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Role of the Physical Environment on Team-Based Primary Care in the Military Health System

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ROLE OF THE PHYSICAL ENVIRONMENT ON TEAM-BASED PRIMARY CARE IN THE MILITARY HEALTH SYSTEM

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ABSTRACT

Primary care in the United States has shifted from a physician-centered care approach to a multidisciplinary, team-based care approach. This shift has resulted in many day-to-day changes in the care delivery process including how clinical staff collaborate; interact with patients; and use space, equipment, and various technologies. Team-based approaches, such as the Patient-Centered Medical Home (PCMH) model, are demonstrating improvements in patient health outcomes. The U.S. Military Health System, one of the largest healthcare organizations in the world, has adopted the PCMH model for primary care clinics. To support this new care model, a team-based clinical module is emerging as a spatial concept that colocates the resources staff need for delivering care. Several different design configurations of team-based clinical modules exist in MHS clinics despite the organization's emphasis on clinic standardization. The purpose of this dissertation is to understand staff perceptions concerning the environmental factors that best support team-based care in the MHS.

Using a qualitative approach and a case study research strategy along with ethnographic data collection techniques, this study investigates how six team-based clinical module configurations in three different clinics influence the delivery of team-based care. Data collection included 58 semi-structured interviews with primary care providers, registered nurses, licensed practical nurses, and specialty care providers. Additionally, 11 hours of observations in team rooms provided insight on how the staff use space. Findings were translated into a set of design recommendations for planning team-based clinical modules aimed at improving staff workflow, functionality, and

workspaces to facilitate both team collaboration and focused work. This study provides initial evidence that can directly support the MHS in updating design guidance criteria to support team-based primary care.

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CHAPTER ONE

INTRODUCTION

The demand for primary care services is amplified due to an aging population, new healthcare reforms, and a critical shortage of primary care physicians. (Cohn & Taylor, 2010; Ward, Schiller, & Goodman, 2014; United States Census Bureau, 2004; Association of American Medical Colleges, 2015). Traditional physician-centric models, centering care delivery on the physician's capabilities, are inadequately delivering care in a new era that appeals to a patient-centered approach for improving health outcomes. Team-based models that leverage the multi-disciplinary medical team approach are addressing the shortage of primary care physicians while delivering better patient outcomes (Rosenthal, 2008). In response, healthcare organizations across the United States are endorsing an established team-based model identified as the Patient-Centered Medical Home (PCMH) (NCQA, 2018). The PCMH model uses a team-based approach lead by physicians to deliver patient care through all stages of life (American College of Physicians, 2011). The PCMH is proving to be successful in delivering better patient outcomes and reducing healthcare spending (Grumbach & Grundy, 2010). In addition, team-based approaches improve working conditions for the clinical staff and can aid in preventing physician burnout (Felton, 1998; Linzer et al., 2009). However, the team-based model is potentially hindered by the physical environment, which was designed for a physician-centric model of care. Therefore, the purpose for this study is to understand the perceptions of clinical staff concerning how the physical environment influences clinic workflow efficiency, functionality for the clinical module, and the ability to perform both collaborative and focused work in team rooms.

Capturing clinical staff opinions and experiences is essential to understand how the physical environment influences team-based care delivery. At the same time, healthcare organizations undervalue the clinical staff perceptions in favor of the patients' views when evaluating patient care delivery and the influences of the physical environment (Leiter, Harvie, Frizzell, 1998; Farley et al., 2014; Petrullo, Lamar, Nwankwo-Otti, Mills, & Viola, 2012; Fenton, Jerant, Bertakis, & Franks, 2012; Zgierska et al., 2014). Few studies obtain the clinical staff perspective for the physical environment, but those studies that incorporate the staff perspective illustrate effective design strategies for primary care settings (Karp et al., 2016; Oandasan et al., 2009; Gunn et al., 2015; DuBose, Lim, Westlake, 2015; Bunniss & Kelly, 2008). Valuing the clinical staff perceptions offers healthcare organization an opportunity to reshape the physical environment to accommodate team-based care activities, which may lead to better health outcomes for patients.

One of the largest healthcare organizations in the United States, the MHS, recently transitioned from a physician-centric to a team-based model in over 400 primary care clinics. The MHS places a high priority on establishing standardize guidelines for healthcare facilities to support clinical staff in delivering patient care (MHS World Class Principles, 2016; Kizer, McGowan, Bowman, 2009). However, newer clinic designs were initially planned using the physician-centric model. During the planning process, the clinics were modified without fully understanding the influence of new team-based staff requirements on the physical environment. Consequently, multiple clinic design variations evolved with limited knowledge on which design strategies support or hinder the delivery of team-based care. At the same time, the MHS still relies on untested design guidance criteria that received few updates in the transformation to a team-based care model in primary care settings. Therefore, the proposed study contributes to filling a void in the current literature while establishing a level of transparency to foster an evidence-based design solution for the MHS to update design guidance criteria. Obtaining the clinical staff opinions facilitates a starting point for the MHS to become a leader for evidence-based practices in designing new primary care environments.

1.1 Problem Statement

The MHS design guidance criteria does not reflect an understanding of team-based care delivery. In fact, the design guidance criteria still reflects care practices where the physician is the main focus of patient care delivery. Clinical staff are still expected to perform at the highest level in physician-centric environments that only support the role of the primary care physician, which is potentially hindering the delivery of team-based care. Lacking evidence from the staff experiences limits the MHS's ability to create optimal physical environments that deliver world-class healthcare.

The team-based clinical module is one of the untested design solutions that exist in multiple variations for primary care clinics in the MHS. Team-based clinical modules are a group of spaces that are dedicated to a care team and usually contain exam rooms, shared workspaces, and storage areas (DuBose, Lim, Westlake, 2015; Whiteaker, 2015; Belknap & Lafferty, 2011; Taylor, Joseph, Keller, Quan, 2011). Care teams consist of registered nurses, licensed practical nurses, and medical assistants led by primary care providers (Saba, Villela, Chen, Hammer, & Bodenheimer, 2012; Grumbach & Bodenheimer, 2004; Wheeler, 2011). Limited studies investigate how the team-based clinical modules facilitate the optimal delivery of patient care (Karp et al., 2016; Freihoefer et al., 2017; Mayne et al., 2014; VA, 2015). Further studies demonstrate that traditional primary care layouts compromise efficient clinic workflow with longer travel distances for the care team, and the ability to conduct both collaborative and focused work effectively (Gunn et al., 2015; Hulshof et al., 2012; Vahdatzad & Griffin, 2016; Swisher & Jacobson, 2002; Norouzzadeh et al., 2015; Farahmand et al., 2011). This means that current physical environments for primary care are focused on the primary care provider role, limiting the potential for the care team to deliver high-quality patient care for the MHS and external healthcare organizations.

1.2 Research Question

New design recommendations for the physical environment that align with team-based care activities require a deeper understanding of staff roles and their activities. A user-centered approach that examines clinical staff roles and activities before evaluating the physical environment offers valuable insights for design recommendations. This study introduces a place-based framework as a theoretical construct that advocates for a user-centered approach (Canter, 1977; Vischer, 2009). The place-based framework promotes examining staff roles and their associated activities first to understand user requirements for the physical environment. Then with the evidence collected from the users an evaluation of the physical environment can be undertaken. Therefore, the framework influences the development of research questions and the design for this qualitative research study.

Studying a single healthcare organization, such as the MHS, reduces the variances of examining team-based activities across multiple healthcare organizations. Additionally, for career advancements clinical staff in the MHS routinely rotate from one primary care clinic to the next. Due to the constant rotation of clinical staff the MHS aims to standardize primary care clinic designs. The ongoing staff rotations that occur in various primary care clinics provide multiple experiences to develop opinions in evaluating the physical environment's ability to best aid in patient care deliver. This study prioritizes the point of view of staff in providing direction on how to design team-based clinical modules that support the clinical team. Therefore, a two-phase study is crafted to understand clinical staff roles, team-based activities, and perceptions for evaluating the primary care environments.

The first phase of the study addresses the following research question through a qualitative approach single case study for an MHS primary care clinic:

1. What are the clinical staff roles and activities for delivering care in a team-based clinical module?
    a. Who is on the clinical team and what role do they play in delivering care?
    b. What are the clinical activities performed by staff in the clinical module and how often do they occur?
    c. Where do the activities occur in the clinical module?

The clinical staff perceptions of their roles and activities in team-based care models lacks documentation. Due to the gap in the literature, this first phase needed to occur. Developing a broader understanding of what each staff role is responsible for within a clinical core team sheds light on how the physical environment can best support patient care delivery. Identifying clinical staff activities and where the activities take place provides valuable insights for interpreting staff opinions for the second phase of this study.

The second phase of the study addresses the following research question through a qualitative approach using multiple case study of MHS primary care clinics:

1. How does the design of the team-based clinical module support or hinder the delivery of team-based care?
    a. How are primary care environments planned and designed in the Military Health System (MHS) to support team-based care?
    b. What are the strengths and weaknesses of three different team-based clinical module configurations for delivery team-based primary care?
    c. How could the team-based clinical module improve to support future needs for team-based care?
    d. How is the team room used and what are the environmental requirements with regard to the room?

Building on the first phase data, the second phase describes staff perceptions in evaluating the three levels of the physical environment: 1. overall clinic, 2. team-based clinical module, 3. team rooms. The three levels are directly interwoven, with each influencing how the clinical staff delivers team-based care. Staff experiences at the clinic level allow for an understanding of what rooms can be located outside the clinical module and shared across all care teams. At the second level, staff provide their perspective of the clinical modules that support or hinder team-based care delivery. Finally, staff opinions at the room level, particularly the team room, illustrate how work areas support collaborative and focused work. Combining staff opinions at these three levels helps to seek a functional layout that accommodates the patient care delivery process for all clinical staff activities.

Future planning and design recommendations that recognize staff roles, activities, and perceptions of the physical environment are vital for enhancing patient care. The study translates staff perceptions into practical guidance, addressing four design-related considerations for developing future primary care clinics:

1. Types of most frequently used rooms outside the team-based clinical modules and locations of the rooms in the clinic.
2. Types of rooms most essential for delivering patien care in the team-based clinical module.
3. Optimal size and configuration of a team-based clinical module.
4. Layout and size of staff work areas that support both collaborative and focused work.

The four design considerations will yield recommendations based on research findings.

1.3 Study Framework

A framework is integrated in this study to link clinic design factors with desired outcomes related to team-based care environments (Battisto & Franqui, 2013). The framework is a tool which identifies performance-based measures used to access the strengths and weakness of primary care physical environments. Desired outcomes linked to the physical environment are studied using qualitative and quantitative data. For example, layout of spaces inside the clinical module (design factors) to create efficient clinic workflow (goal/objective) are measured through staff opinions on travel distances and travel distances calculated from floor plans. This approach triangulates data sources to foster reliable design recommendations rooted in both qualitative and quantitative evidence.

Academics and design professionals agree that that the physical environment influences the effectiveness for delivering patient care (Devlin & Arneill, 2003; Ulrich et al., 2004; Ulrich et al., 2009). Three outcomes linked to the delivery of team-based care in clinics emerged: (a) efficient clinic workflow, (b) functionality of the clinical module, and (c) balancing collaborative and focused work in team room. The first outcome, an efficient clinic workflow, is concerned with minimizing staff travel distances and unnecessary efforts to delivery patient care (Thompson & Pelletier, 1959; Freihoefer et al., 2017). Achieving an efficient workflow in the clinic occurs in the physical environment through three design considerations: (a) proximity between support rooms and patient care areas, (b) layout of spaces in the clinical module, and (c) sharing corridors with patients. The second outcome, the functionality of the clinical module pertains to how well programmatic elements such as the size of rooms, location of rooms, and overall allocation of square footage supports the delivery of patient care (Preiser & Vischer, 2005). Three design considerations influence the functionality of the clinical modules with (a) types of rooms in a clinical module, (b) sizes for rooms, and (c) the layout of the rooms to create a team-based clinical module. The last outcome addresses how collaboration and focused work in the team room provide opportunities for clinical staff to work as individuals or as team without distractions and interruptions (Gunn et al., 2015). Two design concepts foster the ability to provide team room collaboration and focused workspace: (a) space for private work, and (b) space for collaborative work. These three outcomes, outlined above, establish a framework to measure the effectiveness of different design considerations to achieve design concepts for team-based care environments.

1.4 Significance of the Study

The study adds a qualitative methodology that evaluates how the physical environment influences team-based primary care environments to provide practical design recommendations for the MHS. Implementing the evidence collected from this study can shape future design guidance criteria, while establishing a database for referencing past project experience. The study links original planning and design intentions to post-occupancy staff experiences to understand how design expectations are fulfilled in practice, unforeseen consequences of design intentions, and insights for future design-making decisions. Collectively, the evidence provides for a greater level of understanding of how the physical environment influences user's activities for accomplishing task-related objectives.

In the MHS, studying the effects of transitioning to a team-based care model captures original design intentions, design modifications, and staff experiences in the physical environment. Detailing the workflow patterns and team-based care activities offers a level of transparency in developing new solutions that enhance rather than not hinder patient care delivery. Conducting post-occupancy evaluations on healthcare facilities that align with the MHS strategies produces evidence-based design solutions. The evidence-based design solutions then directly inform design guidance criteria that establish standardized solutions that support effective patient care delivery.

The study sets the stage for debates on theoretical and research approaches that evaluate the physical environment. Identifying the clinical staff roles, activities, and physical environment perceptions argue for a user-centered framework to study architecture. Ethnographic data collection methods that gain the user perception of how the physical environment influences day-to-day activities is an invaluable resource for design-related research studies. The qualitative approach contributes to providing a deeper level of understanding of the physical environment. Qualitative studies continuously replicated through identical outcomes and measures can lead to the discovery of new design recommendations that enhance team-based care environment.

1.5 Organization of Chapters

The ten chapters are organized in two parts that include (a) what is currently known for team-based care environments, and (b) evaluation and design recommendations for team-based care physical environments. Part one includes the first four chapters that introduce the study, provides a literature review of the state of current knowledge regarding team-based care environments, and illustrates the first phase of the study that establishes staff roles and activities in a PCMH clinic for the MHS. Part two starts with the research methods for the study, followed by the findings of three cases, and finishes with a cross-case analysis to propose design recommendations for future primary care clinics in the MHS. The final chapter discusses the major findings from the study, studies implications, limitations of the study, and potential future studies for primary care clinics.

Part one starts with the first chapter by introducing the study, examining the research problem, and defining the objectives of the study. Chapter two, the literature review, shows what is currently known about delivering team-based care and how the physical environment is shaped to support the model. In addition, the chapter shows that limited studies examine how the physical environment influences the delivery of team-based care in both older and newer primary care clinics. Chapter three identifies why the MHS is an ideal case to study team-based care environments in primary care settings. The final chapter, presents the first phase of the study by showing clinical staff roles and team-based care activities in relationship to the physical environment.

Part two includes the research design and methodology, findings from the three cases, and a cross-case analysis to establish design recommendations for future primary care clinics in the MHS. Chapter five covers the research design and methodology for the study's second phase. Chapter's six to eight show the findings from the three cases in evaluating the physical environment’s ability to enhance or hinder team-based care delivery. Chapter nine presents the cross-case synthesis and design recommendations based on the findings from the three cases. In chapter ten, the conclusions discusses how the research questions were addressed, major findings, and proposes future studies that advocate for a user-centered approach to evaluate primary care environments.

CHAPTER TWO

LITERATURE REVIEW

The current literature for the delivery of primary care and its relationship to the physical environment plays a critical role for completing this study. Since the delivery model for primary care is important to understand the role of the physical environment, it is important to understand the evolution of primary care. Furthermore, emerging research on primary care environments offers insights for evaluating the design of the physical environment. Linking the activities of team-based care to the design of the physical environment provides an initial step for developing a user-centered approach for this study.

The chapter is divided into five sections that explore current scholarship about primary care, the delivery of team-based care, and how the physical environment is shaped to support the model of care. Section 2.1 establishes the historical evolution of primary care by describing the early influences of primary care and traditional physician-centric clinic design. Section 2.2 examines the primary care staffing crisis and how the quadruple-aim strategy offers a solution to the crisis. Section 2.3 introduces the adoption of team-based care and how new patient care activities are changing patient care delivery. Section 2.4 examines new design approaches for the physical environment that support team-based care activities. Section 2.5 analyzes the existing literature on primary care clinics to identify the gap in understanding how the physical environment influences staff experiences in delivering team-based care. Additionally, this section identifies the three goals/objectives critical towards evaluating primary care settings that utilize a team-based approach for patient care. Section 2.6 summarizes the evidence from the literature to illustrate the influence on the study.

2.1 Historical Evolution of Primary Care

Primary care is indispensable for delivering healthcare in the United States and throughout the World. The role of primary care functions in two approaches for patient care. First, primary care acts as a gateway into the larger healthcare system, offering patients a first point of contact for healthcare (Academy of American Family Physicians, 2018). Second, primary care offers a healthcare delivery method to improve public health for underserved populations (Geiger, H.J., 1993). Therefore, primary care offers medical services that include "health promotion, diagnosis and treatment of acute and chronic illnesses, and chronic disease management" (Academy of American Family Physicians, 2018, Pg. 1). Healthcare professionals who offer primary care include primary care providers, registered nurses, licensed practical nurses, and medical assistants who are specialized in family medicine, pediatrics, or internal medicine (Academy of American Family Physicians, 2018).

The formalization of primary care began fewer than 100 years ago in the United Kingdom. Justification for creating primary care services was introduced in 1920 through the Dawson Report (Consultative Council on Medical and Allied Services, 1920). Lord Bertrand Dawson headed a national committee that published a report advocating for a paradigm shift away from the specialization of acute-care health centers to a general medical service (Frenk, 2009; Phillips & Bazemore, 2010). The Dawson Report claimed that the existing healthcare delivery model only provided reactive specialized acute healthcare to a narrow population and undervalued proactive healthcare for the general population. As a result, the Dawson Report recommended the separation of specialty acute-healthcare centers and general medical services, establishing primary care.

Furthermore, the report outlined a new physical environment to house the proactive general medical services, called community healthcare centers (Consultative Council on Medical and Allied Services, 1920). The new community healthcare centers were to house “operating rooms, beds, radiography, laboratory, and dispensing facilities, massage, and physical culture services” (Lewis & Brookes, 1983, Pg. 156). The report established a radical new approach for delivering patient care, which received little traction for practical application at the time (Valins, 1993). However, the concepts from the Dawson Report laid the foundation for primary care delivery and the establishment for primary care physical environments.

After nearly 15 years from the publication of the Dawson Report, a new community health center was created to promote primary care services. The Pioneer Health Center, commonly referred to as the Peckham Health Center, was created in 1935 by Dr. George Scott Williamson and his wife, Dr. Pearse (Gruffudd, 2001). Dr. Williamson and Dr. Pearse established the health center to study what constituted a healthy individual, especially in relationship to family health (Lewis & Brookes, 1983). Therefore, the Pioneer Health Center was a hybrid recreation and medical facility that included a gymnasium, swimming pool, café, consult rooms, and radiographic and laboratory services (Yellowless, 1950; Valins, 1993).

The staff modeling for the Pioneer Health Center represented a team-based approach. Physicians were grouped into teams of six to deliver efficient patient care and pool available knowledge (Lewis & Brookes, 1983). The physician teams covered a specific geographic population of families that corresponded to a 25 to 50 mile radius from the health center (Lewis & Brookes, 1983). Furthermore, physician teams created a system of checking treatment plans and patient diagnosis to enhance patient care. Therefore, the Pioneer Health Center represents the birth of a physical environment for primary care and a team-based care approach.

The creators of the Pioneer Health Center believed that physicians in primary care needed to control all aspects of the patient's health, and not just act as a gateway into specialty acute-health centers (Lewis & Brookes, 1983). This belief created a distinct difference from the Dawson Report, and received criticism from the medical community. Critics of the new health center labeled the delivery model as merely "sociological activities", which lead to a lack of funding and closure of the health center in 1950 (Hubble, 1949; Williamson, 1952).

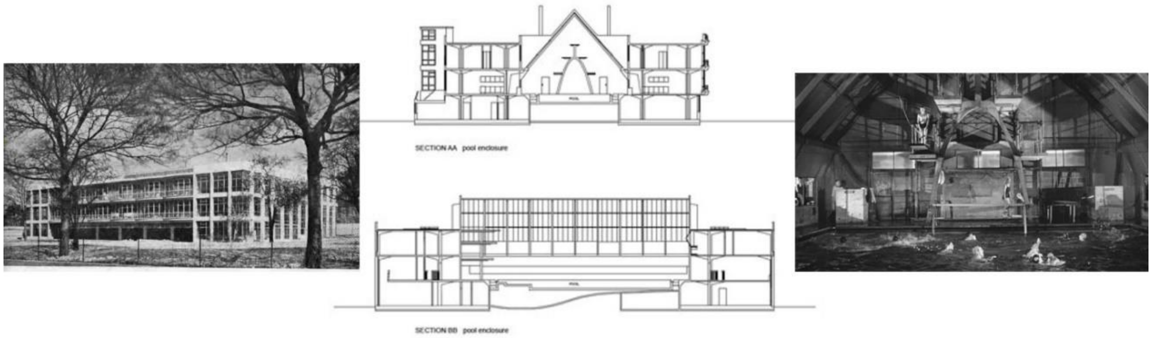


Figure 2.1: Pioneer Health Center (Sources: Sochealth.co.uk, 2018; Ivan Ovversteeg Architecture, 2018; Getty Images, 2018)

The next version of a health center occurred three years after the Pioneer Health Center and aligned strategically with the Dawson Report. In 1938, the Finsbury Health Center, located in a suburb of London, opened the doors to provide primary care services that ranged from outpatient surgeries to recreational rooms (Valins, 1993). The Finsbury Health Center established one of the first polyclinics “that housed tuberculosis clinic, public health laboratory, cleansing and disinfection station, mortuary, and offices for health visitors and sanitary inspectors” (Lewis & Brookes, 1983, Pg 159).

Architecturally, the Finsbury Health Center was a modern clinic design that fostered abundant sunlight and fresh air to promote a healing environment compared to the industrialized landscape of London (Gruffudd, 2001). The clinic design focused on incorporating abundant daylight by facing the building to the south and integrating windows throughout the clinic (as illustrated in Figure 2.1). The physical environment and the primary care services garnered the Finsbury Health Center popularity, unlike the Pioneer Health Center. Additionally, the Health Center performed as a gateway for patients to transition to specialty acute-care health centers. As a result, the Finsbury Health Center aligned strategically with concepts published in the Dawson Report. This established a physical environment separate from inpatient hospitals for delivering patient care.

Figure 2.2: Finsbury Health Center (Sources: Wikiarquitectura, 2018; Municipal Dreams in Healthcare, 2018; Municipal Dreams in Healthcare, 2018)

The ability to deliver preventive healthcare to under-served populations gained traction outside of the United Kingdom. One country that launched a preventive health campaign was South Africa. In 1940, a pilot primary care clinic was established in the Drakensberg Mountains of South Africa, which was led by Dr. S. Kirk and Dr. E. Kark (Kark & Kark, 1999). The Pholela Health Center was a basic building located in the rural countryside, which provided primary care services that included “physiology, infectious diseases, hygiene and health promotion, and nutrition.” (Yack & Tollman, 1993, Pg.1044).

The new healthcare center incorporated a team-based approach different from the Pioneer Health Center. The Pholela Health Center created a team for patient care lead by two physicians that worked alongside a local medical aide and a nurse (Yack & Tollman, 1993). Later, more nurses and local medical aides joined the team enhancing the delivery of patient care. The pilot program was labeled a success and resulted in 40 additional clinics that modeled the physical environment and team-based approach. The health care center movement was halted by the Apartheid of South Africa, which forced the creators of the team-based approach to leave the country. As a result, Dr. S. and E. Kark took their successful health centers and team-based approach to Israel (Yack & Tollman, 1993). This relocation fostered the spread of health centers to other countries in the world.

Figure 2.3: Pholela Health Center and Early Version of Team Huddle (Sources: Primary Care Development Corporation, 2017; National Institute of Health, 2018)

Interestingly, an American medical student spent his final year of medical school at the Pholela Health Center. In 1957, Jack Geiger a medical student from Case Western University, sent a letter to Dr. Sidney Kark asking to spend a year working in his health center. The request was granted, and the following year Jack Geiger returned to the United States with a understanding of delivering team-based primary care. Furthermore, the physical environment of the Pholela Health Center that housed multiple medical services influenced future development of community-based clinics in the United States.

The early development of the health care centers in the United Kingdom and South Africa inspired future primary care clinic designs. However, the Pholela Health

Center created a global movement for establishing primary care health centers in the 20th century (Geiger, 1993). This movement resulted in clinics located within communities to deliver primary care services. As a result, the physical environment was simplistic and emphasized preventive patient care. The exploration of how the physical environment influenced patient care was left unaddressed in these community clinics.

2.1A Primary Care Takes Shape in the United States

Following World War II, the United States experienced a critical crisis for access to healthcare. Healthcare outside urban environments was limited, leaving a gap for delivering care to the growing population of the United States (Verderber & Fine, 2000). Therefore, the Federal Government established two types of grants to aid in the construction of new healthcare centers. The two grants were the Hill-Burton Act of 1946 and the Economic Opportunity Act of 1964. The federal grants directly shaped the development of primary care environments in the United States.

First, the Hill-Burton Act of 1946 funded more than $3.7 billion during a 24 year period for building new healthcare centers throughout the United States (Cark, Field, Koontz, Koontz, 1980). The new healthcare centers were representative of traditional hospitals that housed both inpatient and outpatient medical services, which included primary care (Whiteaker, 2015). The Hill-Burton Act also funded additions and renovations to existing inpatient hospitals, establishing new outpatient wings that supported primary care. At the same time, healthcare organizations in the same geographical area began to merge, creating opportunities to transform inpatient hospitals into outpatient health centers. The new outpatient health centers birthed the movement for Medical Office Buildings (MOBs), which housed primary care services separate from inpatient hospitals (Whiteaker, 2015).

Second, the Economic Opportunity Act of 1964 funded the first two community health centers in the United States (Longlett, Kruse, Wesley, 2001). Dr. Jack Geiger and Dr. Count Gibson were responsible for establishing the model of care for the Columbia Point and Mound Bayou Health Centers. Since Dr. Jack Geiger had previous experience at the Pholela Health Center he created a similar staff structure, medical services, and physical environment. This meant that the location of the clinic in the community was prioritized over the design of the physical environment. For example, the Columbia Point Health Center was located in a renovated housing building in Dorchester, Massachusetts (Rodriguez-Robbins, N.D.). Meanwhile, the Mound Bayou Health Center was a new construction project that established a one-story health center (Geiger, 1966).

The two health centers were supported by a team of healthcare professionals that included internists, pediatricians, community health nurses, social workers, health educators, physical therapists, laboratory technicians, and pharmacists (Geiger, 1966). Additionally, the health centers offered space for exam/consult rooms, an emergency room, a laboratory, pharmacy, and x-ray (Geiger, 1966). This highlights the origins of primary care community- based clinics and team-based care approach. The later success of the two health centers facilitated a movement for building community-based primary care clinics across the country. This resulted in the establishment of a third type of primary care environment labeled as a community-based clinic.

The physical environment for the three primary care typologies, regardless of the model of care, supported a physician-centric design (Figure 2.4). The physician-centric design was organized around the physician requiring supporting clinical staff to produce inefficient workflow for patient care. The physicians were allocated private offices that are located in between two exam rooms, creating shorter travel distances for patient care (Nyberg, 2015). At the same time, physician offices located adjacent to exam rooms breached staff privacy, allowing patients to overhear confidential conversations (Vickery, 2012). The remaining staff were located in shared offices or nursing stations located in the back of the clinic. Furthermore, supply rooms were decentralized in the physical environment, requiring staff to travel inefficient distances to support physicians in delivering patient care (Nyberg, 2015). As a result, the separation of staff into different rooms fostered hierarchical a staffing model in which physicians are at the top.

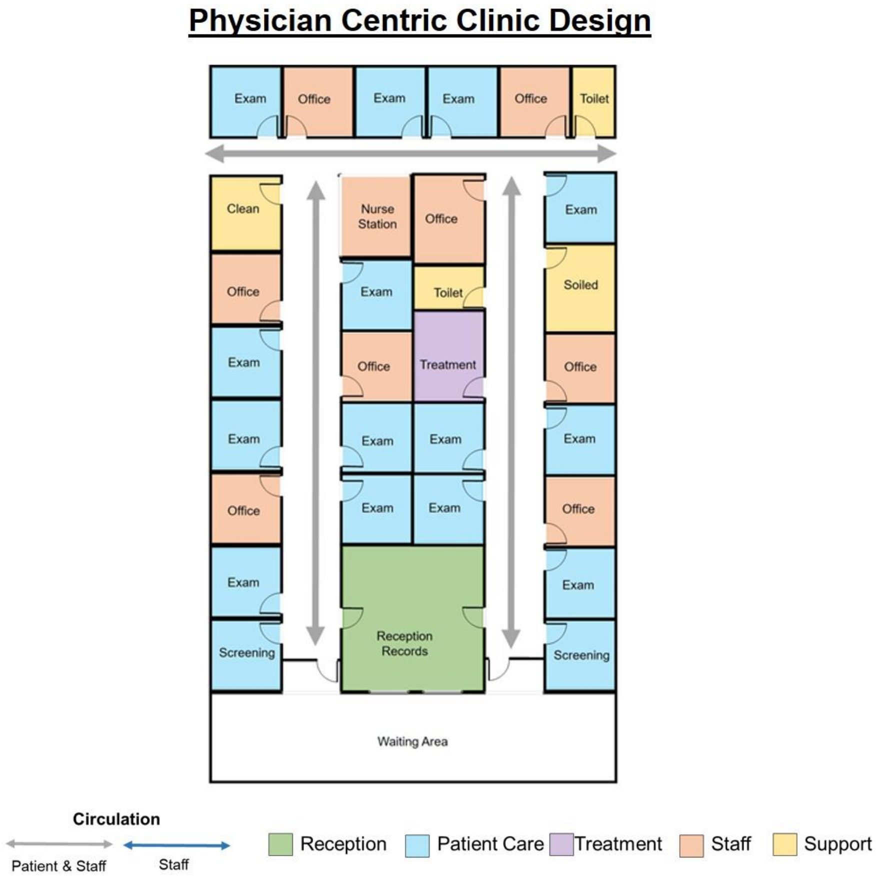


Figure 2.4: Physician Centric Clinic Design

The hierarchical staffing model facilitated physicians working in individual silo's absent of team members, which departed from the earlier models of team-based care demonstrated at the Pholela and Peckham Health Centers. Additionally, the hierarchical staffing model contributed to the primary care physician controlling all of the activities for patient care delivery. This led primary care physicians to become burned out with delivering patient care, which resulted in a critical staffing crisis for physicians.

2.2 Physician Staffing Crisis for Primary Care

The expansion of new healthcare facilities and implantation of socialized medical care in 1965 presented the initial signs of a staffing crisis. The Social Security Amendment of 1965 formalized Medicaid and Medicare healthcare reimbursement policies that increased access to primary care for under-served populations. As a result, the increased access to primary care services presented a gap in availability of physicians to provide the services. The emerging staffing crisis was identified in two reports in 1966 that articulated the future crisis and potential solutions.

First, Dr. J.S. Millis, the President of Case Western University, the same school Dr. Jack Geiger attended, was the head of the Citizens' Commission on Graduate Medical Education (Millis, 1966). The Citizens Commission produced a report that emphasized two main concepts to support the delivery of primary care in the new era of healthcare. The first concept advocated that for healthcare to be successful in the United States every individual needed a primary care physician. Therefore, the second concept recommended a medical education system that produced more primary care physicians to support demands of primary care.

Second, Dr. William R. Willard, founding Dean of the University of Alabama College of Community Health Sciences, headed a committee commissioned by the American Medical Association's Council on Medical Education (Willard, 1966). The committee was charged with predicting future demands for delivering healthcare and determining how to adjust the medical education system. Findings from the report argued that the medical system focused on specialty acute-care services, and lacked education for family medicine. As a result, the report established the foundation of a family medicine specialization to deliver primary care services.

Findings from the two reports pointed out the impact of the physician shortage on the United States healthcare system. Furthermore, the reports provided the foundation for formalizing medical education systems to address physician shortages in primary care. However, the reports advocated for more physicians as a single source for improving the delivery of primary care. This propagated a physician-centric model of care, which places the burden of delivering effective patient care on the physician.

2.2A Primary Care Physician Crisis for the 21st Century

Primary care in 21st Century is experiencing the issues identified in the Millis and Willard Reports. A shortage of primary care physicians and increased demand for primary care services is a sweeping challenge for the current healthcare system. Shortages for primary care physicians are expected to range from 12,000 to 35,000, largely due to increased demand for primary care (Association of American Medical Colleges, 2015). The increased demand is due to one in four adults with two or more chronic health conditions needing primary care services (Ward, Schiller, & Goodman, 2014). Additionally, 10,000 adults turn 65 every day, which account for 80% of patients with one or more chronic disease conditions (Cohn & Taylor, 2010). Experts predict that by 2030, the population of adults 65 and older is expected to account for one in every five United States citizens, which contributes to more patients with chronic disease conditions (United States Census Bureau, 2004; Cohn & Taylor, 2010). As a result, the increasing population of patients with chronic diseases is influencing primary care physician stress levels, morale, and degree of satisfaction.

The dissatisfaction among primary care physicians is credited to inadequate pay rates, long work hours, and responsibility for administrative services. The pay rate for a 30-minute appointment with a specialty acute-care physician pays triple the amount of the same appointment length with a primary care physician (Bodenheimer, 2006). Therefore, the gap in pay is a leading factor for a majority of United States medical graduates to prefer careers in lucrative specialty acute-care fields (Bodenheimer, 2006). The administrative work for physicians to support patient care requires two additional hours for every one hour of direct patient care (Sinsky et al., 2013). Consequently, primary care physicians need to work 21.7 hours per day to manage a panel of 2,500 patients (Yarnall et al., 2009). The working conditions for primary care physicians puts immense burden on the profession in delivering patient care.

Primary care physicians are required to provide more services with less time, leading to staff burn out and occupational stress. Primary care physicians cite stressful work environments as a leading cause for staff burn out (Shanafelt et al., 2015). Stressful work environments are caused by the limited 13-16 minute medical appointment duration to address multiple patient healthcare concerns (Beeasely et al., 2004; Pecham, 2016). Interactions with electronic health records during a medical appointment leaves less time to address the multiple patient health concerns (Asan & Montague, 2012). Mounting pressure to accommodate all the demands for a typical patient encounter are causing dissatisfaction, occupational stress, and physician shortages (Linzer et al., 2009). As a result, 81% of primary care physicians describe their working conditions at full capacity or overextended (The Physician Foundation, 2016). An alarming 68% of primary care physicians would choose alternative medical careers if they started over again (Peckham, 2016). Primary care is experiencing an all-time high for physician dissatisfaction, volume workloads, and physician shortages in the United States.

2.2B Quadruple Aim Addresses Staffing Shortages

At the end of the 20th Century the United States Institute of Medicine (IOM) examined the delivery of healthcare in the United States. The IOM launched a series of reviews to understand the potential shortfalls of the healthcare system in the United States. In 1996, the IOM published *Primary Care: America's Health in a New Era* as a first step towards transforming the nation's healthcare system (Donaldson, Yordy, Lohr, & Vanselow, 1996). The publication revised an earlier 1978 definition to "Primary care is the provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing a sustained partnership with patients, and practicing in the context of family and community" (Donaldson, Yordy, Lohr, & Vanselow, 1996, Pg. 31). This significant publication articulates the valuable role of primary care as the foundation for delivering effective healthcare in the United States.

In 2000, the IOM published *To Err is Human: Building a Safer Health System*, which estimated that thousands of patients die in hospitals due to medical errors (Donaldson, Corrigan, Kohn, 2000). This publication claimed that the medical errors were rarely directly caused by clinical staff, but were due to the existing focus on reactive acute-care treatment strategies. The findings from the publication called for a transformation in healthcare instead of punishing clinical staff working in the existing healthcare system.

The following year, the IOM published *Crossing the Quality Chasm: A New Health System for the 21st Century* (Institute of Medicine, 2001). This publication the IOM articulates that physicians are overburdened with technology, new medications, and increasing patient populations with chronic diseases. Therefore, the IOM advocates for a focus on delivering effective primary care through a team-based approach. This publication is one of the first to advocate for the entire nation, not just healthcare organizations, to switch the model of care to improve healthcare delivery.

In the following years, the United States healthcare system was dealt an additional blow of negative criticism. The Commonwealth Fund Commission on High Performance Health Systems ranked seven countries' healthcare systems based on five metrics that included (a) healthcare expenses, (b) access to care, (c) patient safety, (d) coordination for care, and (e) equity (Schoenbaum, Doty, Schoen, Audet, Davis, 2004). The seven countries included Australia, Canada, Germany, Netherlands, New Zealand, United Kingdom, and the United States. The United States ranked last due to the most expensive health system, inadequate access to care, low patient safety scores, the lack of coordination for care, and equity. Furthermore, the study was replicated in 2006 and 2007 producing the same ranking from the first publication (Davis, Schoen, Schoenbaum, Audet, Doty, Holmgren, Kriss, 2006; Davis, Schoen, Schoenbaum, Doty, Holmgren, Kriss, Shea, 2007). Accordingly, the original IOM publications were validated with the results of these studies, which lead to a transformation for patient care.

The ‘Triple-Aim’ business strategy is proposed to improve the performance of healthcare in the United States. The development of the ‘Triple-Aim’ was a direct response from the low rankings published in the Commonwealth Fund Commission (Cantor et al., 2007). ‘Triple-Aim’ business strategy advocates for healthcare systems to improve the quality of patient care through three strategies: enhancing patient experiences, improving population health, and reducing healthcare costs (Berwick, Nola, & Whittington, 2008).

First, enhancing the patient experience caused healthcare organizations to focus on decreasing waiting times, providing clean environments, and reducing noise levels in healthcare environments (Ulrich, Zimring, Zhu, DuBose, Seo, Choi, & Joseph (2008); Zimring, Joseph, Choudhary, 2004; Delvin & Arneill, 2003). Second, improving population health lead to healthcare organizations building a continuous relationship with patients, along with offering care in proximity to the patients through retail and community-based clinics (Cabana & Jee, 2004; Kripalani, LeFevre, Phillips, Williams, Bassaviah, Baker, 2007; Buzza, Ono, Turvey, Wittrock, Noble, Reddy, Resinger, 2011; Guagilardo, 2004) Finally, reducing healthcare costs required healthcare systems to restructure payment systems to advocate for preventive healthcare measures (de Brantes, Rosenthal, Painter, 2009; Cebul, Rebitzer, Taylor, Votruba, 2008). However, the ‘Triple-Aim’ and IOM publications lacked emphasis on obtaining clinical staff perspective for achieving better patient care delivery.

The lack of staff perceptions created an uphill battle to achieve the strategies outlined in the ‘Triple-Aim’. Furthermore, satisfaction ratings for primary care physicians were associated with lower patient satisfaction, reduced health outcomes, and increased costs. Additionally, primary care physician burnout is associated with increased costs due to over-utilized medical resources for patient care (Kushnir et al., 2013; Sirovich, Woloshing, & Schwartz, 2011). As a result, physicians who report dissatisfaction are more likely to prescribe wrong medications, causing expensive complications for patient care (Williams et al., 2013). As a result, physician dissatisfaction leads to reduced adherence for patient treatment plans resulting in negative health outcomes (DiMatteo et al., 1993). Therefore, lower patient satisfaction scores are correlated to lower physician satisfaction scores (Linzer et al., 2017; McHugh, Kutney-Lee, Cimiotti, Sloane, & Aiken, 2011; Whitebird et al., 2017). This means that lacking the staff experiences for improving patient care, undermines the strategies outlined in the ‘Triple-Aim’.

The ‘Quadruple-Aim’ is then introduced to fill the void of rising concerns for clinical staff shortages, dissatisfaction, and burnout. The ‘Quadruple-Aim’ builds on the previous ‘Triple-Aim’ by adding a fourth business strategy that focuses on improving the clinical staff experience in delivering patient care (Bodenheimer and Sinsky, 2014). Bodenheimer and Sinsky (2014) analyzed the emerging literature and found that low clinical staff satisfaction undermined the ability to achieve the ‘Triple-Aim’ business strategies. For example, dissatisfied clinical staff are two to three times more likely to leave the health organization (Coomber & Barriball, 2007; Aiken, Clarke, Sloane, Sochalski, Silber, 2002). Furthermore, this creates a staffing shortage for the healthcare organization that they leave, while at the same time increasing the patient workload for the remaining clinical staff causing higher-burnout rates. Therefore, improving the working conditions for clinical staff provides an opportunity to improve clinical staff satisfaction ratings for patient care.

