care providers, and both home care providers, family caregivers and patients have access to the application. According to Imad Chakri, a fifth-year medical student and co-founder of PocketDoc, the app is currently being tested to support chronic care management interventions around three themes. First, (1) **team-based care**, that is 'the provision of health services by at least two health providers who work collaboratively with patients, their families and communities'. In PocketDoc, this is supported by (2) **system navigation** to 'enhance real-time communication between patients and their caregivers, and facilitate communication and integration across healthcare settings'. (3) The third component, **patient-centered care**, aims to understand and develop patients' strengths to meet their goals, and 'empower them to take a lead role in the management of their health and recovery'. These three components together make PocketDoc a high-value practice model in which all healthcare professionals collaborate around patients' needs. In fact, the app is considered the most optimal approach for designing health information systems for chronic condition management, and deployment tests in Morocco are already linked to 'improvement in patient-provider relations, health

promotion and better clinical outcomes'. **Figure 1** details the model on which Pocket Doc is (partly) based, and how e-health technology enables a unified circle of home care.

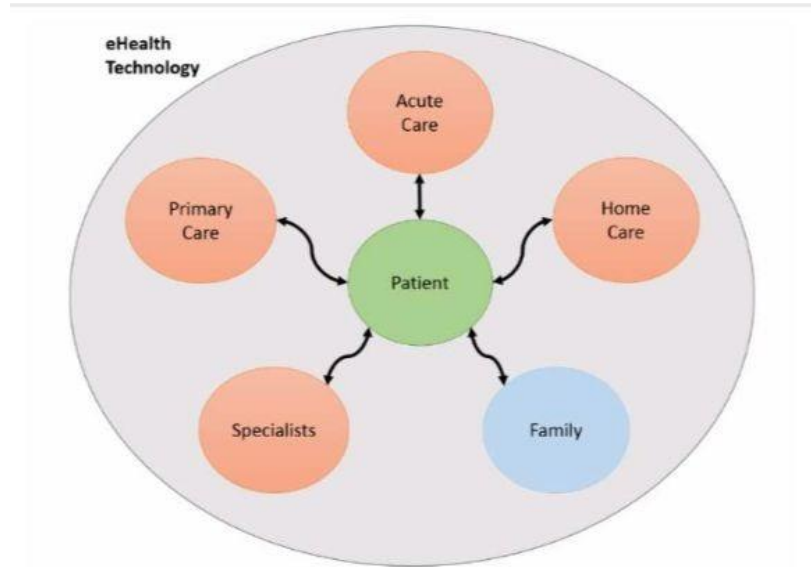


Figure 1. e-Health technology and chronic condition management **source**

However, unlike the model in Figure 1, the design of PocketDoc does not support all providers to *actively* participate in the patient's circle of care. Patients and family caregivers can view PocketDoc documentation but have no permission to write or make contributions in the current version of the application. In addition, although the inclusion of primary care in the PocketDoc circle of care was explored during the early stages of PocketDoc design, the idea was determined 'beyond the budget scope and time available within the funding model'. The non-inclusion of primary care is a huge limitation in the current version of the app, as the study has established that quality care requires 'everyone in the circle of care to be efficiently informed and sufficiently knowledgeable about patients' conditions, roles and responsibilities in the team'. It is to address this gap that the study aims to identify user group requirements and define specifications for the design and implementation of an enhanced version - called PocketDoc 2.0 - that includes primary care in the app's circle of care.

2. LITERATURE REVIEW

The study context section helped situate the research problem in the specific context in Morocco. It demonstrated why the study and its implications are significant for chronic care management in Morocco. In contrast, this section aims to place the study within the broader healthcare literature pertaining to the research problem, focusing on the themes of interprofessional collaboration, system silos, and e-Health for chronic care management.

2.1. Gap in meaningful communication, collaboration and integration across health settings

Meaningful collaboration and communication between different care providers and different health settings (e.g.: acute, primary and home care) is essential, especially at transition points. Transition points describe time periods when a patient is moved from one sector to another. The most critical point for elderly patients is being discharged from a hospital (e.g.: acute care) to a community (e.g.: home care, rehabilitation center). Unfortunately, the continuum of care at transition points is rarely well-integrated, and collaboration and information sharing is usually missing when multiple professionals are involved. Organizational health theory stresses the importance of bridging this gap to 'ensure that patient information and related care plan are shared timely to support consistency and **continuity of care**'. Continuity of care describes 'an ongoing relationship between a patient and their healthcare provider(s)', and requires coordination to facilitate seamless patient transitions between healthcare settings and across the continuum of programs, organisations and levels of care. Yet, 86% of practitioners in a worldwide survey admitted that at least one of their patients experienced issues due to a lack of coordination and fragmented care across the continuum of different healthcare settings. In mild to extreme cases, poor coordination and miscommunication may negatively impact on quality of care and lead to the improper use of healthcare services.

Ensuring continuity of care for is especially challenging for home-cared patients, as primary care and home care maintain separate patient records. In addition, the majority of patients receiving home care services are older adults with **multiple chronic conditions (MCC)**. These MCC patients suffer from multiple diseases at a time and need care from different healthcare specialists, which requires integration across healthcare settings. Specifically,

primary and home care settings play an important role in the chain of care and monitoring the health of people. Studies indicate that ‘elderly patients with consistent access to both are twice as likely to have better health’. Yet, primary care providers do not communicate regularly with home care teams, and efficient collaboration and communication between the two settings most often does not exist. In the rare instances where they communicate, the circle of care is unfamiliar with each other’s authority and responsibility in the team, which may cause inconsistency in care planning and delivery. Figure 2 presented at the 12th European Public Health (EPH) conference, illustrates the current state of disconnection between primary, acute, sub-acute, urgent and home care. The diagram indicates that traditional healthcare tends to consist of silos between each setting/level of the continuum:

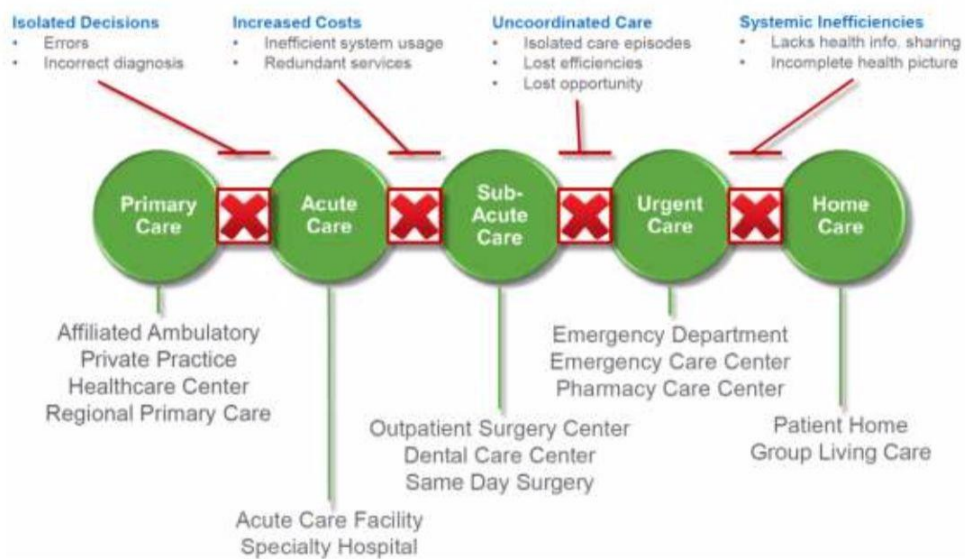


Figure 2. Traditional healthcare orientation [source](#)

The silos (represented by red X's in the diagram) are the cause for many **healthcare system failures**. Healthcare providers build trust within their silos, such as a specific department, and rarely expand beyond it. Without trust, team collaboration cannot be formed and siloed healthcare systems fail to operate efficiently across different teams and departments. Moreover, in a siloed system, healthcare professionals tend to focus on their practice and may become complacent with their circumstances, which can prevent them from seeking new opportunities for collaboration. As a result, silos often increase the potential for duplication, increased costs, or worse, safety issues for the patient. Missing or incorrect information could include changes in diagnosis, treatment and any other care requirements such as medication dosage or allergies. Inefficient collaboration and

miscommunication between acute, primary and home care, especially at transition points, may therefore increase the incidence of life-threatening medical errors.