Figure 2.5: Quadruple-Aim

The ‘Quadruple-Aim’ offers a solution for improving clinical staff satisfaction levels through a team-based approach for patient care. Team-based approaches improve working conditions for clinical staff, which increases clinical staff satisfaction levels (Bodenheimer & Sinsky, 2014). For example, a study in Spain of 53 primary care clinics found that a team-based approach for patient care improved staff satisfaction, patient satisfaction, and efficiency for delivering care (Goni, 1999). Similarly, a study in the United Kingdom examined 42 primary care clinics that incorporated a team-based approach, which resulted in high levels of staff innovation and effectiveness for delivering patient care (Bower, Campell, Bojike, Sibbald, 2003). Furthermore, primary care physicians who work in tight-knit team atmospheres lead to less exhaustion for delivering patient care (Willard-Grace et al., 2014). The main success of the team-based approach for patient care is credited with staff sharing responsibility for patient care and allowing non-physicians to work at the highest level of their professional licensure (Sevin, Moore, Shepherd, Jacobs, 2009). Therefore, a team-based approach for primary care is effective for improving clinical staff satisfaction and achieving the 'Quadruple-Aim' objectives.

2.3 Adoption of Team-Based Care Model

The historical evolution of team-based care in the United States is parallel to the construction of new healthcare facilities. Team-based approaches for primary care started developing in the 1950s, which fits into the timeline for the Hill-Burton Act of 1946 (Wise, Bechard, Rubin, Kyte, 1974; Lashof, 1968). Furthermore, community healthcare centers were strong proponents for the development of team-based care models in the 1960s, corresponding to the Economic Opportunity Act of 1964 (Lashof, 1968; Wise, 1972). One specific team-based model that emerged from the community healthcare centers was the Patient-Centered Medical Home (National Center for Medical Home Implementation & American Academy of Pediatrics, 2017).

In 1967, the Patient-Centered Medical Home (PCMH) was proposed to address shortfalls by advocating for a team-based approach for delivering effective primary care. The PCMH uses a family centered, physician-led team-based approach that should "be community based (geographically and financially assessable and available); offer continuity, comprehensive, and coordinated care; and use the resources of related services in the neighborhood" (Sia et al., 2004, Pg. 1474). A team-based approach is defined as "the provision of health services to individuals, families, and/or their communities by at least two health providers who work collaboratively with patients and their caregivers-to the extent preferred by each patient-to accomplish shared goals within and across settings to achieve coordinated, high-quality care" (Nayor et al., 2010 ; Mitchell et al., 2012, Pg. 5). Therefore, the PCMH team-based approach resembles earlier models of primary care demonstrated in the Pholela, Columbia Point, and Mound Bayou Health Centers (Northwest Regional Primary Care Association, 2015). This means that the PCMH team-based model is a descendent of earlier community-based health centers.

Early PCMH models centrally focused on the delivery of care for pediatric patients. The first PCMH model was adopted by the state of Hawaii in 1979 for community-level pediatric clinics, which addressed a growing concern for Hawaii with continuity of care for pediatric patients (Sia et al., 2004). The success of the PCMH model in Hawaii led to the first medical home conference in 1989, which was sponsored by the American Academy of Pediatrics (AAP) (Sia et al., 2004). After the first conference, training programs for the team-based model of care started emerging from Florida to Washington (Sia et al., 2004). In the following years, the AAP formally updated the definition for a medical home and established standardized criteria to achieve medical home status (American Academy of Pediatrics, 2017; Klund, 2015). As a result, the PCMH model gained positive traction in the United States medical community for enhancing pediatric patient care delivery.

The popularity of the PCMH model for pediatric patient care transitioned to encompass adult patients. In 2005, the American College of Physicians (ACP) develop the "Advanced Medical Home" for adult and pediatric patients (American College of Physicians, 2005). Furthermore, the Patient-Centered Primary Care Collaborative organization was established in 2006, with the sole objective of promoting the PCMH model for primary care clinics (Patient-Centered Primary Care Collaborative, 2018; Klund, 2015). In the same year, The American Academy of Family Physicians (AAFP) conducted a National Demonstration Project (NDP) to validate the PCMH model for adult patient care (Crabtree, Nutting, Miller, Stange, Stewart, Jaen, 2010). All of these events resulted in the publication of the Joint Principles of the PCMH endorsed by the AAFP, AAP, ACP, and the American Osteopathic Association (AOA) in 2007. The Joint Principles establish seven characteristics of a PCMH model that include (a) personal physician, (b) physician directed medical practice, (c) whole person orientation, (d) coordinated care, (e) quality and safety, (f) enhanced access to care, and (g) payment restructure. This resulted in the PCMH model becoming a mainstream approach for delivering team-based primary care in the United States.

Figure 2.6: PCMH Model (Center for Advanced Design Research and Evaluation, 2015, p. 15)

The standardization and accreditation of PCMH clinics facilitated the growth for team-based care delivery. In 2008, the National Committee for Quality Assurance (NCQA) started a national accreditation program for PCMH clinics (National Committee for Quality Assurance, ND). At the same time, the Accreditation Association for Ambulatory Health Care (AAAHC) and Joint Commission adds the PCMH as an official type of health center to accredit for healthcare insurance reimbursement (National Association of Community Health Centers, 2014). In the following years, two of the largest healthcare organizations in the United States, the Veterans Administration and Military Health System, formally adopt the PCMH model as the standard for delivering primary care (Office of the Assistant Secretary of Defense, 2009; Department of Veteran

Affairs, 2009). As a result, the acceptance of the PCMH model continues to grow, which is leading to a paradigm shift for team-based primary care in the United States.

2.3A Proven Effectiveness of the PCMH Model

A PCMH model is proven effective for achieving better outcomes through a team-based approach for patient care. The literature provides evidence for the transformation due to healthcare organizations achieving better health outcomes, reducing cost, improving patient experiences, and increasing clinical staff satisfaction. As a result, healthcare organizations across the country are transitioning from traditional primary care approach to the PCMH model (Costello & McNamara, 2016). This suggests that the strategies of the 'Quadruple Aim' are achievable through the enactment of the PCMH model of care.

Healthcare organizations that implemented the PCMH model demonstrated improved adherence to chronic disease treatment plans, increased screening of patients for depression, and reduction in patient visits to the emergency department. Intermountain Healthcare Medical Group performed a longitudinal study of 27 PCMH and 75 traditional clinics from 2003 to 2007 to measure the quality of health outcomes for patients (Reiss-Brenna et al., 2016). The study found that patients utilizing a PCMH clinic were screened more for patient depression and improved adherence for diabetes treatment plans. Friedberg et al. (2015) analyzed 17,363 patient claims from 27 PCMH and 29 traditional clinics to evaluate the effects of patients utilizing the PCMH clinics in northeast Pennsylvania. The study concluded that the PCMH outperformed traditional clinics by producing 1.7 fewer inpatient hospitalizations and 4.7 fewer emergency department visits per 1,000 patients a month. Rosenthal et al. (2013) conducted an interrupted time series research study for five PCMH and 34 traditional clinics in Rhode Island to examine healthcare quality outcomes. Findings from the study established an 11.6% reduction in patients visiting the emergency department when assigned to a PCMH clinic. These studies represent a growing body of evidence that validates that the PCMH model improves the quality of healthcare for patients.

The effectiveness of the PCMH model reveals the reduction of cost for delivering patient care. The state of Colorado piloted the PCMH model in 16 primary care clinics over three years (Rosenthal et al., 2015). After the three years, the state reported a 9.3% patient reduction in visiting the emergency department, which resulted in cost savings of approximately $5 million per year. The city of Rochester, New York, piloted seven PCMH healthcare clinics over three years to evaluate the performance of the new model (Rosensthal et al., 2015). The results from the study demonstrated that patients saved $11.75 per month on medications through increased availability of patient appointments. Van Hasselt et al. (2014) analyzed national Medicare costs for patients that utilized 308 PCMH and 1,906 traditional clinics. The study found that Medicare patients that utilized a PCMH clinic had $164 lower cost for inpatient hospital treatments and saved Medicare insurance $265 annually per patient. The results of these limited studies illustrate how the PCMH model is effective in reducing healthcare costs.

In addition, patient experiences improved with the PCMH model through better access to medical appointments and achieving goals for approving overall health. Chu, Tu, Lee, Sayles, and Sood (2016) compared seven PCMH safety net clinics to 110 traditional safety net clinics in Los Angeles for a year to evaluate patient access to care. The findings of the study demonstrated that the seven PCMH safety net clinics provided 163 more medical appointments per 1,000 patients per year, which signals better access to patient care. Langston, Undem, Dorr (2014) analyzed 3,454 survey responses of patients 65 and older to understand what Medicare patients want from primary care. The study signaled that patients 65 and older preferred receiving patient care in a PCMH clinic over a traditional primary care clinic due to the ability to improve their quality of health. The state of Oklahoma implemented the utilization of PCMH clinics for Medicaid patients to improve accessibility to patient care in 2009 (Takach, 2011). After a one year period, the state reported that patient inquires for same-day/next-day appointments decreased from 1,670 to 13 inquires. This finding points out that patients received better access to care with a PCMH clinic than a traditional primary care clinic.

The literature also indicates that staff satisfaction increases while working in a PCMH model of care, which improves staff experiences for patient care delivery. Group Health piloted a PCMH model for 24 months, which resulted in the clinical staff reporting significantly less burnout and exhaustion compared with traditional models of primary care delivery (Reid et al., 2010). Nelson et al. (2014) conducted a staff survey to examine staff burnout rates for 77 PCMH clinics compared to 836 non-PCMH clinics. The findings from the study revealed that staff experiences were significantly higher in PCMH clinics, resulting in lower staff burnout rates. Lewis et al., (2012) performed an analysis of 65 PCMH safety net clinics across five states to evaluate staff morale. The study concluded that the PCMH clinics were associated with higher staff morale and lower burnout rates for 95% of the clinical staff. Similarly, Richardson et al., (2016) surveyed 121 physicians who reported 60% satisfaction with transitioning to a PCMH model of care from a traditional model of primary care. The limited studies represent an emerging trend of how the PCMH model is improving staff experiences for delivering patient care.

The expanding evidence from the literature reveals the success of the PCMH, and how the model of care is capable of achieving strategies outlined in the 'Quadruple-Aim'. Furthermore, this evidence validates the IOM logic for advocating of a team-based approach for primary care. However, these studies lack an understanding of team-based care activities and how the physical environment affected the delivery of patient care. This lack of evidence hints at a potential gap in the literature for understanding the role of the physical environment in delivering team-based care.

2.3B New Activities for Team-Based Care

Traditional staff roles are evolving and becoming more effective through team-based care. The effectiveness of team-based care is credited with two main strategies. First, primary care physicians are shedding the lone-wolf persona by sharing patient care responsibilities with registered nurses, licensed practical nurses, and medical assistants (Ladden et al., 2013). The formalization of daily team huddles and secondary reviews of patient medical charts foster a shared responsibility for patient care among the staff (Fogarty & Schultz, 2010; Chen & Bodenheimer, 2011; Mundell et al., 2013). Second, physician assistants and nurse practitioners are supplementing primary care physicians to address critical shortages (Hing et al., 2017). As a result, patient health outcomes improve when primary care clinics incorporate both nurse practitioners and physician assistants for delivering team-based care (Park, 2015). Additionally, the employment of a single physician assistant in primary care clinic creates cost savings of $52,000 in staff salaries (Grzybicki, Sullivan, Oppy, Bethke, Raab, 2002). Therefore, team-based approaches, such as the PCMH model, decrease the stress levels for primary care physicians and create cost savings for patient care.

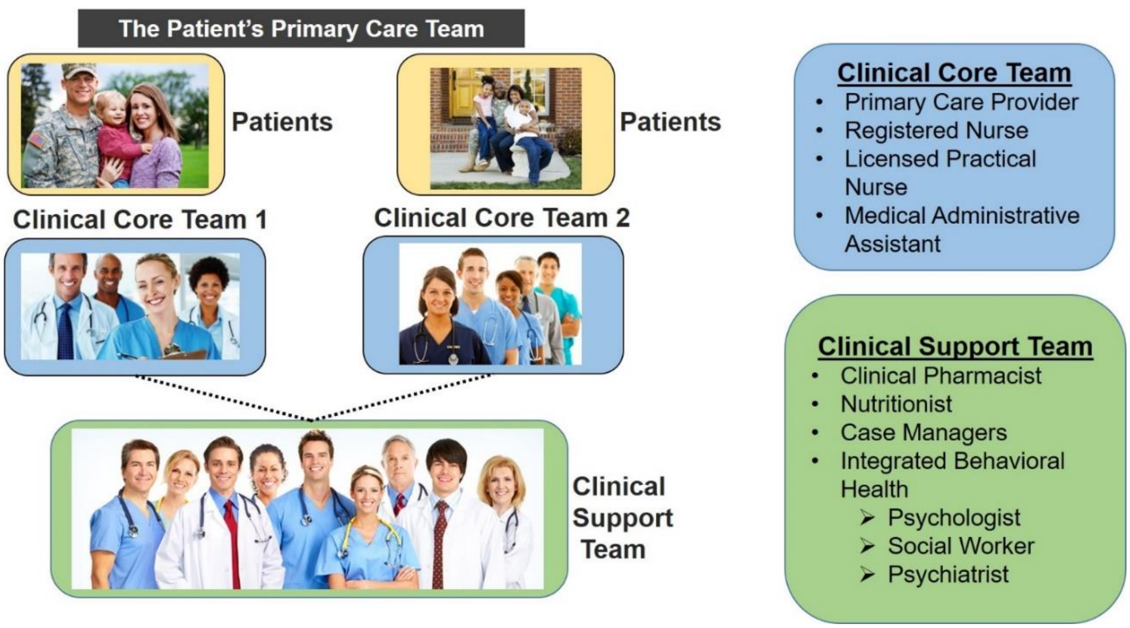


Figure 2.7: Clinical Core Team and Clinical Support Team (Sources: CDN Skim, 2018; patients: Army One Source, 2018; Army One Source, 2018; Bon Secours, 2017; Halos Daily, 2018; Red Alfa Neurciencias, 2017)

The role of registered nurses in primary care clinics is expanding with the PCMH model. Traditional roles for registered nurses focused on triaging patients in the clinic (Ladden et al., 2013); however in the PCMH model, registered nurses provide chronic care management, acute-care treatment, patient case management, and leadership roles for the clinical team (Altschuler, Margolius, Bodenheimer, Grumbach, 2012;

Bodenheimer, Wagner, Grumbach, 2002; Bodenheimer & Smith, 2013). Furthermore, variations of the PCMH have registered nurses participating as health coaches, patient care quality managers, and telephone triage consultants (Smolowitz et al., 2015). Therefore, the expanded responsibilities of the registered nurses allow primary care clinics' workload to increase for delivering effective patient care (Bodenheimer & Bauer, 2016). The new patient care activities for the registered nurses aid in reducing primary care physician dissatisfaction with traditional patient care models.

Licensed practical nurses and medical assistants who work alongside primary care physicians reduce work-related stressors, while increasing patient workload. The licensed practical nurses and medical assistants decrease physician work-related responsibility by escorting patients to exam rooms, collecting height/weight and vital signs, and conducting initial screening questions (Bodenheimer, 2007; Bodenheimer, 2011). Additionally, primary care physicians assigned two dedicated licensed practical nurses or medical assistants increased the patient workload by 60% without causing additional stress levels for the physicians (Anderson & Halley, 2008). This means that the licensed practical nurses and medical assistants play a significant role for reducing stressors for primary care physicians.

Colocating specialty providers in primary care clinics improves health outcomes, increases staff satisfaction, and reduces healthcare costs. Specialty care providers for primary care include dietitians, physical therapists, clinical pharmacists, and behavioral health providers. Including dietitians in primary care enhances the quality of chronic care management for patients, which provides an additional resource of knowledge for physicians (McClarney, Timmerman, Woscyna, & Hanson, 2017). Physical therapists provide a valuable resource for reducing healthcare and medication costs for patients with lower-back injuries (Fritz, Childs, Wainner, &Flynn, 2012). The colocation of clinical pharmacist in a primary care clinic improved primary care physician satisfaction by 75%, which mitigates the burden of primary care physicians remembering extensive medication formularies. Furthermore, embedding behavioral health providers in primary care clinics reduced emergency room visits for patients, while at the same time reducing healthcare costs (Conis, 2009). Therefore, the integration of specialty providers on a clinical team enhances the ability for primary care physicians to deliver effective patient care.

Finally, advances in technology are creating new activities that improve patient care delivery. The new activities created by advances in technology mainly occur through two systems. First, electronic health records (EHRs) transitioned healthcare from a paper-based to a digital-based system (Zhou, Garrido, Chin, Wiesenthal, & Liang, 2007). As a result, the ability to manage and transfer patient records in the clinic along with external healthcare providers is simplified (Irani, Middleton, Marfatia, Omana, & D'Amico, 2009). Second, the growing usage and ownership of technology devices, such as smart phones, tablets, laptops, and computers, affords opportunities to increase accessibility for patient care (Bashsur et al, 2016; PEW Research Center, 2014). For example, telemedicine appointments are shown to reduce face-to-face patient encounters by 40%, while improving access to patient care (Adamson & Bachman, 2010). Additionally, new patient communication portals provide patients with instant access to patient care outside of traditional medical appointments (Bodenheimer & Pham, 2010; Zhong, Li, Bain, & Musa, 2017). Therefore, healthcare organizations offer salary bonuses for clinical staff who engage in telemedicine appointments more than traditional face-to-face patient encounters (WellPoint, 2012). The advances in technology are dramatically changing the methods for delivering primary care.

The new roles and activities for delivering patient care are radically changing how the clinical staff performs day-to-day activities. Primary care physicians are sharing responsibilities with additional staff for patient care delivery, which improves physician experiences for patient care. At the same time, registered nurses are increasing patient care responsibilities, yet limited studies indicate how the new activities influence their experiences for patient care. Similarly, licensed practical nurses and medical assistants are performing more activities for patient care without understanding the impact on their staff roles for patient care. Embedded specialty providers in primary care are emerging, however little is known with regards to their experience for delivering team-based care. Finally, advances in technology are shaping new delivery methods for primary care, which alter the activities and demands for staff in the physical environment for patient care. Therefore, the new roles and activities for patient care require new approaches for the physical environment that support team-based care activities.

2.4 New Design Approaches to Support Team-Based Care

The nature of clinical staff activities are evolving with team-based care, which requires the physical environment to adapt to the new activities. The designers for the new primary care environments rely on individual intuition from past experiences to produce solutions for team-based care environments. The past experiences are based on subjective perspectives that are influenced by social, cultural, and job employment. As a result, there are multiple design solutions that are untested in the literature to support team-based care environments. The design literature advocates for four main concepts for establishing PCMH environments that include (a) on-stage/off-stage layout, (b) clinical modules, (c) open-staff work spaces, and (d) exam rooms that accommodate patient and family members. Therefore, examining how these intuitions influence the design of the physical environment is an integral component for this study.

First, the on-stage/off-stage concept fosters the separation of patient and clinical staff spaces. The on-stage/off-stage design concept is based on the Disney approach for establishing a physical environment for a theatrical performance (Taylor, 1999; McGough et al., 2013). The 'on-stage' is a reference to where the audience views the theatrical performance, which relates to the waiting areas and exam rooms for primary care settings. The 'off-stage' expresses how staff members freely move around to support the theatrical performance unseen by the eyes of the audience. This concept relates to the location of staff work areas in primary care settings, which afford staff privacy in delivering patient care. The simple design concept has led to multiple interpretations in application for primary care settings (Vickery, 2012; VA, 2015; Mahlum, 2011; Center for Health Design, 2016; Agee Steinberg, and Day, 2016; McGough et al., 2013; Quan, Taylor, and Zborowsky, 2016). The multiple interpretations point out that designers' intuition influences how the on-stage/off-stage concept is implemented.

Second, the clinical module concept establishes flexibility and modularity for the initial design phases for a new primary care clinic. The clinical module is a physical space that supports clinical core teams in delivering patient care (DuBose, Lim, and Westlake, 2015). Furthermore, the clinical module includes spaces for team rooms, exam rooms, storage rooms, and clinical support rooms that are clustered together (Belknap and Lafferty, 2011; Capital Link, 2011; Quan et al., 2011; Boulder Associates, 2011; VA, 2015). Additionally, clustering these types of spaces into a clinical module allows designers to "plug and play" and produce "repeatable" modules in the initial design phases (Taylor, Joseph, Keller, Quan, 2011, p.18). As a result, the clinical module concept provides designers with flexibility in how to organize the layout and where to locate the space in the primary care clinic. At the same time, multiple interpretations of the clinical module exist with limited evaluations of how the layout influences patient care delivery (Mayne and Dellenbach, 2014; Belknap et al., 2011, VA, 2015; Boulder Associates, 2011, Vickery et al., 2015; Cahnman, 2011; Hubble, 2011). Furthermore, the literature uses the terms "pod" and "module" interchangeably to explain the design concept, which leads to different interpretations and design approaches for the physical environment.

Third, open-staff work areas enhance the ability for staff to collaborate and improve situational awareness of activities for patient care delivery. This concept derived from the understanding that clinical teams separated into private offices decreases opportunities for face-to-face interactions (Oandasan et al., 2009; Gunn et al., 2015; Mayne and Dellenbach, 2014; Agee, Steinberg, and Day, 2016; Sinsky et al, 2013).

Additionally, colocating staff in open office spaces increases visual connections, which results in more opportunities for collaborative interactions (Watkins, Gandolf-Frietchen, Siddiqui, 2015; Taylor, Joseph, Keller, Quan, 2011; Saaty-Tafoya, Malkin and Wingler, 2003). At the same time, staff situational awareness is improved to aid patients and fellow team members during patient care delivery (Quan et al., 2011; Boulder Associates, 2011; Sweetland, Kitteredge, Kircher, 2012). The open staff work areas illustrate how the physical environment influences the delivery of team-based care.

The integration of the open staff work areas limits the size of staff workstations and availability of private work spaces in the clinic. As a result, designers incorporate several approaches to offer privacy in the open staff work areas. Belknap and Lafferty (2011) recommend 48-60 Sq. Ft. per staff workstation to offer a level of privacy. Watkins, Gandolf-Frietchen, and Siddiqui (2015) advocate for glass partitions between staff workstations to decrease noise-related distractions, while promoting staff visibility. Furthermore, design literature recommends that private workstations be located adjacent to the open staff work areas to decrease distractions (Quan et al., 2011; Capital Link, 2011). Additionally, the literature signals that the size of clinical teams in open staff work areas range from four to seven individuals to reduce privacy issues (Hubble, 2011). The multiple design solutions are limited in evaluating the open-staff work areas through the experiences and opinions of the clinical staff. This indicates a limited understanding on the influence of staff performance in an open staff work area that supports both collaborative and focused-work for patient care.

Lastly, the size of exam rooms is increasing to accommodate patients and family members during a medical appointment. The integration of a team-based approach for primary care leads to more clinical staff in the exam room to support patient care (Mahlum Architects, 2011; Capital Link, 2011; Center for Health Design, 2016; Joseph, Keller, Gulwadi, 2009; Cahnman, 2011). Therefore, the design literature recommends that the size of the exam room range from 100 to 132 Sq. Ft. to accommodate staff, patient, and family members (Nyberg, 2015; Freihoefer, Nyberg, Vickery, 2012; Belknap and Lafferty, 2011; Hubble, 2011). Furthermore, best practices illustrate the significant role of transforming exam rooms into universal spaces that support patient care, education consults, and telemedicine appointments (Herman Miller, 2011; Battisto et al., 2009; CADRE, 2015; Nyberg, 2015; Saaty-Tafoya, Malkin, and Wingler, 2013; Watkins, Gandolf-Frietchen, and Siddiqui, 2015). At the same time, there are few studies that analyze the size of the room from the clinical staff perspective. This reveals that exam rooms are altering to accommodate team-based care with limited input from studies that evaluate the size of the space.

The design literature illustrates how design concepts are shaping team-based care environments. At the same time, designers combine different design concepts without understanding how the physical environment influences the delivery of team-based care. This leads to the development of primary care settings that offer both strengths and weaknesses for promoting team-based care. Furthermore, the design literature establishes three types of clinical modules based on staff and patient circulation patterns for team-based care environments: (a) T-shape, (b) on-stage/off-stage, and (c) race track. Each of the clinical modules offer different approaches for creating primary care settings that support team-based care environments.

2.4A T-Shape Clinical Module Layout

The T-shape clinical module emphasizes an ‘on-stage/off-stage’ design concept by separating staff and patient areas. This clinical module locates staff work areas in the ‘off-stage’ of the clinic, while exam rooms are located in the ‘on-stage’ module (Figure 2.8). The top portion of the T-shape includes the location and circulation patterns of staff. Patients circulation through patient care areas that include exam rooms, patient toilets, and treatment rooms are located in the middle of the ‘T-shape’. Additionally, the staff and patients share the middle corridor to access the exam rooms. This clinical module supports two corridors for patient care areas, which are dividable among two to three clinical core teams. The design of the T-shape clinical module represent both strengths and weakness for team-based care delivery.

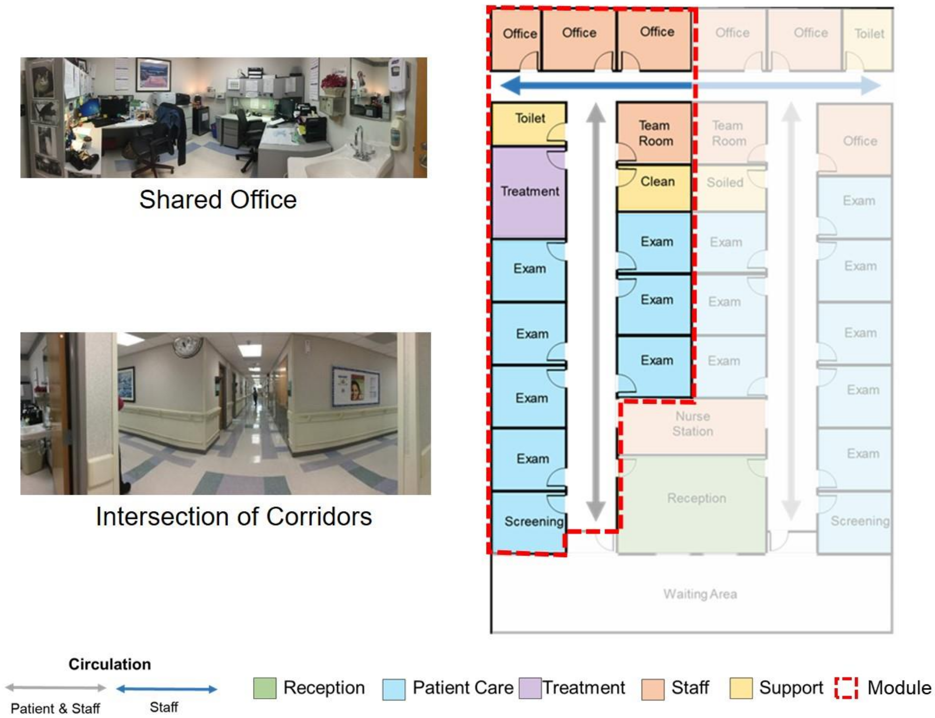


Figure 2.8: T-Shape Clinical Module

Clinical staff privacy is enhanced through the T-shape module that creates spatial barriers from patient areas. A private circulation corridor is created to emphasize staff access to an ‘off-stage’ area that allows fluid movement to access decentralized clinical support rooms. At the same time, locating the exam rooms in front of the clinical module reduces patient travel distances (Vickery, 2012). Furthermore, the clinical module layout prevents patients from walking past clinical staff private work areas, reducing the opportunities for breaches in privacy. These design attributes signal the strengths for the T-shape clinical module.

Clustering staff work areas in the ‘off-stage’ area both supports and hinders team collaboration. The staff work areas in this clinical module include open nursing stations, private offices, and shared offices. The clustering of staff work areas promotes opportunities for collaboration, which represents a strength for the module design (Zwarenstein and Bryant, 2000). However, primary care providers are located in private offices, while registered nurses, licensed practical nurses, and medical assistants share workspaces. Consequently, the separation of staff work areas limits visibility, decreasing opportunities for collaborative interactions (Zborowsky, Bunker-Hellmich, Morelli, and O'Neil, 2010). Additionally, clinical staff who utilize the nursing station are located in the 'on-stage' area, which limits staff privacy from patient areas. Therefore, the separation of staff work areas and the open nursing station hinder collaboration for team-based care.

The T-shape module layout affords opportunities to support team-based care, but demonstrates a traditional physician-centric layout. Primary care provider offices are moved away from the exam rooms, offering staff privacy. However, the primary care providers are located in private offices, which create barriers for staff interactions (Zborowsky, Bunker-Hellmich, Morelli, and O'Neil, 2010). Therefore, clinical staff are forced to move to the primary care provider's office space to collaborate for patient care. The staff workflow matches a traditional physician centric clinic layout, which limits the capability to perform team-based care activities.

2.4B On-Stage/Off-Stage Module Layout

The 'on-stage/off-stage' clinical module clearly separates patient and staff circulation to enhance privacy. Instead of placing the clinical staff in the back of the clinic, staff work spaces are located in the central area of the module (Figure 2.9). Staff access the exam rooms from the central workspace that colocates the entire clinical core team. At the same time, patients utilize a separate corridor from staff to access exam rooms, which limits breaches in staff privacy. Furthermore, the ‘on-stage/off-stage’ is associated with self-rooming policies and double entry exam rooms to improve privacy and workflow efficiency (Nyberg, 2015). The design of the ‘on-stage/off-stage’ clinical module represents both strengths and weakness for team-based care delivery.

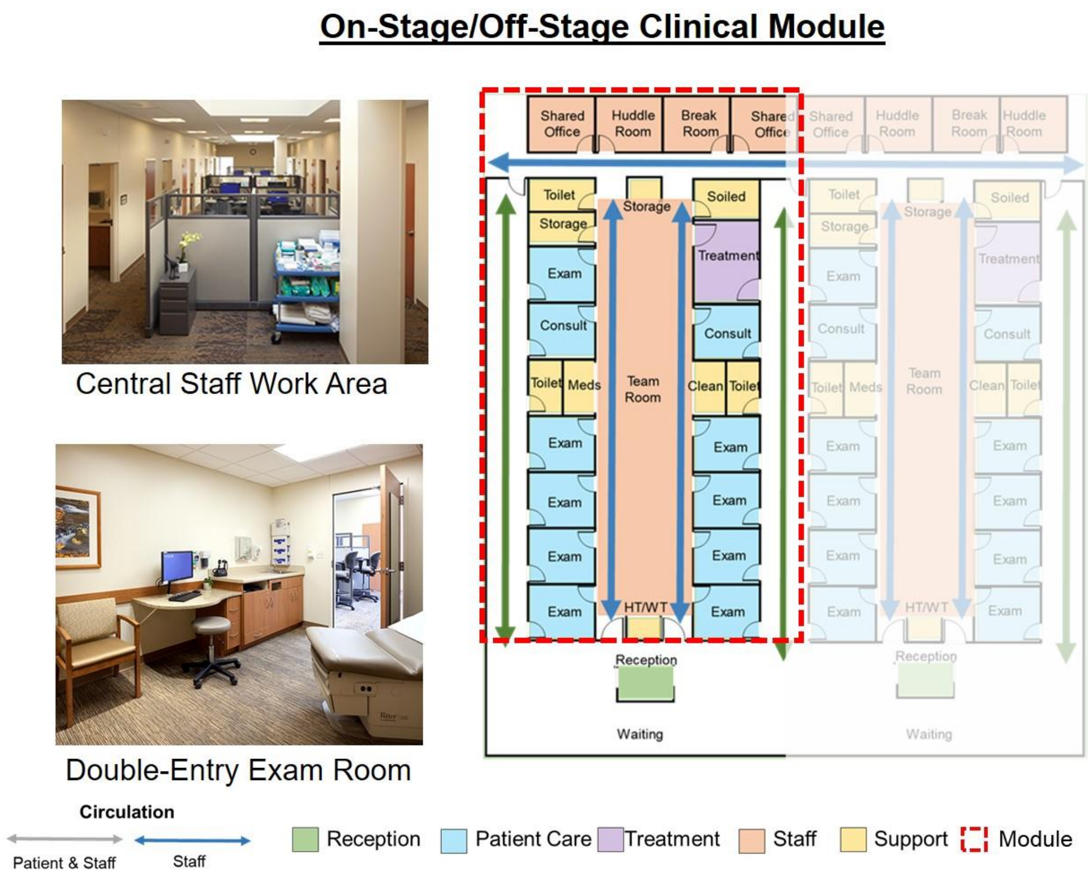


Figure 2.9: On-Stage/Off-Stage Clinical Module (Source: Silvis, 2016)

The centralized team room surrounded by exam rooms improves workflow efficiency for patient care. The team room is an open office concept that increases staff visibility to cut down on time hunting for team members (Harvey, Pati, Evans, Waggener, & Cason, 2008). The dual-entry exam rooms reduce staff travel distances for routine patient care appointments (Mayne and Dellenbach, 2014). Additionally, clinical support rooms are colocated in the team room to minimalize staff travel distances for supplies needed for patient care (VA, 2015). Therefore, the ‘on-stage/off-stage’ clinical module improves workflow efficiency in comparison to the ‘T-shape’ clinical module.

The colocation of the entire clinical core team into an open team room affords opportunities for collaboration and distractions. Open team rooms facilitate staff visibility, which leads to a natural collaborative environment (Becker and Steele, 1995). However, the increased opportunities for staff interactions cause excessive noise that can result in distractions for completing focused work (Evans and Johnson, 2000). Furthermore, the staff utilizing the team room as a circulation corridor to reach exam rooms adds to the noise level. Therefore, designers often integrate office cubicle walls or glass partitions to aid in reducing distractions in the team room (Watkins, Gandolf-Frietchen, and Siddiqui, 2015; Stroupe, 2016). This evidence indicates that the open team room affords both strengths and weaknesses for team-based care.

The ‘on-stage/off-stage’ clinical module establishes a team-based environment that no longer emphasizes a physician-centric clinic. Multiple healthcare organizations, such as the Veteran Administration and Group Health, adopted this clinical module layout for their primary care clinics. Additionally, this module design facilitates the ability to “plug and play” during the initial design phases, providing flexibility for designers. However, one weakness is colocating clinical staff in an open team room, which may lead to distractions related to excessive noise. As a result, the ‘on-stage/off-stage' clinical module contributes to both strengths and weaknesses for team-based care environments.

2.4C Race-Track Module Layout

The 'race-track' clinical module focuses on increasing staff visibility for monitoring patient care activities. This clinical module is organized around a central open staff work area with exam rooms on the perimeter of the module to improve visibility (as shown in Figure 2.10). A circulation corridor shared by staff and patients, mimicking a race track, separates the staff and patient areas. Additionally, the race-track module is dividable among two clinical core teams. This creates flexibility for organizing staff workspaces in the central area (Belknap and Lafferty, 2011). However, the 'race-track' module locates the clinical staff in the center 'on-stage' area, which limits staff privacy. Therefore, the 'race-track' clinical module offers strengths and weaknesses for supporting the delivery of team-based care.

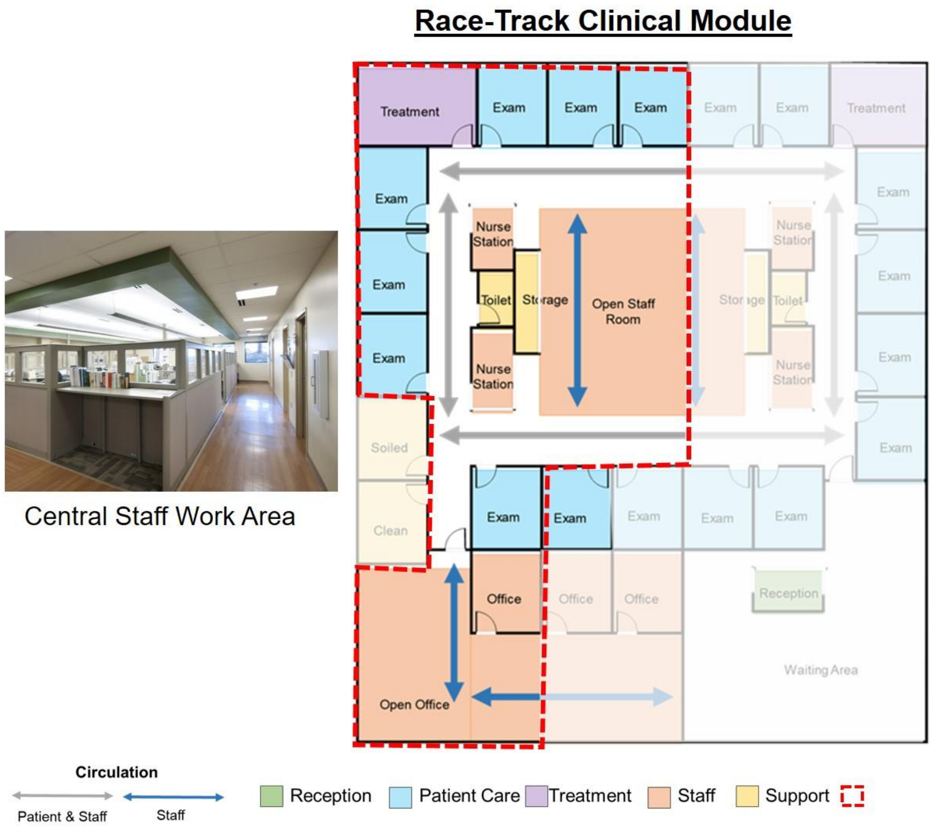


Figure 2.10: Race-Track Clinical Module (Source: Boulder Associates, 2016)

The 'race-track' clinical module facilitates efficient workflow similar to the 'on-stage/off-stage' module. Staff travel comparable distances to reach exam rooms as the 'on-stage/off-stage' clinical module. The colocation of equipment storage in the staff work area reduces travel distances to find equipment for patient care (VA, 2015). Additionally, the staff work areas provide adjacent nursing stations, which minimalizes travel distances and reduces potential distractions (Nyberg, 2015). Furthermore, the enhancement of staff visibility in this module increases situational awareness of team members' locations, which cuts down on time spent hunting for team members (Harvey et al., 2008). This evidence indicates that the ‘race-track’ clinical module provides efficient workflow for patient care.

A central open staff work space increases visibility for patient care, while limiting staff privacy. Similar to the ‘on-stage/off-stage’ module, the open work space facilitates staff visibility, which leads to a natural collaborative environment (Becker and Steele, 1995). At the same time, the patient’s ability to see staff work areas creates an undesirable ‘fishbowl’ effect (Goodrich, 1982). This means that staff are constantly ‘on-stage’ during operation hours for patient care appointments. Consequently, designers enclose the centralized staff work area with glass walls, which affords a limited level of privacy (Capital Link, 2011; Boulder Associates, 2016).

The ‘race-track’ clinical module offers a team-based care environment without separating patient and staff circulation pathways. This module allows designers to create flexible workspaces that accommodate multiple clinical core teams. Healthcare organizations such as Duke Health and Whittier Clinic have adopted this module for their primary care clinics (Evans, Gierman, Westlake, 2017; Nyberg, 2015). This indicates an alternative team-based care environment from the ‘on-stage/off-stage’ module, which allows staff to maintain situational awareness of patient care activities. However, a weakness in the module design is the limited staff privacy from the patients. Therefore, the ‘race-track’ clinical module offers trade-offs for supporting the delivery of team based care.

2.4D Lack of Consensus on the Best Clinical Module

This section reveals how design intuitions based on prior knowledge are shaping team-based care environments. Four design concepts that include (a) on-stage/off-stage layout, (b) clinical modules, (c) open staff work spaces, and (d) exam rooms that accommodate patient and family members are altering the environment with limited evaluations. Additionally, the literature establishes three types of clinical modules based on circulation pathways for staff and patients in primary care settings. The shortage of assessments on these three types of clinical modules further advocates for the reliance on designer intuitions to create team-based care physical environments.

The literature points out that there are multiple design solutions that are untested in supporting team-based care environments. Furthermore, the three different interpretations of a clinical module offer variations in types of spaces, sizes, and layout. Therefore, little is known about how the physical environment influences the delivery of team-based care. Complicating the issue further is the lack of a consensus on which module design best supports team-based care. This further illustrates a gap in understanding how the different clinical module layouts support or hinder the delivery of team-based care.

2.5 Role of the Physical Environment on Delivering Primary Care

The analysis of the current literature reveals four themes in how primary care physical environments are evaluated based on the analysis of primary data sources and not designers intuition. First, studies emphasize patient satisfaction in shaping the physical environment. Second, there is a lack of attention to obtaining clinical staff opinions of experiences with the physical environment. Third, limited studies identify individual staff roles, activities, and experiences in delivering team-based care. Fourth, studies that obtain the entire clinical team perspective offer insightful design solutions for the physical environment. Furthermore, examination of the current literature signals critical outcomes for studying primary care team-based environments that shape this study.

2.5A Prioritization of Patient Satisfaction for the Physical Environment

Patient satisfaction for the physical environment is given more weight than staff satisfaction in examining the delivery of team-based care and the physical environment. A emerging trend for prioritizing patient satisfaction is the monetary incentives for health organizations due to the recent enactment of the ACA 2010 (Farley et al., 2014). Therefore, healthcare organizations value patient satisfaction survey results over staff satisfaction for evaluating team-based environments. As a result, healthcare organizations and existing literature focus on patient satisfaction to enhance the physical environment in primary care settings.