For this reason, it is critical to develop **strategies** that consolidate healthcare planning, responsibility, and navigation between different health and community sectors to reduce the incidence of medical errors. Reliance on voice messages for sharing important information, which is the method currently used in the traditional healthcare orientation, is not a reliable communication process. Asking patients to share or disclose specific information is not appropriate either, as patients may suffer from a disability (e.g.: impaired memory) and fail to convey information properly. Rather, primary care must engage more in patient care and clinical outcomes, and primary care delivery should be better aligned with home care settings. For instance, managing primary care services through the same unit in charge of home care could facilitate alignment. Integrating and expanding the use of mutual electronic health records (EHR) accessible by all team members, regardless of their settings, may also help standardize and enhance ongoing and real-time communication in the circle of care. More generally, there is a consensus in the **care transformation** literature that e-technology such as EHR can engage all stakeholders through a coordinated care orientation, as well as support health analytics using integrated health information exchange. This signals that the role of e-health in enhancing connection and coordination across healthcare settings must be further investigated in the literature.

2.2. e-Health : a facilitator tool for communication?

The most established means of communication across healthcare settings are non-electronic such as phone calls or face-to-face communication. The resulting silos and miscommunication are often a barrier to efficient collaboration around patient care, especially for patients that require care from multiple providers. **Healthcare Information Technology** (HIT) has the potential to eliminate these siloed structures and build well-integrated, coordinated healthcare teams that positively impact quality of care. HIT tools such as telehealth and EHR systems 'support patients to stay at home and self-manage their conditions'. Electronic records also help healthcare clinicians better monitor and manage patients' conditions, collect and assess patient information, efficiently exchange information, reduce paper filing records and duplications and limit medical errors. Thus, not only can e-health tools facilitate two-way communication between primary and home care teams, it also allows the two settings to be better involved in patient care planning.

However, over a hundred case controlled-trials conducted in the last decade indicate that to be fully efficient, e-Health tools must be designed using the **patient-centered care** approach to bring about all mentioned benefits for patients. The patient-centered care approach coined in 1988 shifts the focus from disease-to-patient and describes ‘evidence-based care that is designed around patient information’. It requires normalized patient records and system interoperability. For example, an integrated electronic platform that includes patient health records and care plans, and is accessible by all team members regardless of their setting, is a strong facilitator tool for patient information sharing, and therefore efficient patient-centered care. Yet, a national survey found that the number of primary care teams worldwide who electronically have access to their patients’ information stored in other healthcare settings is on average very low (3 out of 10). A UN assessment of national e-Health and data management strategy in 85 countries also concluded that ‘more progress in the development and use of normalized patient records and is required for the traditional healthcare system to gain full benefits of e-Health innovations’.

Therefore, it is not sufficient that e-health tools facilitate communication across different health settings, as the design must also support a patient-centered care orientation around patient information sharing. Healthcare providers involved in the patient’s circle of care must have a mutual knowledge of patient’s needs, preferences and conditions, ‘without which patient-centered goal setting, decision-making and planning cannot be achieved’. Morocco is among the countries lagging behind in comprehensive patient-centered e-Health application, as patient information sharing between primary care and home care teams is non-existent on PocketDoc. Consequently, while the literature on e-Health is large, our study of PocketDoc 2.0 will explicitly focus on the synergy between patient-centered e-Health design and chronic condition management, as illustrated in Figure 3:

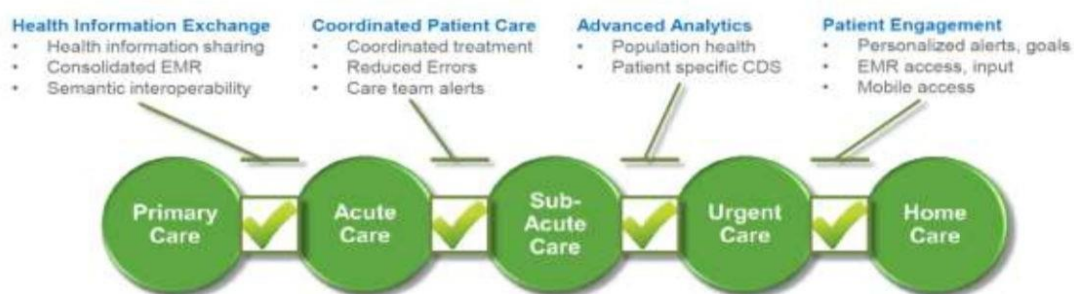


Figure 3. Patient-centered care approach (source)

2. 3. Conceptual framework: Continuity of care maturity model (CCMM).

The literature review found that on average chronically ill patients do not receive effective care plan due to healthcare system failures such as discontinued care. It flagged that healthcare system improvements in meaningful communication, collaboration and integration across settings is essential for chronic condition care planning and management. To address this gap in PocketDoc, the study uses as a reference the **Continuity of Care Maturity Model** (CCMM) which was developed by the Healthcare Information and Management Systems Society (HIMSS), a non-profit US organization, in order to optimize holistic care management and healthcare outcomes through the use of IT.

The CCMM initiative consists of three divisions - clinical, IT and governance divisions, and therefore regroups stakeholders from multiple care and non-care settings. All stakeholders are involved in fulfilling the eight CCMM goals, in the following order of progression : (0) Limited **e-communication**, (1) basic **peer-to-peer** exchange, (2) **patient-centered clinical data** using basic system-to-system exchange, (3) normalized patient record using structural interoperability, (4) **Care coordination** based on actionable data using a semantic interoperable patient record, (5) **Community-wide** patient record using applied information with patient engagement focus, and (6) **Closed loop** care coordination across team members. Ultimately, the (last) goal of CCMM is to create (7) **knowledge engagement** for a dynamic, multi-organizational interconnected healthcare delivery model.

Therefore, the CCMM model supports collaboration and information sharing across multiple settings by means of health information technology (HIT). It relies on advanced analytics, and allows to optimize the utilization of EHR and HIT by the patient and healthcare providers involved in the circle of care. The purpose of this study, which is to better connect primary care and home care through the use of an e-Health tool, is therefore well-aligned with CCMM goals. The study can learn from this model that many other steps need to be taken before achieving 'a multi-organizational interconnected healthcare delivery model' (final stage of CCMM). For instance, a patient-centered care approach (stage 3) and in-setting collaboration (stage 4) must be implemented first before aiming for 'coordinated inter-setting healthcare', which is the final stage of CCMM and the goal of this study. The study also aims to create specifications and features for PocketDoc 2.0 based on CCMM best practices.

3. METHODOLOGY

3.1. Co-design

Usability of electronic apps depends on three aspects: the app interface (10%), system navigation and user interaction with the app (30%), and how the app meets users' mental model (60%). Therefore, understanding end user needs is critical in defining requirements and designing a new piece of technology. These user requirements are often ignored in healthcare IT, which results in poor application design and implementation issues. Moreover, e-Health projects are becoming increasingly multidisciplinary and more stakeholders with different backgrounds and expertise are involved in the design process. Engaging all stakeholders and product end users in the design process is therefore critical to build technologies that are better aligned with all user needs and increase system acceptance. For this reason, the study first considered directly asking end users to define their requirements for PocketDoc 2.0, but found it inappropriate because 'it is hard for everyday users to think about a system which does not exist and expect novel notions'. Rather than *asking*, the study chose to *work with* users (e.g.: physicians) to identify their activities within the context of their work (e.g.: care services). This **co-design** method refers to the process of designing *with* users, where users and developers collaborate towards developing a shared understanding of the topic and achieve meaningful system design and development.

3.2. User Centered Design (UCD)

There are several co-design methods to gather system requirements, such as focus groups and interviews with stakeholders. **User Centred Design** (UCD) is the newest approach developed in the field of human computer interaction design for data collection and user engagement. Core principles of UCD are: (1) the user must be at the centre of the design process; (2) design is focused on users and their tasks from the initial stage; (3) system usability is tested and evaluated based on experiments; and (4) the system is designed, evaluated and amended with end users participation through iterations. Consequently, there is a deep communication and shared understanding between end users and software development teams in UCD. All user requirements (and limitations) are incorporated into the system design.