The Hospital Consumer Assessment for Healthcare Providers and Systems (HCAHPS) is widely utilized survey tool to obtain patient satisfaction scores for patient care and the physical environment. The HCAHPS survey were developed for traditional inpatient care hospitals and focus on 27 questions that ask patients to rate the delivery of patient care and physical environment (Petrullo, Lamar, Nwankwo-Otti, Alexander-Mills, & Viola, 2012). Only two questions on the survey evaluate the physical environment based on patient experiences of cleanliness and noise levels. Furthermore, patients' limited three-hour annual exposure to primary care settings are valued more than the staff who spend roughly 9,600 hours per year in the clinic (Centers for Disease Control and Prevention, 2015). This method for evaluating the delivery of patient care under-values the staff experiences in primary care settings for monetary incentives established by the ACA.

Furthermore, higher patient satisfaction scores are not correlated to better patient outcomes. Fenton et al. (2012) performed a cohort analysis of 51,956 adult patients in the United States from 2000 to 2007 to analyze the impact of patient satisfaction in delivering care. The findings from the study demonstrated that patient satisfaction resulted in fewer emergency room visits but increased admission for inpatient care, medication costs, and patient mortality rates. The data for the study was prior to the enactment of the ACA, but signals that patient satisfaction is limited in evaluating the delivery of patient care. The evidence from this study signals the inadequacy of evaluating healthcare performance based on patient satisfaction scores. This implies that HCAHPS surveys offer limited results in evaluating healthcare environments as well.

Patient satisfaction scores negatively influence physician satisfaction with delivering patient care, which affects the physical environment. Zgierska et al. (2014) conducted a statewide survey of 155 physicians, which included 25 primary care physicians, to study how patient satisfaction scores impact physicians in delivering patient care. The findings revealed that 58% of physicians claim that patient satisfaction scores are tied directly to their salaries, which influences their satisfaction with patient care and potentially the physical environment. This means that physicians cater to the demands of the patient to achieve monetary gains, while shaping the physical environment to appease the patient.

Wingler and Hector (2015) demonstrate that higher clinical staff satisfaction increases productivity for delivering patient care. In the Wingler and Hector (2015) study, they examined 75 clinical staff in three primary care settings to understand how the physical environment influences productivity for delivering patient care. The study concluded that staff production improved when higher satisfaction ratings were reported for privacy and noise level. This finding suggests that examining staff satisfaction of noise level instead of patient satisfaction leads to improvements for delivering patient care. Furthermore, this study provides evidence in how the current HCAHPS surveys are limited for evaluating the physical environment.

The prioritization of patient satisfaction scores over clinical staff satisfaction negatively influences the delivery of patient care through two main themes. First, studies demonstrate that HCAHP patient satisfaction scores are not adequate to evaluate the physical environment based on two environmental conditions. Second, the literature signals that improved environmental conditions increases staff workflow and satisfaction scores. This means that the staff perspective, not the patients, provides insights that enhance the physical environment for patient care delivery. As a result, neglecting to collect clinical staff opinions and experiences facilitates the inability to achieve the Quadruple-Aim discussed earlier in this chapter.

2.5B Lack of Clinical Staff Experiences that Evaluate the Physical Environment

Workflow efficiency is a metric that is materializing as the new currency for developing design solutions for primary care environments. The evolution of technology makes observational data collection combined with simulation modeling easier to incorporate in research studies for the physical environment (Groat & Wang, 2013; Peterson, 2015). However, observational studies and simulation modeling lack the staff experiences in describing how and why the physical environment influences the delivery of patient care. The lack of staff experiences limits the results of the studies in understanding how the physical environment influences the delivery of team-based care.

Swisher and Jacobson (2002) demonstrate the optimal staffing configuration and allocation of exam rooms for profitability. The study created a simulation model to analyze staffing configuration and number of exam rooms for efficient patient care delivery. The study incorporated archival documents that included patient throughput, staff utilization, staff overtime, and clinic profitability. The authors created 17 different staffing configurations and number of exams to evaluate the profitability of each model.

Findings from Swisher and Jacobson (2002) point out the most desirable configuration consisted of one physician assistant, one nurse practitioner, one registered nurse, one medical assistant, and seven exam rooms. The findings illustrate that the physician assistant and nurse practitioner are allotted three exam rooms with a shared exam room for patient overflow. Furthermore, the study demonstrates that a team-based approach for primary care is profitable. The study is limited towards evaluating the physical environment based on profitability. Consequently, staff opinions and experiences are lack and not valued for understanding how to improve profitability of patient care delivery.

Norouzzadeh et al., (2015) establishes that sharing a cluster of ten exam rooms in a pod configuration enhances workflow efficiency for a clinical team. The study incorporates a discrete even simulation model that replicates 730 days of patient care delivery for internal medicine clinic of 20 exam rooms in evaluating two rooming policies (Figure 2.11). The first rooming policy consist of a next available room approach, while the second rooming policy includes sharing a group of exam rooms, pod approach, among physicians. The staffing model for the clinical teams evaluated variations that included four, six, and nine physicians, twelve resident physicians, and eight medical assistants.

The Norouzzadeh et al., (2015) study concluded that the pod approach increased the clinical team workflow for delivering patient care. Furthermore, the pod approach limited the physician's interactions to fewer than four medical assistants, compared to the next available room approach with eight medical assistants. As a result, the pod approach allowed clinical teams to split the 20 exam rooms evenly, which limited the walking distances for staff and increased visibility of exam rooms by being in the same hallway. The clinical staff opinions were gauged in the study to evaluate the two different rooming policies, but it is limited to identifying which team members participated in the evaluation. Additionally, staff satisfaction is reported as improved with little evidence to demonstrate who expressed satisfaction with the new rooming policy. Consequently, the study lacks clarity in exploring the opinions and experiences of the different clinical staff members with the rooming policies.

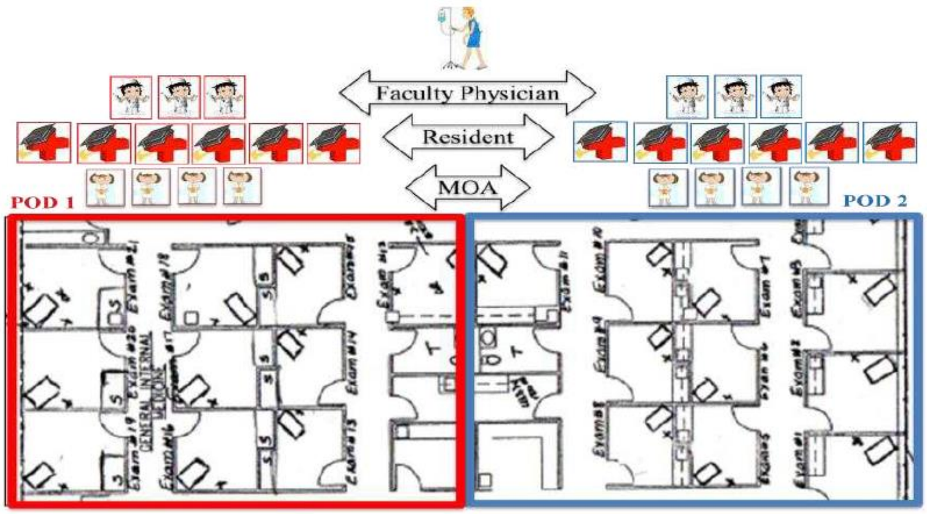


Figure 2.11: Floor Plan Layout (Norouzzadeh et al., 2015, p. 1360)

Vahdatzad and Griffin (2016) illustrates that an on-stage/off-stage module layout decreases staff walking distances and improves access to exam rooms compared to a T-shape module layout. The study references the two floor plans as non-shared pod and shared pod, which are representative of the T-Shape and on-stage/off-stage clinical modules (Figure 2.12). The study established a simulation model to evaluate two modular layouts for an orthopedic outpatient clinic that incorporate three types of rooming policies. The three room policies included a dedicated exam room, pooled exam room, and hybrid approach, which limited the number of rooms shared. The staffing model for the T-shape module included two physician teams with access to three dedicated exam rooms. Alternatively, the on-stage/off-stage module layout contained four physician teams with access to nine exam rooms.

The Vahdatzad and Griffin (2016) findings indicate that the on-stage/off-stage module layout, regardless of the rooming policy, increases workflow efficiency for patient care. The study lacks an understanding of the workflow for the different staff roles in delivering patient care. Furthermore, the study lacks the staff opinions and experiences regarding the two module layouts and different rooming policies. As a result, the study undervalues critical staff opinions in explaining how the physical environment supports the delivery of team-based care.

Figure 2.12: Clinical Module Concepts Evaluated (Vahdatzad and Griffin, 2016, p. 3669)

The development of workflow efficiency in evaluating the physical environment reveals layout configurations that enhance the delivery of patient care. The studies point out that a module layout that clusters seven to ten exam rooms in the same hallway improves workflow for patient care. Additionally, Swisher and Jacobson (2002) demonstrate the most profitable staffing configuration for a team that in supporting patient care with four staff members and seven exam rooms. However, all of the studies lack input from the clinical staff in exploring and describing how the physical environment influences patient care delivery. This points out that simulation modeling focuses on quantitative data and removes the critical experiences of the clinical staff from the studies. Therefore, simulation research methods lack a deep understanding of the relationship between team-based care and the physical environment.

2.5C Studies Lack the Perspectives of Individual Staff Roles

Limited studies of primary care environments examine individual staff roles and how their activities influence the delivery of team-based care. Additionally, there are fewer studies that analyze the entire clinical team experiences on how the physical environment influences the delivery of patient care. As a result, research studies focus on the role of the primary care provider or lump the responses of the entire team together. These approaches lack the description of team-based care delivery complexities, which undervalues the individual staff roles in the physical environment.

Mayo Clinic (2006) demonstrates the value of testing new primary care physical environment conditions through mock-ups. The research department at the Mayo Clinic conducted a 30 day foamcore mock-up of new physical environment conditions for a primary care clinic. The study involved both patients and clinical staff walking through the mock-ups and leaving post-it notes on the walls to share their opinions. Accordingly, the study established mock-up spaces for the waiting room, reception desk, exam room, consult room, and staff work areas to evaluate new design approaches. Additionally, the research team observed four primary care physicians while providing patient care in new exam room configurations.

The Mayo Clinic (2006) study findings revealed three key design implementations to support both the staff and patient in the delivery of care. First, the exam room needs to accommodate additional family members and patient consultation.

The study recommends new furniture in the exam room to accommodate family members and patient consultation, while the size of the exam room is left unexplored. Second, colocating staff in the same workspaces support both collaborative and private work enhances the delivery of patient care. The study recommends establishing an open collaborative space with adjacent private enclosed workspace to foster a team-based environment (Figure 2.13). Lastly, the study suggests that waiting rooms include a variety of amenities for patients to engage in that include entertainment, education, administration, and medication information.

The Mayo Clinic (2006) the study lacks the identification of responses from clinical staff, which means there is no clarity in understanding how the different staff roles interpret the new spaces. Furthermore, the study only observes primary care physicians in the exam room with the patient, which neglects the role of registered nurses, licensed practical nurses and medical assistants providing patient care in the exam room. Therefore, the study lumps the experiences of all staff members into a single response represented through primary care physicians to provide new design recommendations for the physical environment.

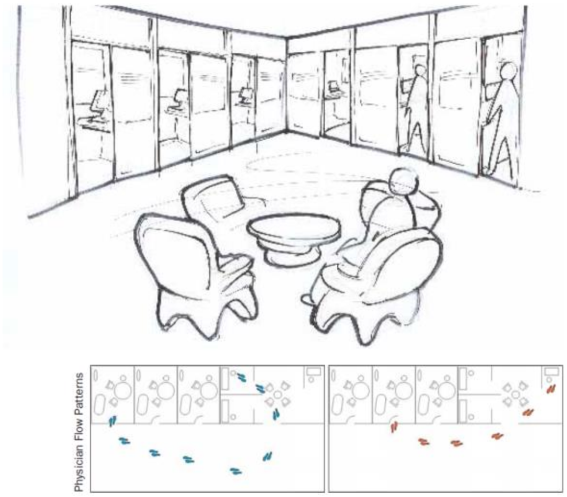


Figure 2.13: Open and Private Staff Workspaces Concept (Mayo Clinic, 2006, p. 17)

Preiser, Verderber, and Battisto (2009) revealed how conducting post-occupancy evaluations of community health centers create future design guideline recommendations. The study evaluated five community health centers in the mid-west region of the United States, which measured safety, functionality, efficiency and comfort of the physical environment. Accordingly, the study utilized a mixed-method approach that incorporated walkthrough observations, interviews, photographs, and physical measurements of the existing community health centers. Furthermore, the study included surveys of 81 clinical staff and 99 patients' opinions to evaluate the physical environment.

In the Preiser, Verderber, and Battisto (2009) study, two main design recommendations for the physical environment emerge to enhance the delivery of patient care. First, the floor plan configuration for the clinic is recommended to replicate a 'U' or 'O' to optimize patient flow. This evidence indicates shared circulation pathways are conducive for primary care clinics, but are dependent on the directional flow of patients. Second, storages rooms located in proximity to staff work areas contribute to a functional physical environment. This implies that a centralized storage room in a clinical module enhances the staff ability to deliver patient care.

The Preiser, Verderber, Battisto (2009) study demonstrates how a post-occupancy evaluation methodology produces practical design recommendations to support the delivery of patient care. A limitation for the study is the lack of understanding how the clinical staff delivery patient care in the five community health centers. As a result, little evidence is provided in illustrating how the individual staff roles influence the delivery of patient care. The survey responses lump together the entire clinical staff opinions in evaluating the physical environment. This means that the different staff roles and activities for patient care are limited in the study, which expresses a lack of understanding on how the physical environment influences those staff roles.

The Center for Advanced Design Research and Evaluation (CADRE, 2015) points out future design recommendations for primary care settings through patients' and primary care physician opinions of the physical environment. The study analyzed 100 family medicine and internal medicine physicians' survey responses to describe how the physical environment supports the delivery of patient care.

The study from the CADRE identified what primary care physicians desire for the physical environment. Primary care physicians wanted exam rooms to accommodate new technology capabilities, such as telemedicine and electronic health records, while providing adequate space for patient and family members that promote collaboration. Furthermore, 60% of the primary care physicians identified that they occupy private workspaces in the clinic. Primary care physicians reported that proximity to the lab was significant for supporting patient care delivery. This implies two important design factors for the physical environment. First, ensuring that the physical environment supports the integration of technology is critical. Second, primary care physicians still insist on working in private work spaces, which limits collaboration opportunities with additional staff or team members.

This evidence illustrates what primary care physicians want from the physical environment to improve patient care. However, the lack of registered nurses, licensed practical nurses, and medical assistants neglects how team-based care is altering the demands for the physical environment. The study relies solely on the opinions and experiences of primary care physicians to create new design solutions for potential team-based care environments.

Freihoefer et al. (2017) compared the staff efficiency for patient care delivery in a linear clinic module and an on-stage/off-stage module layout. The study performed a pre and post comparative analysis from an old clinic to a new clinic configuration. The linear clinic module, which is similar to a T-shape module, represented the prior clinic used for patient care (Figure 2.14). The on-stage/off-stage module layout represents the new clinic used to deliver patient care. The study incorporated a mixed-method approach that included 35 hours of shadowing clinical staff, 54 hours of clinic observations, and 269 patient surveys to measure staff efficiency in the two clinic layouts.

Findings in the Freihoefer et al. (2017) study illustrated that the on-stage/off-stage module layout improved staff workflow, reduced travel distances, increased staff communication, and enhanced patient throughput. However, the study is limited in describing the individual clinical staff activities for delivering patient care in both the old and new clinic module layout. Furthermore, the study lacks identification of how many different clinical staff roles were observed. Lastly, patient surveys were developed to measure satisfaction with the physical environment, which devalues the staff experiences and opinions. This means that the individual staff experiences and opinions are absent in evaluating the workflow efficiency in the two clinic module designs.

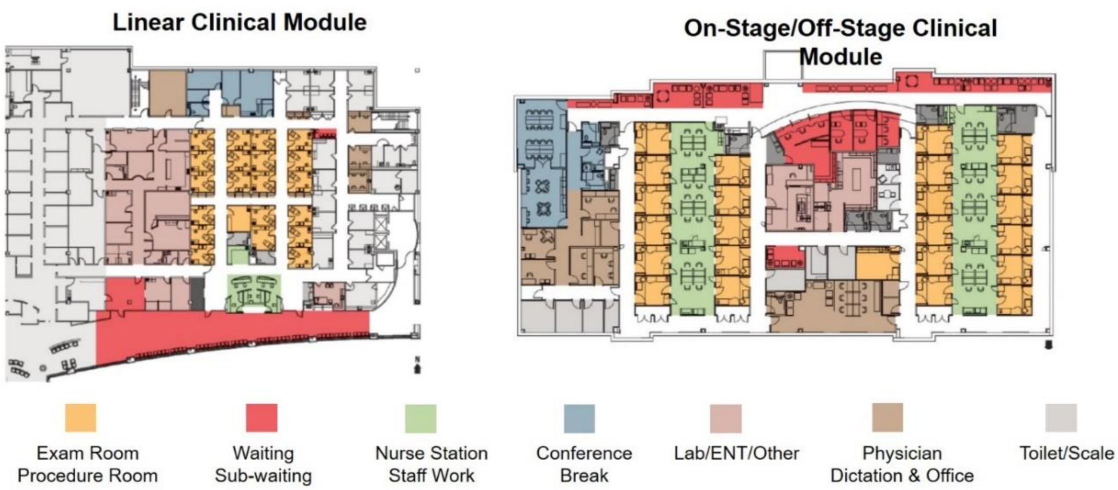


Figure 2.14: Two Clinical Module Layout (Freihoefer et al, 2017, p. 91-92)

In summary, the studies discussed in this sub-section point out that the physical environment influences the delivery of care through three main factors. First, the layout of the physical environment is significant in establishing efficient workflow for patient care delivery. The literature implies that separating patient and staff areas or creating a unidirectional flow facilitates efficient workflow (Freihoefer et al, 2017; Preiser, Verderber, Battisto, 2009). Second, colocating clinical staff in the same workspaces increases collaboration, which improves workflow efficiency (Freihoefer et al, 2017; Mayo Clinic, 2006). However, primary care physicians desire private workspaces to perform patient care activities outside the exam room (CADRE, 2015). Lastly, technology is playing a larger role in patient care that improves patient /staff communication and workflow (CADRE, 2015). Therefore, exam rooms need to accommodate technology to support the clinical staff. The limitations of the studies in this sub-section include a lack of understanding of the clinical team roles and activities for delivering patient care. This signifies that there is gap in describing individual clinical staff experiences and opinions for evaluating the physical environment in primary care settings.

2.5D Studies of Individual Clinical Staff Experiences Offer Design Solutions

Identifying and describing individual staff roles along with their activities provide insights for practical design solutions in primary care settings. The various roles and activities of team-based care in primary care establish complex conditions for the physical environment. Few studies examine the complexity of team-based care and the relationship with the physical environment. The literature that analyzes the individual staff roles and activities presents practical design solutions that enhance the delivery of team-based care. These study present methods to develop evidence-based design recommendations from the staff perspective.

Bunniss and Kelly (2008) utilized an ethnographic strategy to understanding how learning occurs in team-based primary care environments in the United Kingdom. The study employed 38 semi-structured interviews and 49 hours of non-participant observations for data collection methods. The findings from the study indicated that the layout of the physical space affects staff learning for team-based care environments.

Interestingly, the staff located in the pharmacy perceived a more cohesive environment for learning than alternative areas in the clinic. Therefore, the study implies that the colocation of staff and shape of the physical environment enhance a team environment for learning. Furthermore, this study illustrates how obtaining the different staff opinions offers an opportunity for deeper understanding of how the physical environment influences team-based care delivery.

Lavender et al. (2015) conducted an ethnographic strategy to interpret how the clinical team experiences with the design of patient rooms support or hinder the delivery of patient care. The study collected 147 clinical staff experiences and opinions that representing 23 different staff roles for a large urban academic medical center in the United States. The data collection methods included focus groups and interviews that incorporated stocked photos of patient rooms to elicit responses.

The findings from the Lavender et al. (2015) study imply that the design of patient rooms hinders the delivery of patient care. The design solutions included three recommendations for the patient rooms to improve patient care. First, medical devices and technology are key components for patient care delivery. Therefore, patient rooms need to accommodate more power outlets, while locating the outlets higher off the ground. Second, the patient room needs to foster staff and patient communication by establishing convenient seating that allows for eye-level conversations. Third, staff need adequate space to circulate around the patient bed for accessing medical equipment in the patient room. This study demonstrates that staff opinions and experiences produce design recommendations that enhance patient care delivery.

Battisto et al. (2009) emphasize how the physical environment for primary care clinics contributes to improving staff efficiency and efficacy for patient care. The study used a qualitative approach to evaluate three outpatient clinics through data collection methods that included 11 'mystery shopper' patient experiences, shadowing of clinical staff, and three clinical staff focus groups that lasted two to three hours. As a result, the evidence collected from the three clinics was applied to new design solutions for a primary care clinic in developing a physical environment for a regional healthcare organization.

The findings in the Battisto et al. (2009) study illustrated four key design solution to enhance the delivery of care through the physical environment. First, the study found that separating patient and staff areas fosters the ability for staff to engage in conversations without breaching privacy of patient information. Additionally, the study highlighted that staff work areas have access to natural light and views outside the clinic. Second, clustering the most frequently-used spaces minimizes staff travel distances and increases workflow efficiency for patient care. Third, the study recommended the transformation of exam rooms into assessment rooms with the absences of traditional exam tables. In the place of the exam table are seating accommodations, such as sofas and chairs, which promote communication between the patient and staff member. Furthermore, the new assessment room is located adjacent to a treatment room, which provides staff accessibility to provide patient care on exam tables. Lastly, the waiting area becomes an integrated resource lounge that includes an open area surrounded by assessment rooms, a lab, and a pharmacy.

The study signals that primary care is evolving and that the physical environment needs adjustments to support the delivery of patient care. The study incorporated the staff opinions and experiences for delivering patient care through observations and focus groups. As a result, design recommendations were based on the entire clinical team perspective for delivering patient care. At the same time, the study lacks a description of how the individual staff roles and activities influence their perception of the physical environment. Therefore, the design recommendations are limited to the regional healthcare organizations due to the nature of staff roles and activities for patient care.

Figure 2.15: Exam Room Configuration (Battisto et al., 2009, p. 9)

Karp et al. (2016) explored the influence of the physical environment on clinical team interactions pre and post-patient appointments. The study utilized a qualitative approach with ground theory strategy to develop how the three primary care settings influence staff interactions. The three primary care clinics represented two traditional module and one on-stage/off-stage module design (Figure 2.16). Data collection tools consisted of 40 hours of staff observations, interviews with one administrator, and two focus groups for each site. The focus groups participants were separated into two groups that included primary care providers and registered nurses, and medical assistants and receptionists. This separation prevented staff leadership roles from altering the opinions of non-leadership staff roles.

The Karp et al. (2016) study found that the on-stage/off-stage module layout improved clinical team interactions that support patient care delivery. However, one drawback for the on-stage/off-stage layout illustrated how the clinical staff were disconnected from other staff in the clinic. Furthermore, the study revealed that the traditional module layout presented challenges for staff interactions, infrequent meetings of primary care providers, and lack of accessibility to private workstations. These findings demonstrate that colocation of clinical teams are significant in establishing physical environments that support team-based care delivery. The study expresses how collecting individual staff opinions and experiences can inform the design of primary care settings.

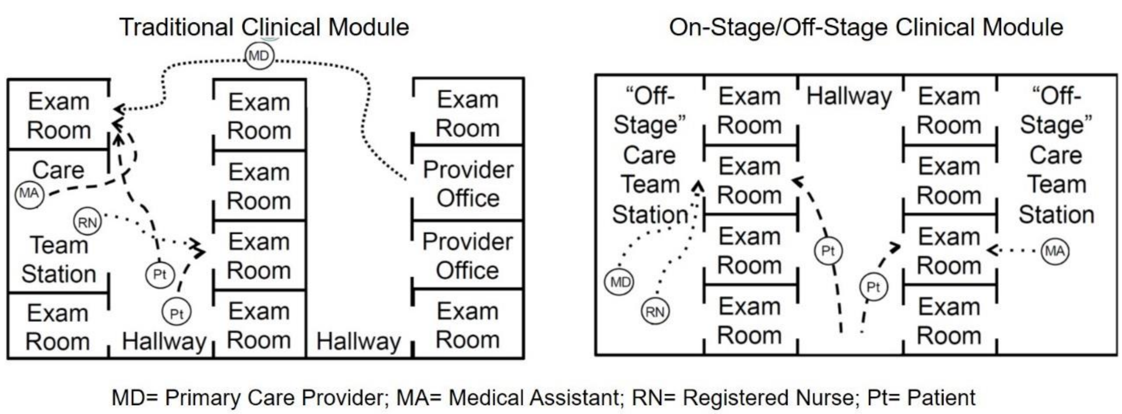


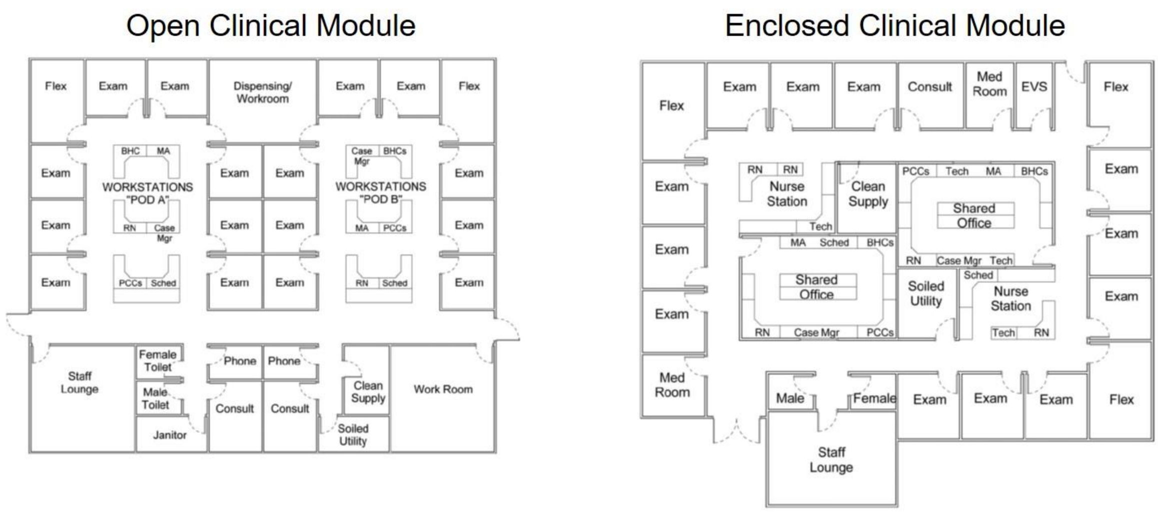
Figure 2.16: Two Clinic Layouts (Karp et al., 2015, p. 6-7)

Oandasan et al. (2009) illustrate the impact of space and time on collaborative teamwork for primary care clinics in Canada. This ethnographic strategy collects 37 interviews and 139 hours of observations for clinical teams across three sites. Additionally, the individual staff roles were identified in the study that included primary care providers, registered nurses, medical assistants, and behavioral health providers. The ethnographic interviews described the individual staff roles, environment conditions, and barriers to team collaboration. At the same time, the observations in the study focused on daily activities, location of activities, and types of staff interactions. Therefore, this study represents a complete understanding of how the physical environment influences team-based collaboration.

The Oandasan et al. (2009) study found that the layout of the physical environment influences the ability to collaborate as a team. The study illustrated that smaller interdisciplinary teams that included physicians, nurses, and sectaries engaged in more collaborative conversations for patient care. Furthermore, smaller staff work areas were a deterrent for team collaboration due to the staff experiencing overcrowding. Additionally, the separation of staff work areas, especially with the primary care providers and behavioral health providers, presented barriers for team collaboration with the lack of visibility and travel distances. Therefore, the major design recommendation from the study implied that smaller interdisciplinary open team spaces that include primary care providers, nurses, medical assistants, and behavioral health providers increased collaboration. This study reveals how individual staff opinions and experiences illuminate the influence of the physical environment on team-based care.

Gunn et al. (2015) point out that clinical teams working in close-proximity engage in significantly more face-to-face collaboration. The study examined 19 primary care clinics in the western United States to describe how the physical environment supports team collaboration. A general qualitative research strategy was utilized in collecting staff interviews, observations, diary posts, staff shadowing, and photographs for the study. Staff interviews included the experiences of administrators, office managers, behavioral health providers, primary care providers, and medical assistants. The observations and staff shadowing occurred over a two - four-day period for each site that collected the activities in team rooms, exam rooms, and clinic corridors. The study illustrates an approach to evaluate the physical environment based on individual staff roles and the delivery of team-based care.

The data analysis from the Gunn et al. (2015) study demonstrated how the configuration and layout of the physical environment influence team-based collaboration. Furthermore, the study illustrated that technology devices intended to increase staff collaboration opportunities were ineffective. As a result, Gunn et al. (2015) developed two types of clinical module layouts to foster team-based collaboration. First, an open module arrangement, similar to the race-track module, is recommended, housing the staff in a central work area surrounded by exam rooms (Figure 2.17). Second, the researchers recommended an enclosed module arrangement that houses two staff work areas and two nurse stations. The second module arrangement provides the staff with private workspaces compared to the open workspaces in the first module. The staff work areas in both modules included workspaces for the behavioral health provider, medical assistant, registered nurses, case manager, primary care provider, and scheduler. The study reveals how collecting individual staff roles provides insights for developing practical design solutions for the physical environment.



BHC=Behavioral Health Provider; MA= Medical Assistant; RN= Registered Nurse; Case MGR= Case Manager; PCC's=Primary Care Providers; Sched= Scheduler

Figure 2.17: Evaluation of Two Team Hubs (Gunn et al., 2015, p. 560-561)

DuBose, Lim, and Westlake (2015) illustrated a mixed-method approach that established design recommendations for team rooms in primary care settings. The study utilized a two phase methodology that included case study and simulation strategies to investigate how team rooms influence team-based care delivery. First, five case studies were examined to analyze the floor plan layout and staff opinions for the physical environment. The data collected from the first phase informed the design of two team room concepts for the second stage (Figure 2.18). Second, eight clinical staff from a regional healthcare organization participated in an evaluation of mock-ups of the team room concepts. The clinical staff included one medical assistant, one case manager, two primary care providers, one behavioral health provider, one dentist, and two administrators. The findings from this study reveal how collecting the different staff roles opinions can inform practical design solutions that enhance the team room environment.

The findings from the DuBose, Lim, and Westlake (2015) study signaled that visibility and ease of communication were desirable design attributes for a team room. As a result, clinical staff who participated in the mock-up evaluation preferred the layout in the first team room concept. Additionally, the five case studies expressed three main design strategies for team room environments. First, exam rooms with double entrances for staff and patients offer privacy from the public, but reduce visibility of patients entering the exam rooms. Second, patients who pass through the team room before entering the exam room increase collaboration with staff, while at the same time increases noise level and limit staff privacy. Lastly, locating primary care provider offices in proximity to nurse workstations improves staff collaboration. These findings imply that team rooms need to support team collaboration and protect staff privacy from patients. Furthermore, the study demonstrates that there is no simple design solution, but rather design solutions that offer trade-offs to support clinical staff in delivering patient care.

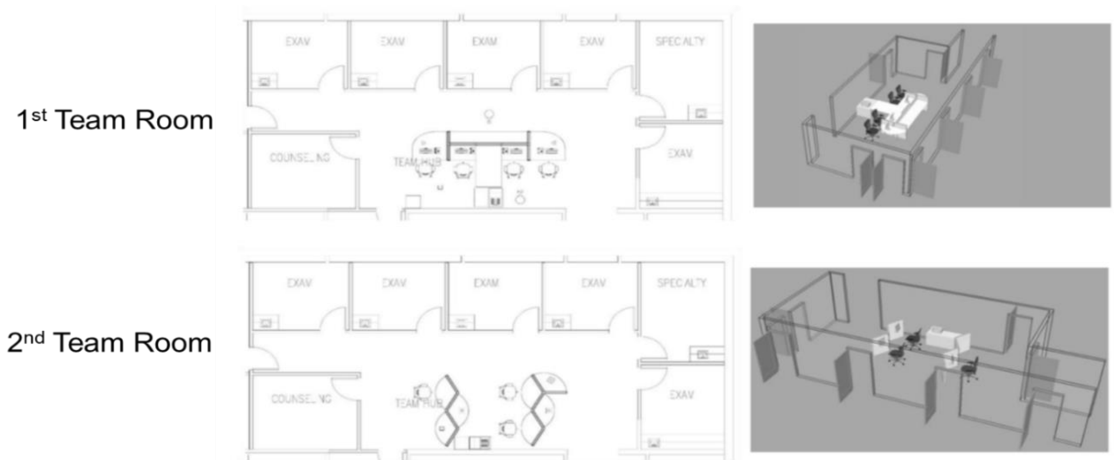


Figure 2.18: Evaluation of Two Team Hubs (DuBose, Lim, Westlake, 2015, p. 63)

In conclusion, the literature points out that team-based care environments are reliant on the ability of staff to collaborate to support patient care activities. The physical environment influences team-based collaboration through establishing open team rooms that support smaller three-to-five individual clinical teams. At the same time, separating the clinical staff into different rooms hinders the ability to effectively collaborate as a team. Furthermore, the studies in this sub-section illustrate the significance of collecting the various individual staff opinions and experiences to create positive design recommendations for team-based care environments. The limitations of the studies reveal there is a lack of understanding of how all of the spaces in the clinical modules function to support patient care. Therefore, a gap exists in evaluating the entire module in how the physical environment supports the delivery of team-based care.

2.5E Critical Goal/Objective for Studying Primary Care Team-Based Environments

The review of the current literature signals three goals/objectives critical to measuring the clinic environment's ability to enhance the delivery of team-based care: (a) efficient clinic workflow, (b) optimizing clinical module functionality, and (c) facilitating collaboration and focused work in the team room. These goals/objectives provide a bridge to link design factors that support high quality team-based care. Integrating these goals/objectives into a framework facilitates a methodology to evaluate team-based primary care setting, which plays a vital role for this study.

The first goal/objective, efficient clinic workflow, provides the ability to minimize staff travel distances and unnecessary efforts to deliver patient care (Thompson & Pelletier, 1959). Efficient clinic workflow occurs in the physical environment through three design considerations: (a) proximity between support rooms and patient care areas, (b) layout of spaces in the clinical module, and (c) sharing corridors with patients. Studies that incorporated simulation modeling provide valuable insights in producing primary care settings that improve staff workflow (Swisher and Jacobson, 2002; Norouzzadeh et al., 2015; Vahdatzad and Griffin, 2016). However, these studies lack the staff opinions and experiences for developing a physical environment that enhances team-based care delivery. Additionally, non-simulation modeling studies are limited in exploring how the physical environment influences individual staff roles in delivering patient care (Freihoefer et al., 2017; Battisto et al., 2009). Therefore, an approach that collects both physical measurements and individual clinical staff opinions is needed to evaluate the workflow efficiency for team-based care environments.

The second goal/objective, optimizing clinical module functionality, captures how well programmatic elements such as the size of rooms, location, and allocation of spaces in the clinical module or clinic supports the delivery of patient care (Preiser & Vischer, 2005). Three design factors are incorporated to create functional clinical modules: (a) types of rooms in a clinical module, (b) clinical module layout, and (c) sizes for rooms in the clinical module. Few studies examine the layout and allocation of spaces in a clinical module (Swisher and Jacobson, 2002; Norouzzadeh et al., 2015; Preiser, Verderber, Battisto, 2009). At the same time, these studies lack the staff opinions and experiences for evaluating the module layouts. Furthermore, the literature evaluates the module and room conditions based primarily based on primary care providers opinions (CADRE, 2015; Mayo Clinic, 2006). Additionally, studies are limited in describing how the functional conditions support the delivery of team-based care (Battisto et al., 2009; DuBose, Lim, Westlake, 2015; Karp et al, 2015; Gunn et al., 2015). These gaps illustrate the significance of collecting both physical measurements and clinical staff experiences to evaluate the functionality of the clinical module.

The last goal/objective facilitates collaboration and focused work in the team room by providing opportunities for clinical staff to work as individuals or as a team without distractions and interruptions (Gunn et al., 2015). The two design factors foster include providing space for private work and space for collaborative work. Studies point out that primary care physician desire private space to complete work that requires focus and concentration (CADRE, 2015; Mayo Clinic, 2006; Gunn et al., 2015). However, these studies are limited in understanding how the different staff roles, registered nurses and licensed practical nurses, desire access to private workspaces. Furthermore, the delivery of team-based care demands the colocation and visibility of team members to enhance collaboration for patient care (Mayo Clinic, 2006; Lavender et al., 2015; Gunn et al., 2015; DuBose, Lim, Westlake, 2015; Oandasan et al., 2009). As a result, team room environments need to support collaboration and focused-work for the clinical staff. The lack of studies that examine team room environments from the perspective of the entire team necessitates additional research in this area (Gunn et al., 2015; DuBose, Lim, Westlake, 2015).

In conclusion, the three critical goals/objectives that measure team-based care environments craft a framework that link design factors for evaluating new and existing primary care settings. The framework is a tool used to identify performance metrics in accessing the strengths and weakness of primary care physical environments. Desired goals/objectives for the physical environment contribute to the production of input measures that collect qualitative staff perceptions and quantitative physical measurements.

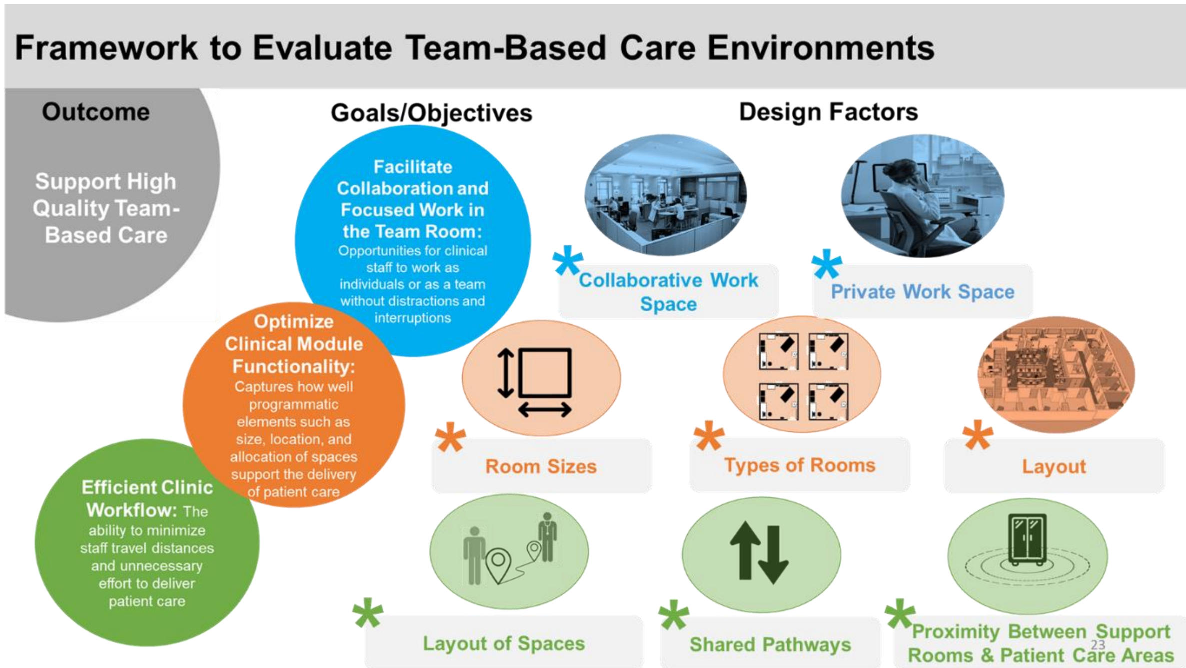


Figure 2.19: Study Framework (Source: Health Design, 2018; Steel Case, 2018; HDS Architecture, 2018)

2.6 Discussion

The gap in the literature points outs a limited understanding of how physical environments influence team-based care delivery. In addition, studies lack the perspectives of different staff roles to evaluate the physical environment, which play an important role for patient care. Studies that engage the staff through interviews while immersed in the physical environment produce the best practical design solutions (Gunn et al., 2015; DuBose, Westlake, Lim, 2015; Battisto et al., 2009; Oandasan et al., 2009; Lavender et al., 2015). Gaining the staff opinions and experiences through ethnographic data collection tools can inform design recommendations for team-based care environments. Therefore, the design of this study is directly influenced from the literature, and aligns with a user-centered approach to evaluate team-based care environments.

CHAPTER THREE

MILITARY HEALTH SYSTEM LITERATURE REVIEW

The Military Health System (MHS) is one of the largest healthcare organizations in the United States and is committed to creating world-class facilities. The MHS operates 431 clinics around the world that deliver primary care services. Furthermore, the MHS offers medical services for 9.4 Million patients, representing 3% of the entire US population (Defense Health Agency, 2016; United States Census Bureau, 2017). Active duty service members, who support and defend the nation, only represent 1.4 million (15%) of patients receiving healthcare from the MHS. The remaining 8 million patients consist of service member children, spouses, and retirees, because the diverse patient population is reflective of a large civilian healthcare organization that offers medical services within the United States, the MHS provides an ideal case to study team-based care.