It is worth differentiating the different types of UCD. **User profile** or/ **persona** is a type of UCD model that helps capture users' past experiences and expectations to construct a 'mental model'. User demographics, actions, needs and emotions are all considered in this profile/persona method. Consequently, the literature on IT system design considers the persona method 'the most efficient way towards creating a shared system understanding between end users and developers'. System developers use the captured user mental model to create a conceptual model, which is then used to develop the final IT application. In some instances, user persona may be used in combination with **scenario-based** design. Scenario-based design is another UCD method to understand and gather end user requirements. Unlike the persona method, scenario-based design focuses on users' tasks and actions without any attention to understanding users. For the purpose of this study, which aims to capture healthcare providers' behaviours within the context of their work tasks, both persona and scenario IT design methods are used. The hybrid method is known as '**persona-scenario**' design.

3.2. Persona-scenario design method

Persona-scenario design describes the combination of user persona and scenario-based design methods. Personas (in this study, imaginary characters representing typical healthcare care providers) and scenarios (storylines in which the imaginary personas interact with the PocketDoc system in practice) are crucial complements to each other. Participants, who are also potential future users, are asked to imagine personas and scenarios based on a set of guiding questions. Personas must be the best representations of the end user group. Persona-scenario guidelines (Appendix II) also identify that scenarios should be well-organized narratives, and adequately detailed to guide IT system design.

Cooper, Bloomquist et Arvola (2002), the persona-scenario method innovators, recommend a progression view of the activity, from high-level to very detailed scenarios and a focus on user-system interactions. In addition, the persona-scenario method allows participants to describe an action or interaction from the points of view of different user groups, and with as much details. Hence, the potential benefits of the persona-scenario exercise for this study may be : (1) it facilitates **meaningful** e-Health application design and implementation, because participants are allowed to be creative and use details of their experiences and perceptions in the creation of personas and scenarios. In addition, (2) the intensity of details

helps identify new elements in system design and potential synergy between them. Thirdly (3), it increases technology uptake and adoption because end users are engaged from the initial to the final stage of the design process. Hence, persona-scenario activity is recognized as the most useful UCD method for understanding and translating user needs to the design team, in particular for large IT system design projects such as national e-health solutions (e.g.: PocketDoc). It is the most successful communication device for ensuring that ‘all stakeholders achieve a unified understanding of project specifications’.

However, although persona-scenario activity describes user needs and conditions of system use, it generally does not detail **system design resolutions**. This is because participants may not have adequate knowledge about system components, which could lead to infeasible scenarios. Instead, IT designers must first analyze and evaluate participants’ suggestions, and all design decisions are made after the persona-scenario exercise. Accordingly, the persona-scenario method cannot be an effective design tool by itself in this study: in addition to empowering end users through the creation of personas and scenarios, the study must also rely on a series of participatory research methods in the form of think aloud exercises where participants are asked to describe things they are doing as they use the system to monitor their comprehension. Data from both the persona-scenario and think aloud sessions was then transcribed and analyzed to create a final table of design and implementation specifications for PocketDoc 2.0 (**Appendix IV**), including a list of actions required to execute the features proposed by participants.

4. DATA COLLECTION

4.1. Participants

With the approval of the research ethics board at Mohammad VI Polytechnic University (UM6P) and Cheikh Khalifa Hospital (CKH), a cohort of 5 primary caregivers from Casablanca, Morocco were invited to participate in a two-hour persona-scenario activity: 2 registered nurses, 1 practitioner nurse, 1 psychologist and 1 social worker. The study used a snowball sampling technique to contact potential healthcare providers, by cold-calling and explaining the nature and purpose of the research. Participants were often identified through members of the CHK stakeholders team, such as research staff, patients, and caregivers. The final sample size was determined based on the practical standards of persona-scenario activity, which state 'there is no need to run usability tests with more than 5 participants to achieve the best results'.

4.2. Sessions

Two persona-scenario sessions were held at CKH. Each session started with a brief introduction of the study objectives, the PocketDoc app as well as the core components of chronic care management that the app supports. A quick demo of the PocketDoc app was also run to present main design features and functions, although participants were encouraged to think beyond what is currently present in the application. Participants were asked to sign consent forms (Appendix I) prior to the persona activity exercise. Due to Morocco's 09-08 personal data protection act which prevents the disclosure of confidential information, the audio-tapes were confiscated after transcription and transcription had to be conducted on-site in the hospital.

Participants were allowed to attend one session only. Three participants (2 registered nurses and 1 practitioner nurse) attended the first session held on June 25th 2019, while the second session on July 6th 2019 included 1 psychologist and 1 social worker. Participants were all female healthcare professionals with different levels of experience working in primary care settings, caring for chronically ill patients and using e-Health tools. Appendix III details participants' backgrounds and demographics. Once groups formed, each persona-scenario activity session lasted one hour and was divided into two parts: first, each

group was tasked with creating a primary care persona and a scenario where the persona interacts with the home and primary care teams using PocketDoc. An off-the-record debate between the researcher and the participants then followed. A post-exercise discussion is useful as group participants can listen to each other's personas and scenarios and comment on them, which helps further inform design and implementation.

A guide for persona and scenario development, available in full in [Appendix II](#), was used to guide participants in the creation of personas and scenarios, by asking questions such as 'what is the discipline of your persona?', 'how much PocketDoc training does your persona have?', and "what is the situation that brings your persona to use PocketDoc?". In total, 3 personas were created with four scenarios across the two sessions: the first persona created, a practitioner nurse, acted two scenarios in the first session. The second and third personas created, a social worker and a psychologist respectively, each had one scenario in the second session. The reason why the second group was asked to create two personas was to understand how PocketDoc 2.0 may be used by two personas from different disciplines. More generally, the created stories represented participants' ideas on the use of PocketDoc features and ways they think it could be implemented in practice. Ideas included how primary care could be brought into the PocketDoc circle of care, how the app could be implemented in day-to-day practice, level of training, etc. [Appendix III](#) details the personas and scenarios created during each session.

5. FINDINGS & ANALYSIS

5.1. PocketDoc 2.0 features

Both persona-scenario sessions were audio-taped and used as a resource in the transcription and analysis of qualitative content. The transcriptions were read many times to pinpoint patterns and extract common ideas. A total of 60 ideas (features) were extracted from the user-created scenarios. These ideas were grouped into **eight broader themes**, based on a qualitative thematic analysis. For instance, the practitioner nurse persona in the first persona-scenario session wished ‘her primary care team had access to a task module in PocketDoc 2.0 to create tasks for the home care team’, while the social worker persona mentioned ‘a possible instant messenger feature in PocketDoc 2.0 that would allow primary care to follow up with home care progress’. Both these suggestions, along with 22 other participants’ ideas, related to (1) ‘interprofessional team communication’ and were therefore classified under that theme.

Based on participants’ features, other themes were identified: (2) referral to community services and resources (e.g.: ‘community reintegration planning’ feature); (3) access to non-medical information (e.g.: ‘patient records’ feature); (4) patient-centered care (e.g.: ‘goal setting’ feature); (5) patient-safety approach (e.g.: ‘medication review’ tab, ‘alert’ feature); (6) system integration (e.g.: calendars and reminders); (7) clinic EMR as a complementary tool and (8) implementation considerations (e.g.: training). Under each high-level theme, ideas were further classified into **four categories** : (1) *existing feature* (to describe an existing feature of PocketDoc that is sufficient to address participants’ proposed features); (2) *addition to an existing feature* (a change to an existing PocketDoc feature is required to actualize the idea); (3) *new feature* (a novel feature is required); and (4), *existing or new feature* (either an existing or a new feature may be sufficient to actualize the proposed features). Therefore, if a feature proposed by participants requires a new or existing feature to be built in PocketDoc 2.0, it is mentioned in the ‘Feature’ column of the final specification table (Appendix IV). The reason behind this categorization is to group ideas in the most efficient way and produce a to-do-list that software programmers can refer to for PocketDoc 2.0’s development.

5.2. PocketDoc 2.0 design and development specifications

For each theme (and corresponding features) extracted from the persona-scenario activity, **design** and **development** specifications were created. Under the 'interprofessional team collaboration' theme for instance, one of the features proposed by the social worker persona was 'for primary and home caregivers to be able to create team record summaries on PocketDoc 2.0'. While a 'Team Meeting Record' feature for home care teams already exists in the current version of PocketDoc, the study simply created an additional action item that allows primary caregivers to be added to the dropdown list of people with access to meeting records. Similarly, under the 'patient safety' theme, the practitioner nurse persona cited the need for 'a new module that enables primary care to access patient information such as physician, pharmacy and power of attorney information on PocketDoc 2.0'. This prompted the creation of a new feature called 'Patient Information' that allows primary care teams to access and look up patient's charts.

This process was repeated for each of the 60 ideas extracted from the persona-scenario exercise, and resulted in the creation of 104 design features (as some ideas required two or more design features to be realized). In addition, the analysis noted that while some of the generated features could be managed by existing features in the current version of the app, others required changes or additions to be built into PocketDoc 2.0 to make the application suitable for future end-users. This is mentioned in the 'existing or new feature' column. **Appendix IV** further details the final table of design specifications, and a sample can be found in **Table 1** on the next page.

Table 1. Sample of design specifications for the features identified under the ‘patient safety approach’ theme:

Theme: patient safety approach	
<i>Category: Existing feature</i>	
<i>Feature</i>	<i>Specifications</i>
Medication review	View record
Record My Visit – (home care action item)	View record
Alert	View and create alerts
Checklist (primary care action item)	View record
Timeline	View and add timeline items
<i>Category: Addition to an existing feature</i>	
<i>Feature</i>	<i>Specifications</i>
Patient checklist	Add a new feature in the existing “Checklist” action item of PocketDoc where home care coordinator can easily click on each concern and notify it to someone in the circle of care (e.g.: primary care team) for their review
<i>Category: Existing feature</i>	
<i>Feature</i>	<i>Specifications</i>
Goal	View and create goals with patient

5.3. PocketDoc 2.0 implementation specifications

In addition to design specifications, **implementation** considerations were also identified. Some were directly raised by participants in the persona-scenario exercise. In other cases, they were extracted post-exercise such as during transcription, as participants do not have adequate knowledge about system components which could have led to infeasible scenarios from an implementation standpoint. Implementation themes identified include (1) ‘comprehensive training’ about PocketDoc 2.0’s main components. Education for physicians is a critical aspect of e-Health programs and may facilitate the meaningful implementation and use of PocketDoc 2.0. Hence, for each generated feature, training specifications were created. Other implementation themes covered (2) ‘hardware requirements’ (e.g.: sufficient level of devices such as laptops and tablets available in the primary care office to access PocketDoc 2.0), and (3) ‘patient preferences’ (e.g.: patient consent and privacy issues related information sharing and document upload in PocketDoc 2.0). More implementation

considerations were extracted both from the perspective of technical capability and healthcare system policy. **Table 2** shows a sample of final results (Appendix IV):

Theme: Implementation Considerations	
<i>Action item</i>	<i>Specifications</i>
Primary care team uses computers or tablets to access PocketDoc 2.0	<p>Hardware requirements</p> <p>There must be a sufficient level of devices available in the primary care office for accessing PocketDoc 2 via the Internet</p>
The home care nurse calls the primary care clinic and requests a medication change including the reason for the change	<p>Healthcare system policy</p> <p>Implementation policy and procedure is required about emergency requests for medication changes. A process to follow up if primary care did not respond within a period of time is also needed.</p>
Patient information from the primary care clinic (such as lab values and vital signs) are added into PocketDoc 2.0	<p>Teams' responsibilities</p> <p>If patient information is going to be manually added into PocketDoc 2.0, there must be an agreed upon policy between primary and home care about who takes the responsibility to add it into PocketDoc 2.0 and keep it up-to-date.</p>

5.4. Feasibility

To check validity, further examination was conducted to determine whether the features extracted from the persona-scenario sessions were *feasible*, *unfeasible* or *required more investigation*. Feasibility was determined based on (1) an estimation of the resources needed for the development of the proposed features, (2) clarity of implementation procedures, and (3) the current data protection legislation in Morocco. For instance, some ideas cited by family caregivers (in interviews) are not feasible in PocketDoc 2.0 due to the currently limited access of family caregivers to the application. For example, family caregivers are not able to leave a message on PocketDoc 2.0 for primary care providers about diagnosis, medication or treatment. For **legal reasons**, 'this access is not going to be expanded in PocketDoc 2.0 at this stage', although it may be considered in future versions of the application which will require family caregivers' involvement in the design and

development process. More generally, the analysis found that the feasibility of some of the proposed features will need further investigation from a technical and healthcare policy perspective (Appendix IV details feasibility of each feature).

6. DISCUSSION

Based on the data extracted from the persona-scenario exercise, the study identified eight themes to be added to the enhanced version of PocketDoc (PocketDoc 2.0), as well as a detailed list of corresponding features (e.g.: functions, modules), design specification, implementation considerations and their feasibility. For the discussion section, the major themes identified were searched in the literature to validate results in the final stage of the analysis.

6.1. Theme 1: meaningful communication between interprofessional healthcare teams

The study analysis flagged the importance of communication and collaboration in continuity of care. Three levels of continuity of care were found: (1) **information continuity** (e.g.: EHR system), (2) **management continuity** (e.g.: quality of care between transition points) and **relationship continuity** (e.g.: trust between primary and home care). In response to these identified gap in meaningful communication, collaboration and integration across health settings, four types of communication strategies between healthcare providers were also identified: (1) **person-to-person** versus (2) **information-sharing with more than one person**, and (3) **coordinated** versus (4) **non-concurrent** communications. These fundamental elements of meaningful communication and collaboration indicate that the patient's circle of care must be structured in a way that enables information continuity, and forms a sense of sufficient trust and knowledge between all stakeholders. Given the study focus on chronic condition management for elderly through the PocketDoc app, the study also underscored the importance of 'continuous communication through the app even after the patient's primary care program is terminated and transitioned to home care'. Participants' stories confirmed that these unresolved miscommunication issues may cause significant patient safety issues and conflict between health settings unless there are clear policies in place around team responsibilities and accountability.

6.2. Theme 2: patient-centred care approach

The second theme identified in the study is **patient-centred care**. The **patient-centered care** approach describes 'evidence-based care that is designed around patient information', such as normalized patient records using structural interoperability. Anecdotes gathered during interviews suggest that **patient-safety issues** are primarily caused by inefficient

patient information sharing. This miscommunication about patients' conditions during transition points between acute, primary and home care emerged as the most recurrent theme in the study analysis, and the most cited cause in the literature for fragmented care and medical complications. Patient information discontinuity may be about changes in patient diagnosis, medication or treatment. An example of ineffective patient information exchange between primary and home care providers was described by a 75 year-old patient with MCC and multiple associated medications who lived alone: 'the patient experienced breathing obstruction in the back of the nose and throat, possibly related to a change in medication, which resulted in an episode of sleep apnea'. Because the primary care provider and pharmacist neglected to notify home caregivers of the potential safety risks related to medication change, a care plan to reduce potential harm was not implemented. Hence, evidence indicates that a patient-centered approach, such as shared access to patient medication records and proper alerts (e.g.: alert of medication change) are critical factors in preventing adverse events for patients.

For this reason, the study identified potential solutions to support **patient-centred care management** in PocketDoc 2.0. The study defined requirements for a medication communication framework between primary and home care, such as 'integrating an electronic health record (EHR) for sharing updates about changes in a patient's medication list, dosage, and allergies'. In this approach, the EHR acts a patient-centered clinical data system, which allows diverse professional to become aware of the required information to coordinate and ensure patient safety. In addition, the study analysis showed that if all healthcare providers have a mutually sufficient level of information, this may enhance goal-oriented care, care planning and decision-making. Lastly, patient-centred care gives patients the power to request preferred individuals to take care of specific tasks or participate in their care team, which may help fix issues related to responsibility and accountability.

6.3. Theme 3: IT system integration

The value of system integration is well-supported in the literature. One of the integration challenges identified in this study is that EMR systems are not sufficiently integrated to support communication and collaboration between different healthcare settings. The traditional workaround for overcoming this challenge is to duplicate or manually enter

documentation into two different systems. However, participants' feedback indicates that duplication is 'a frustrating and time consuming solution', and 90% of participants wished that patient information could be 'pushed over from EMR's and integrated into PocketDoc 2.0'. In addition, one of the registered nurses interviewed revealed that when primary care providers do not explicitly request to review lab values, the probability that home care will add this information to the app is very low. Therefore, it is important to find out the type of patient information that each care provider cares to see on PocketDoc 2.0, to determine which content to integrate or not.