This chapter is divided into five sections to describe the evolution of primary care in the MHS and how the physical environment is shaped to support patient care. Section 3.1 establishes the crisis for primary care in the MHS. Section 3.2 introduces the transformation of primary care to team-based care and the effectiveness of the PCMH model. Section 3.3 illustrates the different types of primary care clinic typologies in the MHS. Section 3.4 examines the current design guidance criteria that influence the delivery of team-based care. Section 3.5 analyzes the existing studies of MHS primary care clinics to identify gaps in previous clinic designs. Section 3.6 discusses the MHS as an ideal case to become an evidence-based practice leader.

3.1 MHS Primary Care Crisis

In the early 2000s the MHS experience low patient satisfaction ratings in healthcare services due to inability to get medical appointments, increased waiting times, and limited access to specialty care appointments. Patient satisfaction scores for the MHS facilities were 10% lower than with the same patients receiving care at civilian medical facilities (Hudak et al., 2013). Furthermore, the average number of days between scheduling an appointment and seeing a healthcare provider averaged four to seven days for the MHS (Mangelsdorff, Finstuen, Larsen, & Weinberg, 2005). The demand for behavioral health services increased dramatically during this period, leading 40% of patients to seek medical care outside of the MHS (Hudak et al., 2013). As a result, MHS patients became disgruntled with the quality of care, causing 70% of MHS patients to seek care from external healthcare organizations (Hudak et al., 2003).

The increased number of military soldiers further complicated patient dissatisfaction with the delivery of care in the MHS. On September 11, 2001, the United States was attacked by foreign terrorists in New York City and Washington D.C.. The attack led the United States into two massive wars in Iraq and Afghanistan. After more than a decade, the wartime effort is still affecting the MHS for patient care. As a result, the wars placed a heavy burden on patient care services with a surge of 17 million medical appointments for primary care compared to pre-war conditions (Medical Surveillance Monthly Report, 2012). At the same time, medical benefits for military retirees expanded, adding a substantial number of patients 65 and over with chronic health conditions (Hudak et al., 2012). Furthermore, the war efforts resulted in 52,627 soldiers wounded in action placing additional burdens on primary care services. The expanding number of patients and growing dissatisfaction put immense pressure on primary care physicians to deliver optimal patient care.

The enormous pressures in primary care resulted in physicians exiting the service through retirement or lucrative employment opportunities through civilian healthcare organizations (Edgar, 2009). As a result, the MHS consistently missed goals for recruiting physicians into military service from 2005 to 2007 by over 140 physicians per year (Holmes, Lee, Charny, Guthrie, & Knight, 2009). Furthermore, the military requires additional administrative roles for primary care physicians in the role of Field Surgeons, who are assigned to a military maneuver unit, requiring administrative duties outside of patient care. Accordingly, primary care physicians predominantely filled these roles, which subtract from the pool of eligible primary care physicians to provide primary care services (Edgar, 2009). The combination of alarming patient dissatisfaction, high volume workloads, and physician shortages required the organization to adopt a new approach for patient care delivery.

3.2 Transforming the Delivery of Primary Care

The MHS transformed the delivery of primary care by adopting the Patient-Centered Medical Home (PCMH) model. In 2009, the PCMH model and team-based approach gained national attention in attaining strategies outlined in the “Triple-Aim.”, which include (a) lower healthcare cost, (b) better patient experience, and (c) and better health outcomes for patients. Furthermore, the adoption of the PCMH model fostered a patient-centered environment that provides patient care through all stages of life, which the MHS wanted to address with their diverse patient population. Therefore, the transition to the PCMH model of primary care addressed the growing concerns of patients and clinical staff in delivering patient care for the MHS.

The adoption of the PCMH model lowered healthcare costs, reduced patient emergency department visits, and increased access to care. In a pilot, a PCMH clinic for the MHS reported that healthcare costs for patients with chronic illnesses were reduced by 11%, while costs for patients with non-chronic illnesses were cut by 7% (Christensen et al., 2013). Savage, Lauby, and Burkard (2013) performed patient claims analysis for two PCMH clinics, which found a 75% reduction in patient utilization of the emergency department. Recently, the MHS reported that their emergency department utilization rate is 15% lower due to the adoption of the PCMH model (Defense Health Agency, 2017). Additionally, patients reported improved continuity of care by accessing the same clinical care team 92% of the time for patient appointments (Defense Health Agency, 2017). This limited evidence signals that the PCMH model is effective in achieving better outcomes for patient care delivery. At the same time, the MHS adopted its own ‘Quadruple-Aim’ business strategy to improve the delivery of patient care further.

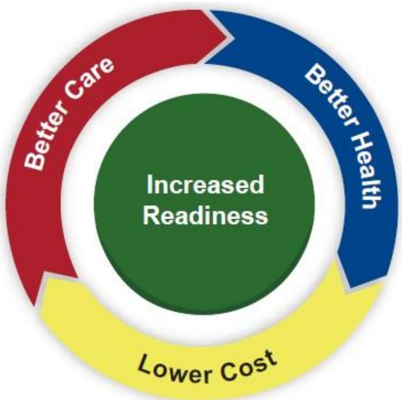


Figure 3.1: MHS Quadruple-Aim (Source: National Capital Region Medical, 2018)

The MHS version of the ‘Quadruple-Aim’ mirrors the earlier business strategies of the ‘Triple-Aim’ (Defense Health Agency, 2013). The ‘Quadruple-Aim’ establishes strategies to enhance the patient experience, improve population health, and reduce healthcare cost. The fourth aim advocates for readiness, ensuring soldiers are healthy and ready to defend the nation. However, the MHS ‘Quadruple-Aim’ does not account for the clinical staff experiences, which creates roadblocks for achieving the four strategies to improve healthcare in the MHS (Bodenheimer and Sinsky, 2014). The lack of staff opinions and experiences is potentially hindering the delivery of team-based care.

The MHS is in the process of replacing and modernizing an aging inventory of primary care clinics. The success of the PCMH model in the MHS occurred in outdated facilities misaligned with team-based care delivery. The existing inventory of 431 facilities is aging, with 74% over 21 years old, while 41% are over 40 years old (Battisto & Franqui, 2012). The aging inventory of facilities creates an additional obstacle in delivering team-based care that is left unexplored. This obstacle is further problematic as there are a limited collection of staff experiences in evaluating the physical environment.

The transformation of primary care from a traditional approach to a team-based approach is proving to be effective for patient care. However, the lack of the clinical staff perspectives in evaluating the PCMH model is potentially hindering the team-based environment At the same time, the MHS is in the process of replacing and modernizing aging facilities. This evidence points out that engaging the clinical staff provides invaluable insight for creating standardize planning and design criteria for future primary care clinics.

3.3 MHS Typologies of Primary Care Clinics

The standardization of primary care clinics starts with limiting the different typologies of clinic environments for a healthcare organization. Primary care clinic typologies are crafted to meet the needs of the healthcare organization and patient population. The literature illustrates four typologies of primary care clinics: (a) embedded-hospital clinic, (b) community-based clinic, (c) medical office building (MOB) clinic, and (d) retail-based clinic. Similarly, the MHS offers three typologies of primary care clinics: (a) embedded-hospital clinic, (b) community-based clinic, and (c) soldier-centered clinics. These three primary care clinic typologies for enable the MHS to meet the demands of its patient population.

Figure 3.2: MHS Primary Care Clinic Typologies (Martin Army Community Hospital, 2017; Wakefield Beasley, 2017; Evans Army Community Hospital, 2017)

The embedded-hospital clinic offers patient care in traditional inpatient hospital settings. The MHS embedded-hospital clinic is located on government installations that provide healthcare for military service members, their family members, and military retirees. The 55 embedded-hospital clinics are owned and operated by the MHS, and represent the oldest facilities in the MHS (Defense Health Agency Trifold, 2017). The adjacency or colocation of the primary care clinic to the inpatient hospital offers robust ancillary services that include pharmacy, radiology, a full lab, physical therapy, emergency department, and several specialty provider consultations. Therefore, primary care services offered in the clinic are typically limited to patient appointments, patient procedures, behavioral health consults, and immunization. This type of clinic establishes a central location that provides access to several categories of patient care services.

Soldier-centered clinics are free-standing facilities that only provide patient care for military service members. The term "soldier" in this study encompasses airmen, sailors, and marines for ease of readability. A soldier-centered clinic is located on government installations with proximity to where military service members work, similar to community-based clinics. The approximately 350 soldier-clinics are owned and operated by the MHS (Defense Health Agency Trifold, 2017). Primary care services offered in the clinic include patient appointments, patient procedures, behavioral health consults, immunization, pharmacy, radiology, a point-of- care lab, and immunization. The robust services allow soldiers to receive patient care in one central location.

The community-based clinics are free-standing facilities that provide patient care for service member families and military retirees. The 27 leased clinics are located off government installations and are operated by the United States Army (MHS Community Based Medical Home Correspondence, 2017). The leased status restricts the size and capability of services offered in the clinic. Typically primary care services include patient appointments, patient procedures, behavioral health consults, immunization, point-of-care lab, and a pharmacy. This type of clinic allows patients who live off government installations to have better access to care in the local community.

The identification of the three different typologies for the MHS illustrates the similarities to the large body of knowledge. At the same time, establishing the clinic typologies for the MHS brings a deeper understanding of the importance of standardizing design guidance criteria. This means that the location and types of services for a primary care clinic are different, but they should share a standard layout to support clinical staff.

3.4 MHS Standardize Design Guidance Criteria

Standardization of healthcare services and facilities allows the MHS to deliver optimal care for a diverse patient population. The frequent relocation of active duty military members and their families every 3-5 years prioritizes the need to standardize the delivery of healthcare (Vergun, 2013). Furthermore, a medical professional who serves in the military experiences these same frequent transitions to new duty assignments. The goal of standardizing healthcare facilities is to aid in reducing costs while easing the transition of healthcare professionals to new physical environments. Therefore, the MHS not only utilizes a standard delivery model for primary care, but standardizes design guidance criteria for medical facilities (Department of Defense, 2016).

Figure 3.3: MHS Design Guidance Tools (Military Health System, 2018)

The MHS design guidance criteria consist of a hierarchy of four nested documents that are routinely updated to reflect new changes in building materials, building codes, technology, spatial allocation, and adjacencies of spaces. The four design guidance documents include: (a) Unified Facility Criteria (UFC) for healthcare facilities, (b) space planning criteria, (c) room templates, and (e) military standard 1691 equipment planning. Each of these documents plays a role in how the physical environment is shaped for primary care clinics.

Starting at the bottom of the hierarchy scheme is the military standard (MILSTD) 1691 equipment planning document, which details the allocation of equipment to outfit designated rooms. For example, the current exam room contains 20 line-items of furniture, fixtures, and equipment (World Class Facilities, 2018). The MILSTD 1691 provides standardized guidelines for outfitting each room in a primary care clinic, allowing the MHS to minimize variances in planning and designing new spaces to support the delivery of patient care.

Room templates provide a visual representation of room layouts, allocation of equipment, and physical dimensions for the room. The current MHS room templates provide standardized guidance for 90 rooms in healthcare facilities that include inpatient hospitals, primary care clinics, veterinary clinics, and dental clinics (Whole Building Design Guideline, 2018). The wide range of templates is limited to only 15 rooms that influence designs for primary care clinics. Analyzing the 15 room templates reveals that team rooms are absent from the guidelines, which presents a major gap in supporting the delivery of team-based care. Furthermore, the historical exam room templates illustrate how the size, layout, and furniture received minimum modifications from 2003 to 2015. For example, the size of the exam rooms remains 120 Net Square Feet (NSF) from 2003 to 2015, even with the integration of team-based care (Whole Building Design Guideline, 2018). This evidence starts to signal that the MHS design guidance is misaligned with the PCMH model.

The space planning criteria (SPC) for primary care clinics provide guidelines for the allocation, size, and adjacencies of rooms. The current SPC is broken out into three main components that describe (a) how the allocation of space is determined, (b) five clinic areas with room titles, sizes, allocation and definitions for each space, and (c) intra-clinic and inter-clinic functional adjacencies of spaces. This single document is critical to informing the design guidance for developing new primary care clinics that support the delivery of team-based care.

Finally, the UFC 4-510-01 details technical guidance, policies, and procedures for planning military medical facilities. The role of this document describes the specific building and technical requirements for all types of military medical facilities. Furthermore, the UFC 4-510-01 supersedes the Facility Guideline Institute (FGI) publications, which are industry standards for building medical facilities. Additionally, the UFC 4-510-01 sits atop the hierarchical scheme of documents that influence the design of medical facilities in the MHS.

The review of the MHS design guidance criteria reveals an approach to modifying the physical environment to support team-based care. The SPC illustrates a single document that is the crux for planning and designing the physical environment for team-based care delivery. An analysis of past and current SPC provides insights to understand how the guidelines are misaligned with the PCMH model of care. Additionally, the team room is a missing component in the MHS room templates, a gap in the current MHS guidelines. Therefore, a review of the SPC for primary care clinics is a critical step for the success of this study.

3.4A Review of 2006 Space Planning Criteria for Primary Care Clinics

The SPC for primary care clinics is an essential document that influences the design of the physical environment. The first public document of the SPC was released in 2006, before the adoption of the PCMH model. The document received no updates until 2015, a major gap for the transformation of primary care clinics to support team-based care. Interestingly, the SPC was revised in 2016 and 2017 with limited modifications in the planning and design of primary care settings. However, the revised SPC documents lack understanding of team-based care functions with the clinic environment. The review of the SPC points out that traditional physician-centric design concepts carried over to existing and new PCMH clinics.

The 2006 SPC reflects a traditional physician-centric model of care for the physical environment. This version of the SPC includes three sections that (a) provide terminology, definitions, and policies (b) establishes programming data requirements, and (c) describe four clinic areas that include room titles, allocation, and sizes of spaces. The 2006 SPC document outlines four main strategies that create a traditional physician-centric physical environment.

First, the number of exam rooms are allocated at two per physician, establishing dedicated exam rooms for each physician to manage. Furthermore, the size of the exam room is 120 NSF, which is the same size as office spaces in the clinic. This creates flexibility for designers to alter spaces in the initial design phases, without costly modifications that require walls to be torn down and affords the clinical staff the opportunity to modify exam rooms into private office spaces. This allows the clinic environment to adapt to potentially new patient care functions, but provides clinical staff the flexibility to potentially create more private offices.

Second, private offices are provided for each primary care provider in the clinic. The remaining staff members are allocated shared offices, which are recommended to provide 60 Sq. Ft. per staff member. Interestingly, the size of shared offices is not restricted, which aligns with allocating sufficient space for a team-based environment. However, the private offices signal a hierarchical staffing model that separates the staff based on their role for patient care. Therefore, the role of the primary care provider is prioritized with the allocation of private workspace, while other staff members share office workspace.

Third, the guidelines identify that embedded-hospital clinics and soldier-centered clinics require different types of ancillary services. For example, soldier-centered clinics would be allocated pharmacy, radiology, and lab sections. Meanwhile, the embedded-hospital clinic relies on the ancillary services located in a hospital. This demonstrates an understanding of spatial programming requirements to align with specific clinic typologies.

Finally, the allocation of spaces is based on the number of primary care providers providing patient care in the clinic. For example, screening rooms are allocated based on increments of every four primary care providers. This means that the patient workload for the clinic is disregarded, and space is allocated based solely on the number of physicians in the clinic. The allocation of space based on the number of primary care providers potentially leads to oversized clinics with too many exam rooms. The over-allocation of exam rooms facilitates the ability to establish more private offices for clinical staff. This creates opportunities for clinical staff to separate their work areas from additional staff workspaces further, and hinders the ability to establish a collaborative environment for patient care.

In conclusion, the 2006 SPC reveals a physician-centric model of care that influences the physical environment for patient care delivery. The 2006 SPC provided design guidance for the physical environment for a nine-year period. At the same time, the MHS adopted a team-based care model, which counters the philosophy of the physician-centric model. However, the 2006 SPC document hints at the ability to align with the future integration of the team-based model. This is accomplished by recommending 60 Sq. Ft. per staff member in shared office spaces. Additionally, identifying that the typologies of primary care clinics require different ancillary services is key for supporting the delivery of team-based care. While not entirely aligning with the principles of the MHS, the 2006 SPC offered the potential to accommodate new functional requirements for the delivery of team-based care.

3.4B Review of 2015-2017 Space Planning Criteria for Primary Care Clinics

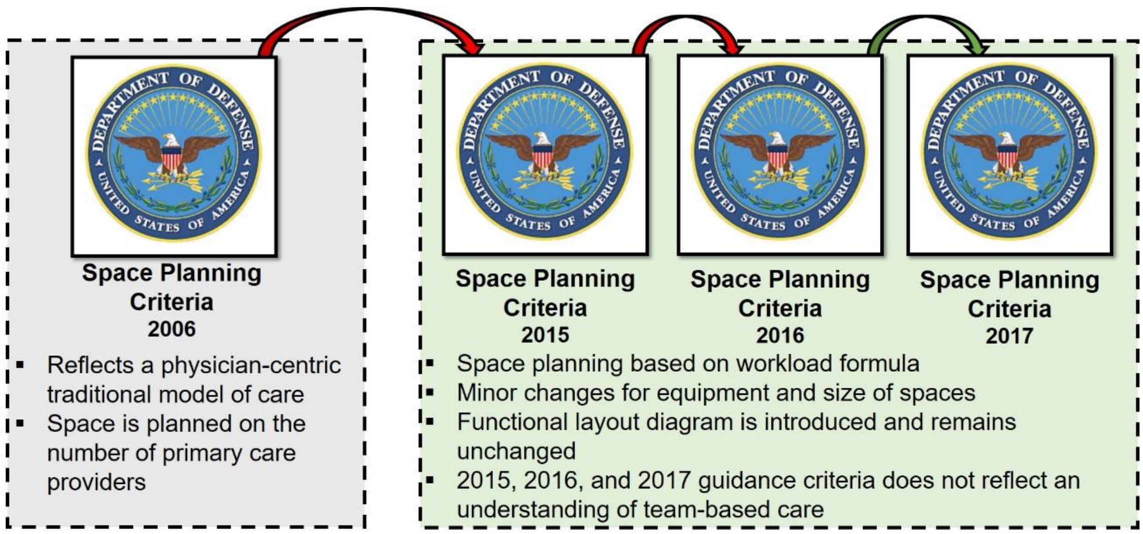


Figure 3.4: MHS Space Planning Criteria Comparison (Department of Defense, 2018)

The updated SPC lacks clarity in understanding the relationship of team-based care and the physical environment. The next version of the SPC was published in 2015, six years after the adoption of the PCMH model. Later, two revised SPC were released in 2016 and 2017, with limited alterations for designing the physical environment. Any clinic constructed from 2006 to 2015 followed the 2006 SPC document. However, revisions in the updated SPC accounted for weaknesses in the prior document that included (a) a workload formula for allocation of space; (b) grouping five clinic areas that describe room titles, sizes, and allocation of spaces; (c) spatial adjacency diagrams for intra and inter-clinic; and (d) planning recommendations for team-based care environments. As a result, these changes resulted in four factors that influence how primary care clinics built after 2015 are shaped to support team-based care.

First, a workload formula for allocation of space moves away from the previous physician-centric approach. The workload formula analyzes the operating days per year, hours of operations, annual face-to-face patient encounter workload, and utilization factor to determine the allocation of exam rooms in the clinic, which in turn determines the allocation of additional spaces in the clinic. For example, the allocation of screening rooms is based on the increment of eight exam rooms. This reveals that allocating the number of clinical support rooms and staff work areas are driven by the total number of exam rooms in a clinic.

Furthermore, the workload formula reduces the overall size of primary care clinics, which indicates prior clinics were potentially over-allocated exam rooms. At the same time, the workload formula doesn’t account for emerging medical appointments that include telemedicine and patient procedures. This hints that the latest MHS tool for space allocation is misaligned with the growing trend for technology-related appointments (CADRE, 2015).

Second, spatial adjacency diagrams for intra and inter-clinic are established to illustrate the layout of the physical environment. The intra-clinic diagram illustrates the grouping of spaces in the primary care clinic. The diagram identifies five clinic areas that include (a) reception/waiting, (b) exam, (c) treatment, (d) support, and (e) staff and administration. First, the reception waiting area includes spaces for patient waiting, reception area, and public toilets. Second, the exam areas support multiple exam rooms, screening rooms/alcoves, patient toilets, and behavioral health provider offices. Third, the treatment areas consist of treatment rooms, pharmacy, lab, radiology, immunization, and additional ancillary services. Fourth, the support area refers to rooms such as the medication room, storage, and clean and soiled linen rooms for the clinic. Finally, the staff and administration area contains offices, team rooms, conference rooms, the lounge, and additional administrative spaces. However, the diagram lacks boundaries for establishing clinical modules to support team-based care. This lack of defining clinical modules is an indicator of misalignment with team-based care clinics (DuBose, Lim, Westlake, 2015; Gunn et al., 2015; Oandasan et al., 2009).

Furthermore, the intra-clinic diagram mimics the T-shape clinical module, which emphasizing the separation of staff and patient areas. The patient areas that include the reception/waiting, exam, and treatment areas are located in front of the clinic or 'on-stage.' The staff areas that include support and staff and administration are located in the back or 'off-stage' of the clinic. Staff is afforded a private circulation pathway behind the clinical support area away from the patient areas. At the same time, the patient and staff share the same circulation pathways in the exam and treatment areas of the clinic. This counters the emerging design trends for clearly separating patient and staff circulation in the primary care clinic (Cahnman, 2011; Mahlum Architects, 2011; Capital Link, 2011; Center for Health Design, 2016; Freihoefer et al, 2017).

Lastly, the SPC planning and design recommendation section illustrates that decentralized support rooms increase staff workflow efficiency. The intra-clinic diagram includes a centralized area for all clinical support rooms. Furthermore, the intra-clinic diagram potentially existed before the 2015 SPC document, which influenced the layout of primary care clinics during the adoption of the PCMH model. Consequently, the intra-clinic diagram offers an unclear design strategy for creating clinic environments for team-based care.

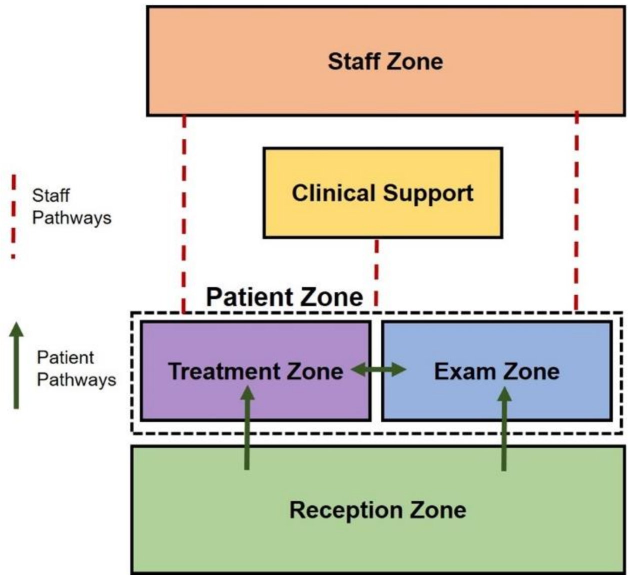


Figure 3.5: Intra-Clinic Diagram (MHS SPC, 2015, p. 18)

The inter-clinic diagram establishes the relationship of a primary care clinic to ancillary services in an embedded-hospital clinic. Additionally, the design recommendation section advocates for “convenient access” to the pharmacy, radiology, lab, and treatment rooms for clinical staff (MHS SPC 2017, Pg. 15). However, the SPC lacks representation of clinical module relationships to ancillary services. Instead, the current SPC locates the ancillary services in the patient care area of the inter-clinic diagram. This presents unclear design guidance for the adjacency of ancillary services such as the pharmacy, radiology, and lab in soldier-centered and community-based clinics. As a result, the current SPC lacks a standardized design approach for describing the spatial adjacencies of clinical modules and ancillary services. This points out that the

MHS lacks identification of different typologies of primary care clinics, which was more evident in the prior 2006 SPC.

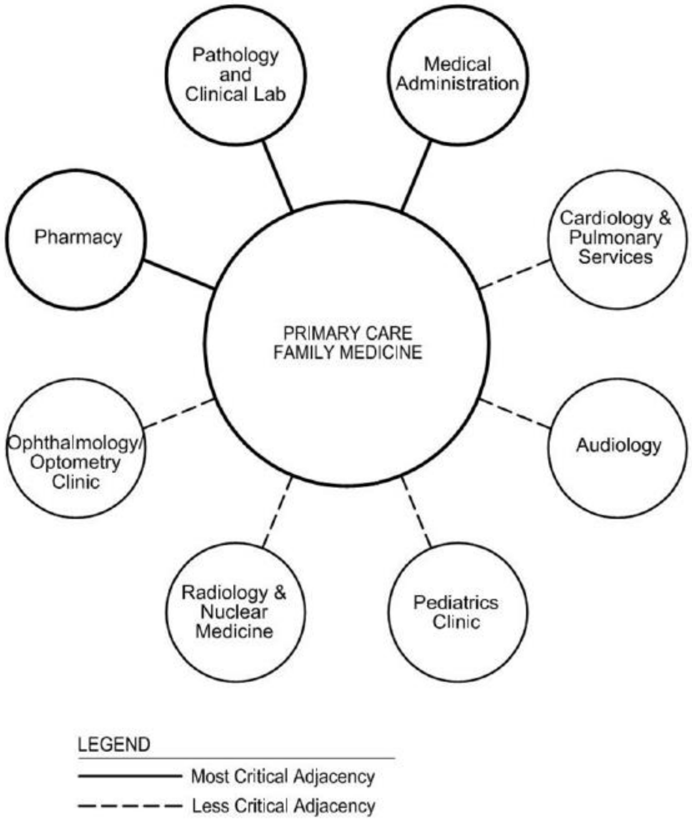


Figure 3.6: MHS Space Planning Criteria Inter-Clinic Diagram (MHS SPC, 2015, p. 17)

Third, the planning and design recommendation section for team-based care is not synced with the size of team rooms. The planning and design recommendation section in the current SPC advocates for team rooms that colocate staff to enhance collaboration for patient care. Furthermore, the section indicates that private offices are limited to healthcare administrators working in the clinic. Additionally, the MHS PCMH operational guide points out that a team room should support eight staff members that include two primary care providers, one registered nurse, and five licensed practical nurses (MHS PCMH Guide, 2011). However, the current SPC section that describes the size of the team room only allocates 120 NSF for the entire space, which provides 15 Sq. Ft. per staff. This demonstrates how the current MHS SPC is misaligned with the size of the team room. At the same time, private offices are allocated to staff based on local user requirements. The literature indicates that primary care providers will primarily choose private offices over shared workspaces when given a choice to provide input (CADRE, 2015). Therefore, the MHS is tepid in altering spatial requirements for team rooms and presenting fuzzy SPC guidance on the allocation of private offices in the clinic.

Fourth, primary care providers are allocated two dedicated exam rooms, which is carried over from the 2006 SPC document. The first section of the 2015 SPC document establishes that the minimum size of primary care clinic consists of two exam rooms, one isolation exam room, and a bariatric exam room. The key takeaway from this initial statement are the two exam rooms, which infers that a single primary care provider is allocated two exam rooms. This inference was validated in interviews with MHS leadership responsible for the planning and design of primary care clinics (MHS Design Interviews 1-5, 2016). However, the 2015 SPC document establishes that “no exam room is intended to be dedicated to any specific provider; rather all exam rooms can be used at all times.” (MHS SPC, 2015, Pg. 17). The same statement was republished in the 2016 and 2017 SPC documents. This demonstrates that the current SPC documents offer confusing and misaligned guidance for designing primary care clinics for team-based care.

In conclusion, the physician-centric 2006 SPC played a heavy role in shaping physical environments intended for team-based care. Additionally, the evidence indicates that physician-centric design strategies are still lingering in the current SPC document for primary care clinics. As a result, the latest SPC documents indicate that MHS is limited in understanding how the physical environment influences team-based care delivery. This means that all of the PCMH achievements in patient care in the MHS are potentially handicapped by the physical environment. Developing new guidelines for the physical environment that align with delivering team-based care can lead to improvements in patient care in the MHS.

3.5 Studies Evaluating MHS Primary Care Clinic Environments

The overnight transformation from a physician-centric model to a team-based model led to the utilization of outdated spatial configurations for patient care delivery. The influence of the 2006 SPC document is illustrated through three studies on primary care settings for the MHS. The three studies prove a lack of standardization of primary care clinics, which is a fundamental business strategy for the MHS. Alternatively, the Veteran Administration, a sister organization to the MHS, performed a study to revamp the organization's design guidance criteria for team-based care environments. The VA approach establishes a standardized design that allows flexibility in adopting future functions for team-based care delivery. These studies can inform future guidelines and shape the research approach for this study.

Battisto, Couvillion, Albury-Crandall, Pauling, Steele (2011) performed an initial pilot study at Bassett Army Community Hospital to establish a post-occupancy evaluation methodology for MHS healthcare facilities. The Bassett Army Community Hospital, which started providing patient care in 2007, was selected for the study as a representation of a new healthcare facility. The study evaluated five departments in the hospital that included (a) primary care, (b) medical-surgical inpatient care ward, (c) maternal, newborn unit, (d) ambulatory surgery, and (e) emergency department. Each of the departments was measured against four outcomes: (a) positive experience, (b) operational efficiency, (c) clinical effectiveness, and (d) healthy environment and sustainability. These outcomes establish a framework to evaluate the physical environment for general healthcare settings.

Figure 3.7: Bassett Army Community Hospital Primary Care Clinic (Battisto, Couvillion, Albury-Crandall, Pauling, and Steele, 2011)

The evaluation of the embedded-hospital based primary care clinic signals an overall physician-centric design approach for the physical environment. The study analyzed 20 staff surveys, three leadership interviews, floor plan take-offs, photographs and walkthrough observations to understand the physical environments influence patient care. The findings from the study revealed three major areas that influence the staff opinions of the physical environment with (a) proximity of spaces, (b) functionality of the exam room, and (c) lack of group space for collaboration and training.

First, the study illustrates that the proximity of staff work areas to the exam room is a strength for the clinic design. The clinic provides primary care physicians with private offices located in proximity to exam rooms. Additionally, staff located in shared offices wherein proximity to exam rooms as well. However, the proximity of staff work areas and exam rooms established shared circulation pathways with patients. The shared circulation patterns created "occasional" breaches in staff privacy (Battisto et al., 2011, Pg. PC 2). This indicates that proximity of staff work areas to exam room is an indicator for staff satisfaction. At the same time, the proximity of staff and patient care areas impedes on staff privacy. Therefore, the 2006 SPC reveals that staff work areas too close to patient care areas breaches staff privacy.

Furthermore, the proximity to support rooms in and outside the clinic represent mixed perceptions for the clinic design. The proximity of the primary care clinic in relationship to support rooms that include the lab, pharmacy, and radiology were identified as a strength. The decentralized medication work areas in the clinic were a weakness for design. This evidence expresses that clustering the most frequently used areas to support patient care enhances workflow in the clinic. Furthermore, these two findings illustrate the significance of establishing clear SPC guidance for the adjacency of support rooms within and outside opf the clinic. This implies that the prior and current SPC documents are misaligned with the delivery of patient care.

Second, the study pointed out that the size of the standard exam room in this clinic was too small for patient care. The standard exam room was sized at 110 NSF, which is smaller than the recommended size of 120 NSF illustrated in the past and current design guidance documents. The staff identified that the interchangeability of exam rooms and offices was a strength, which is due to the same size of the spaces. This finding expresses that staff favor the ability to alter spaces, potentially with exam rooms becoming more offices. Furthermore, the finding indicates that the clinic is either over-or-under allocated the right number of exam rooms. The 2006 SPC document for spatial allocation based on the number of primary care providers is inadequate for spatial planning of primary care clinics.

Third, the primary care clinic lacks space for collaborative work and staff training, which is attributed to the restriction of the size of rooms to fit in a circular layout. The study findings point out that the circular layout of the clinic limits future growth and expansion. Additionally, the physician-centric design approach of separating staff work areas into private and shared offices is a potential factor for limited collaborative space. As a result, the circular clinic design for primary care clinics is problematic for the adoption of a team-based approach for patient care.

The Battisto et al. (2011) study establishes that MHS 2006 SPC design guidance criteria are misaligned with the delivery of primary care. Additionally, the study demonstrates how the MHS design guidance criteria are not always implemented in the physical environment. This counters the MHS approach for attempting to standardize healthcare facilities, especially with primary care clinics. Therefore, the embedded-hospital clinic in the study lacks the flexibility to accommodate the new functions for delivering team-based care. Furthermore, this study points out how the physical environment hinders the delivery of patient care.

Figure 3.8: Fort Belvior Family Medicine Clinic (Battisto, Franqui, and Bouchard, 2012, p. 18)

Battisto, Franqui, Bouchard (2012) is the follow-up study to Battisto et al. (2011), and utilizes the validated post-occupancy evaluation methodology to study a new healthcare facility. The study evaluates a second MHS facility, Fort Belvoir Army Community Hospital, that began patient care services in 2011. Similar to the previous study, six departments were evaluated in the hospital that included (a) primary care, (b) operative services, (c) behavioral health, (d) labor and delivery, (e) mother-baby clinic, and (f) medical ward. The study measured four outcomes for each department: (a) positive experience, (b) operational efficiency, (c) clinical effectiveness, and (d) healthy environment and sustainability. Accordingly, the data collection methods for the primary care clinic mimicked the previous study with 40 staff and 58 patient surveys, three leadership interviews, floor plan take-offs, photographs and walkthrough observations.

The evaluation of this embedded-hospital based clinic indicated a mixed approach of the 2006 SPC and designers intuition to create team-based care environments. The mashup occurred due to the similar timelines of construction for the hospital and adoption of the PCMH model in 2009. As a result, the clinic floor plan is representative of the MHS intra-clinic diagram, which separates patient and staff areas. Additionally, primary care providers are located in private offices, while nursing staff utilize three open workstations. The design of the clinic integrated four clinical modules into the layout, which is not represented in the guidance outlined in the 2006 SPC or intra-clinic diagram. Therefore, the findings from the study indicate design strategies that apply to team-based care environments that include (a) establishing team-based clinical modules, (b) separating staff and patient areas, and (c) fostering staff collaboration with staff workspaces.

First, the establishment of a clinical module supports a team-based approach with the ability to accommodate increases and decreases with the patient workload. The study reveals that standardize clinical modules A and B with centralized clean and soiled utility rooms best support the clinical staff for patient care activities (as indicated in Figure 3.8).

At the same time, the lack of clean and soiled utility rooms increases staff travel distances for patient care in clinical module C and D. This implies that clean and soiled utility rooms play an important role in supporting efficient workflow for patient care. Furthermore, the findings demonstrate how lack of defining clinical modules in the SPC influences the delivery of patient care.

Second, the separation of staff and patient areas mitigate breaches in staff privacy. This is accomplished by locating staff work areas in the back or ‘off-stage’ area, while patients are located in the front or ‘on-stage’ area. Additionally, the back corridor provides a private circulation corridor for staff to move around the clinic. At the same time, open nursing stations are located in the front of the clinical modules, placing the staff in an ‘on-stage’ area. This finding reveals that the intra-clinic diagram was a factor in MHS design guidance before the official publication in 2015 SPC document. Therefore, the intra-clinic diagram facilitates a standardize clinic layout that offers clinical staff privacy away from patient care areas. This indicates a new MHS design guidance that moves away from the physician-centric model depicted in the Battisto et al. (2011) study.

Third, staff work areas hinder team collaboration for patient care. The clinic design reinforces a physician-centric approach by establishing private offices for primary care providers in the ‘off-stage’ area of the clinic. Consequently, the separation of staff into different workspaces limits visibility, which influences the ability to collaborate as a team. Furthermore, the separation of staff work area fosters a reliance on limited access to wireless technology devices to collaborate with team members. This finding expresses how the physical environment directly influences the ability of staff to collaborate, which hinders the delivery of patient care. At the same time, the finding establishes how physician-centric design strategies were implemented due to the influence of the 2006 SPC document.

The Battisto, Franqui, Bouchard (2012) study demonstrates how the role of the physical environment influences staff opinions for supporting a team-based care environment. The findings from the study indicate the need to define a standard clinical module for team-based care environments. Furthermore, the study illustrates that staff opinions and experiences are a valuable asset in developing physical environments that support team-based care delivery. However, the study is limited to the evaluation of one primary care clinic for the MHS. Additionally, the study lacks identification of the different staff roles that participated in the study, instead of lumping the different staff opinions into one response. Ultimately, the study is unclear on how many different staff perceptions represent the responses on the influence of the physical environment on patient care delivery.

Zimring and DuBose (2016) illustrate how existing MHS primary care settings lack design standardization, which is significantly influencing the delivery of patient care. The study utilized a mix-methodology that included case study and simulation strategies to investigate the variances of multiple primary care settings. The case study included a two step-process to analyze nine MHS primary care clinics that represent the influence of the 2006 SPC and design intuition. First, archival documents and floor-plans were collected to analyze the physical environment layouts through space syntax simulation. Next, six cases were selected for site visits that collected staff interviews, photographs, duration of appointments, and behavioral mapping. This data informed a discrete event simulation model that analyzed exam room utilization rates across the nine cases, revealing the optimal number of exam rooms for each case. As a result, the study presented three major themes that included (a) inconsistent size of exam rooms and team rooms, (b) non-standardized layout of clinical modules, and (c) the over-allocation of exam rooms.

First, the size of exam rooms and team rooms were inconsistent across the nine cases. The size of exam rooms ranged from 100 NSF to 120 NSF that consisted of different layouts for each site. This study found that the size of the exam room is lacking standardization and restricts collaboration between staff and patients. Additionally, the size of the team rooms ranged from 100 NSF to 1,030 NSF, which supported a range of two to thirteen staff members. Therefore, the spatial layout of the team rooms in the study provides a range of 25 Sq. Ft. to 80 Sq. Ft. per staff member when all staff members are working in the team room. This finding indicates the size of the team rooms is inconsistent with the 2006 SPC, which establishes 60 Sq. Ft. per staff member. The variations in exam room and team room sizes influences the dynamics of collaboration for delivering team-based care.

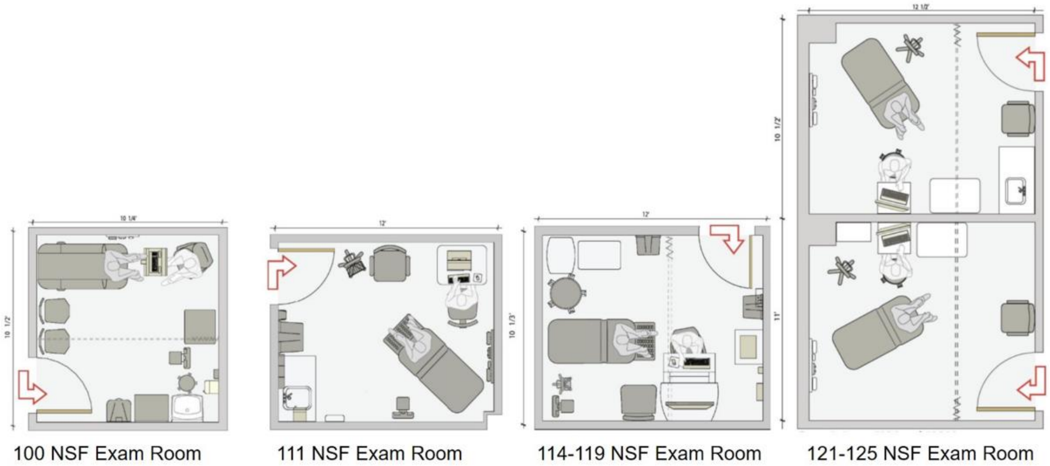


Figure 3.9: MHS Exam Room Sizes and Layouts (Zimring and DuBose, 2017, p.10)

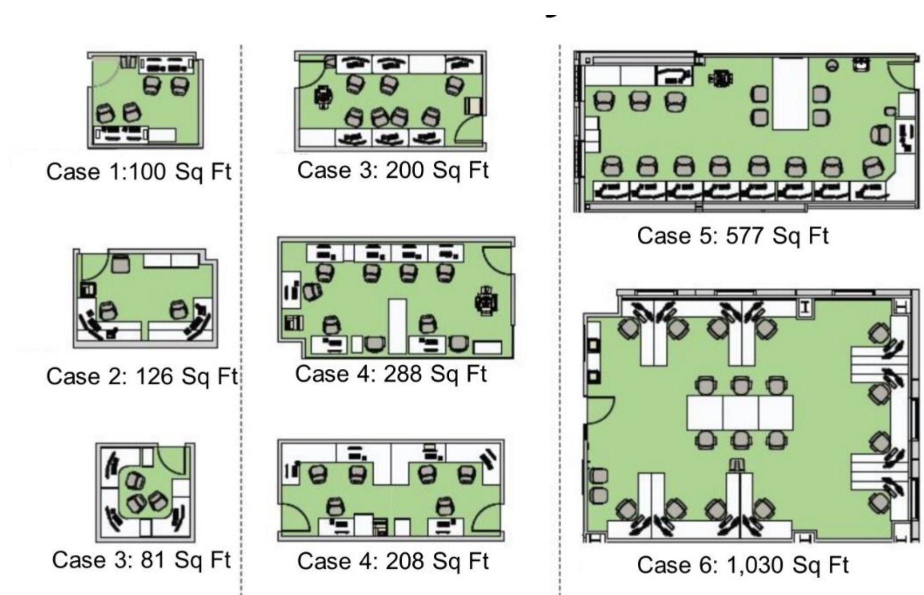


Figure 3.10: MHS Team Room Sizes and Layouts (Zimring and DuBose, 2017, p.8)

Second, the nine cases signal a non-standard approach for clinical module layouts. The study categorized the clinic layouts into five typologies that include (a) scattered, (b) traversed, (c) clustered, (d) augmented, and (d) hybrid. The five clinic layout typologies are grouped by circulation patterns and location of staff work areas. The findings point out that circulation patterns are consistently shared among staff and patients with limited clinics offering private staff corridors. At the same time, the location of the team rooms is mixed throughout the clinic.

Furthermore, the study revealed that registered nurses are separated from the team rooms, which restricts the ability to establish a collaborative team environment. These findings for the clinical layouts indicate potential issues for breaches of staff privacy, which are left unexplored in this study. Furthermore, the new clinic layout typologies are unclear in referencing the relationship to the existing design literature for primary care clinics.

Third, the discrete event simulation implies the over-allocation of exam rooms with guidelines established in the past and present SPC documents. The study examined both the 2006 and 2017 SPC exam room allocation policy compared to literature recommended pooled exam room policy. The findings demonstrate that both the old and current SPC documents allocate too many exam rooms for primary care clinics. Additionally, the study supported the SPC design recommendation for establishing shared exam rooms instead of dedicated exam rooms per primary care provider. This signals that the size of the current primary care clinics is oversized, which leads to ineffective staff workflow for patient care.

The findings from the study demonstrate how the past and present SPC documents are misaligned with the delivery of team-based care. Furthermore, the study points out how non-standardized designs are influencing staff in delivering patient care. However, a limitation of this study is the lack of identifying which staff and how many were interviewed in the study. Furthermore, behavioral mapping, space syntax, and simulation modeling of staff activities are prioritized over their opinions and experiences in evaluating the physical environment. This presents a gap in exploring and describing the influence of the physical environment on delivering team-based care.

The Veteran Administration (2015) performed an analysis to develop new physical environments that support the delivery of team-based care. The VA utilized a lean design process with input from designers, leadership, and clinical staff to develop a new solution for the physical environment. The results of the analysis established that the organization needed to implement an on-stage/off-stage clinical module design. The on-stage/off-stage model provides a central location to colocate all staff members, which increases collaboration for patient care. Furthermore, the central staff work area provides proximity to exam rooms to minimize staff travel distances. The on-stage/off-stage clinical module created a standardized environment that clusters frequently used rooms to support patient care delivery. As a result, this clinical module created additional flexibility to replicate multiple modules in a clinic, while establishing a clear standard design for primary care environments across one of the largest healthcare organizations in the world.

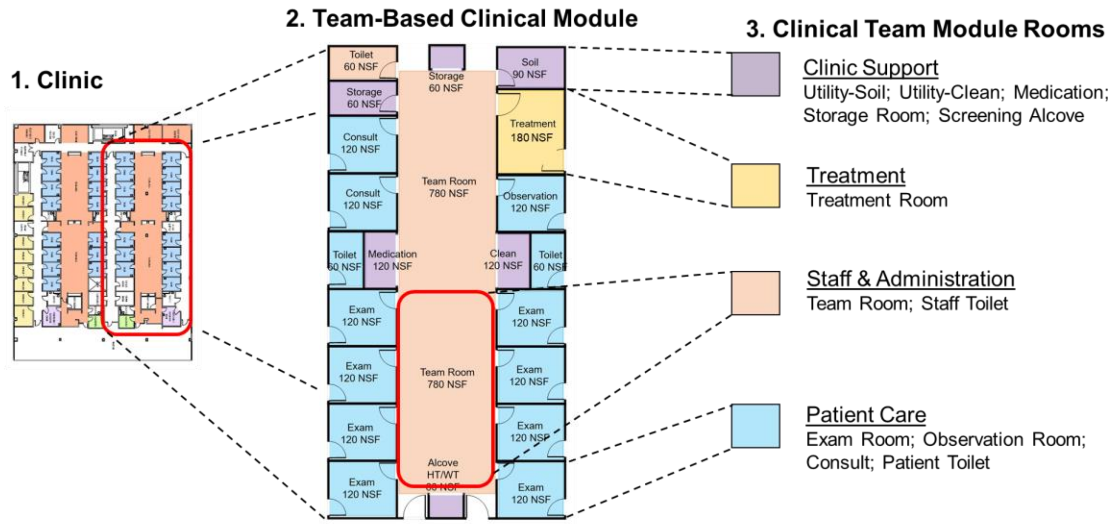


Figure 3.11: Veteran Administration Clinical Module (VA, 2015)

Also, the analysis pointed out that the current exam room configuration was inadequate to support new activities for patient care. The analysis recommended an increase in the size of the exams from 120 NSF to 125 NSF to accommodate more equipment and family members. The added equipment included patient screening equipment, a consulting table with three chairs, and access to a screen to review treatment plans with patients. This establishes a universal exam room that makes separate consult rooms and screening alcoves unnecessary for a functional clinical module. Additionally, the traditional door is replaced with a sliding door to improve the availability of space in the exam room, which is restricted by the door swing in traditional exam rooms. The increased size and added equipment indicate a better alignment with the delivery of patient care in primary care settings.

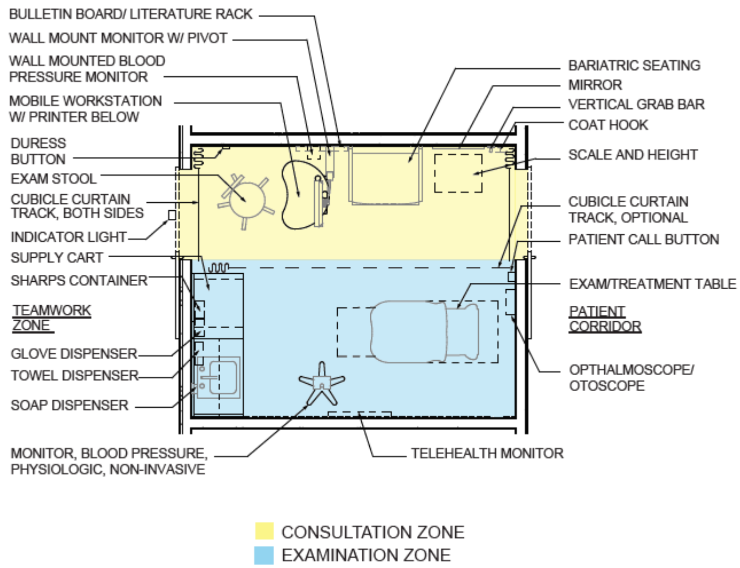


Figure 3.12: VA Proposed Exam Room (VA, 2015, p. 35)

The VA analysis articulates a clinical module design that aligns with the delivery of team-based care and the emerging literature. This analysis is important to the MHS, as the VA represents a similar healthcare organization with a common patient population. At the same time, the VA analysis is limited in evaluating staff opinions and experiences of the new physical environment. This means that potential strengths and weaknesses for the on-stage/off-stage clinical module are left unexplored.

In summary, the studies that evaluate MHS primary care environments illustrate a misalignment of past and current design guidance that influence the delivery of team-based care. The studies also establish a lack in the standardization of primary care clinics, which counters the strategic guidance of the MHS. The VA analysis demonstrates how developing a standard clinical module design can improve the staff's ability to deliver patient care. However, there is a gap in the literature in gaining staff opinions and experiences to evaluate different layouts for team-based care environments. This means that a research study immersed in the physical environment that collects staff perspectives can add significant value to the existing body of design knowledge.

3.6 Discussion

The MHS is presented with an opportunity to become leaders in creating an evidence-based practice for the planning and design of primary care clinics. The initial steps of developing publicly available design guidance criteria are already in place. The current MHS studies offer insights into how the physical environment influences the delivery of patient care. However, the current design guidance lacks reflection in capturing the design recommendations from these studies. Furthermore, the MHS studies lack an in-depth understanding of how the staff perceives that existing primary care environments support or hinder the delivery of patient care.

A future study that incorporates staff opinions and experience will fill a gap in the current design literature while creating a level of transparency to foster public trust. The direct application of the staff experiences and opinions can inform design guidelines for the MHS as demonstrated in the literature (Gunn et al., 2015; Oandasan et al., 2009; Karp et al., 2016; Lavender et al., 2015; Battisto et al., 2009). Additionally, a qualitative approach that obtains staff perspectives provides a deeper understanding of how clinical staff thinks about, use and behave in the physical environment.

CHAPTER FOUR

UNDERSTANDING THE NATURE OF CLINICAL STAFF ROLES AND ACTIVITIES FOR A PCMH MODEL OF CARE

The first phase of the study aimed to understand the nature of clinical staff roles and activities for performing team-based care in a PCMH model. Capturing the clinical staff roles and activities provides insights to understand how the physical environment influences the delivery of patient care. Furthermore, this initial phase of the study directly informed the data collection instruments for the second phase of the study. This type of approach aligns with a user-centered methodology for evaluating the physical environment (Canter, 1977; Vischer, 2009). In a user-centered methodology, understanding staff roles and activities are essential first steps preceding the evaluation of the physical environment.

This phase of the study will answer the first set of research questions through a qualitative single case study for an MHS primary care clinic:

1. What are the clinical staff roles and activities for delivering care in a team-based clinical module?
    a. Who is on the clinical team and what role do they play in delivering care?
    b. What are the clinical activities performed by staff in the clinical module and how often do they occur?
    c. Where do the activities occur in the clinical module?

These questions address a current gap in the literature for understanding the roles and activities for the delivery of team-based care in the physical environment. Developing a broader understanding of what each staff member is responsible for within a clinical core team is a prerequisite to understanding how the physical environment supports patient care delivery. Identifying clinical staff activities and where the activities take place provides valuable insights for interpreting staff opinions for future evaluations of the physical environment.

The organization of this chapter includes four sections. Section 4.1 describes the research methodology and data collection tools. Section 4.2 describes the patient care environment through (a) identifying staff roles for team-based care, and (b) defining the clinical module. Section 4.3 analyzes where staff work in relationship to the physical environment by identifying: (a) what staff do day-to-day, and (b) where the team works. Section 4.4 examines the staff activities performed to deliver team-based care for a team room, routine scheduled patient appointments, and exam room. Section 4.5 presents a discussion on recommendations for the second phase of the study.

4.1 Research Methods

This phase of the study utilized a single case-study research strategy that employed ethnographic interviews to explore and describe clinical staff roles and activities for team-based care (Yin, 2014; Fetterman, 2010). The data collection methods included interviews using three different formats, photographs, and floor plan analysis for this phase of the study. Interviews captured the staff roles and activities for team-based care which consisted of three formants (a) walkthrough administrator interviews, (b) clinical staff walkthrough interviews of the clinical module, and (c) think-aloud interviews of the exam room.

First, the purpose of the virtual walkthrough interview with the clinic Officer-in-Charge (OIC) and Noncommissioned-Officer-In-Charge (NCOIC) was to learn about workflow patterns that occur in the overall clinic. The walkthrough interview engaged participants with a printed floor plan to capture the clinic activities that occur in team-based care. Two participants were interviewed during a single 20-minute session in their offices to allow for convenience. Data collected from this session provided additional evidence to support clinical staff opinions and experience in delivering team-based care.

Second, the virtual walkthrough interviews with staff of the clinical module aimed to understand their roles and activities for team-based care delivery to answer: (a) who is on the clinical team; (b) what are the commonly performed activities for each team member; (c) how the team members perform the activities; (d) what rooms the team uses and perceived frequency of each activity; and (e) where the activities occur. The walkthrough interview occurred in a empty exam room and engaged participants with a printed floor plan to capture the clinic activities that occur in team-based care. The interviews were performed during low clinical usage periods, which lasted approximately 15 minutes. Staff who participated in the interviews consisted of two primary care providers, two registered nurses, five licensed practical nurses, and one specialty provider.

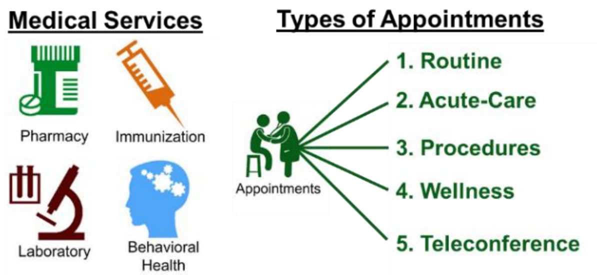
Third, the think-aloud interviews with clinical staff in the exam room aimed to capture the clinical staff activities, and workflow patterns during a routine patient appointment visit. Clinical staff who participated in these interviews were asked to talk-aloud while re-enacting a typical medical appointment in an empty exam room in the clinic (Blakstad et al., 2008; Blakstad et al., 2010). The interviews were performed during low clinical usage periods, and lasted approximately seven minutes. Staff who participated in the interviews consisted of two primary care providers, two registered nurses, five licensed practical nurses, and one specialty provider. These interviews informed the mapping sequence of activities that occur during patient care in the team-based clinical module and exam room.

The combination of these three types of interviews facilitated a deeper understanding of how team-based care is delivered in the physical environment. Staff opinions and experiences that were collected from this case reveal the differences in staff roles and activities for team-based care. Furthermore, immersing the participants in the physical environment during the interviews afforded opportunities to explore elements of the physical environment in a more meaningful way.

4.2 Description of the Patient Care Environment

Design Method	Design-Build (2009-2011)
Location	Southeast United States
Clinic Size	12,422 GSF
Business Hours	M/W/F: 0800-1130 1300-1600 T/TH: 0830-1130 1300-1600

Recognized Level 3 (2016)



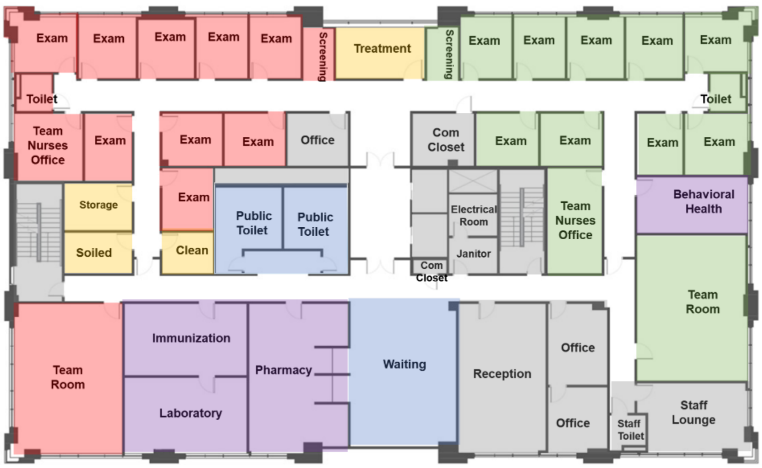
Total Encounters	**37,255** (2016)	
Patient Encounters	19,948	**54%**
Patient Teleconference (TCON)	17,307	**46%**

Each Physician averages **19 patient per day**
National Average is **21 patients per day**
(Physician Foundation, 2016)

Figure 4.1: Overview of the Clinic

The case selected for review is a community-based clinic for the MHS. The clinic is located in the southeastern part of the United States and occupies 12,422 gross square feet (GSF). The clinic is located on the second floor of a multi-story leased building in a community setting. The effort to create this clinic was initiated in 2009, using a design-build project delivery method. In 2011, the clinic project completed construction activities and began delivery patient care to active duty military soldiers, their family members and military veterans.

Primary care is delivered using a team-based approach to patient care in which physicians, licensed practical nurses and registered nurses work side by side as a team. Two clinical teams work in two separate care modules (indicated in red and green in Figure 4.2) and provide patient care independent of one another. The two clinical teams provide patient appointments for routine care, acute-care, procedures, wellness visits, and teleconferences consultation. Ancillary services within the clinic include a pharmacy, immunization, point-of-care lab, and behavioral health provider sections. Locations for ancillary services in the clinic are indicated purple for Figure 4.2.



Area	Space Allocation	%
Module 1	1,958 NSF	16%
Module 2	2,052 NSF	17%
Clinical Support	482 NSF	4%
Ancillary Services	1,270 NSF	10%
Waiting Area	930 NSF	7%
Other	1,525 NSF	12%
Circulation	4,205 NSF	34%
Total	**12,422 GSF**	**100%**

Figure 4.2: Clinic Layout

4.2A Description of Team-Based Clinical Modules

The team-based clinical modules in this community-based clinic offer similar designs for a module layout. The two team-based clinical modules are a group of spaces that contain exam rooms, team rooms, patient toilets, shared nurse's office, and screening alcoves. The two clinical modules support 14 staff members with 18 exam rooms in 4,010 Net Square Footage (NSF) (Figure 4.2). In the front of the clinic is the public waiting area, reception desk, public toilets, administrative offices, pharmacy, immunization, and point-of-care lab that occupies approximately 4,000 NSF. Clinical module one include nine exam rooms, one team room, one shared office, one screening alcove, and one patient toilet. Clinical module two contains nine exam rooms, one team room, one shared office, one screening alcove, and one patient toilet.

Type of Room	# of Rooms	Average NSF	Average Guideline NSF
Exam Room	9	124	120
Shared Office	1	170	120
Team Room	1	608	120
Alcove/Screening	1	64	60
Patient Toilet	1	41	60

Clinical Staff Team	Planned #	Actual #
Provider	3	2
RN	2	2
LPN	6	3
Total	**11**	**7**

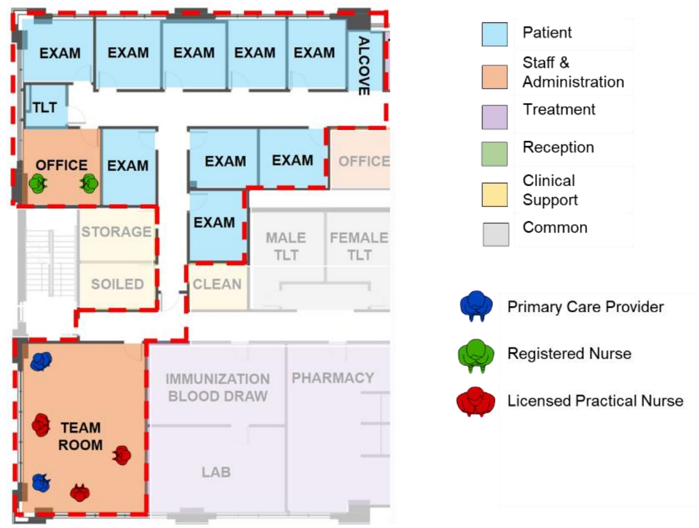
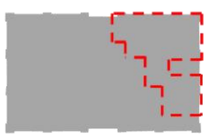


Figure 4.3: Clinical Module 1 Layout



Type of Room	# of Rooms	Average NSF	Average Guideline NSF
Exam Room	9	125	120
Shared Office	1	215	120
Team Room	1	603	120
Alcove/Screening	1	61	60
Patient Toilet	1	41	60

Clinical Staff Team	Planned #	Actual #
Provider	3	2
RN	2	2
LPN	6	3
Total	**11**	**7**

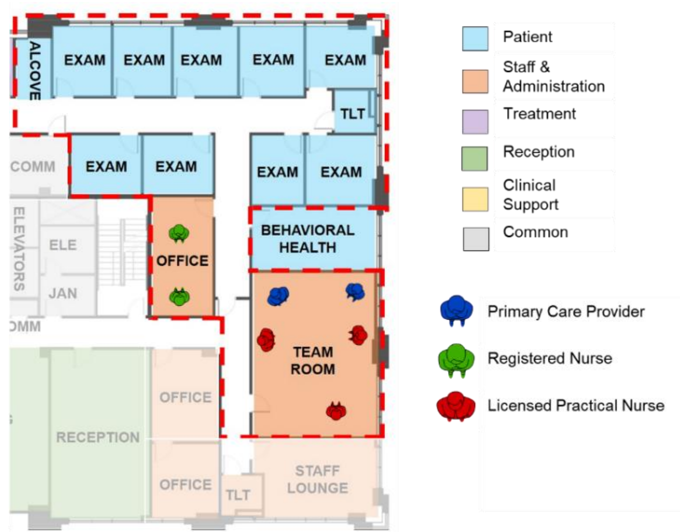


Figure 4.4: Clinical Module 2 Layout

4.2B Description of Clinical Core Team Structure

Utilizing a team-based approach, each clinical core team is led by the primary care provider and supported by nursing staff (Figure 4.5 and 4.6). The clinical core team consist of three staff roles that are represented by (a) primary care providers, (b) registered nurses, and (c) licensed practical nurses. The clinical support team include two specialty providers: (a) behavioral health provider, and (b) pharmacist. Staffing for the clinic is comprised of two types of employees that are either government service members, and/or government contracted employees. Both clinical core teams include seven staff who are a combination of primary care providers, registered nurses, and licensed practical nurses.

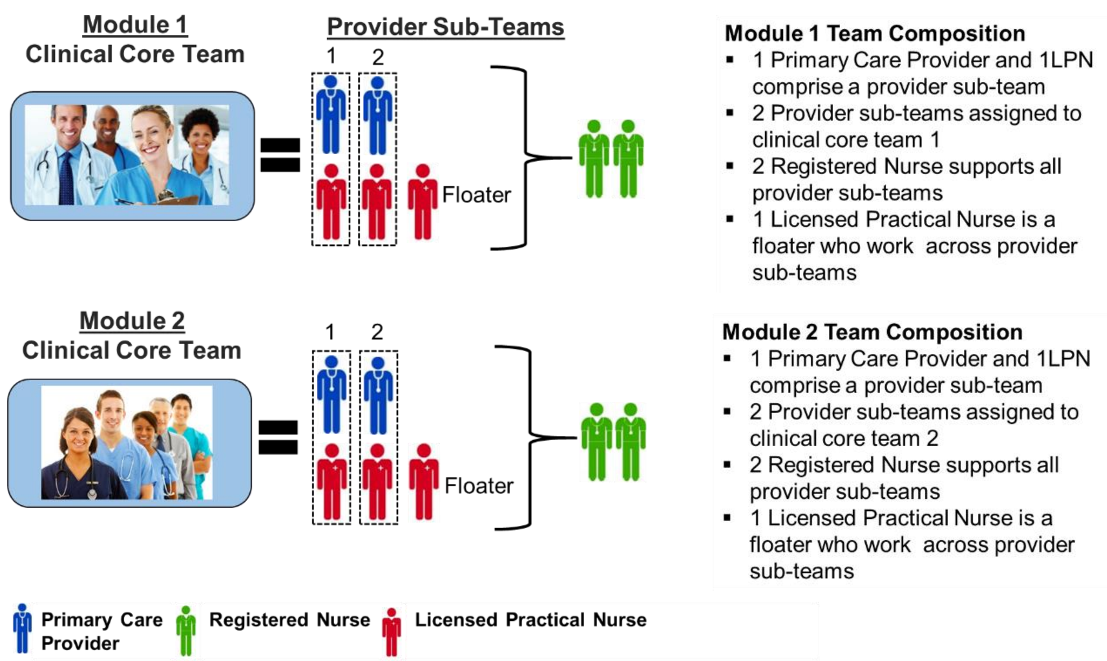


Figure 4.5: Clinical Core Teams Composition (Bon Secours, 2017; Halos Daily, 2018)

Clinical core team one and team two include two provider sub-teams and two registered nurses. The provider sub-team structure contains one primary care provider and one licensed practical nurse. The two provider sub-teams work out of the team room located in front of the clinical modules. One licensed practical nurse, located in the team room, is a floater that supports works across both provider sub-teams to deliver patient care. The two registered nurses are responsible for managing the daily workflow, supervision of licensed practical nurses, and telephone consultations. The registered nurses are colocated in a separate shared office in the middle of the clinical module.

The clinical support team consist of one pharmacist and one behavioral health provider. The pharmacist and behavioral provider offer consultations for both clinical core teams. The pharmacist is colocated in the pharmacy, which requires the care teams to travel to the front of the clinic for consultation. The behavioral health provider is located in a private office that is immediately adjacent to clinical module two (as indicated in Figure 4.6).

Figure 4.6: Team-Based Care Staff Roles (Winn Army Community Hospital, 2017; University of South Florida, 2014; Army Nurse Corps, 2018; Typepad, 2018)

4.2C Description of Patient Workload

In this clinic, patient care took place five days a week, eight hours per day accounting for 19,172 patient encounters in 2016 for the entire clinic. The total annual patient encounters fell under the 41,472 standard benchmark, which is based on every exam room accounting for ten daily face-to-face patient encounters for 240 days per year (DoD Space Planning Criteria, 2017). Therefore, the annual patient workload for patient encounters missed the MHS benchmark by approximately 21,000 patient encounters. Patient teleconferences (TCONS) are not calculated in the annual patient encounter workload, but counted for an additional 17,307 patient encounters. The low number of patient encounters is due to only having four primary care providers in the clinic, which includes 18 exam rooms. However, each primary care provider averaged 19 patient face-to-face encounters per day, which closely resembles the national average of 21 patients per day (Physician Foundation, 2016). This means that the clinic is either under-staffed or over allocated exam rooms leading to under-utilized space for patient care.

Performance Metrics	MHS Planned	Actual #	Utilization (%)
# Exam Rooms		9	
Daily Exam Room Workload	10 Pts	5 Pts	
Annual Exam Room Workload	2,304 Pts per room	1,150 Pts per room	50%
Annual Patient Workload	20,736 Pts for all rooms	10,346 Pts for all rooms	50%

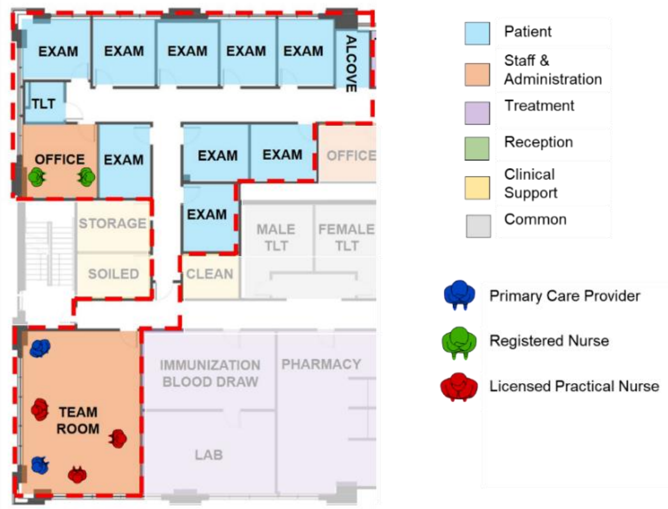
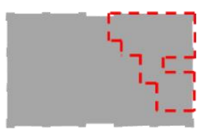


Figure 4.7: Clinical Module 1 Workload



Performance Metrics	MHS Planned	Actual #	Utilization (%)
# Exam Rooms		9	
Daily Exam Room Workload	10 Pts	4 Pts	
Annual Exam Room Workload	2,304 Pts per room	981 Pts per room	43%
Annual Patient Workload	20,736 Pts for all rooms	8,826 Pts for all rooms	43%

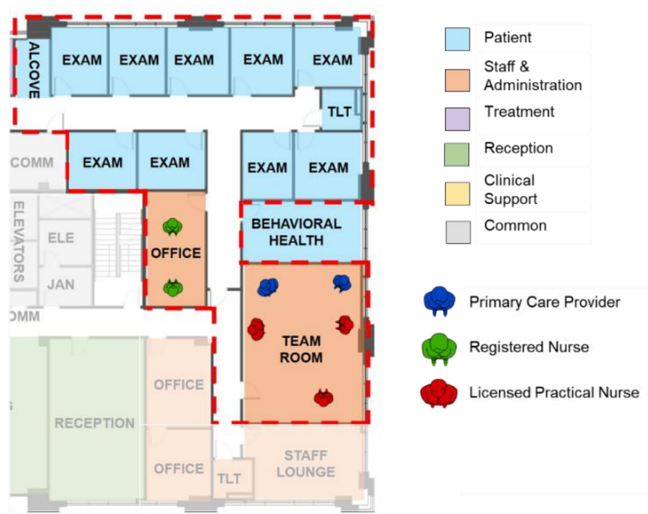


Figure 4.8: Clinical Module 2 Workload

4.3 Identifying Where Staff Work in the Physical Environment

Identifying where staff work in the clinic is the first step in developing an understanding of team-based care. The location where staff work influences how they experience the physical environment in delivering patient care. Additionally, studying the locations reveals which areas of the clinic are most active on a daily-basis. This information is then used to analyze the floor-plans to describe the spatial configurations related to the delivery of patient care.

Activity	Staff Involved	Space
Review Medical Charts & Patient Notes	Entire Staff	Exam Room; Team Room
Medical Exam	Providers; LPNs	Exam Room
Telephone Consult	Providers, RNs, LPNs	RN Office; Team Room
Lab Drop-Off	LPNs	Exam Room; Laboratory
Consult Provider	RNs, LPNs, Specialty Providers	Team Room
Retrieve Medical Supplies	RNs, LPNs	Storage Room; Treatment Room
Immunizations	LPNs	Immunization Room
Behavioral Health Appointment	Specialty Provider	Behavioral Health Office
Behavioral Health Consult	Providers, LPNs, Specialty Provider	Exam Room
Faxing & Scanning Documents	RNs	Reception Room
Team Huddle	Providers, RNs, LPNs	Team Room
Procedures	Providers, RNs, LPNs	Treatment Room

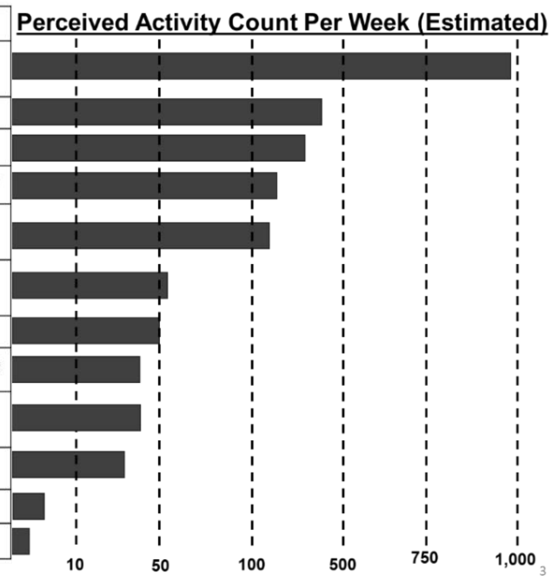


Figure 4.9: Team Day-to-Day Activities for Delivering Care

Clinical staff perform multiple types of patient care activities using a team-based approach as illustrated in Figure 4.9. Clinical staff claim that reviewing medical charts and patient notes are the most frequent activity to support patient care. Reviewing medical charts and patient notes are performed by all clinical staff in either exam rooms or staff work areas (team room or shared office space). This points out that staff need access to individual workspace to complete these associated activities for patient care.

The second most commonly performed activity is the patient examination, which occurs in the exam room. As previously stated, primary care providers in the clinic average 19 patients per day, and the one floater licensed practical nurse shares the workload with the other two licensed practical nurses. This means that each licensed practical nurses typically encounters nine-to-ten patients per day. This finding shows that primary care providers and licensed practical nurses make frequent trips from the team room to the exam rooms while seeing patients.

Patient teleconferences are the third commonly performed activity reported by staff for delivering patient care. Patient teleconferences occur in the registered nurses shared offices or in the team rooms. This suggests that individual workspaces need to support conversations with patients that occur over the phone. This further hints that staff need a level of privacy in performing this activity to reduce unnecessary distractions.

The two team-based activities reported as least frequent are the daily team huddles and procedures in the treatment room. Daily team huddles only occur once per day in the team room and are a required activity for the PCMH model. Patient procedures occur in the treatment room, which staff reported only occur a few times a week. This indicates that the one treatment room is a sharable space between the two clinical core teams, especially with the perceived low volume of procedures in the clinic.

The team room and exam rooms are identified by the staff as the primary areas were patient care activities routinely occur on a daily basis (as indicated in Figure 4.10). The team room supports the majority of collaborative patient care activities among the different staff. The exam rooms are frequently used by primary care providers and licensed practical nurses for team-based medical examinations. Additionally, registered nurses perform patient teleconferences in the shared office space, which is separated from the team room in both clinical modules. The separation requires registered nurses to make frequent trips to the team room to consult with primary care providers and manage the licensed practical nurses workflow. The initial analysis suggests that team rooms are the central hub for the clinical staff in supporting team-based care activities.

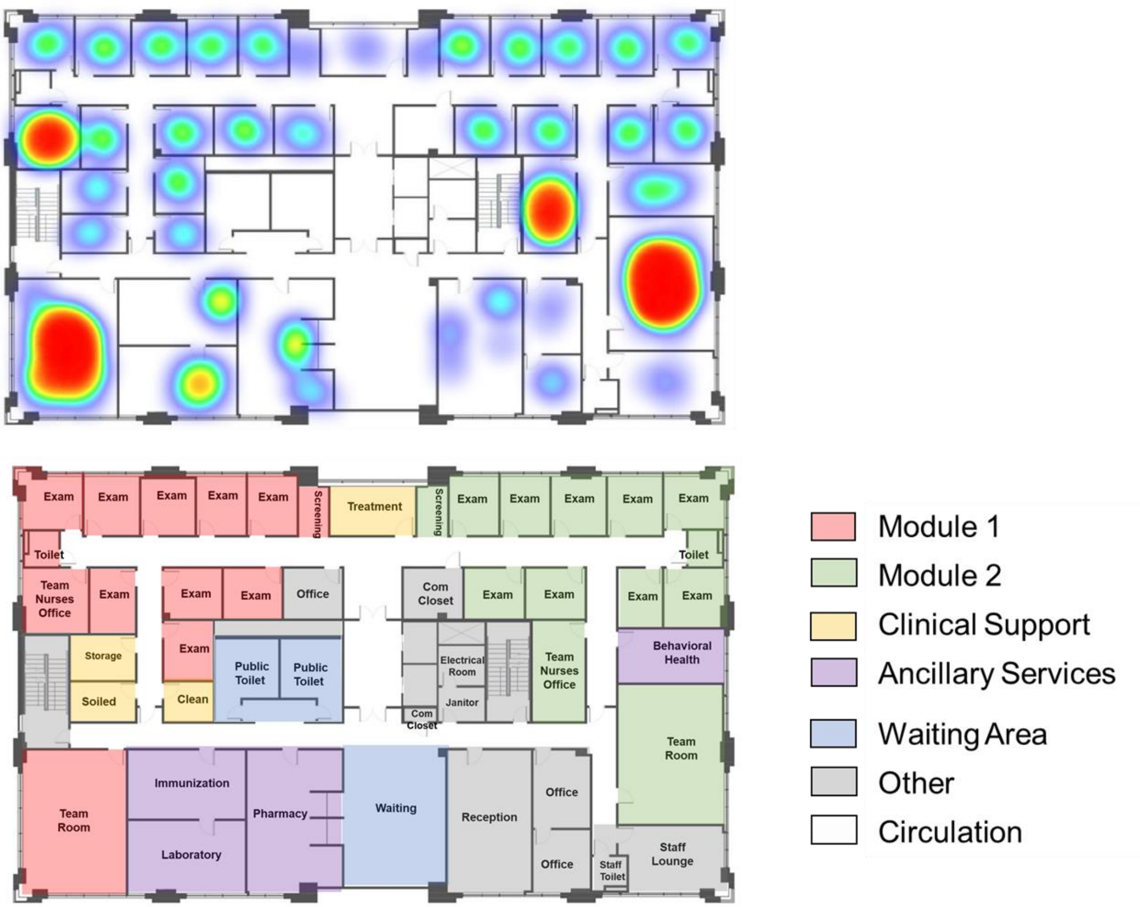


Figure 4.10: Location of Team-Based Activities in the Clinic

4.4 Defining Team-Based Activities in the Physical Environment

The second step in describing team-based care environments is to develop a understanding of activities and work flow patterns. Mapping the sequence of activities contributes to defining necessary and unnecessary steps in delivering patient care. Furthermore, identifying how specific activities occur within the team and exam room offers insights for functional requirements of the clinic. This section analyzes staff activities in three areas that include the (a) team room, (b) clinical module, and (c) exam room. Each of these areas piece together the larger picture of how team-based care is delivered in the clinic.

4.4A Team Room Activities

Team rooms as illustrated in Figure 4.11 support the functions of both individual and team-based patient care activities including charting, taking medical notes, dictation, patient telephone conferences, staff collaboration, and getting ready for the next patient appointment. The team room allows staff to communicate and collaborate with team members in a single consolidated space. Large tables are placed in the center of the room help to facilitate team huddles and group discussions. Cubicle dividers provide clinical staff with a sense of private work area to support individual patient care activities.

Clinical staff selectively choose where to sit in the team room based on their role for delivering patient care. Primary care providers are seated in the corners of the team rooms, with the most privacy in the room and the ability to complete focused work. Licensed practical nurses are located in the remaining central workstations in the team room. The central workstations have a mixture of single and double cubicle workstations.

Registered nurses travel to the team room to oversee the activities of the licensed practical nurses and consult with primary care providers for patient care. Additionally, specialty providers travel to the team rooms from their dedicated office spaces to consult with primary care providers periodically throughout the day. Findings show that the team room is a universal environment that supports multiple activities for patient care. The environmental conditions of this single room are potentially the largest factor that influences staff opinions of the physical environment.

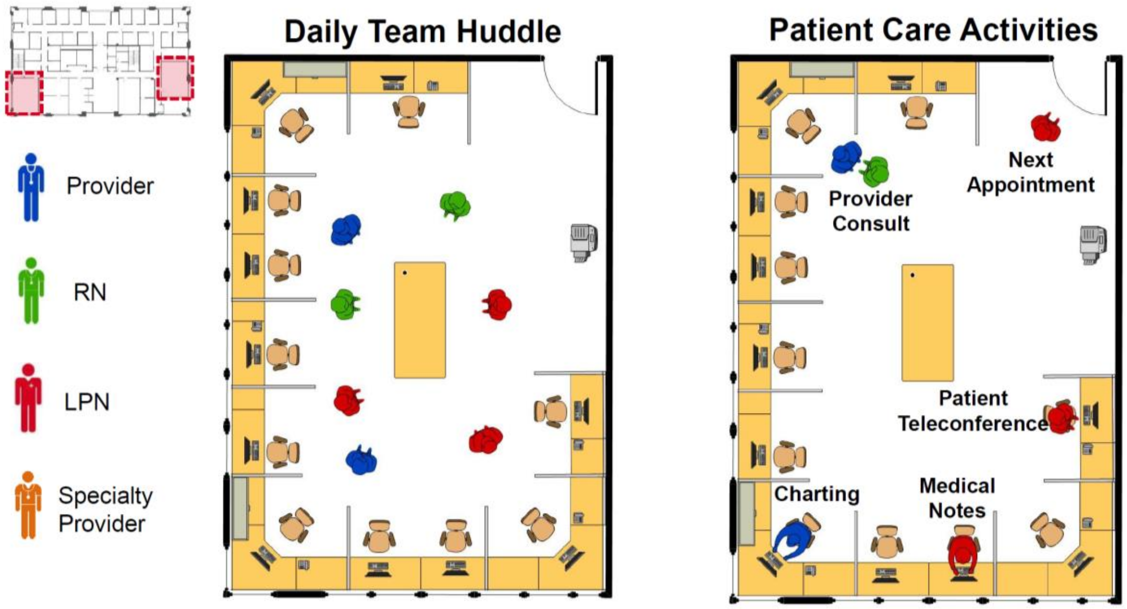


Figure 4.11: Team Room Activities

4.4B Sequence of Activities for Staff Workflow in the Clinical Module

The nature of how team-based care is delivered in a PCMH model is illustrated through a routine scheduled patient appointment. A routine scheduled patient appointment occurs through 12 steps and typically involves three staff members. The following sequence of activities illustrated through Figure 4.12-4.18 demonstrate where and how team-based care is delivered.