These integration issues must be clarified prior to further development or implementation. As such, the study also identifies potential integrated models of care to make PocketDoc 2.0 a more stable and unified e-Health solution. For instance, PocketDoc 2.0 could have a hyperlink that connects to the primary care clinic's EMR so that primary caregivers can check and update information. This led to the creation of one of the eight themes called 'EMR as a complementary tool' as part of the study analysis. However, these technical workarounds alone are not sufficient to overcome the integration challenges related to independent electronic systems. Governance and effort-building mechanisms are also needed. For example, healthcare information technology (HIT) vendors could cooperate with healthcare providers to design systems that support the integration of electronic systems across different settings (e.g.: hospital, rehabilitation center). Broader collaboration between HIT vendors, healthcare settings, educators, governments, regulators and financial support should also be in place. These partnership consortiums are a form of collaboration, and are critical during programme development, monitoring, evaluation and implementation.

6.4. Theme 4: Implementation considerations

The study analysis identified potential system implementation risks, and implementation specifications for risk detection and mitigation are offered for consideration in PocketDoc 2.0 implementation. At least five implementation considerations were identified: (1) hardware requirements, (2) healthcare system procedure and policy, (3) patient's privacy, (4) patient's preferences, (5) training (6) collaborative governance.

Under (1) 'hardware requirements', primary care participants cited the need for ' a sufficient level of devices such as laptops and tablets available in the primary care office to access

PocketDoc'. Procedure issues and legal concerns were also mentioned under (2) 'healthcare system policy'. For instance, most healthcare professionals cited the difficulties of 'complying with well-defined interoperability procedures' following implementation, whereas HIT software developers said they struggle to 'adapt systems and apps to changing ethical and legal requirements'.

On the side of patients and family caregivers, participants stressed the need to clarify regulatory concerns around (3) 'patient privacy' and (4) 'patient preferences' prior to implementation, such as patient consent. Patient privacy is highly emphasized in the healthcare information technology (HIT) literature, which argues it is essential to support clinical activity and the sharing of valuable information 'without breaching the ethical code of conduct of the care community'.

(5) 'HIT training' is another implementation recommendation made by participants, some of whom suggested 'on-going PocketDoc training through Q&A forums, online videos and monthly refreshers'. These findings suggest hands-on training could be a strong facilitator for meaningful e-health implementation, and sufficient resources and appropriate time should be dedicated to this goal.

(6) Lastly, the study analysis highlighted the need for (6) collaborative governance. All interviewees agreed that e-Health is not only a technical development but also 'a state-of-mind and commitment for **networked, global thinking** to promote best health practices'. Consequently, a clear policy framework between stakeholders is needed to harmonize all involved roles and sectors and facilitate the meaningful implementation of e-Health solutions. After all, eHealth is an emerging field at the intersection of public health, medical informatics, governments and business. For this reason, the study produced specifications implementations that consider all aspects of the healthcare practice environment (e.g.: system functionality, legislation, governance, finances).

7. STUDY LIMITATIONS

It became clear during the participant selection phase that the snowball sampling technique was not a satisfactory method to secure diverse input from all disciplines involved in primary and home care. The difficulties in recruiting diverse caregivers prevented the study from collecting perspectives from other healthcare providers who could not be recruited, such as physicians, pharmacists, occupational therapists and dieticians. Therefore, findings are somewhat limited as other providers' expertise and knowledge on chronic care management could have further answered the study's design questions. For example, a pharmacist may have helped with identifying the appropriate way of designing the 'patient medication list' feature in PocketDoc 2.0, and help overcome patient safety issues such as dosage errors. Better participant recruitment strategies, such as contacting large healthcare practices instead of targeting individual care providers, must therefore be considered in the future.

In addition, the researcher (myself) served as both the person-scenario activity facilitator and data evaluator, which may have influenced data analysis as well as the extraction of features and specifications from the exercise. For instance, the role of facilitator required the researcher (myself) to guide participants when they were confused, which may have unintentionally biased them. Ideally, another researcher should have fulfilled the role of facilitator, although not possible for this research project due to time and resource constraints (e.g.: time selecting a secondary researcher, monetary compensation).

In addition, the study did not prompt participants during the persona-scenario exercise to think 'what do you think the roles of patients should be on PocketDoc 2.0?', instead focusing on the relationship between primary and home care teams. This question would have added an important dimension about the level of control that patients and their family may have. A patient's perspective (e.g: patient-centered care) will need to be investigated in future developments of PocketDoc 2.0 and focus on greater access and engagement for patients and their family using the app.

Lastly, PocketDoc was designed specifically for elderly patients with multiple chronic conditions, and so is PocketDoc 2.0. This means the findings of this study may not be applicable for the design of all health information systems other than programs for elderly MCC patients. In fact, the study only claims to identify specifications for developing an

expanded version of PocketDoc to include primary care, and solve the primary-home care collaboration gap identified in the literature.

8. FUTURE RESEARCH AVENUES

Since e-Health is an emerging field and the PocketDoc app still in the beta phase, the knowledge produced in this study has initiated as many questions as it has answered, and opened the way for further practice and research. Hence, specific action planning and next steps are required:

(1) First, future work is needed to continuously assess and engage primary care, home care, patients and their family caregivers regarding requirements for using PocketDoc 2.0. Future studies could also use the persona-scenario method to further define specifications and combine them with the results of this study.

Although not possible in the context of this master's level research project, the next step after the collection of end-user requirements should be sharing the extracted design and development specifications with software programmers to develop a prototype of PocketDoc 2.0. Unlike in this study, a software usability testing method (e.g.: think aloud' session) could be run with PocketDoc 2.0 end-users to verify the app's functionality and ease of use before its implementation in practice.

Lastly, future studies must implement one or more pilot studies to test the efficiency of PocketDoc 2.0 as a communication and collaboration facilitator tool between primary and home care settings involved in the patient's circle of care. Future research could also identify implementation specifications to build a PocketDoc 3.0 version of the app that supports all care performance (clinical, laboratory), which could mark the emergence of a new paradigm for healthcare.

9. Conclusion

11. APPENDICES

Appendix I.

Letter of information and consent for participants

Study title: Enhancing e-communication and collaboration between primary care and home care in multiple chronic condition care: the case of an e-Health application in Morocco

Researcher:

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You have agreed to participate in a persona-scenario exercise to help in the co-design of the expansion of an application called PocketDoc to include primary care providers into the circle of care for home-cared adults aged 65 and older with multiple chronic conditions (MCC).

To determine whether or not you wish to participate in this study, you must understand the potential benefits as well as the risks involved in the study. This form provides detailed information about the study. Please ensure you have carefully read the form, and sign it to confirm you wish to participate. Your participation in this research is completely voluntary. As such, you may refuse to answer any question, and may withdraw from the study for any reason and at any moment, without penalty of any sort.

What is the purpose of the study?

The purpose of this master's thesis is to identify primary care team user group requirements for an e-Health app called PocketDoc, which was developed for MCC patients and their home care providers and family caregivers. The study is interested in your opinions, based on your past experiences and knowledge, about specifications for the design and implementation of an enhanced version of PocketDoc (PocketDoc 2.0) that includes primary care providers into the circle of care to help support meaningful communication and integration between home care and primary care teams through the mobile health technology app.

What will be my role and responsibilities if I participate in the study?

If you agree to participate in the study, you will be asked to attend a one-hour long group session to be held at the Community Health Research Unit (CHRU) at Cheikh Khalifa Hospital, Casablanca, Morocco. During the session, a brief presentation of PocketDoc functions and the main features and components of care interventions that PocketDoc supports. Each session will be divided into two stages: first, participants are asked to create a persona and scenarios in small groups (see Appendix II). The researcher (myself) will facilitate the conversation by clarifying questions and providing directions regarding proper completion of the exercise. Next, participants are asked to report on their personas and scenarios in a large group. Participants may be contacted after the exercise if results need further clarification.

What are the possible risks?

The study anticipates that there will be no risks or harm from taking part in the study. Participants may feel uncomfortable sharing their opinions and thoughts, however, they have no obligation to answer questions they do not wish to answer.