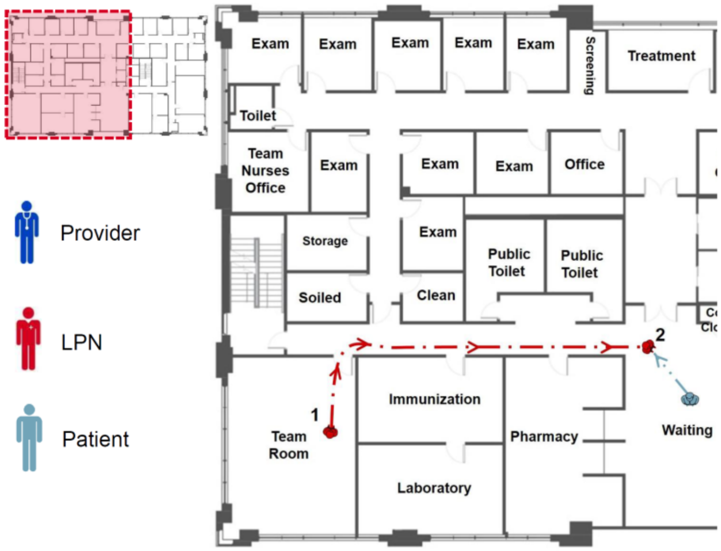


Figure 4.12: Routine Patient Appointment Steps 1-2

Description of Steps:

Step 1: Licensed practical nurse leaves the team to meet the patient

Step 2: Licensed practical nurse greets the patient in the waiting room area

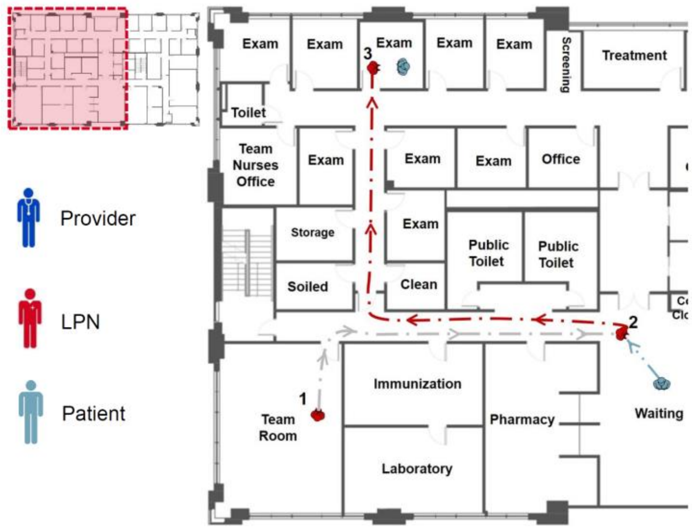


Figure 4.13: Routine Patient Appointment Step 3

Step 3: Licensed practical nurse escorts the patient to a designated exam room. Then the licensed practical nurse collects the initial vitals and screens the patient for medical issues

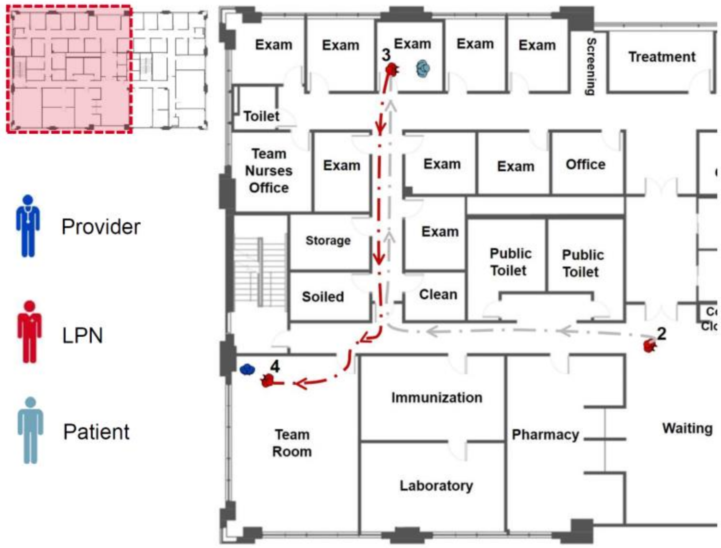


Figure 4.14: Routine Patient Appointment Step 4

Step 4: Licensed practical nurse departs form the exam room back to the team notifying the primary care provider that a patient is ready to be examined

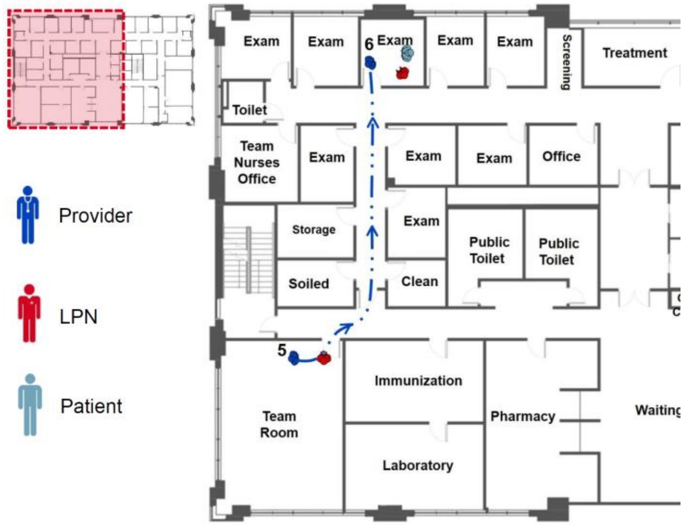


Figure 4.15: Routine Patient Appointment Steps 5-6

Step 5: The primary care provider and licensed practical nurse travel back to the exam room

Step 6: The primary care provider and licensed practical nurse conduct the medical appointment. A second licensed practical nurse gets the next patient ready for a medical appointment in the adjacent exam room

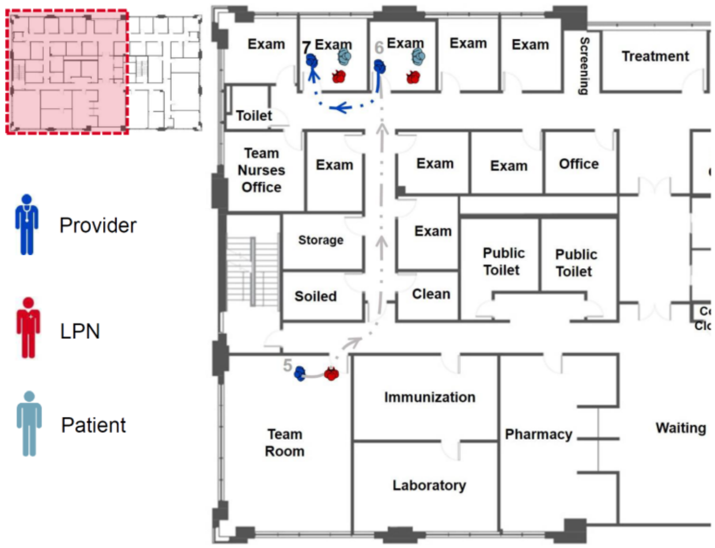


Figure 4.16: Routine Patient Appointment Step 7

Step 7: The primary care provider has completed the medical appointment and travels to the next exam room.

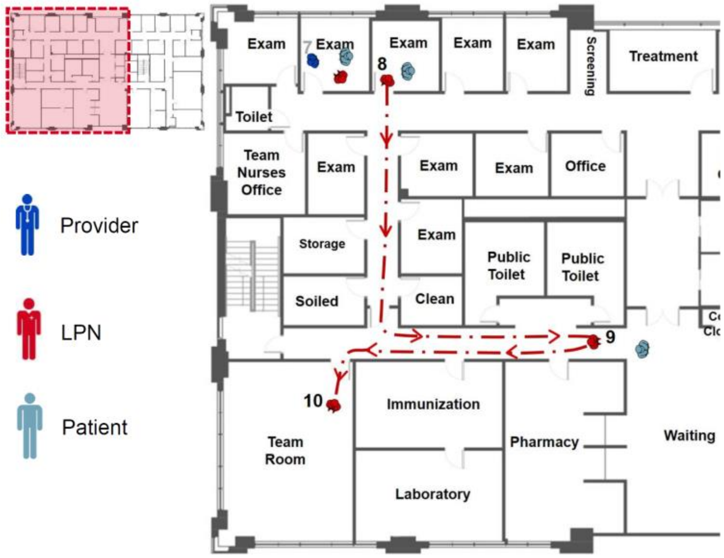


Figure 4.17: Routine Patient Appointment Steps 8-10

Step 8: The licensed practical nurse in the original exam room escorts the patient back to the waiting room

Step 9: The licensed practical nurse exchanges any pleasantries with the patient in the waiting room area. The licensed practical nurse may also assist the patient in getting a ticket for the pharmacy

Step 10: The licensed practical nurse returns to the team room

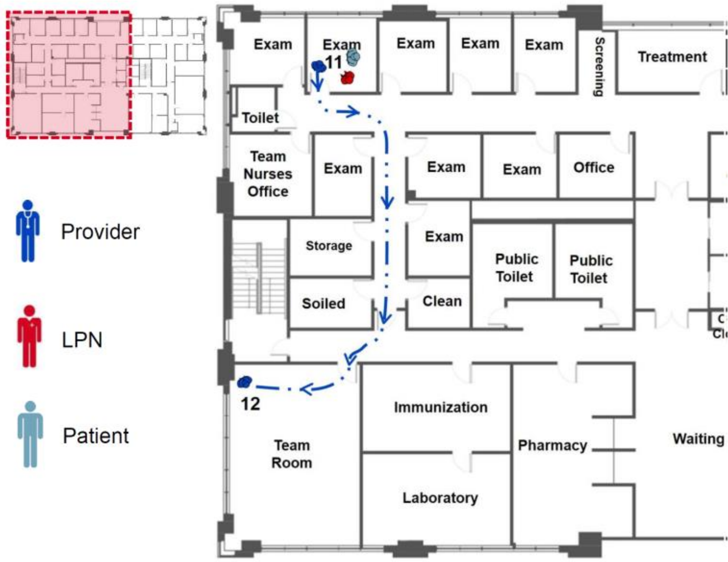


Figure 4.18: Routine Patient Appointment Steps 11-12

Step 11: The primary care provider completes the second medical appointment

Step 12: At the conclusion of the second medical appointment the primary care provider returns to the team room and completes any necessary charting, dedications, and closes out the two medical appointments in the electronic database

The analysis from the routine scheduled patient appointment demonstrates the necessary steps for providing team-based patient care. The initial screening of the patient's vitals occurs in the exam room, removing a normal step from the traditional routine patient appointment. Primary care provider's assigned two licensed practical nurses are able to increase their patient workflow by having one licensed practical nurses always setting up the next patient appointment. This indicates that a provider sub-team with one primary care provider and two licensed practical improves staff workflow for patient care.

From a spatial analysis the location of the team room in relationship to the exam rooms and waiting room are key planning factors for reducing time spent in traveling for patient care appointments. In this clinic, staff travel distances are reduced by colocating height and weight screening equipment in the exam room. This reduces clinical staff travel distances for routine patient appointments adding valuable time back for clinical staff and potentially leading to better health outcomes for patients.

4.4C Patient Care Activities that Occur in the Exam Room

The sequence of activities that occur for a routine medical appointment conducted in an exam room are illustrated through four distinct phases: (a) screening and preparation, (b) examination and diagnosis, (c) treatment and education, and (d) discharge and checkout. The following sub-sections illustrate the process of a standard medical appointment providing a comprehensive description of how team-based care is delivered in the exam room. The sub-sections are organized by providing a contextual background for the physical environment of the exam room. The remaining sub-sections illustrate the process of a team-based approach for a routine medical appointment in an exam room.

The typical exam room for the clinic consist of 124 NSF and allocated windows for potential exterior views as illustrated in Figure 4.19. Furniture and medical equipment in the typical exam room support multiple types of patient care activities. An exam table is located in the back of the room with medical equipment immediately adjacent to aid in the collection of patient vitals. A height and weight scale is located directly across from the exam table. The collocation of the height and weight scale in the exam room removes the traditional step for collecting the patient information in the corridor. Two chairs are located in the back of the room to accommodate additional staff and patient family members. The exam rooms are outfitted with a sink and a cabinet mounted on the front wall for medical supply storage. The lack of wireless technology capabilities in the clinic require clinical staff to use hard-wired connection ports, which allow clinical staff to access electronic health records during a medical examination.

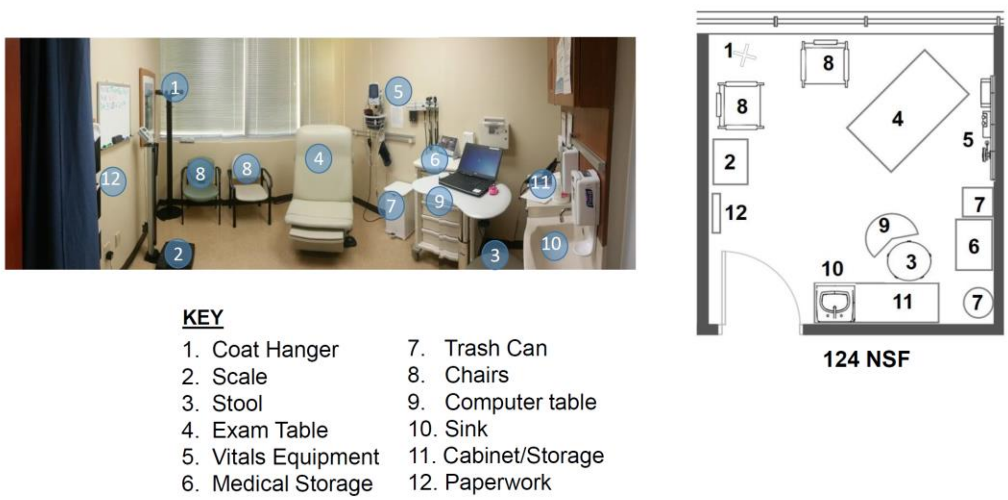


Figure 4.19: Typical Exam Room

The first phase of a medical appointment in the exam is screening and preparation. The first phase starts when the licensed practical nurse enters the room with a patient. Clinical staff wash their hands with soap and water or hand sanitizer gel upon each entrance to an exam room. Handwashing is a fundamental task in patient care and helps prevent the spread of viruses and diseases (Boyce & Pittet, 2002). Then, as shown in Figure 4.20 the licensed practical nurse collects the patient’s height, weight, and vital signs. Patients are asked a series of screening questions while sitting on the exam table. The screening and preparation phase is completed when the licensed practical nurse leaves to notify the primary care provider that the patient is ready to be seen.

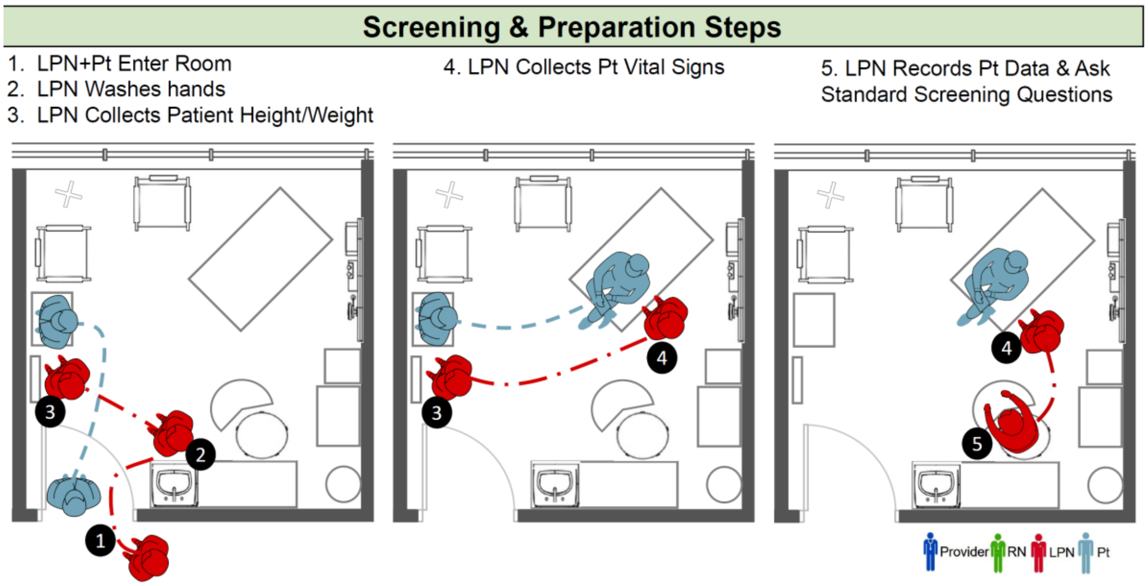


Figure 4.20: Screening & Preparation Phase

The second phase, examination and diagnosis, starts when the primary care provider and licensed practical nurse return to the exam room (Figure 4.21). During this phase, the primary care provider greets the patient and asks the patient follow-up screening questions, while conducting an examination. At the same time, the licensed practical nurse takes digital notes with a laptop and inputs the data into the patient’s electronic health record. The second phase concludes with the primary care provider ending the examination and treatment phase while the education phase begins.

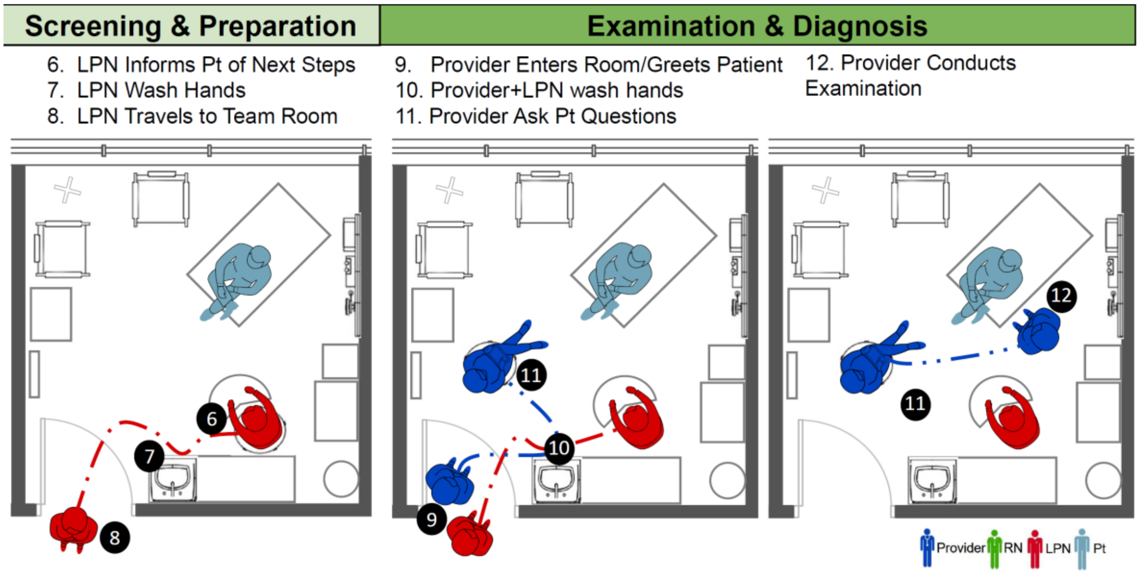


Figure 4.21: Screening & Preparation through Examination & Diagnosis Phase

In the next phase (Figure 4.22), the primary care provider and the patient review the appropriate treatment plan based on the examination assessment. The primary care provider also discusses any educational material with the patient during this phase. The activities that occur during this specific phase carry over into the final phase of the examination.

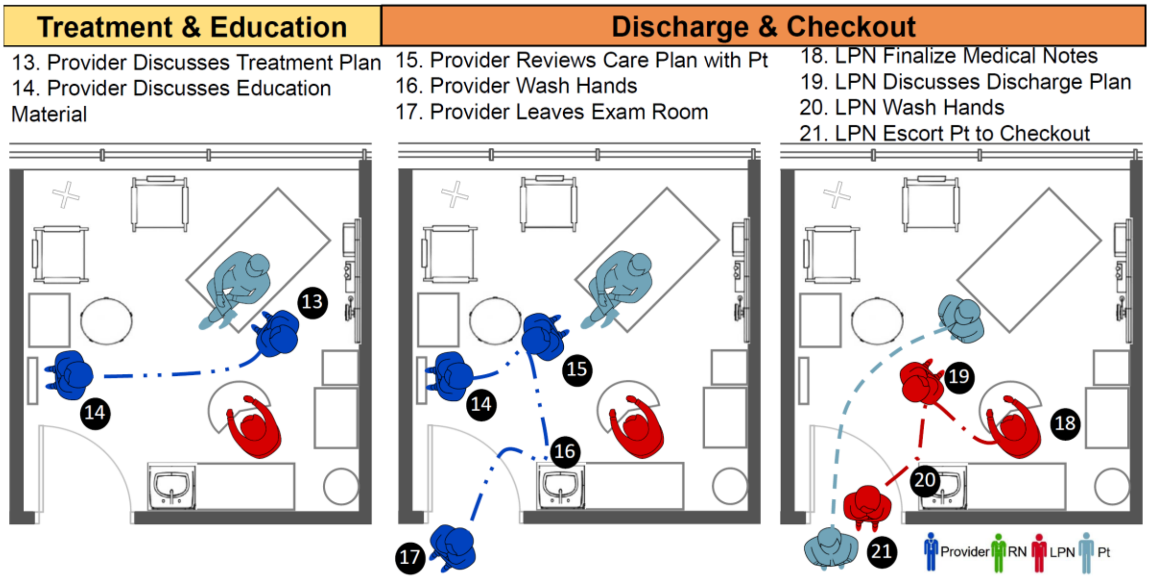


Figure 4.22: Treatment & Education through Discharge & Checkout Phase

The final phase starts when the primary care provider reviews the final care plan with the patient and then departs for the next medical appointment (Figure 4.22). The licensed practical nurse finalizes the patient's medical notes and discusses the discharge plan with the patient. The licensed practical nurse then escorts the patient back to the waiting room, ending the sequence of activities in the exam room.

The illustrations from the analysis of a medical examination describe how the team-based care approach is more efficient than the traditional physician-centric model. Licensed practical nurses assist primary care providers in taking patient notes to stream-line the examination process. Allowing the licensed practical nurse to assist in the examination process provides opportunities for primary care providers to fully engage and focus on communicating with the patient.

The size of the exam room ranged from 119 NSF to 142 NSF allowing for additional equipment for patient care and furniture to accommodate family members. The

MHS standard exam room size is 120 net square feet (NSF), but in this clinic the average size is 124 NSF. This starts to imply that the existing exam room size is inadequate to fully support the functions of a team-based environment.

4.5 Discussion

Understanding the roles of clinical staff and nature of team-based activities for a PCMH model are fundamental for aligning the physical environment with the delivery of care. Findings in this initial phase of the research study offered insights into the clinical staff roles and activities for team-based care in the physical environment. Three key themes emerged that are addressed in the second phase of the research study.

First, there is lack of understanding in where the team room should be located to enhance patient care delivery. The location of the team is critical to ensuring efficient travel distances for patient care activities. Furthermore, organizing the clinical module around the team room seems to establish a functional environment for patient care. Therefore, the second phase of the research study will focus on the clinical module room types, travel distances, and layout to support a team-based care environment.

Second, the physical environment needs to support work areas for team-based care. This initial study signals that the team-based care model involves a significant amount of collaborative work to enhance patient care. The physical environment needs to support the ability to complete work that requires both focus and concentration without distractions. These two objectives seem to counter each other in a team-based environment. The second phase of the study will examine how team rooms promote collaboration and the ability to complete focused work.

Lastly, the exam room is the central point for providing patient care in the physical environment. Findings from this initial study reveal that screening equipment is consolidated into the exam room to reduce unnecessary steps in the clinical module corridor. This starts to illustrate that more equipment is added to exam rooms limiting available space for patient care. a standard 120 net square foot (NSF) room is restricted on available space for patient care. Additionally, team-based care requires two staff members in the exam room at the same time to provide patient care. The literature indicates that additional family members accompany patients, which further reduces possible crowding in the exam room (Omoloe et al., 2011; McDaniel et al., 2015). All of these factors suggest that the size of the exam room may need to be reconsidered in the context of team-based care.

In summary, this first phase of the research study gained insights on staff perspectives regarding their roles and activities in delivering team-based care. The initial insights from the study establish a foundation that describes the different staff roles for a team-based environment, which is limited in the literature. Additionally, the staff activities mapped out in the clinic show workflow patterns in how team-based care is delivered, which can be used to evaluate unnecessary travel distances for patient care. These findings are used to better understand how to evaluate the clinic environment best supports a MHS team-based care model.

CHAPTER FIVE

RESEARCH DESIGN AND METHODS

This study aimed to explore and describe the perceptions of primary care staff concerning how the physical environment influences the delivery of team-based care. A research design based on a qualitative approach employing multiple case studies offers opportunities to explore staff opinions and experiences in understanding team-based care environments. Ethnographic data collection methods, particularly interviews and direct observations allowed the researcher to establish findings rooted in the staff experiences in the primary care clinic. At the same time, integrating a post-occupancy methodology creates an approach to link initial design strategies to staff opinions for evaluating the conditions of the physical environment. This research design illustrates a user-centered approach that recognizes a relationship between the delivery of team-based care and the physical environment.

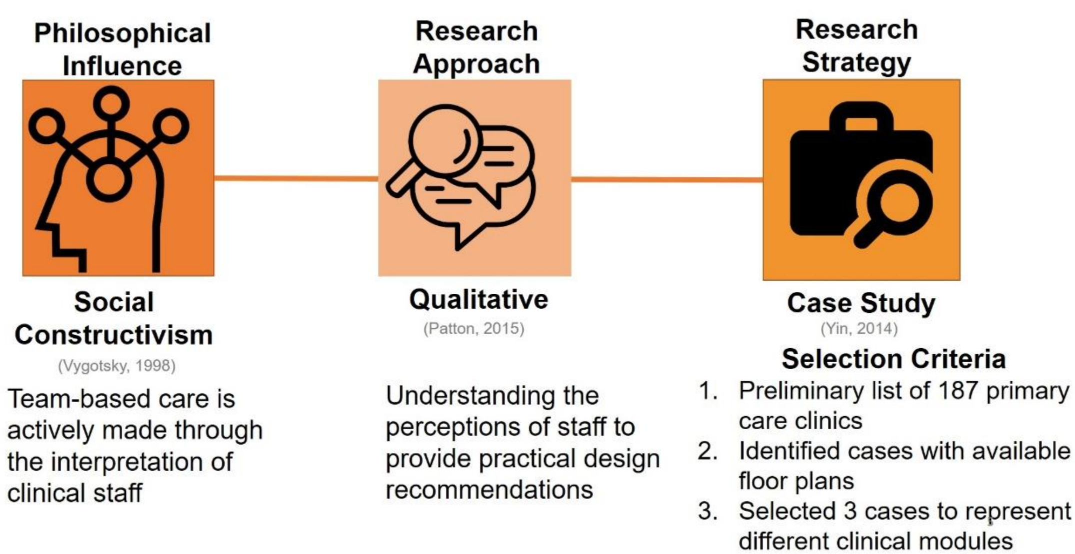


Figure 5.1: Research Design Overview

The research design and methods chapter is discussed in six sections to understand the overall methodology for the study. Section 5.1 discusses why a qualitative study offers the best approach to understand the role of the physical environment on team-based care delivery in primary care. Section 5.2 describes the role of theory in a qualitative research and how theoretical influences informed the design for this study. Section 5.3 expresses how combining case study and post-occupancy evaluation methodologies facilitates the ability to evaluate the physical environment of primary care clinics influence with patient care. Section 5.4 illustrates the selection criteria for the cases and participants in the study. Section 5.5 demonstrates how the data collection methods relate to measuring the goals/objectives proposed in this study evaluation framework. Section 5.6 discusses the significance of the studies research design to evaluate team-based care environments.

5.1 Qualitative Research

The concept of research offers multiple interpretations in how one can develop new knowledge. Kumar (2005) articulates that the purpose of research is "to generate knowledge for theoretical or applied applications" (p.6). Robson (2011) defines research as "systematic study or investigation including the use of existing evidence and the collection of new data" (p. 532). Leedy and Ormrod (2005) claim the purpose of research is to establish a systematic process that allows for the investigation of knowledge through the collection and analysis of data. Therefore, research is simply expressed as a systematic process that contributes to the development of new knowledge towards understanding a phenomenon.

The systematic process of research provides an avenue or lens to explore, describe, and explain a phenomenon. Research begins with the selection of an approach that includes quantitative, qualitative, or mixed-methods. First, quantitative research approaches test theories to demonstrate the explanation of a specific phenomenon (Creswell, 2014). Traits of quantitative research are propositions, hypotheses, and variables that are constructed from numerical values to support a claim (Singleton and Strait, 2010). Second, a qualitative research approach explores and describes the meaning of a phenomenon through empirical data (Patton, 2015). Characteristics of qualitative research consist of verbal interruptions and non-numerical values to provide a rich and in-depth analysis of a phenomenon (Patton, 2015). Lastly, a mixed-method approach is utilized due to shortcomings of qualitative and quantitative approaches, while combining the two approaches allows for triangulation of data (Creswell, 2014). In addition, a mixed-method approach fosters flexibility with a research design by interchanging when a qualitative and quantitative approach occurs in the study's design. As result, all three research approaches offer different avenues to explore, describe, and explain a phenomenon in the world. The selection of the correct research approach is dependent on the purpose of the study.

Qualitative research offers a credible approach to develop new knowledge concerning the planning, design, and evaluation of the physical environment. The natural sciences consider qualitative research as soft and lacking the validity to develop critical knowledge for the world (Cook and Campbell, 1979). However, depending entirely on quantitative research to establish new knowledge undervalues the social and cultural meanings of a phenomenon (Silverman, 2015). Developing the social and cultural meanings of a phenomenon through a qualitative approach provides a deeper understanding of the transactions among people, activities, and places (Patton, 2015). Furthermore, qualitative approaches create insights for the physical environment through emerging themes that occur from data saturation (Strauss and Corbin, 1998). Therefore, qualitative research provides the ability to focus on meaning and interruptions of individual's experiences. A qualitative approach is the best approach to explore how the physical environment influences the delivery of team-based care from the point of view from the clinical staff.

A qualitative approach that engages participants immersed in the physical environment influences the research design and data collection methods for developing practical design recommendations. Individual clinic staff's social, cultural, and political perceptions, as well as past experiences, may illuminate how the physical environment supports or hinders the ability to deliver team-based care (Patton, 2015). Furthermore, Van Cauwenberg et al. (2012) argues that "it is difficult to capture individual perceptions of environmental factors when participants are not simultaneously exposed to these factors" (p. 10). Gathering data in the field is essential to understand multiple staff opinions of the physical environment influence on delivery of team-based care. Therefore, a qualitative approach best aligns with capturing clinical staff opinions and experiences in active primary care clinic.

This evidence implies that individual's perception of the world are different and without exposing these different perception to the conditions of the physical environment conditions will result in limited findings. Therefore, a qualitative research approach fosters the ability to understand multiple staff opinions of how the physical environment influences the delivery of team-based care.

5.2 The Role of Theory for Qualitative Research Approach

The role of theory in qualitative research can inform the theoretical lens, overall framework, and data collection methods (Patton, 2015). In this study, a user-centered strategy is used to develop planning and design recommendations for primary care clinics that support team-based care delivery. Therefore, the selection of theories to guide the design of this study needs to recognize that the user is fundamental to understand team-based care environments for primary care. Two user-centered theories have been selected to provide guidance in the research design of this study.

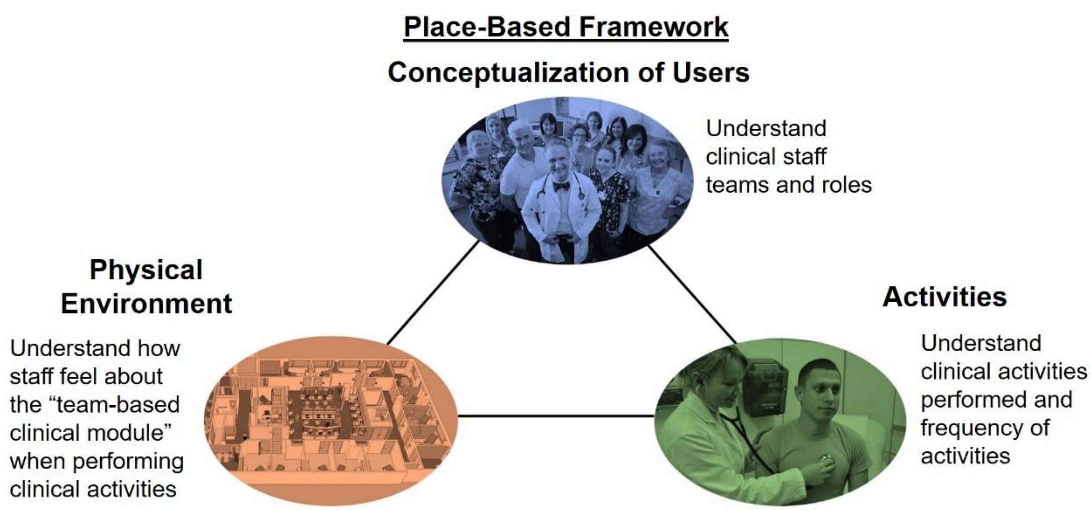


Figure 5.2: Place-Based Framework (Woodstown Practice, 2018; Military.com, 2018; HDS Architecture, 2018)

First, Canter's (1977) Theory of Place establishes a theoretical lens that links the user demands to the physical environment. The transactional theory is expressed through the interaction between people, activities, and the place. The first facet advocates for exploring the role of the users, which supports a social constructivism worldview, where the primary care environment is actively created through user experiences (Vygotsky, 1997; Murphy, 1977). This illustrates that the user's roles and perceptions are critical factors that are tied to how the primary care clinic is shaped to support patient care. The second facet, user activities, emphasizes the need to collect insights on what staff do, their role, and how they move in primary care clinics. Describing the staff activities in the physical environment reveals a further level of how perceptions are established for primary care clinics that support team-based care delivery. These two facets, user roles, and their activities facilitate a deeper level of understanding to examine the third facet of the physical environment. The absences of the user perspectives and activities limits the capability to evaluate how primary care settings influence team-based care delivery.

Second, Vischer's (2008) User-Centered Theory proposes a framework to capture user's perspectives at the macro and micro levels of primary care clinics. This theory further supports a social constructivism worldview by building on the various user's perceptions of the physical environment (Vygotsky, 1997; Murphy, 1977). The users of a physical environment can be organized in two distinct groups of individuals for this study. First, the macro level group represents the architects, administrative leadership, and facility managers who influence how the physical environment is created and used over time. Second, the micro level group include those who use the building on a daily bases. In the case of primary care, it is the clinical staff, patients, and family members that represent the micro level group. Clinical staff occupy the clinic the most and are the care givers, which makes these individuals a focal area to understand team-based care environments. These two groups have different perspectives as they interact with the physical environment in different manners. Therefore, the theory advocates for a user-centered approach that considers both the macro and micro user groups to understand what is needed from the physical environment. This theory signals that gaining the perspectives of designers, planners, and clinical staff can enhance the description of the physical environment role that best supports or hinders the delivery of team-based care.

The two theories provide a pivotal role in shaping the design of this study, which evaluates the clinic environment influences on team-based care. The Theory of Place influenced a research design that involves two phases to examine the physical environment. First, staff roles and activities of team-based care were studied to understand how team-based care is delivered in the MHS clinics. Second, an evaluation of the physical environment was structured around the different staff roles and activities. Additionally, the User-Centered Theory expresses the importance of including both the macro level and micro level groups in the study. The combination of the two theories suggest that a qualitative approach employing ethnographic interviews in the clinic along with on-site observations would yield invaluable insights on the staff perspectives on the functionality of the clinic, workflow efficiency, and team rooms that facilitate collaboration and focused work.

In summary, these two theories advocate for understanding the relationships among user’s roles, activates, and physical environment to produce evidence that supports user-centered design recommendations. At the same time, describing how the primary care clinics were intended to function from the macro level group provides a vision of the original design factors for delivering team-based patient care. This affords the opportunity to evaluate past design factors to determine which work the best for team-based care environments.

5.3 Case Study and Post-Occupancy Evaluation Methodology

Case study research offers a systematic process for understanding PCMH clinics and team-based care environments. A case study method offers the ability to “investigate a contemporary phenomenon (the case) in its real-world context, especially when the boundaries between phenomenon and context may not be evident” (Yin, 2014, p. 2). The physical environment and delivery of patient care often blur together, which presents a challenge in studying the phenomenon of team-based care. However, a case study methodology allows for a flexible, and repeatable process to investigate in-depth team-based care in relationship to the clinic environment.

A multiple case study strategy was selected to compare and contrast the strengths and weaknesses of different team-based care environments. Utilizing replication logic and comparative analysis, three primary care clinics from the MHS were studied across three levels including the clinic, clinical modules, and rooms that support patient care. Exploring the three levels provides a more thorough understanding of clinics that use team-based care. Furthermore, incorporating a systematic case study methodology starts the process of studying clinics using ethnographic interviews that may lead to theory development in the future.

Utilizing a Post Occupancy Evaluation (POE) within a case study methodology affords the opportunity to evaluate team-based care environments that produce evidence-based design factors for primary care clinics. A POE methodology specifically relates to the two transactional theories discussed previously by studying the interaction between people, activities, and the physical environment as an assessment tool for obtaining user feedback (Preiser, 2015). POE as a tool advocates for a "more systematic way to determine best practices in facility design," especially when users are currently occupying primary care clinics (Battisto and Franqui, 2014, p.408). The systematic process allows the comparison of specific performance metrics for a primary care clinic to the original design factors that influenced the delivery of team-based care.

Linking a case study and POE methodology could be used to continuously evaluate the performance of the clinic functionality, workflow efficiency, and facilitate collaborative and focused work in team rooms. The history of primary care clinic design reveals multiple and evolving recommendations that should be constantly evaluated. The constant evaluation of primary care clinic performance allows for new design recommendations to be studied and refined based on clinical staff feedback. This type of strategy justifies a better decision making process for investing government funds and developing standards for building and operating world-class healthcare facilities. Finally, the adoption of the case study and POE methodology fosters an evidence-based planning and design approach that would create a level of public trust for the MHS.

5.4 Selection Criteria for Sites and Participants

The cases in this study were chosen from three main selection criteria. First, primary care clinics were selected since they represent a large part of the overall facility portfolio for the MHS. The MHS operates 431 primary care clinics for three branches of the military that include the U.S. Army, U.S. Air Force, and U.S. Navy. The U.S. Army was chosen since the branch is the largest and operates 187 primary care clinics that delivers patient care to over 50% of the patient population for the MHS (Defense Health Agency, 2017).

Figure 5.3: MHS Primary Care Clinic Typologies (Martin Army Community Hospital, 2017; Wakefield Beasley, 2017; Evans Army Community Hospital, 2017)

Second, the criteria for selecting which primary care clinics to include in the study was determined by reviewing available floor plans of recently constructed primary care clinics. A total of 11 floor plans were received of clinics built after the 2009 adoption of the PMCH model of care. The cases were then categorized into the three different MHS primary care clinic typologies: (a) embedded-hospital clinic, (b) soldier-centered clinic, and (c) community-based clinic (as indicated in Figure 5.3). The 11 cases reviewed included five embedded-hospital, three soldier-centered, and three community-based clinics. Each of the floor plans were then examined to identify the similarities and differences across the team-based clinical modulus.

The floor plan analysis of the clinic layouts revealed four cases that represent different clinic and team-based clinical module layouts. The first case was a community-based clinic and was examined in the first phase of this research study. Community-based clinics were not evaluated in the second phase of the study due to limitations of leased facilitates being renovated to accommodate team-based care environments compared to new construction clinic designs. The second case, a soldier-centered clinic was selected and included two team-based clinical modules (Figure 5.4). The team-based clinical modules, in this case, resembled the clinic layout advocated for in the MHS space planning criteria.

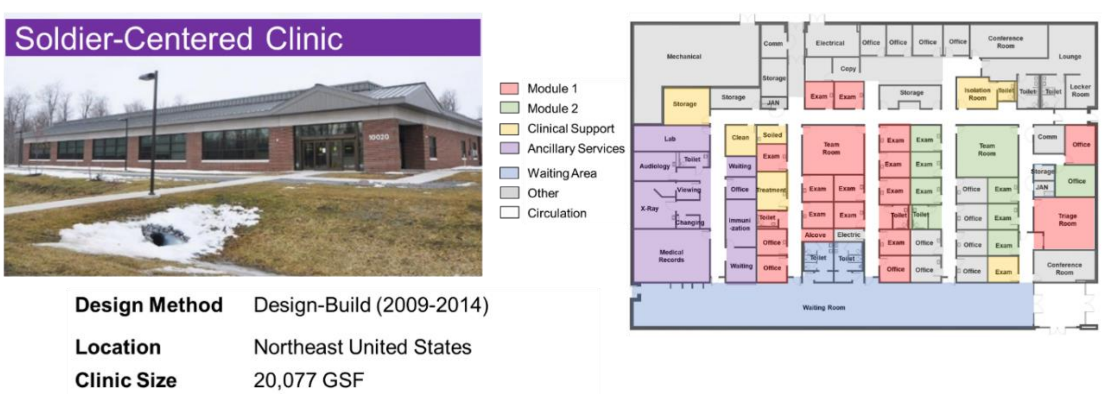


Figure 5.4: Case 1 Soldier-Centered Clinic (Army.mil, 2018)

Two embedded-hospital clinics were selected based on the variations in floor plan layouts across the 11 cases. The second case, one of the largest clinics of the 11, was selected with two different layouts of team-based clinical modules which were representative of primary care modules (Figure 5.5). Case three was unique as staff workspaces were located on the perimeter of the two clinical modules and exam rooms in the center (Figure 5.6). This clinical module layout countered existing design recommendations from literature, which created the chance to evaluate a new clinical module design.