What are the potential benefits of this study?

The study hopes that the results of this study will help design and implement an e-Health app that supports meaningful communication and integration between home care and primary care teams involved in caring for older adults with MCC.

Are participants paid to take part in the study?

Participants will not be paid to take part in the study and will choose to volunteer.

Are there costs to participating in the study?

There are no costs for participation in the study except for participants' time.

What information will be kept private?

Personal data will not be shared with anyone without the participants' consent as required by the law in Morocco. All personal information such as names will be removed from the information gathered and will be replaced by fictitious name or number in the final research produced. The discussion will be facilitated by the author of the research (myself) only. The sessions will be audio-taped and transcribed for content analysis. However, audiotapes will be returned to Cheikh Khalifa Hospital, as per Moroccan law. Participants' names will not be identified in the transcription and will be replaced by a number. Data such as demographics, gender, disciplines, experience in primary care and level of comfort using e-Health apps will be collected. However, individual responses will not be linked with personal identifiers such as names. If the results of the study are published, participants' names and no information that discloses their identity will be released without specific consent to disclosure.

Can participants end the study early?

Participation in the study is voluntary and participants may withdraw at any moment. Participants have the option to remove their data from the study if it has not yet been integrated in the study. Participants may refuse to answer any question that makes them uncomfortable and still remain in the study. Participants may be removed from the study if conditions arise which warrant to do so.

If have questions about the study, who can I contact?

If you have any questions about the study now or later, please contact the student researcher (myself) Soukaina Rabii via telephone (+447470349996) or email (soukainarabii@yahoo.fr)

The study has been reviewed by the ethics boards at Mohammad VI Polytechnic University and Cheikh Khalifa University Hospital. These ethics boards are responsible for ensuring that participants are aware of the potential risks or harm associated with the research, and that participants are free to decide to participate. If you have any questions about your right as a participant, please contact the ethics manager at the UM6P ethics committee at recruitment@um6p.ma

CONSENT

I have read the information provided in the information form. I have been given the opportunity to ask questions about my involvement in the study and received additional details when requested. I understand that if I sign this form, I agree to participate in this study and may withdraw at any time.

.....
Name of participant

.....
Signature

.....
Date

Appendix II
Participants demographics

	Participant #1	Participant #2	Participant #3	Participant #3	Participant #4
Discipline	Nurse practitioner	Registered nurse	Registered nurse	Social worker	Psychologist
Number of years working in healthcare	12 years	9 years	5 years	3 years	15 years
Type of care delivery model	Community health center	Family health teams	Family health teams	Community health center	Family health teams
Degree of experience working with home-dwelling patients (1: not at all comfortable - 10 extremely comfortable)	9	7	8	5	7
Level of comfort working with MCC patients aged 65 and over (1: not at all comfortable - 10 extremely comfortable)	9	6	7	4	8
Comfortable working with e-Health tools	yes	depends on the app	yes	No	yes

Appendix III

Persona Scenario Development and Discussion Guide for Participants

PocketDoc is a web-based e-Health app developed by a team at the Community Health Research Unit (CHRU) at Cheikh Khalifa Hospital. The app aims to support home-cared adults with multiple chronic conditions and their home care team by enhancing communication and planning among those in the patient's circle of care. Home care providers (e.g.: care coordinator, nurse) and patients and their family caregivers have access to the application. Access may be restricted on the role and responsibilities of the user. For instance, patients and their family caregivers can only view PocketDoc documentation but do not have permission to write or add documentation in the app. In addition, primary care providers are not included in the current version of the app.

The aim of this persona-scenario exercise is to identify and define specifications for the design and implementation of an enhanced version of PocketDoc (PocketDoc 2.0) that includes primary care providers into the circle of care, to help support meaningful communication and integration between home care and primary care teams through the mobile health technology.

Pocket Doc currently supports:

- Patient-centered care
- Collaborative practice
- Evidence-based care
- A proactive comprehensive approach
- Facilitation of referral to community resources
- A strength-based development approach
- Patient empowerment and self-management

Your scenarios must involve all or some of the above components. Based on experience and your knowledge as a primary care provider, you must create an imaginary but realistic persona. For each persona, two scenarios must be created where the primary care persona interact with the home care team using the PocketDoc system. At the end of the exercise, report back to the larger group.

STEP 1: Create a persona (10 minutes)

Your persona must be a primary care provider who is using PocketDoc to communicate with the home care team in the circle of care of a home-dwelling patient with MCC. Describe the following:

- name, age, gender
- discipline
- years of working in primary care
- experience communicating with home care teams in providing care for home-cared patients
- experience and attitudes around using modern technology such as e-Health
- experience with multiple chronic condition care management and prevention

STEP 2: Create at least two scenarios (25-35 minutes)

You should create at least two scenarios for your persona, where they use the PocketDoc system to communicate with the primary care and home care teams. Consider the following elements to create your storyline:

- What is the situation that brings your persona to use PocketDoc ? How did the interaction start?

- How much PocketDoc training does your persona have ? How was the persona trained to use it ?
- What are primary care, home care, patients and their family caregivers doing in the scenario?
- How is PocketDoc being used by the primary care team in the scenario ?
- What happens when primary care and home care providers use PocketDoc ? What happens after?
- What are the results of this interaction for patients and their primary care and home care teams?

STEP 3. Report to the larger group and provide a high-level summary of your persona and scenarios (15 minutes)

The group sessions are audiotapes for analysis.

Appendix IV.

Personas and scenarios created during the group sessions

Session 1

Persona 1: Leila is a 25 year old practitioner nurse (PN) in a family doctor's office working alongside a physician. She has 3-5 years working in home care and usually interacts with home care nurses in charge of patients at Leila's clinic. She is proficient in the use of technology. However, she has very limited experience in MCC rehabilitation. Leila received PocketDoc training as part of her work in nursing services and family health. She uses an office computer to access PocketDoc.

Scenario 1:

It was a typical working day, when Leila received a call from a home care nurse requesting medication information on a patient. To fulfill the nurse request, Leila had to retrieve the patient's medication list from the clinic's EHR system. She also had to log into PocketDoc and check when the medication was last reviewed, but many information had not been added to the app such as 'is there a way to find out if the medication on the list is up-to-date?', 'should the medication be administered by dosette?'. Ideally, primary care medical records would have been linked to PocketDoc. That way, if there are any changes by the primary care provider, it will be automatically reflected in PocketDoc. Leila started wondering whether PocketDoc could have a hyperlink that link to the EHR.

The interaction prompted Leila to think about other ideas. For instance, for Leila to give as much information to the home care nurse regarding medication changes, the medication list along with other important information such as vital signs and lab values should be duplicated into PocketDoc from the clinic's EHR. Leila should also be able to put alerts for other providers involved. In fact, Leila believes that every primary care office should have access to an iPad with PocketDoc that receives alerts of top priority. 'Why not create a PocketDoc indicator (yellow, green, red) to indicate how urgently a patient needs to be seen?'. Someone also has to reassess medication and report back to the healthcare provider about what has worked (or not) for a patient. 'Could nurse do the follow-up, gather the information and input it to PocketDoc?'. Leila could then check back into PocketDoc to access the follow-up added by the nurse. Leila should also be able to instant message the home care nurse and get an immediate response instead of waiting for the home care nurse to call back.

Scenario 2:

As part of the monthly checkup of a patient registered in the primary care clinic where Leila works, she receives a report from a nurse that the patient is not taking his insulin regularly anymore. Leila wants to know what has caused this change but the patient has not been to the clinic yet. Leila wishes she could message the patient's home care team through PockeDoc to find out more and ask questions such as 'can you check for medication compliance?', 'has medication changed?', 'has the patient's lifestyle changed?', 'what is his quality of life?'. She also wishes she had access to the patient's assessment checklist. Leila believes both home care and primary care should be given more access to the PocketDoc platform to document patients' conditions. 'There needs to be more trust between disciplines in the team', she thinks. Leila should be able to write tasks in PocketDoc for each provider discipline based on the issue (e.g.: write to the patient to enquire about lifestyle, write to the home care team to check medication compliance). This way, Leila would be able to coordinate all of the above concerns with the patient's home care team. For example, the home care team might send a message to Leila indicating to put in more nursing because the patient does not regularly check his blood sugar. Having a 'primary care and home care coordinator' tab in PocketDoc for direct linkage and communication could facilitate collaboration between the two settings.