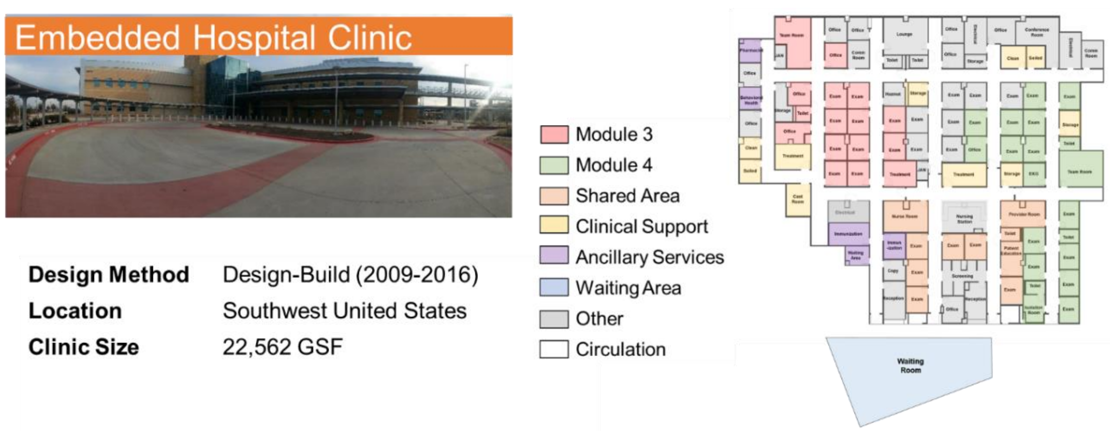


Figure 5.5: Case 2 Embedded Hospital Clinic

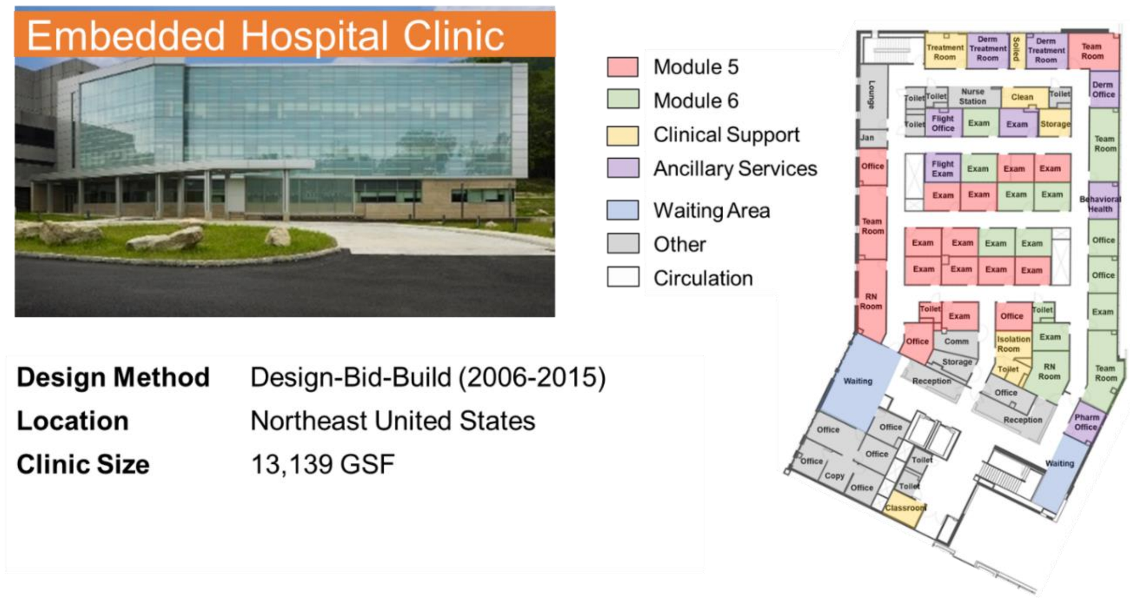


Figure 5.6 Case 3 Embedded Hospital Clinic (Ewing Cole, 2018)

The three selected cases provided a wide range of floor plan layouts and sizes to explore and describe team-based care environments. At the same time, examining one single organization, the MHS, contributed to developing an database on primary care clinic typologies.

5.4A Participant Selection

This study utilized a convenience sample for selecting participants from the multiple cases (Singleton & Straits, 2010). Participants in the study included two groups of users: (a) planners and designers, and (b) clinical staff. The planners and designer participants involved individuals with direct involvement in the design and construction of the clinic. Participants from this group consisted of two to three individuals per site, which resulted in a total of eight planners and designers in the study.

The clinical staff participants were categorized into five sub-groups: (a) Healthcare Administrator, (b) Primary Care Provider, (c) Registered Nurse, (d) Licensed Practical Nurse, and (e) Specialty Provider.

a. Healthcare administrators are the clinic Officer-in-Charge and Non-Commissioned Officer-In-Charge. This sub-group included two participants per site, which resulted in a total of eight healthcare administrators in the study.
b. Primary care providers are physicians, nurse practitioners, and physician assistants. This sub-group included two to four individuals for each clinical module, which resulted in four to seven individuals interviewed for each case. The total number of primary care providers interviewed in the study was 16 individuals.
c. Registered nurses are team leaders or case managers for each clinical core team. This sub-group included two participants for each clinical module, which resulted in four registered nurses for each case. The total number of registered nurses interviewed in the study was 12 individuals.
d. Licensed practical nurses are military medics, licensed vocational nurses, and licensed practical nurses. Participants interviewed in this sub-group included two to six individuals per clinical module, which resulted in seven to twelve interviews for each clinic. The total number of licensed practical nurses interviewed in the study were 27 individuals.

e. Specialty providers are clinical pharmacist and behavioral health providers. Case one did not have any specialty providers in the clinic, while the remaining two cases have specialty providers in the clinic. This sub-group consisted of one clinical pharmacist and one behavioral health provider for the two cases. The total number of specialty providers interviewed in the study were four individuals.

5.5 Areas of Study: Data Collection Methods and Analysis

This qualitative nature of this research study included ethnographic data collection methods understand staff opinions and experiences. Stake (2010) claims that to understand the world we live in one must “pay attention to what people are doing and what they say” (p.2). Similarly, Fetterman (2010) describes how ethnographic interviews of multiple individuals from a place contributes to data saturation of findings. Additionally, the literature demonstrates that collecting 20 to 40 interviews over multiple sites produce design recommendations that enhance the physical environment for patient care delivery (Gunn et al., 2015, Karp et al., 2016; Oandasan et al., 2009). This suggest that staff interviews and direct observations are valuable tools in collecting data to explore and describe team-base care environments.

Following Preiser et al. (1998) recommendations for POE, archival documents, floor plans, and photographs were collected to analyze the physical environment. These data sources offer standardize data elements that can be compared across three clinics. Additionally, the data contributes to an understanding of the physical context where the clinical staff work. Combining facility data with staff interviews provides rich descriptive data set to evaluate team-based care environments.

The framework for this study provides a novel approach to measure the three goals/objectives towards evaluating primary care team-based care environments: (a) facilitate team room collaboration and focused work, (b) optimize clinical module functionality, and (c) efficient clinic workflow. Each of the goals/objectives are directly linked to design factors, which are measured through quantitative and qualitative data. The framework shows each type of data collection tools and how the data is measured to a corresponding goal/objective, which are used to evaluate team-based care environments (as indicated in Figure 5.7).

OUTCOME	GOALS/OBJECTIVE	DESIGN FACTORS	MEASUREMENTS	QUANTITATIVE DATA	QUALITATIVE DATA
Support High Quality Team-Based Care	**Efficient Clinic Workflow:** The ability to minimize staff travel distances and unnecessary effort to deliver patient care (Thompson & Pelletier, 1959; Freihofer et al., 2017)	Layout of Spaces	1. Staff travel distance from team room to waiting room 2. Staff travel distance from team room to exam room 3. Staff travel distance for routine patient appointments	Floor Plan - Team room to waiting room travel distance - Average distance from team room to exam rooms - Average travel distances for staff roles perfoming routine patient appointments	Interview 1. How do you feel about your travel distances in your team area to deliver team-based care?
		Sharring Corridors with Patients	1. Circulation patterns in the clinical modules	Floor Plan - Patient and clinical staff circulation pathways	Interview 2. How do you feel about sharing corridors with patients to delivery patient care?
		Proximity Between Support Rooms & Patient Care Areas	1. Location of support rooms in relationship to clinical modules	Floor Plan - Types of support rooms in the clinic - Location of support rooms in and outside the clinic	Interview 3. How do you feel about your travel distances outside of your team area for patient care activities? 4. What types of areas do you travel to outside the clinical module? How frequently do you travel to those areas to support patient care activities?
	Optimize Clinical Module Functionality: Captures how well programmatic elements such as size, location and allocaiton of spaces in the clinical module or clinic support the delivery of patient care (Prieser, 1995)	Room sizes	1. Size of room 2. Number of individuals in room	Floor Plan - Size of rooms - Number of staff in the rooms Observations -Staff activities in the team room - Physical measurement of spaces	Interview 5. What space works best in your team area for supporting the delivery of team-based care? 6. If you could change one space to better support the delivery of team-based care in the clinic what would it be?
		Types of Rooms	1. Rooms needed directly available in a team-based clinical module 2. Sharable room types across the team-based clinical module	Floor Plan - Types of rooms in the clinical module - Types of rooms shared across the clinical modules Observations - Walkthrough of clinical module	Interview 7. Which rooms need to be directly available in your team area to support team-based care? 8. Which rooms should be shared among teams in the clinic?
		Clinical Module Layout	1. Allocation and location of rooms in a team-based clinical module	Floor Plan - Allocation of rooms - Location of rooms	Interview 9. How do you feel about the location of your team room in the clinic and in your team area? 10. How satisfied are you with the design of you clinical module ?
	Facilitate Collaboration and Focused Work in the Team Room: Provide opportunities for clinical staff to work as individuals or as a team without distractions and interruptions in a PCMH clinic (Gunn et al., 2009)	Space for Private Work	1. Space for work that requires focus and concentration	Photographs - Photographs of staff work areas Floor Plans - Measurements of staff work areas Observations - Type of workstations in the team room - Location of staff in the team room - Staff activities in the team room	Interview Questions: 11. How do you feel about the ability to visual connect with fellow staff members in your clinical module area? 12. Where do you go to perform work that requires focus and concentration? 13. Where in your clinical module do you go to coollaborate with fellow staff members for preparation for patient care?
		Space for Collaborative Work	1. Visual connections and direct sight lines to staff work areas 2. Colocaiton of clinical care teams		

Figure 5.7: Study Framework Linking Design Factors to Measureable Goals/Objectives

The data collection tools for the this phase of the study included interviews using two different formats, direct observations, photographs, and floor plan analysis. First, the two different formats for interviews addressed the macro level and micro level user groups to understanding how the clinic environment influences patient care delivery. Second, the direct observations were used to describe how the team room facilitates collaborative and focused work. Lastly, the photographs and floor plan analysis captured data to compare the environmental conditions across the selected cases.

5.5A Interviews with Planners and Designers

The purpose these semi-structured interviews was to capture the original planning and design objectives for the overall clinic in relation to delivering team-based care. Potential identification of participants were certified through an interview with the facility manager from each of the sites. The eligible planners and designers for each clinic were then emailed and asked to participate in a 20 minute telephone interview. The total number of planners and designers interviewed in the study were eight individuals. The participants were asked a serious of questions to obtain an understanding of initial design concepts, how the clinic was designed for team-based care and any deviations from the MHS space planning criteria that occurred. The list of interview questions for planners and designers is located in Appendix C.

The analysis for the planners and designers interviews identified key themes concerning design decisions related to the physical environment. Each of the interviews responses were noted by the researcher and then annotated in a memo to capture the data (Rubin and Rubin, 2012). The analysis of the interview data allowed the themes to emerge, which emphasizes an inducte approach (Miles, Huberman, Saldaes, 2013). The data were then coded to identify key themes to capture design thinking and strategies related to the physical environment.

In addition, responses were utilized to describe the historical context and external factors that influenced the design for each clinic. This afforded the opportunity to build a rich description of design factors prior to the adoption of PCMH, PCMH design strategies, and what occurred with the user occupancy of the clinic. This created a bridge to understand upfront design thinking to user's perception of the clinic environment, which aligns with a POE methodology.

5.5B Interviews with Clinical Staff

The purpose of these semi-structured interview were to capture the clinical staff opinions and experiences on how team-based care environments for those who deliver patient care. The interview questions specifically related to the study's evaluation framework to understand the clinical module functionality, staff workflow efficiency, and the team room's ability to facilitate collaborative and focused work. The researcher interviewed clinical staff participants during low volume periods in the clinics. Interviews occurred in empty rooms that were located in the clinic. The participants were asked a serious of open-ended questions to obtain their opinions and experiences of the clinic, clinical module, team room, and exam rooms. Additionally, clinical staff were asked a closed-ended question using a four-point Likert scale to measure their satisfaction with the design of the clinical module in supporting team-based care delivery. The list of interview questions for clinical staff is located in Appendix C.

The study utilized field notes and audio recordings to capture staff opinions and experiences of the clinic environment. Field notes were captured on a pre-printed floor plan and researcher's field journal (Cranz, 2016). Each participant received a pre-printed floor plan to establish a visual tool in explaining his or her experiences. Additionally, staff were encouraged to draw and write notes on the floor plans. Audio recordings were transcribed for each participant, while the researcher's field journal contributed to memoing of staff responses and daily activities in the clinic. Interviews did not occur in rooms with patients being examined or treated by clinical staff. No information was asked of participants regarding patient treatment or medical information.

The analysis for the clinical staff interviews utilized thematic and evaluation coding to produce evidence from the staff perspective (Miles, Huberman, and Saldana, 2013). Participant's responses were first analyzed using a deductive coding strategy to categorize the interview data into the eight design factors relating to the framework: (a) collaborative work spaces, (b) private work spaces, (c) room sizes, (d) types of rooms, (e) clinical module layout, (f) travel distances, (g) shared pathways, and (h) access to support rooms. Then each participant's data was evaluated as a strength or weakness across the eight design factors. The data were input into a Microsoft excel document that included columns to identify each participants site, staff role, and coded evaluation description for each design concept. This was done to allow for data analysis of staff perceptions across the cases, clinical modules, and staff roles.

Finally, the data were analyzed to describe the overall clinical core team and different staff roles perspectives concerning how the clinical environment supported or hindered workflow efficiency, functionality for the clinical module, and a team room that supports collaborative and focused work. This layer of analysis revealed the clinical core team's perception related to his or her assigned clinical module. The cross-case analysis of the primary care providers, registered nurses, licensed practical nurses, and specialty providers provided insights in how each of the four sub-groups of perceived the clinic environment (see chapter nine). This pointed out that the user's role is a significant factor in describing how the physical environment supports patient care delivery.

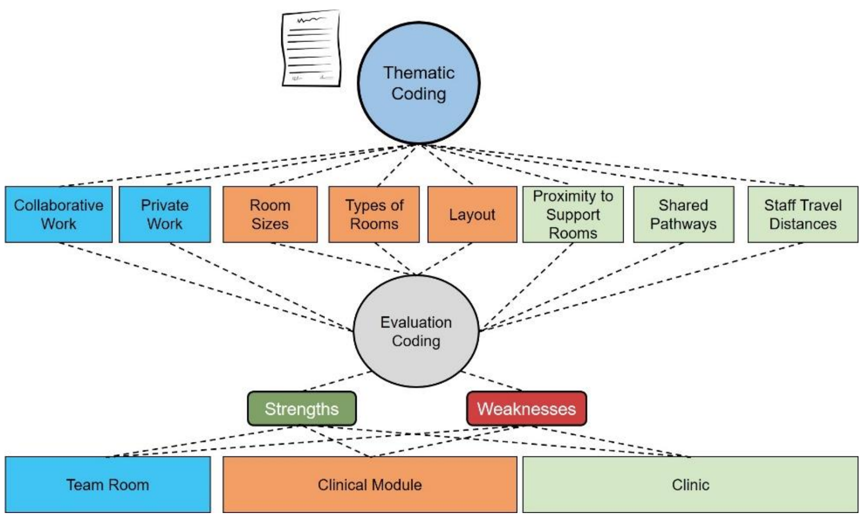


Figure 5.8: Interview Coding Scheme

5.5C Observations on the Team Room and Huddles

The purpose of the field observations uncovered where staff work, the activities they perform, and how staff collaborate in the team room. Observations in the team room occurred from a location that didn't hinder the staffs' ability to deliver patient care. Each team room was directly observed four times per day in five-minute sessions over the course of two days, except case three. External events occurred in case three that were uncontrollable due to weather and a patient with a contagious illness, which resulted in limited observations of the team rooms. Across the cases, the location and activities of clinical staff in the team room were documented on a pre-printed observation worksheet. The pre-printed observation worksheet consisted of an open-box area to sketch the room layout, movements of staff, activities performed and notes regarding the conditions of the physical environment. The protocol for the observation is listed in Appendix C.

In addition, team huddles were observed separately from the team room observations as the location varied on where the event took place. A team huddle occurs on a daily basis to allow staff to engage in group discussions for patient care related activities. Observations of team huddles that occurred in the team rooms were observed in five-minute sessions once per day over the course of two days. Alternatively, team huddles that occurred once per day in the hallway or nursing station were observed two to three times per week in five to ten-minute sessions. This provided further data to analyze how the clinic accommodates collaborative work.

The analysis of the observation data from the team room revealed workflow patterns and activities performed by staff in the team room. The data from the observation worksheet were transferred into Microsoft excel document in columns that included site location, clinical core team, room location, start time, end time, staff role, staff identification number, location in the room, activity performed, and researcher notes. The researcher’s notes articulated who was talking to who, the movements of the individual throughout the room, and conditions of the physical environment, such as excessive noise. The data were then transformed into a drawing illustration which represented the team room activities.

The illustrations of the team rooms were thematically coded utilizing an inductive approach (Miles, Huberman, and Saldana, 2013). Themes emerged based on a review of staff activities in the team room. Collectively the themes were compared across the multiple observations to establish major themes occurring in each team room and huddle space. This offered supplemental data to support the staff opinions and experiences concerning the team room's ability to support both collaborative and focused work.

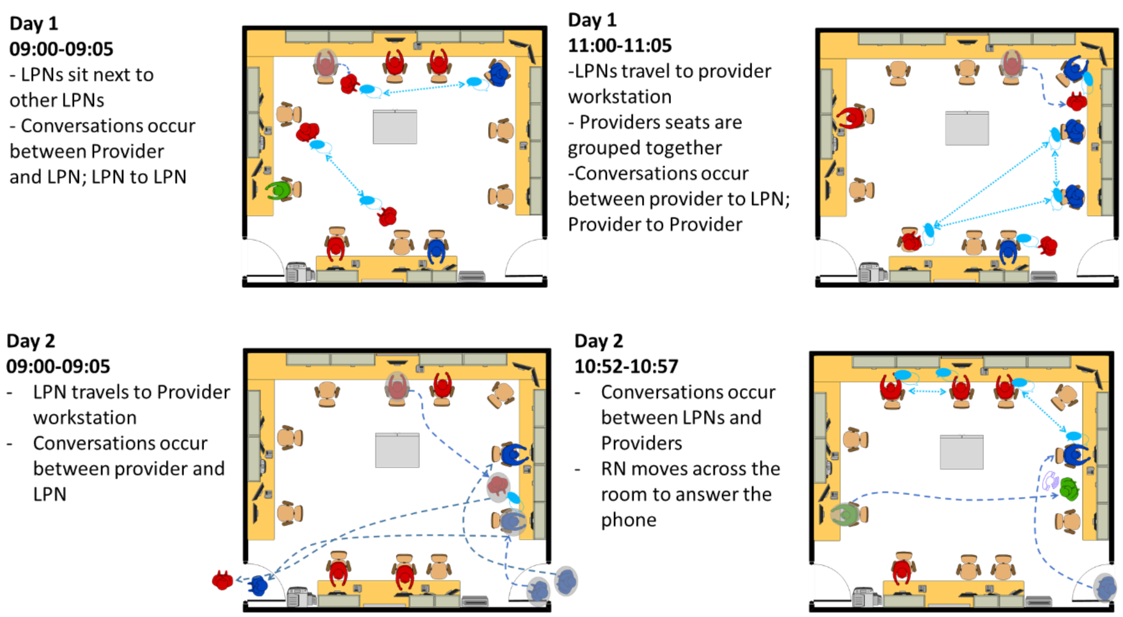


Figure 5.9: Team Observation Analysis

5.5D Photographs

Photographs are used to document the on-site facility conditions of the clinic. The researcher took photographs of the clinic during low-usage periods which did not interfere with the staff's daily operations. All photographs excluded clinical staff, patients, and family members. Photographs incorporated both standard and panoramic views to capture the entirety of the physical environment. The protocol for the photographs is listed in Appendix C.

5.5E Archival Data

The purpose of the archival data collection tool was to collect background information on the current clinic staffing, types of patient visits, workload, and clinic layout (floor plan). Archival documents were captured from including staffing data, policies and procedures, number and type of patient appointments, hours of operations, types of medical services offered, and facility floor plans. A review of these data revealed background information that offered an understanding of the operational context of the clinic. The protocol for the archival data analysis is listed in Appendix C.

Researcher as Instrument of Analysis

The role of the researcher in qualitative studies encourages “bracketing” to mitigate influences on data collection and analysis. Bracketing allows the researcher, who is the main instrument tool in qualitative research, to express opinions with regards to assumptions, emotions, and experiences while immersed in a sitting (Glaser and Strauss, 1967). This technique benefits the researcher by limiting bias opinions that may influence coding and evaluation of staff perspectives. Furthermore, as the main instrument, the researcher in qualitative data analysis offers in-depth exploration of staff opinions as being a part of a lived experience. However, a weakness for a researcher, as the main instrument, is the lack of exactness in the evaluation of 58 staff perspectives of the clinic environment. Therefore, the researcher needs constant awareness of avoiding bias opinions when evaluating a qualitative data set. Bracketing through external memos and phone conversations with committee members occurred regularly to reinforce awareness of bias opinions with the analysis of the staff opinions and experiences.

5.6 Conclusion

This study uses a comparative case study research strategy with ethnographic data interviews and observations to understand how the clinic environment either supports or hinders the delivery of team-based care. Collecting staff opinions and experiences offer direct insights into how specific design factors affect a team-based environment. Furthermore, interviewing the staff in their work environment improves the quality of responses as the participant can point out or visualize elements that are strengths and weaknesses. Therefore, field interviews allow the researcher to interact with various clinical staff while they are immersed in the workplace and collect rich descriptions for how the design of the built environment influences team-based care. In addition, the limited knowledge on team-based care environments suggest a qualitative approach aimed at discovery using face-to-face interviews with staff will yield insight on the different staff roles and activities that define team-based primary care.

CHAPTER SIX

FINDINGS – CASE 1

The first case selected for review is a standalone soldier-centered clinic for the MHS. The clinic is located in the northeastern region of the United States and occupies 18,611 gross square feet (GSF). The effort to create this clinic was initiated in 2009, using a design-build project delivery method. In 2014, the construction of the clinic was completed and delivering patient care to soldiers began. The original design of the clinic is a T-shape clinic layout that separates patient and staff areas. The adoption of a PCMH model of care during the 65% design phase developed a redesign of the clinic layout to include clinical modules with team rooms. The integration of the clinical modules and team rooms resulted in staff workspaces being moved closer to patient care areas which compromised staff privacy. This resulted in a hybrid T-shape layout that lacks a private staff corridor. The shift to a PCMH clinic presents an opportunity to evaluate how the changes to clinic design made by the planning and architecture team influence the delivery of team-based care.

The research design for this case study used a qualitative approach using a case study research strategy with ethnographic interviews and observations to collect data. The first data collection method used semi-structured interviews with healthcare planners and an architect to describe the planning and design intentions for the clinic. Next, on-site observation of clinic operations provided insight on how the clinic is used in practice. Finally, semi-structured interviews obtained clinical staff perceptions of how the clinic layout is influencing the delivery of team-based care.

The findings presented for this case study are organized in five sections. Section 6.1 describes the background of the patient care environment, and presents an overview of the clinic layout, team staffing structure, and patient workload for the clinic and teams. Section 6.2 examines how the clinic environment influences workflow by soliciting staff perceptions on the following three design concepts: (a) access to support rooms; (b) the proximity of the team room to the waiting room; and (c) sharable circulation pathways. Section 6.3 studies the functionality of the team-based clinical module. The layout of the team-based clinic modules are examined through staff opinions and floor plan analysis across three design factors: (a) types of rooms in the team-based clinical modules, (b) room size, and (c) module layout. Section 6.4 evaluates how team rooms influence collaborative and individual-focused work, using ethnographic observations of staff work patterns to examine: (a) colocation of staff, (b) visibility of staff workspaces, and (c) the space used for individual-focus work. Section 6.5 presents the findings and the design recommendations from the case. This clinic highlights how PCMH implementation influenced the delivery of team-based care in a soldier-centered clinic and importance of the clinic environment. The evidence from this study starts to build a database of strengths and weaknesses for clinic designs that support the PCMH model.

Design Method	Design-Build (2009-2014)
Location	Northeast United States
Clinic Size	18,611 GSF
Business Hours	M-F 0745 to 1600

Total Encounters	**69,271 per year**	
Patient Encounters	51,257 per year	**74%**
Patient Teleconference (TCON)	18,014 per year	**26%**

Clinic averages 214 patients per day
MHS Standard is 190 patients per day (DoD, SPC 2017)

Patient Appointment Types

Figure 6.1: Overview of the Clinic (Army.mil, 2018)

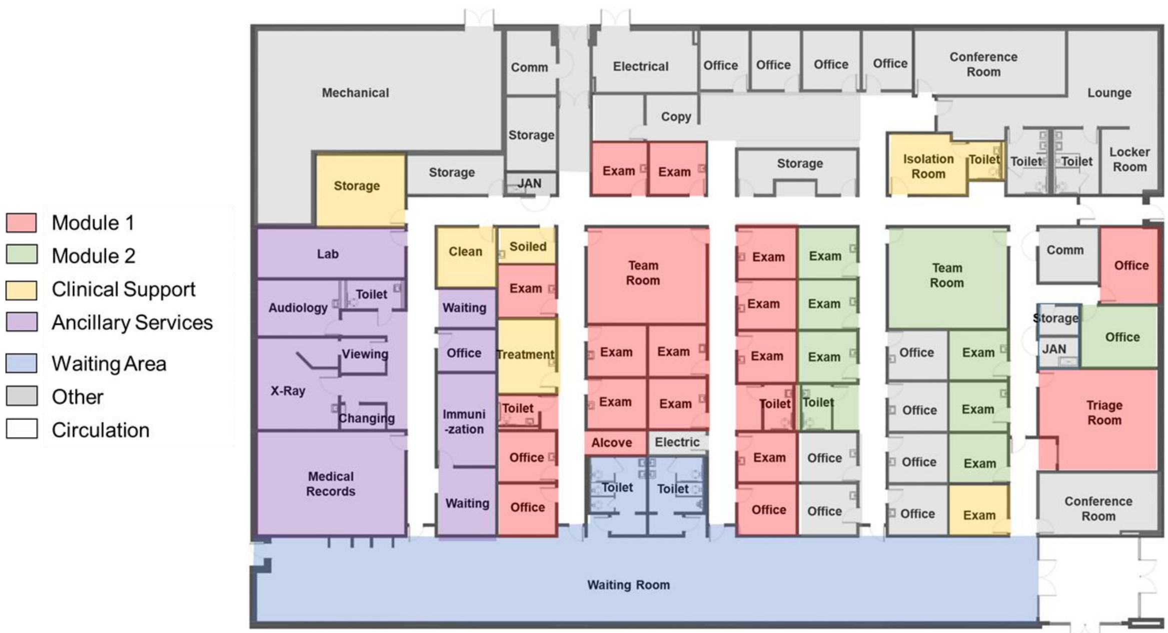


Figure 6.2: Clinic Floor Plan

The soldier-centered clinic is part of a medical outpatient campus that supports a government military installation. The outpatient medical campus only provides healthcare services to active duty military soldiers, supporting approximately 20,000 soldier beneficiaries. The outpatient medical campus contains two primary care clinics, a pharmacy building, a behavioral health building, and a physical therapy building. The soldier-centered clinic presented in this study provides the outpatient medical campus with immunization, radiology, audiology, and triage medical services.

The triage section is a unique service located in this clinic, providing the space to screen walk-in patients during sick-call operations. The military prohibits soldiers from calling in sick for work without written documentation from a medical provider. This administrative requirement results in the creation of what is known as a “sick-call” service, to accommodate soldiers needing unscheduled care at the beginning of the workday. The sick-call process allows the soldiers to receive initial patient care and meet work-related accountability protocols for the military. Additionally, the triage section provides health services for medical conditions that are not emergencies but still require care within 24 hours. For example, soldiers who accidentally fall and twist an ankle or hurt their knee would come to the triage section for patient care. The triage section includes on-call private offices for primary care providers and a large, open-bay room as indicated in Figure 6.2.

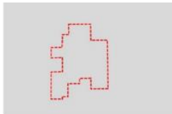
Figure 6.3: Triage Room

Primary care is delivered using a team-based approach to patient care in which physicians, licensed practical nurses and registered nurses work side by side as a team. Two clinical teams work in two separate care modules (indicated in red areas and green areas in Figure 6.2). The clinic provides patient care through two clinical teams that are independent of one another. The two clinical teams provide patient appointments for routine care, acute-care, procedures, wellness visits, and teleconference consultations. Ancillary services within the clinic include a point-of-care lab and the previously discussed immunization, radiology, audiology, and triage sections. Locations for ancillary services in the clinic are indicated in purple for Figure 6.2, except the triage section.

Figure 6.4: Clinical Module Layout

6.1A Description of Team-Based Clinical Modules

The team-based clinical modules in this soldier-centered clinic offer two slightly different variations of a hybrid T-shape clinic module layout. A team-based clinical module, or a clinical module, is a group of spaces that contain exam rooms, team workspaces, and storage areas that support clinical core teams in delivering effective patient care (DuBose, Lim, Westlake, 2015; Whiteaker, 2015; Belknap & Lafferty, 2011; Taylor, Joseph, Keller, Quan, 2011). The two clinical modules support 33 staff members with 18 exam rooms in 3,946 Net Square Footage (NSF) (Figure 6.4 and 6.5). In the front of the clinic is the public waiting area, reception desks, and public restrooms that occupy 2,926 NSF. Clinical module one includes three private/sharable offices, one team room, two screening alcoves, two patient toilets, and eleven exam rooms. The triage section (indicated in light blue in Figure 6.5) only provides patient care for soldiers assigned to clinical core team one. Clinical module two contains one patient toilet, one screening alcove, one shared office, one team room and six exam rooms.



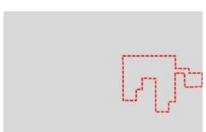
Type of Room	# of Rooms	Average NSF	Average Guideline NSF
Exam Room	11*	118	120
Shared Office	2	120	120
Team Room	1	468	120
Alcove/Screening	2	52	60
Patient Toilet	2	52	60
Office	1	118	120

Clinical Staff Team	Planned # of Staff	Actual # of Staff
Provider	5	6**
RN	4	3
LPN	9	11
Total	**18**	**20**

*Triage room, which has two exam tables, supports this team in performing patient care, which are allocated to this model
**1 rotating primary care provider and 2 licensed practical nurses are in the triage room that support this team

Provider Sub-Teams Share One Team Room

Figure 6.5: Clinical Module 1 Layout



Type of Room	# of Rooms	Average NSF	Average Guideline NSF
Exam Room	6	117	120
Shared Office	1	188	120
Team Room	1	480	120
Alcove/Screening	1	47	60
Patient Toilet	1	54	60

Clinical Staff Team	Planned #	Actual #
Provider	5	4
RN	4	2
LPN	9	7
Total	**18**	**13**

Provider Sub-Teams Share One Team Room

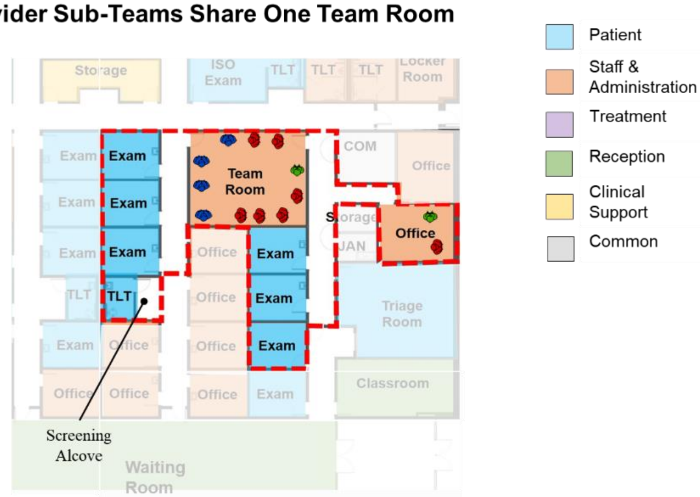


Figure 6.6: Clinical Module 2 Layout

6.1B Description of Clinical Core Team Structure

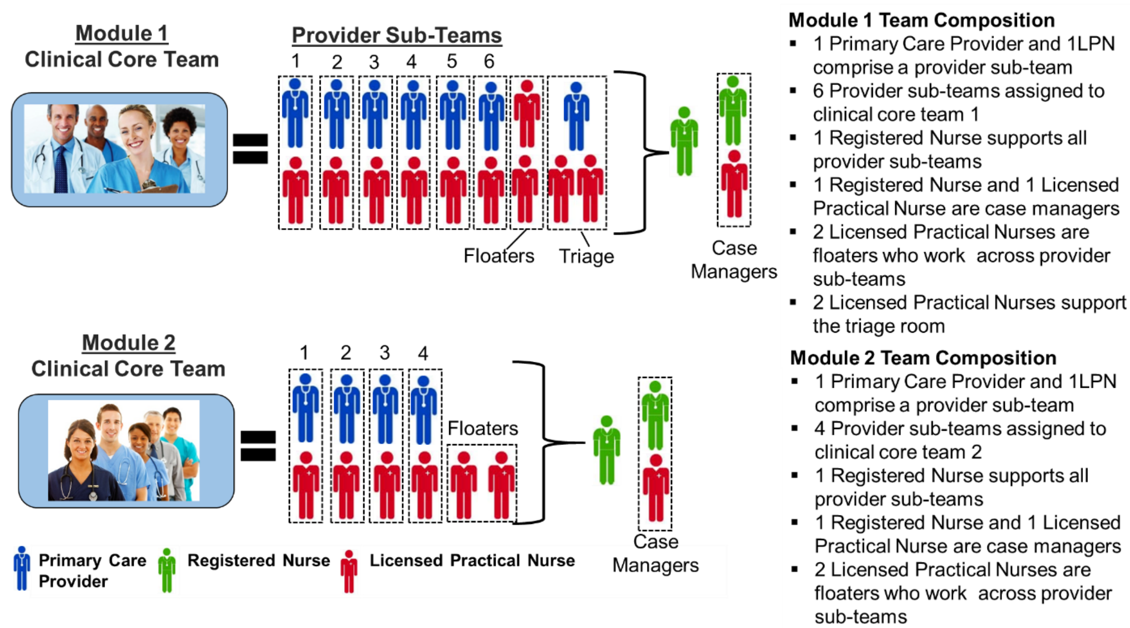


Figure 6.7: Clinical Core Teams Composition: (Bon Secours, 2017; Halos Daily, 2018)

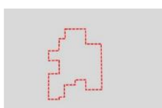
Utilizing a team-based approach, each clinical core team is assigned to a team-based clinical module, which is led by the primary care providers and supported by nursing staff (Figure 6.6). Staffing for the two clinical core teams consists of active duty military soldiers, government service members, and/or government-contracted employees. Active duty military staff require external duties for military training, as a result there work hours in the clinic may vary. External duty obligations determine the availability for primary care providers and licensed practical nurses to perform patient care activities onsite due to military training. Registered nurses in the clinic are non-military members, which causes minimal fluctuations in patient workload. Clinical core team one includes 20 staff and team two contains 13 staff who are a combination of primary care providers, registered nurses, and licensed practical nurses.

Clinical core team one is comprised of six provider sub-teams, two case managers, and a team leader (Figure 6.6). The provider sub-team structure includes one primary care provider and one licensed practical nurse, both housed in the team room dedicated to the clinical module. Six provider sub-teams delivered patient care during the observational period of this study. One registered nurse is responsible for managing the daily workflow and supervision of licensed practical nurses on the team. Located in a shared office at the front of the clinical module are two case managers, one a registered nurse and the other a licensed practical nurse. Two licensed practical nurses in the team room act as floaters who support all of the provider sub-teams by filling daily staffing gaps caused by external military duties. An additional two licensed practical nurses are assigned to the triage room and work out of a shared office located in the front of the clinical module.

Clinical core team two is comprised of four provider sub-teams, two case managers, and a team leader. The provider sub-team structure is made up of one primary care provider and one licensed practical nurse who both work from the team room dedicated to the module. Provider sub-teams in this clinical module ranged from one to four during the observational period for this study. The remaining clinical core team staffing structure is similar to clinical core team one.

6.1C Description of Patient Workload

The annual patient workload for the clinic surpassed the standard benchmark established by the MHS due to the addition of a triage section. The MHS establishes patient workload standards based on available exam rooms accommodating ten face-to-face patient encounters for 240 days per year (DoD Space Planning Criteria, 2017). For this clinic in 2016, patient care took place five days a week, eight hours per day, accounting for 51,256 patient encounters. The annual patient workload in the clinic exceeded the MHS-expected 43,776 face-to-face patient encounters by approximately 7,000 patient encounters. Patient teleconferences (TCONs) are not calculated in the annual patient encounter workload, but counted for an additional 26% of patient encounters. Clinical core team one produced 40,205 face-to-face patient encounters, which accounted for 78% of the clinic workload, due to additional exam rooms and a triage section for walk-in patients.



Performance Metrics	MHS Planned	Actual #	Utilization (%)
# Exam Rooms		13***	
Daily Exam Room Workload	10 Pts	13 Pts	
Annual Average Visit per Exam Room	2,304 Pts per room	3,092 Pts per room	134%
Annual Patient Workload	29,952 Pts for all rooms	40,205 Pts for all rooms	134%

Note:
* Pts= Patients
** Workload numbers are based on the annual patient workload, which was provided by the MHS.
*** Triage room, which has two exam tables, supports this team in performing patient care. Therefore, the two beds are added to the annual exam room workload calculation.

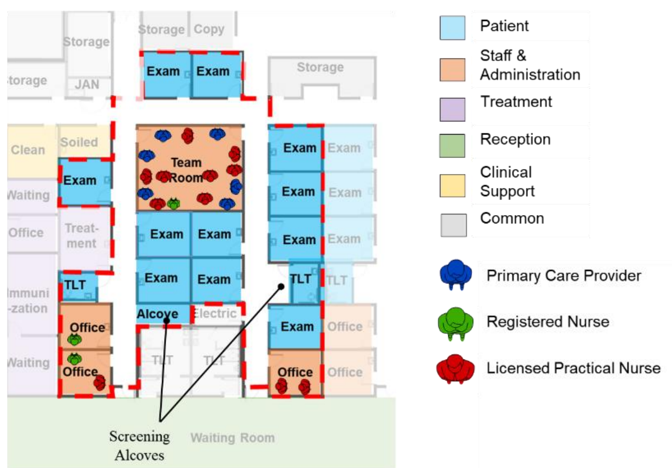
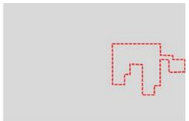


Figure 6.8: Clinical Module 1 Patient Workload Overview



Performance Metrics	MHS	Actual	Utilization (%)
# Exam Rooms		6	
Daily Exam Room Workload	10 Pts	8 Pts	
Annual Average Visit per Exam Room	2,304 Pts per room	1,842 Pts per room	80%
Annual Patient Workload	13,824 Pts for all rooms	11,051 Pts for all rooms	80%

Note:
* Pts= Patients
** Workload numbers are based on the annual patient workload, which was provided by the MHS.

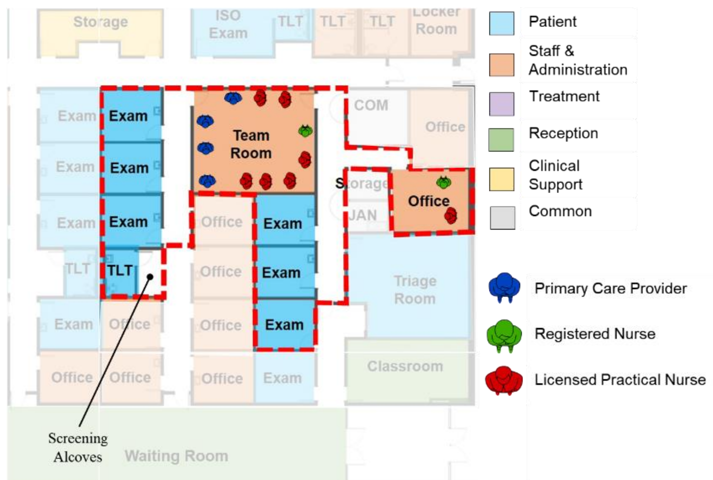


Figure 6.9: Clinical Module 2 Patient Workload Overview

6.1D Original Design Intentions

MHS design guidance criteria from 2006 does not include planning or design recommendations to address a team-based approach for patient care. This design guidance led to an entire clinic layout similar to a T-shape, which offers staff a private corridor in the back of the clinic (Figure 6.9). According to the interviews, the architect designed the clinic to "separate staff and patient spaces, with the on-stage area defined as where the exam rooms are located. The off-stage area is where staff work and is located in the back of the clinic" (Architect Interview Case 1, 2018). The "off-stage" areas are separate from patient exam rooms with a semi-private corridor, matching the staff circulation patterns indicated in Figure 6.9. In the front of the clinic is public waiting that connects to the "on-stage" area that houses all the clinic exam rooms (exam zone in Figure 6.9). The location of ancillary services as indicated in Figure 6.9 (treatment zone) are on the perimeter of the clinic. Patient circulation pathways are contained to the front of the clinic, while in the back of the clinic are staff-only circulation pathways. Patient and staff circulation pathways are separate except for pathways in the exam and treatment zones.