Session 2

Persona 1: Meryem is a mid-30 year old primary care social worker. She has 4 years of experience in social counselling. She has an acceptable and competent level of experience using working with technology. However, Meryem has very limited experience working with home care teams and is a novice in the area of chronic care management. She received PocketDoc training as part of a learning program in a clinic and access to online training content.

Scenario 1:

Due to his inability to speak French (the second official language in Morocco), an Arabic speaking patient was misreading his prescription and overtaking his blood pressure (BP) medication, which lowered his BP level and caused him to faint. The patient's family told Meryem that the patient was on a home care program and asked Meryem to help find translation services for the patient and his circle of care.

Meryem also figured there was an information flow issue between the primary clinic and the patient's home care team. Initially, Meryem thought about using of the existing system in the office called TAPESTRY which is used for communication between primary care social workers and home care teams. However, an IT tech support employee in the office suggested that Meryem used a new app called PocketDoc which is specifically designed for home-dwelling patients. The patient (who needed translation services) agreed to sign up with PocketDoc as the home care team and Meryem thought it might be useful in the following areas: accessing the circle of care information, view home assessments, and add community referrals, and make recommendations. Meryem will also be able to create a reminder in the clinic's EMR to check back in PocketDoc and follow alerts to inform other primary care members if necessary. 'Ideally, PocketDoc would act as a virtual team to communicate with the home care team', she concludes.

Persona 2: Sarah is a 28 years old psychologist. She works part-time in a primary care clinic and part-time in a rehabilitation center for older adults. Sarah is proficient in the use of modern technology and trained to use PocketDoc. However, she has a very limited experience of working with homecare team.

Scenario 2:

A home care coordinator came into the primary care clinic asking for a psychologist for a patient 'whose mood had been down'. Sarah was informed about PocketDoc and that the patient is signed up with the app. Sarah is trained to use PocketDoc. However, she wishes the app would let her use task modules to create tasks for other providers in the patient's circle of care, and communicate with the home care team more often to follow up with the patient's progress. The app does not allow her either to communicate with the patient's family to check on the patient's mental health state and put on recommendations, such as uploading guide documents and resources for the patient and his family caregivers for future reference. Patients and their family caregivers are not allowed to leave a message for Sarah on the current version of PocketDoc either. 'What if someone linked the PocketDoc app to primary care providers' emails and the clinic's EMR?' she thinks. 'Realistically', Sarah thinks, it would be the only way to follow up until the patient's mental health issues are resolved.

Appendix V.
Detailed final specifications table

Interprofessional team communication					
Existing feature					
	Primary care social worker creates task for home care providers	feasible	1. Primary care team has access to task module of PocketDoc 2.0 and is able to create tasks for the home care team	1. Training for primary care about how to create a task for the home care team 2. Training for the home care team about how to complete each task	Task creation
	Primary care nurse practitioner sends an alert in PocketDoc 2.0 to the circle of care about the updated medication list	feasible	1. Primary care has access to alert functionality of PocketDoc 2.0 and is able to create alert for circle of care	1. Training for primary care team about how and when to create an alert for homecare team, and what to include in their alert 2. Training for home care team about how regularly check	Alert

				the alerts they received	
	Primary care social worker creates goals with patients and calls on other providers for achieving the goal	feasible	1. Primary care team has access to a goal creation module of PocketDoc 2.0 to create patient goals	1. Training for primary care team about how and when to create goals with patients	Goal setting

	Primary care psychologist uploads a guide on recommended resources for patient and call on other providers for achieving the goal	feasible	1. Primary care team has access to a goal creation module of PocketDoc 2.0 to create patient goals	1. Primary care team has access to a goal creation module of PocketDoc 2.0 to create patient goals	Goal setting
<i>Addition to an existing feature</i>					
	Primary care practitioner nurse creates task for the home care team with different priorities (green/yellow/red) on PocketDoc 2.0.	feasible	1. Primary care team has access to task module of PocketDoc 2.0 and is able to create tasks for home care team 2. The task module in PocketDoc 2.0 has an additional feature that the task creator can use to prioritize task.	1. Training for primary care team about how to create a task for home care team 2. Training for home care team about how to complete each task 3. Creation of a policy code about how to prioritize tasks	Task creation

	Primary care team checks and acknowledges each homecare team meeting record	feasible	<p>1. A new feature in the existing team meeting record module of PocketDoc 2.0, where the primary care team can easily check the team meeting record summary by clicking on a check sign</p> <p>2. Primary care has access to completed team meeting record, and can view the summary</p>	<p>1. Training for primary care team about where to check the home care team meeting summary</p>	Team meeting record
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<i>New feature</i>					
	PocketDoc 2.0 has an instant messenger which allows primary care the practitioner nurse to do follow up with the home care nurse	feasible/needs more investigation	<p>1. New module in PocketDoc 2.0 which is an instant messenger</p> <p>2. Primary care and homecare teams both have access to the module and can send an instant message for each other</p>	<p>1. Feasibility of adding this new module should be investigated from a policy point of view</p> <p>2. There should be policy around the use cases of it by each team.</p>	messenger

	Home care team sends an electronic update on Pocket Doc 2.0 about the actions taken by home care team following the primary care update about a clinical report	feasible	<ol style="list-style-type: none"> Care coordinator adds any updates regarding actions taken by home care team following a primary care team request for home care team review in this module. Primary care team has access to view such updates (maybe by accessing the whole module). 	<ol style="list-style-type: none"> Training for care coordinator about when and how to complete this module Training for primary care t about where and how to view such updates 	Direction communication
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	Home care team shares a picture relevant to patient's context with the primary care team, which might help in adding additional information related to the context of the patient in the home environment	feasible	<ol style="list-style-type: none"> A new feature in PocketDoc 2.0 for uploading documents and sharing it with other providers in the circle of care Both primary care and home care teams have access to the uploaded documents, they can share it with each other and add comments. 	<ol style="list-style-type: none"> Training about the use cases of this feature 	document upload
	Home care provider starts a video conference with primary care team while visiting patient in the home	not feasible	<ol style="list-style-type: none"> A new feature in PocketDoc 2.0 for conducting video conference – telehealth Primary care team is notified somehow when a video conference call is requested, and answer the request 	<ol style="list-style-type: none"> Feasibility of adding this new feature must be investigated from the point of view of health care system policy and technology capability development. 	telehealth

<i>Existing or new feature</i>					
	Home care nurse requests a list of medication changes including the reason for changes through PocketDoc 2.0	feasible	1. A new module in Pocket Doc 2.0 for creation of a time sensitive request	1. Training for teams about how to write the request with sufficient explanation 2. Training for teams about how to view the request	request (task) with urgency rating

	Primary care nurse practitioner nurse asks home care providers to do a quick assessment following seeing a new patient's lab report	feasible	1. A new module in PocketDoc 2.0 for the creation of a time sensitive request (maybe same as task with an urgency rating and a push feature). 2. Home care team has access to view the request in a timely manner 3. Mechanism to alert PC that the request has been seen and completed.	1. Training for primary care team about how to write the request with sufficient explanation 2. Training for home care team about how to view the request and respond to it (take an action) in a timely manner 3. Policy around time sensitive requests	request (task) with urgency rating
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	Primary care social worker adds a summary of the patient's visit including concerns about the patient		1. New module in PocketDoc 2.0 for primary care providers to add a summary of their visit and also their concerns about the patient 2. Primary care has access to add info into this section 3. Home care team has access	1. Training for primary care where to add their visits info and what level of info 2. Training for home care about where to find primary care visit's info	primary care update
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		feasible	to view this module		
	Patient's family are able to leave a message on PocketDoc 2.0 for psychologist about patient's mental health state	not feasible	<ol style="list-style-type: none"> 1. Patient's family has access to add a timeline item 2. Primary care team has access to see patient's family's messages (items) 	<ol style="list-style-type: none"> 1. Need to investigate the level of patient and his family's responsibility in inputting data 	messenger

patient safety approach					
Existing feature					
	Primary care nurse practitioner checks the last date of medication update which is done by home care nurse and is recorded in PocketDoc 2.0	feasible	<ol style="list-style-type: none"> 1. Primary care team has access to view the medication review module 	<ol style="list-style-type: none"> 1. Training for primary care team about how to view medication review updates 	medication review
	Primary care practitioner nurse checks home care assessments and scores before changing patient's medication	feasible	<ol style="list-style-type: none"> 1. Primary care team has access to view homecare visit record module of PocketDoc 2.0 which is including assessments and scores 	<ol style="list-style-type: none"> 1. Training for primary care team about how to view assessments 	home care visit record

<i>New feature</i>					
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	Primary care nurse practitioner needs to check the list of patient's medication on the clinic EMR or PocketDoc 2.0	feasible	1. A new module in PocketDoc 2.0 for adding patient's medication list 2. Primary care team has access to view the medication list on PocketDoc 2.0	1. Training for primary care team about where to look for the most up to date patient's medication list	medication list
	List of patient's medications is integrated/updated in the PocketDoc 2.0 while added/changed on the primary care EMR automatically	needs more investigation	1. Medication list is pushed from the clinic's EMR into PocketDoc 2.0 while added/changed on the EMR automatically	1. If list is going to be automatically pulled from clinic's EMR into the PocketDoc 2, the feasibility should be investigated from a technology and policy view	list synchronization with primary care EMR

	Patient's lab values from primary care clinic is added into PocketDoc 2.0	needs more investigation	1. A new module in PocketDoc 2.0 for adding patient's lab values (automatically pulled from clinic's EMR)	1. If it is going to be manually added into PocketDoc 2.0, there should be a policy between primary care and homecare about who takes the responsibility to add to the list into PocketDoc 2.0 and keep it up to date 2. If it is going to be automatically pulled from clinic's EMR and into PocketDoc 2.0 the feasibility (technology and policy) must be investigated	lab values
	Primary care practitioner nurse checks	feasible	1. Primary care team has access to view patient's recent lab	1. Training for primary care team on how to view lab	lab values

	patient's lab values on the PocketDoc 2.0		values in PocketDoc 2.0	report values in PocketDoc 2.0	
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	Home care team shares a picture relevant to patient's context with the primary care team	feasible	<ol style="list-style-type: none"> 1. A new feature in PocketDoc 2.0 for uploading documents with other providers in the circle of care 2. Both primary care and home care team have access to upload documents and share it with each other and add a comment about it 	<ol style="list-style-type: none"> 1. Training about the use cases of this feature 2. Address patient consent and privacy issues around sharing information that are on staff devices after upload 3. Clear policy on what images can and should be taken and by whom for what purpose 	document upload
Existing or new feature					

	Primary care social worker adds a summary of the patient's visit including her concerns about the patient.	feasible	<ol style="list-style-type: none"> 1. A new module in PocketDoc 2.0 for primary care providers to add a summary of their visit and also their concerns about the patient (visit record action item) 2. Primary care has access to add info into this section 3. Home care team has access to view this module or (maybe 	<ol style="list-style-type: none"> 1. Training for primary care where to add their visits info and what type of info to add into PocketDoc 2.0 to share with the circle of care 2. Training for home care about where to find primary care visit's info 	primary care update (or add a new timeline item)
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Access to non-medical information					
Existing feature					
	Primary care team looks at patient's info such as address before conducting a home visit	feasible	1. Primary care has access to view patient information module	1. Training for primary care team about where to find this info	patient information
	Primary care social worker has access to view patient's circle of care info including their phone numbers	feasible	1. Primary care has access to view patient's circle of care such as all providers' phone numbers	1. Training for primary care team about where to find this info	patient's circle of care
Addition to an existing feature					
	Patient's physician name, contact info, and hours of operation are available for home care team in PocketDoc 2.0	feasible	1. New tab added to the existing "Patient's Information" module of PocketDoc 2.0 for adding patient's physician information 2. Care coordinator or primary care team have access to add this information into the PocketDoc 2.0	1. Training for homecare team about where to look for patient's physician information	Patient information
	Patient's pharmacy info is available for home care team In PocketDoc 2.0	feasible	3. New tab added to the existing "Patient's Information" module of PocketDoc 2.0 for adding patient's physician information	1. Training for homecare team about where to look for patient's physician information	Patient information

			4. Care coordinator or primary care team have access to add this information into the PocketDoc 2.0		
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New feature					
	<p>Primary care team searches patient's name in PocketDoc 2.0 to find out if patient's chart exists in the system, and then request access to his chart</p>	<p>feasible/ needs more investi gation</p>	<ol style="list-style-type: none"> 1. A new module in PocketDoc 2.0 called "search" that is accessible by primary care to look for patient's chart 2. Primary care is able to send a request for accessing patient's chart to the patient's care coordinator that can be authenticated 3. Home care coordinator receives notification when access is requested, and is able to confirm or cancel the request 4. If request is confirmed, Pocket Doc 2.0 accounts need to be created for the relevant primary care providers 	<ol style="list-style-type: none"> 1. Feasibility of searching PocketDoc 2.0's database to look for a specific patient's chart needs to be investigated from the privacy point of view 2. Clear policy developed around who will have the responsibility of creating PocketDoc 2.0 accounts for primary care providers (PC or HC) and mechanism for authentication. 3. It should be determined whether it is care coordinator's role to confirm or cancel requests 	<p>patient search function/authentication function</p>

	Primary care team has access to calendar in PocketDoc 2.0, to create a reminder in for themselves to follow up	feasible	<ol style="list-style-type: none"> 1. A new feature available in PocketDoc 2.0 2. Primary care and homecare have access to this feature and they can create reminders in PocketDoc 2.0 for themselves to follow up on a specific date 	<ol style="list-style-type: none"> 1. Training for both primary care and homecare team about how to use this feature 	calendar & reminder
	When primary care team creates a reminder on PocketDoc 2.0 it will be automatically sent to their email or linked to their clinic's EMR	needs more investigation	<ol style="list-style-type: none"> 1. A new feature available in PocketDoc 2.0 2. Primary care has access to this feature and can create reminders in PocketDoc 2.0 to be notified within their clinic's EMR 	<ol style="list-style-type: none"> 1. Feasibility of this feature should be investigated 	calendar & reminder
Facilitation of referral to community services and resources					
Existing feature					
	Primary care social worker is able to add community services and resources	feasible	<ol style="list-style-type: none"> 1. Primary care social worker needs to have access to view and add into the community reintegration plan module in PocketDoc 2.0 	<ol style="list-style-type: none"> 1. Training for primary care team about where to add this info 	community reintegration plan

	Patient's lab values from primary care clinic is added into the PocketDoc 2.0	feasible /needs more investigation	1. A new spot (module) in PocketDoc 2.0 for adding patient's lab values	1. If it is going to be automatically pulled from clinic's EMR into the PocketDoc 2.0, the feasibility (technology and policy) should be investigated	lab values
	When the primary care team creates a reminder on Pocket Doc 2.0 for themselves, it will be sent automatically to their email or linked to their clinic's EMR	needs more investigation	1. A new feature in PocketDoc 2.0 2. Primary care has access to this feature and they can create reminders in PocketDoc 2.0 and be notified within their clinic's EMR	1. Feasibility of this feature should be investigated	calendar & reminder
Clinic EMR as a complementary tool					
	Primary care social worker and psychologist create a message for themselves in the clinic's EMR to check PocketDoc 2.0 to follow up results of actions being taken by home care in response to their requests	feasible		1. Training for primary care team about creating a reminder for themselves to check PocketDoc 2.0 in their clinic EMR	

	When primary care team creates a reminder on PocketDoc 2.0 for themselves, it will be automatically sent to their email or linked to their clinic's EMR	needs more investigation	1. A new feature available in PocketDoc 2.0 2. Primary care has access to this feature and they can create reminders in PocketDoc 2.0 and be notified within their clinic's EMR	1. feasibility of this feature should be investigated	calendar & reminder
implementation considerations					

	PocketDoc 2.0 has an instant messenger which allows primary care NP to do a quick follow up with homecare nurse if she is available	feasible /needs more investigation		1. If adding a messenger functionality is feasible, there must be a policy around the use cases on how/when user may use this new feature.	
	List of patient's medication is available in PocketDoc 2.0	feasible		1. if the list is going to be manually added into the PocketDoc 2.0, there must be an agreed upon policy between primary e and home care about who takes responsibility to add the list into PocketDoc 2.0 and keep it up to date	