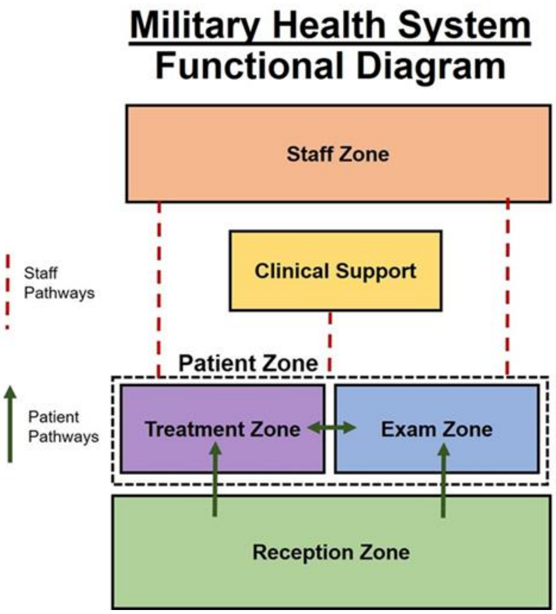


Figure 6.10: MHS Recommended Clinic Layout (MHS Space Planning Criteria, 2015)

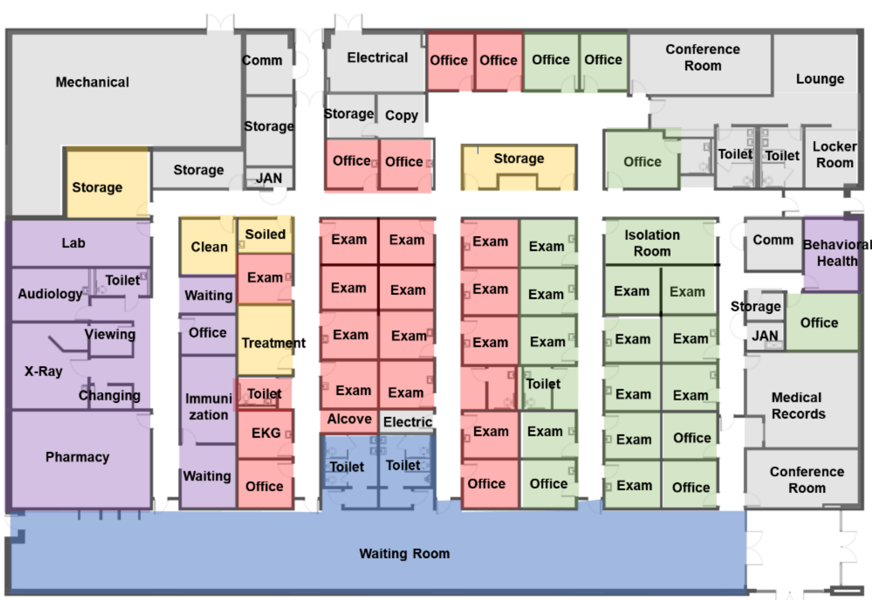


Figure 6.11: Original Proposed Clinic Layout

Area	Space Allocation		%
Module 1	2,461	NSF	13%
Module 2	1,485	NSF	8%
Clinical Support	982	NSF	5%
Ancillary Services	2,078	NSF	11%
Waiting Area	2,926	NSF	16%
Other	5,648	NSF	30%
Circulation	3,031	NSF	16%
Total	**18,611**	**GSF**	**100%**

Net to Gross Factor=**1.19**
MHS Net to Gross Factor is **1.4** (DoD SPC, 2016)

*Other Area= space allocated to administration, clinic mechanical space, information technology closet, lounge, and conference room

Figure 6.12: Current Clinic Layout

6.1E PCMH Model Adoption

The MHS adopted and implemented the PCMH model in 2009 resulting in design modifications to currently planned clinics by the architects. Two of the biggest changes were space accommodations for clinical modules and team rooms. First, two clinical modules were created in this clinic by dividing and colocated exam rooms, screening alcoves, and patient toilets. Second, team rooms were created by moving private staff offices in the back of the clinic, to shared team rooms dedicated for each clinical module. The architect stated that, “we relocated staff work areas originally planned to allow for natural light in the back of the clinic middle of the clinic and converted four exam rooms to create a team” (Architect Interview Case 1, 2018). The conversion of eight exam rooms in the clinic created team rooms for each of the clinical modules. The team rooms were “centrally located to the primary workflow and offered sufficient space for the staff” (Healthcare Planner Interview Case 1, 2018). Therefore, to accommodate the new team rooms, four exam rooms from each module were relocated. Consequently, two exam rooms and the isolation exam room for the entire clinic were moved to spaces located behind the new team room in originally envisioned private corridors.

The new team room concept was intended to be shared staff workspaces instead of dedicated private workspaces. This was a new concept from the PCMH implementation that re-envisioned staff workspaces in the clinics. Healthcare planners envisioned that staff would spend the majority of their time outside of the team room and at the point of care, in exam rooms. One healthcare planner said, “the team room was planned to accommodate only brief periods when all staff would be in the same physical space" (Healthcare Planner Interview Case 1, 2018). It was believed that creating sharable workspaces in an open-office environment would encourage staff to collaborate as a team for delivering patient care. Consequently, the team room did not include cubicle dividers to separate staff workspace to allow for privacy during foucsed work.

6.1F User Occupancy

After the clinic construction was completed, local leadership modified spaces in the clinic to accommodate specific requirements to support the overall outpatient medical campus. First, the pharmacy and behavioral health functions were originally located in the clinic, but leadership relocated them across the street to better support the entire outpatient medical campus. The vacancy of the two spaces allowed leadership to create a triage section within the clinic. Second, new team rooms left a vacancy in the office spaces located at the back of the clinic so an administrative section from outside the clinic moved into those office spaces. Third, the supply room located directly behind the two team rooms was given to an external administrative function as well. Finally, six exam rooms in clinical module two were repurposed to accommodate an administrative medical service unrelated to patient care provided in the clinic. The size of clinical module two and number of exam rooms were reduced from eleven to six exam rooms.

The design overview illustrates how the PCMH adoption and needs of the outpatient medical campus evolved from the original intentions of the clinic. Furthermore, both the original and modified designs are untested in understanding what works best for team-based patient care delivery. This presents a gap in establishing design guidelines for team-based care environments for the MHS. Findings in the next three sections examine the themes that emerge from staff opinions of how the clinic environment influences team-based patient care.

6.2 Workflow Concerned with the Overall Clinic Design

The layout of a clinic directly influences the staff workflow for delivering patient care by creating shorter or longer travel distances when performing commonly performed patient care activities. Efficient clinic workflow is the ability to minimize staff travel distances and reduce unnecessary effort to deliver patient care (Thompson & Pelletier, 1959; Freihoefer et al, 2017). Staff perceptions of clinic workflow are evaluated through three themes: (a) accessibility to support rooms, (b) proximity of team room to waiting room, and (c) sharing of staff and patient corridors (Tables 6.1-6.4). The first sub-section on accessibility to support rooms examines how the staff feel about travel distances to frequently-used rooms for delivering care outside the clinical module. The second sub-section appraises the staff views for traveling from the team room to the waiting room to get new patients or escort patients out. The final sub-section examines staff opinions in sharing corridors with patients to deliver patient care.

6.2A Access to Support Rooms

Clustering the most frequently used areas outside, yet nearby the clinical modules nearby can enhance staff workflow for patient care. The proximity of support rooms to team rooms creates efficient workflow for staff in supporting patient care delivery (CADRE, 2015, Battisto et al., 2009; Boulder Associates, 2011). Support rooms located outside the clinical modules are ancillary services and clinical support rooms. Ancillary services include the point-of-care lab, audiology, radiology, and immunization as indicated in purple in Figure 6.10. Clinical support rooms consist of the medical storage, clean and soiled linen rooms, treatment room, isolation exam room, and an overflow exam room as indicated in yellow in Figure 6.10. Findings in this sub-section evaluate staff views in traveling to frequently-used support rooms outside the clinical modules.

Table 6.1
Staff Perceptions of Support Rooms Most Frequently Used

STAFF ROLE	N	SUPPORT ROOM (# of Staff that Idenitied the Room)
Primary Care Provider	7	Radiology (4) Immunization (2) Point of Care Lab (2) Pharmacy (2)
Registered Nurse	4	Immunization (2)
Licensed Practical Nurse	12	Point of Care Lab (8) Supply Room (5) Radiology (2) Pharmacy (2)
Healthcare Administrator	2	Team Room (1) Exam Room (1) Triage Room (1)

The point-of-care lab is the room staff feel is most frequently traveled to from the clinical modules, especially with the licensed practical nurses who primarily drop off specimens for lab test after the initial patient screening occurs. A point-of-care lab offers support in conducting initial specimen testing to determine patient illnesses during a medical appointment. Completing this task during a patient appointment allows primary care providers the ability to immediately review lab results with the patients in exam rooms.

All clinical staff identified the radiology and immunization rooms as the second most frequently rooms visited outside the clinical module. Primary care providers of the two clinical core teams claimed they visited the radiology room most frequently to support patient care. The radiology section offers a high resolution computer screen and task lighting that enhance the ability to view patient x-ray images. The small size of the clinic offers easy access to view radiology test results outside the team rooms. On the other hand, registered nurses said they frequently travel to the immunization room to support patient care. Traveling to the immunization room aligns with their duties for supporting preventive healthcare vaccinations for patients.

The proximity from staff work areas to frequently-used rooms contributes to a more efficient workflow. Clustering frequently-used support rooms in a central sharable area near exam rooms reduces staff travel distances for supporting patient care (Battisto et al., 2009). An audiology and isolation exam room, described as the least frequently traveled areas, indicates that the location of these rooms can be further away from the two clinical modules. Accordingly, colocating a point-of-care lab, radiology, and immunization room in a central area to the two clinical module would improve access to support rooms frequently used by clinical staff.

Table 6.2

Staff Perceptions Concerning Proximity of Team Room to Support Rooms

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
1	Primary Care Provider	4	Strength (3)	"Traveling outside the team area is very minimal."
1	Registered Nurse	2	Weakness (2)	"Triage is so far away, causing a disconnect for finding people."
1	Licensed Practical Nurse	6	Strength (3)	"Relatively small clinic makes distances pretty good."
2	Primary Care Provider	3	Strength (3)	"Pretty easy to navigate around the clinic."
2	Registered Nurse	2	Strength (2)	"Not that far away to the lab or radiology."
2	Licensed Practical Nurse	6	Strength (6)	"Supply Room and lab are fairly close."
	Healthcare Administrator	2	Strength (1)	"Pretty reasonable distances in the clinic."

The proximity from team rooms to support rooms outside the clinical modules is perceived to be a strength overall for the two clinical modules. Staff from both teams report that the “relatively small clinic” size contributes to shorter travel distances from their assigned team rooms to support rooms. A licensed practical nurse from clinical module one explained that travel distances outside the clinical module “are pretty good because the clinic is not huge” (Licensed Practical Nurse Case 1 Interview, 2018). Therefore, primary care clinics sized under 19,000 GSF with two clinical modules might decrease travel distances to ancillary services located on the perimeter of the clinic.

The separation of the triage function and clinical module one hinders convenient access by clinical staff to provide situational updates on patient care activities. Triage provides patient services for urgent acute-care injuries and requires a registered nurse to constantly be updated on a patient’s injuries or illness. One registered nurse deemed that the travel distance from the team room in module one to the triage section is a weakness claiming that “there is definitely a detachment for those staff members who work in the

Triage Room" (Registered Nurse Case 1 Interview, 2018). As a result, the registered nurse constantly travels back and forth from the triage room to the team room to receive updates. Therefore, the spatial separation influences the registered nurse's travel distances to find staff members and maintain awareness of patient care activities in the triage room.

The overall size of the clinic supports efficient workflow for staff to access ancillary services, with the exception of the triage room. The integration of a triage area and placement occurred after the staff occupied the clinic. Furthermore, the triage area is staffed and controlled by clinical core team one, which is spatially separated by clinical module two compromising staff workflow. Therefore, repositioning the triage room inside or adjacent to clinical module one would foster an efficient workflow and situational awareness of patient care activities. At the same time, the triage section, which is not addressed in the MHS guidance, for a soldier-centered clinic plays a pivotal role for aligning with the functional requirements for military organizations.

6.2B Proximity of Team Room to Waiting Room

A common staff activity for delivering patient care is performing a patient medical appointment, as discussed in chapter four. Each provider sub-team is expected to see 20 patients per day, which can result in a licensed practical nurses to travel 40 times from the team room to the waiting room to pick up and drop off a patient. Travel distances to support the 20 medical appointments should ideally be minimized to support staff workflow. This sub-section addresses staff travel distances for a routine patient appointment. Travel distances for staff are discussed based on their perceptions regarding traveling from the team room to the waiting room. These two rooms represent the starting and end points for a patient appointment as discussed in chapter four. The travel distance between these two rooms were calculated from the floor plan measurements. Findings in this sub-section examine the perceived strengths and weaknesses for travel distances that support routine patient appointments.

Table 6.3
Staff Perceptions Concerning Proximity of Team Room to Waiting Room

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
1	Primary Care Provider	4	Strength (4)	"You don't get a whole lot of steps in if you are looking to do that."
1	Registered Nurse	2	Strength (2)	"I like the proximity to get to our front desk."
1	Licensed Practical Nurse	6	Strength (6)	"Satisfied, everything is pretty close in our team area."
2	Primary Care Provider	3	Strength (2)	"They are all pretty close, definitely short enough."
2	Registered Nurse	2	Strength (2)	"Team room is in good location making traveling easy for patient care."
2	Licensed Practical Nurse	6	Strength (6)	"Not a lot of distances between [team room and waiting room] so it is not that big of a deal."

The distance from the team rooms to the waiting room is perceived to be a strength for the two clinical modules. The travel distance from the team room to the waiting room for both clinical modules is 66 feet (ft) (Figure 6.11 and 6.12). Primary care providers experience the shortest travel distances ranging from 52 ft. to 64 ft. for both clinical modules (Figure 6.11 and 6.12). One primary care provider claimed that “the longest distance I have to go from my desk in the team room to a particular patient room might be 30 or 40 feet” (Primary Care Provider Case 1 Interview, 2018). Licensed practical nurses average the longest travel distances among the staff, averaging 141 ft-186 ft. in the two clinical modules (Figures 6.11 and 6.12). A licensed practical nurse claimed that traveling inside the clinical module is “not a problem, because the layout is structured so that nothing is really far away" (Licensed Practical Nurse Case 1 Interview, 2018). This implies that travel distances within the clinical module are satisfactory for patient care.

Providing only one screening alcove to support two corridors with exam rooms creates longer travel distances in clinical module two. Licensed practical nurses in clinical module two travel an additional 45 feet because of the one screening alcove to collect the patient's initial height and weight. One licensed practical nurse explained the problem with having one screening alcove: "We have to weigh the patient and then walk around [the team room] to these other exam rooms. [I] wish we just had one hallway for patient care" (Licensed Practical Nurse Interview Module 2, 2018). Lacking a screening alcove in each corridor that contains exam rooms hinders optimal workflow for licensed practical nurses during patient appointments.

Planning and designing efficient workflow for patient care activities needs to center around the licensed practical nurse's travel distances. The licensed practical nurses travel the longest distances for routine patient care appointments, as indicated in Figures 6.11 and 6.12. At the same time, primary care providers mainly travel from the team room to the exam rooms. The primary care providers travel shorter distances than the licensed practical nurses in a typical day and probably should since providers are a more expensive resource along with leaders of the team. The registered nurses' travel patterns for medical appointments don't occur on a regular basis, limiting the need to plan around their travel distances. Therefore, planning and designing the clinic workflow around licensed practical nurses may improve workflow during the delivery of patient care.

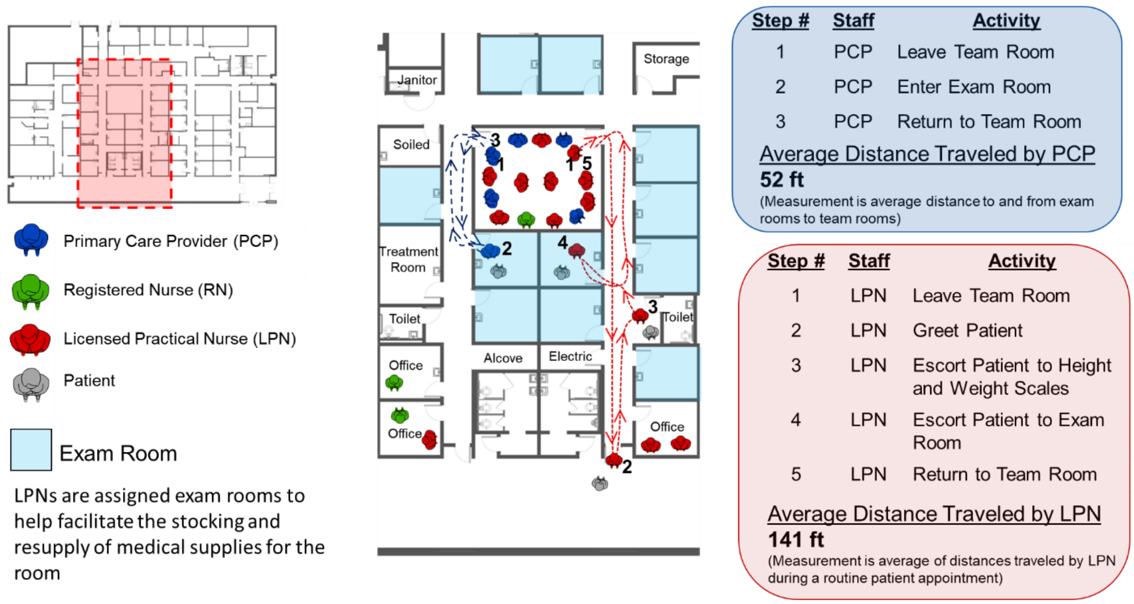


Figure 6.13: Clinical Module 1 Staff Workflow for Routine Patient Appointment

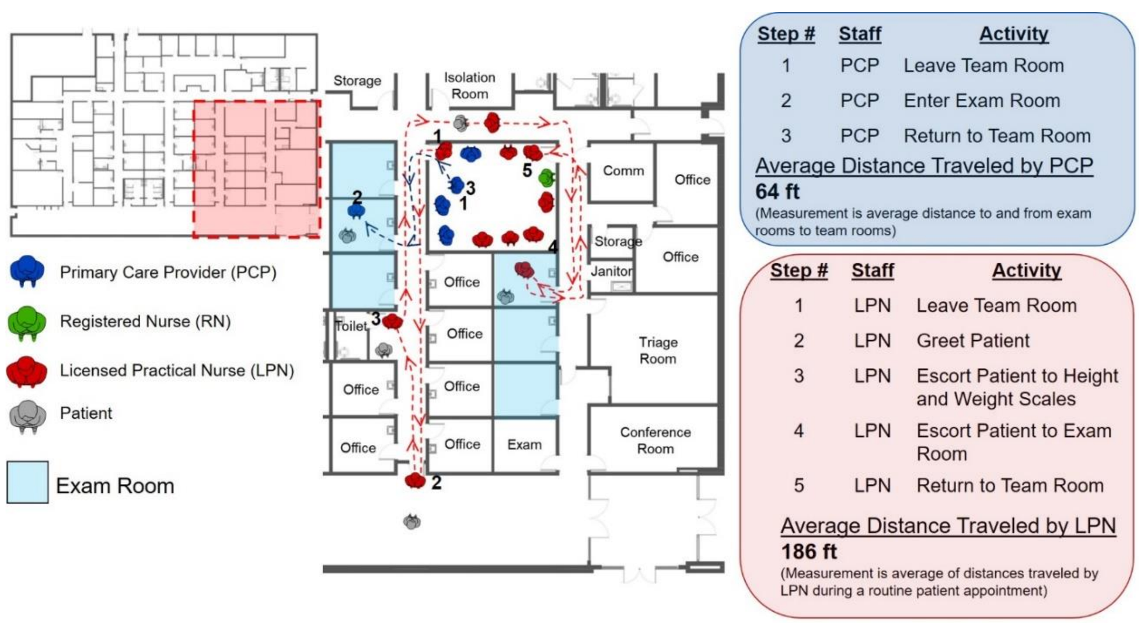


Figure 6.14: Clinical Module 2 Staff Workflow for Routine Patient Appointment

6.2C Shared Staff and Patient Corridors

Studying patient and staff movement through corridors during patient visits offers insight into workflow patterns. The prevailing view in the literature is that separating staff and patient corridors fosters staff privacy and the ability to move more fluidly in the clinic (Battisto et al., 2009; Karp et al., 2016; Freihoefer et al, 2017). In the MHS guidance criteria, staff and patients share corridors, which contradicts much of the recommendations in the literature. Findings in this section report on staff opinions with sharing corridors with patients.

Table 6.4
Staff Perceptions Concerning the Use of Shared Corridors

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
1	Primary Care Provider	4	Non-Issue (3)	"I don't think it affects anything."
1	Registered Nurse	2	Non-Issue (1)	"We do a really good job at keeping personal information kind of hush hush."
1	Licensed Practical Nurse	6	Non-Issue (6)	"Very rarely do we get stopped in the hallway."
2	Primary Care Provider	3	Non-Issue (2)	"I don't think that it matters much to share hallways with patients."
2	Registered Nurse	2	Non-Issue (2)	"I don't see any issues with that."
2	Licensed Practical Nurse	6	Non-Issue (3)	"We don't do too much talking in the corridors so not a lot of patient information is put out in the corridor."
	Healthcare Administrator		Non-Issue (1)	"I don't see that as an issue."

All staff interviews between the two clinical modules believe that sharing corridors with patients is not a problem. Staff collaborate less frequently in the corridors since the location of both team rooms is within short distances of the exam rooms, especially in this smaller sized clinic (Figures 6.11 and 6.12). Furthermore, shortening travel distances from exam rooms to the waiting room limits the patient opportunities to interrupt staff in the corridors. Due to the proximity of the team room to the waiting room, staff report that sharing corridors with patients is not detrimental. One primary care provider reported that sharing corridors with patients "doesn't affect anything, and keeping them in the same area is actually better" (Primary Care Provider Case 1 Interview, 2018). This evidence indicates that separating patient and staff corridors may not be a necessary requirement for team-based clinical modules.

Findings in this section indicate that patients and staff sharing corridors is not detrimental for clinic workflow. The proximity of the team rooms to exam rooms and waiting room is not an issue from the staff point of view. It appears the length of corridors is the primary factor for establishing efficient workflow in the clinic and clinical modules.

6.3 Functionality of the Team-Based Clinical Module

The design of clinical module influences the staff's ability to perform daily activities for patient care. Functionality for the clinical module captures how well programmatic elements such as type of room, size, location, and allocation of space in the clinical module support patient care (Prieser & Vischer, 2005). This section measures functionality through staff opinions across five areas: (a) types of rooms needed in a clinical module, (b) sizes of rooms in the clinical module, , (c) location of the team room, (d) layout of the clinical module, and (e) types of sharable rooms between two clinical core teams (Tables 6.5-6.9). The first sub-section gauges what room type staff deem the most important for a clinical module to support patient care. In the second sub-section, analyzes the size of the exam and team rooms and the available workspace per individual are analyzed. The third section reports on the location of the team room in the clinical module based on staff opinions. The fourth section rates the staff satisfaction with the clinical module layout. The final section classify rooms that should be sharable across the two clinical modules.

6.3A Types of Rooms in Team-Based Clinical Modules

The MHS design guidance criteria does not clearly identify which types of rooms should be in a team-based clinical module. Identifying the rooms perceived to be important for the sub-provider teams is the first step toward defining the team-based clinical modules. This sub-section evaluates staff opinions on which room types are essential for inclusion in the clinical module.

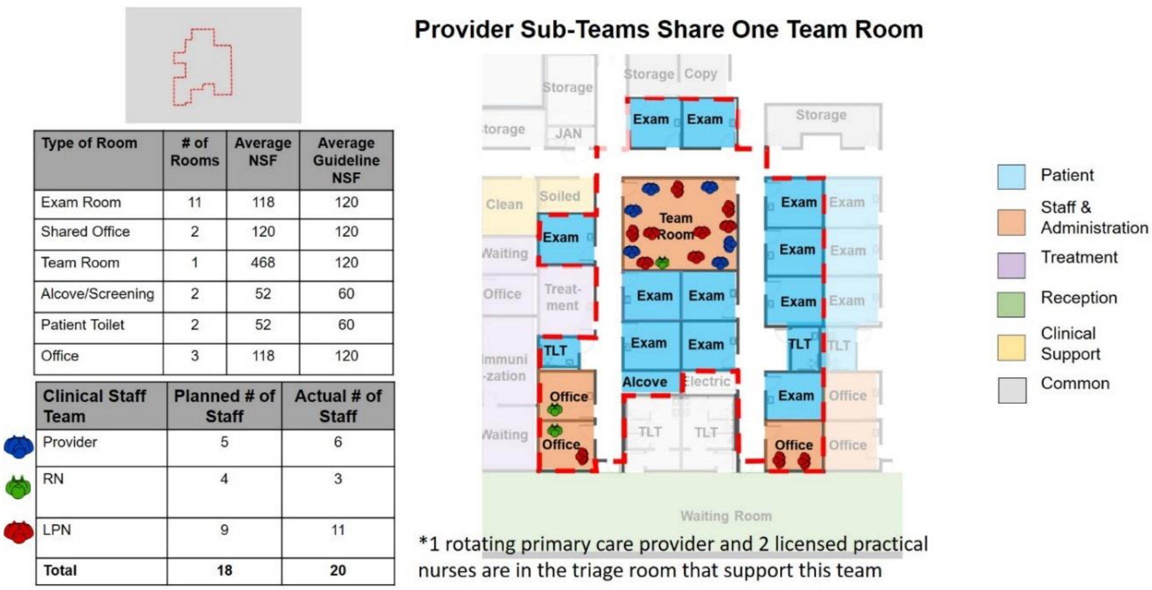
Table 6.5
Rooms Staff Deem as Most Important in Clinical Modules

MODULE	**STAFF ROLE**	**N**	**ROOM TYPES** (# of Staff that Identified the Room)
1	Primary Care	4	Exam Room (4)
1	Registered Nurse	2	Exam Room (2)
1	Licensed Practical Nurse	6	Exam Room (6)
2	Primary Care Provider	3	Exam Room (3) Treatment Room (2)
2	Registered Nurse	2	Exam Room (2)
2	Licensed Practical Nurse	6	Exam Room (6) Team Room (2)
	Healthcare Administrator	2	Team Room (1) Exam Room (1) Triage Room (1)

All staff, regardless of team or role, identified exam rooms as the most important room in the clinical module. The exam room is considered a foundational element in establishing a functional clinical module to support patient care. Primary care providers in clinical module two identify a treatment room as the second most important room for a clinical module. Although this should be read with caution as only two out of three primary care providers mention this concern in clinical module one. These views may be influenced by the lack of an adjacent treatment room in clinical module two, while clinical module one provides direct access to the treatment room.

The floor plan analysis highlights additional room types for a clinical module that staff may have overlooked in the interviews. Four additional rooms are generally in the clinical module including a screening alcove, patient toilet, team room, and office spaces. For the first room type a screening alcove allows staff to collect patient’s height and weight for a medical appointment. In the MHS, screening alcoves in corridors are common, while in civilian clinics screening functions may occur in the exam rooms. The second room type not identified by staff was the patient toilet. The terminology patient toilet is misleading as both staff and patients utilize this room. The third room type, the team room, is a shared workspace for all the provider sub-teams in the clinical module. The fourth type of space in the clinical module are private and shared offices. The offices support the case managers and administrator functions outside of the team room. While these four room types were not noted by staff, they are instrumental in creating team-based care environments.

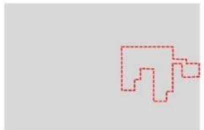
Findings indicate that a clinical modules generally include five types of rooms: (a) exam rooms, (b) a team room, (c) a patient toilet, (d) screening alcoves, and (e) offices. Each of the room types supports the clinic core team’s ability to deliver self-sustaining patient care in a clinical module. The team room and office spaces need to be included in the clinical module to support team-based activities. This aligns with the stance in the literature, but counters the MHS design guidance criteria (Belknap & Lafferty, 2011; VA, 2015; DoD SPC, 2017; Taylor et al., 2011; Capital Link, 2011; DuBose, Lim, Westlake, 2015; Vickery, 2012). In conclusion, developing a clinical module that includes the five-room types noted above cultivates a functional team-based environment for patient care.

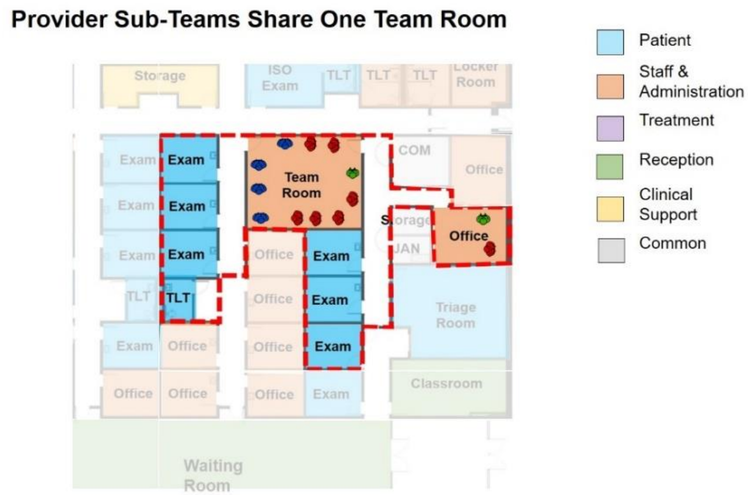


Type of Room	# of Rooms	Average NSF	Average Guideline NSF
Exam Room	11	118	120
Shared Office	2	120	120
Team Room	1	468	120
Alcove/Screening	2	52	60
Patient Toilet	2	52	60
Office	3	118	120

Clinical Staff Team	Planned # of Staff	Actual # of Staff
Provider	5	6
RN	4	3
LPN	9	11
Total	18	20

Figure 6.15: Clinical Module 1 Layout Overview





Type of Room	# of Rooms	Average NSF	Average Guideline NSF
Exam Room	6	117	120
Shared Office	1	188	120
Team Room	1	480	120
Alcove/Screening	1	47	60
Patient Toilet	1	54	60

Clinical Staff Team	Planned #	Actual #
Provider	5	4
RN	4	2
LPN	9	7
Total	18	13

Figure 6.16: Clinical Module 2 Layout Overview

6.3B Room Sizes and Shapes: Exam Room and Team Room

The literature suggest that new team-based care activities reduce occupational stress from working as an individual in a private office and support patient care in the exam room. The colocation of staff in a shared workspace increases opportunities for collaboration shown to enhance the staff capabilities to deliver effective patient care (DuBose, Lim, Westlake, 2015; Gunn et al., 2015; Oandasan et al., 2009). A team-based approach in the exam room allows primary care providers to concentrate more, while the licensed practical nurse enters notes on the computer, which reduces workload demands for primary care providers (Chesluk & Holmboe, 2010; Shanafelt et al., 2016; Bodenheimer, 2011). The size and shape of exam and team rooms influence how team-based care activities occur (Herman Miller, 2011; Cahnman, 2011; Mahlum Architects, 2011; Capital Link, 2011; Center for Health Design, 2016). This sub-section analyzes the size of these two key rooms based on the number of staff and patients in a room. The first

sub-section analyzes the size of an exam room compared to the number of individuals in a room for an appointment. In the second sub-section, team room sizes are examined based on the available workspace per staff member. Staff perceptions are compared with the floor plan analysis to evaluate the size and shapes of the rooms.

Site	Team	# of Exam Rooms	Exam Room Size	Average Sq. Ft. per Individual (Two Staff and One Patient)	Average Travel Distance to Team Room
Case 1	Module 1	11	118 NSF	39	26 ft

Figure 6.17: Clinical Module 1 Exam Room

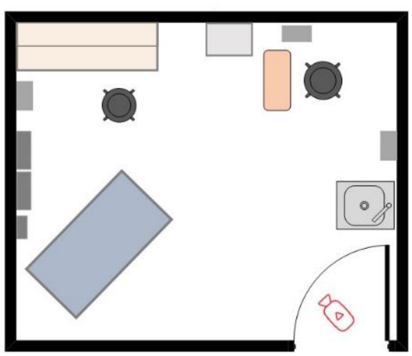


Figure 6.18: Typical Exam Room Layout for Clinical Module 1 & 2

Site	Team	# of Exam Rooms	Exam Room Size	Average Sq. Ft. per Individual (Two Staff and One Patient)	Average Travel Distance to Team Room
Case 1	Module 2	6	117 NSF	39	32 ft

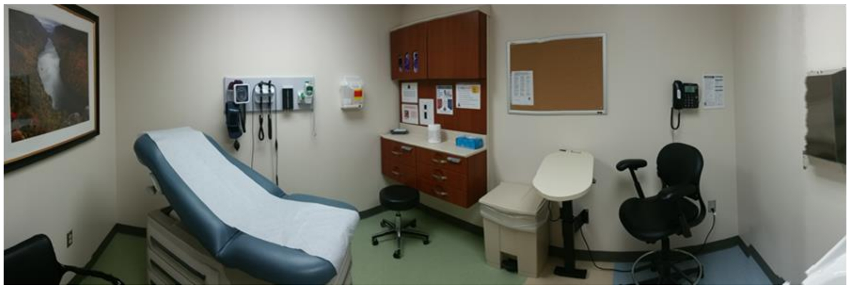


Figure 6.19: Clinical Module 2 Exam Room

The size of the exam room is based on the MHS guidance criteria. However, there is limited space to accommodate team-based activities. Exam room sizes and layouts are consistent between the two clinical modules (Figures 6.16, 6.17, and 6.18). As discussed in chapter three, a team-based approach includes at a minimum one primary care provider, one licensed practical nurse, and the patient occupying an exam room at one time. At the same time, in many cases the patient may have another person with him or her in the exam room (Omole et al., 2011; Rosland et al., 2011; McDaniel et al., 2005). In this clinic, exam rooms average 117 to 118 NSF for the two clinical modules, providing a limited 39 sq. ft. for each of the three individuals to occupy, which does not include family members either. This is slightly smaller than the recommended 120 NSF in the MHS design guidelines. In comparison, the Veteran Administration, a sister organization to the MHS, increased the size of exam rooms to provide 42 sq. ft. per individual, which is 125 NSF, to support team-based care activities (Veteran Administration, 2015). The floor plan analysis provides evidence that the exam room size is smaller than the recommended MHS guidance criteria.

Table 6.6
Staff Perceptions for the Size of Team Rooms

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
1	Licensed Practical Nurse	6	Weakness (3)	"Make the team room a little bigger for providers."
2	Primary Care Provider	3	Weakness (1)	"Make the team room a little bigger for more workspace."
2	Licensed Practical Nurse	6	Weakness (3)	"A little bit bigger team room with more computers and access to my own laptop."
	Healthcare Administrator	2	Weakness (2)	"Staff need a little bit more space in the team room."

According to the staff, the size of the team room offers inadequate workspaces for individual staff, particularly when 11 to 15 individuals occupy the team room at one time. Licensed practical nurses view the size of the team room as a weakness for the two clinical modules. Both healthcare administrators claim that the sizes of team rooms are too small for 11 to 15 staff members. Assuming all staff are in the team room at one time, the rooms in the two clinical modules only offer staff 31-44 square feet (Sq. Ft.) per staff member just for dedicated workspace, lower than the recommended 48-60 sq. ft. (Belknap & Lafferty, 2011). At the same time, the team room was envisioned to have flexible workstations instead of dedicated workstations and not all staff would use the room. Staff do however claim a dedicated personal workspace, countering the intended design strategy of only providing sharable workspace in the team room. One primary care provider said of the workspace, “It gets a little bit cramped in there at times, and not everyone always has a dedicated place to site” (Primary Care Provider Case 1 Interview, 2018). The result is that clinical core teams have limited workspace in the team rooms to perform individual activities that require focus. The following section explores the team room by examining staff opinions on the ability to conduct both collaborative and focused work for patient care.

Site	Team	Team Room Size	# of Staff in Room	Team Room Sq Ft Per Staff	Team Room Location	Type of Team Room	Average Travel Distance to Waiting Room
Case 1	Module 1	468 NSF	15	31 NSF per Staff	Back	Shared Team Room	66 ft

Clinical Staff Team	Actual #
Primary Care Provider	6
Registered Nurse	1
Licensed Practical Nurse	8
Total	15

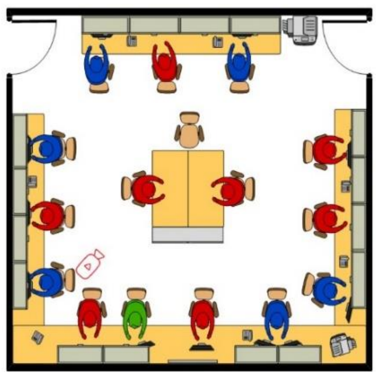
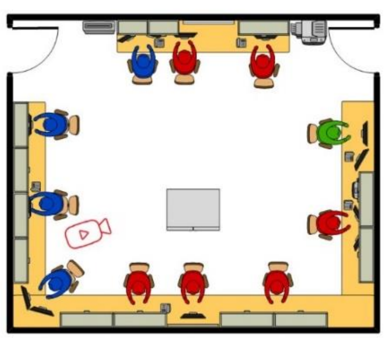


Figure 6.20: Clinical Module 1 Team Room

Site	Team	Team Room Size	# of Staff in Team Room	Team Room Sq Ft Per Staff	Team Room Location	Type of Team Room	Average Travel Distance to Waiting Room
Case 1	Module 2	480 NSF	11	44 NSF per Staff	Back	Shared Team Room	66 ft

Clinical Staff Team	Actual #
Primary Care Provider	4*
Registered Nurse	1
Licensed Practical Nurse	6
Total	11

*Actual number of primary care providers ranged from 2 to 8 in the team room; The average number of primary care providers was 4 in the team room at one time



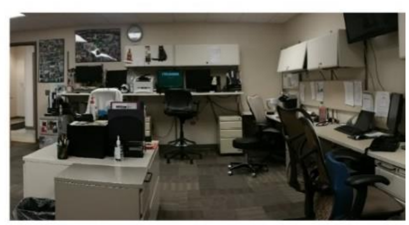


Figure 6.21: Clinical Module 2 Team Room

6.3C Layout of Clinical Modules

The previous sections illustrated the most important room types needed in a clinical module. This sub-section examines the staff opinions on how the current clinical module layout influences the delivery of team-based patient care. A clinical module should be organized to minimize travel distances for staff, while also ensuring patient privacy (Herman Miller, 2011; Battisto et al., 2009; Whiteaker, 2015; Farahmand et al., 2011; Taylor, 1999). The first sub-section evaluates staff perceptions based on the location of the team room. Then staff satisfaction with the clinical module layout is discussed. Lastly, staff opinions are then assessed to determine what types of rooms can be shared between the teams in different clinical modules.

Table 6.7
Staff Perception Concerning the Location of Team Room in the Clinical Module

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
1	Primary Care Provider	4	Strength (4)	"I like that the room is centralized in the patient rooms."
1	Registered Nurse	2	Strength (2)	"Team room is pretty centrally located to everything."
1	Licensed Practical Nurse	6	Strength (2)	"Overall the team room is effective and centrally located."
2	Primary Care Provider	3	Strength (2)	"Proximity to the [clinic] entrances and exits is easy."
2	Registered Nurse	2	Strength (1)	"Satisfied with exam rooms on either side of the team room."
2	Licensed Practical Nurse	6	Strength (6)	"Team room is in a central location for patients and staff."
	Healthcare Administrator		Strength (1)	"Access people quickly and conveniently."

All staff, regardless of team or role, expressed that a centralized team room in the back of a clinical module is a strength. Centrally locating the team room between two corridors with exam rooms on either side created shorter travel distances for staff, as discussed in Section 6.2. A licensed practical nurse described the team room location as a “fairly good place, with a central location for patients and staff that just works” (Licensed Practical Nurse Case 1 Interview, 2018). Findings suggest that a centralized team room in the back of a clinical module with proximity to exam rooms is a desirable location.

Locating private or shared offices for case managers in front of the clinical module creates disruptions for the staff. The office space at the front of clinical module one exposes case managers to as many as 84 patients and staff walking past their doorway per day. The case manager located in the front office said “I’d like to move my office down the hall further because it does get a little loud with people you know clamoring in and out from the waiting room” (Registered Nurse Case 1 Interview, 2018). Similar to the recommendations for the team room location, staff offices should be located towards the back of the clinical module to offer more privacy and less distractions.

For future design recommendations, the team room should be located in the back of the clinical module. The location of the team rooms in the back of the clinic offers direct access to exams that are located in two different corridors. Placing the team room in the back of the clinical module provides a level of staff privacy by keeping patients in corridors away from the team rooms. A team room located in the back of the clinical module fosters the off-stage design concept discussed previously in chapter two. However, in clinical module one there are two exam rooms located behind the team room resulting in a conflict. This results in patients encroaching on the team areas. Providing off-stage staff workspaces may improve the functionality of the clinical module for delivering patient care.

Table 6.8
Satisfaction with Clinical Module Layout

MODULE	STAFF ROLE	N	SATISFACTION
1	Primary Care Provider	4	75% Satisfied
1	Registered Nurse	2	100% Satisfied
1	Licensed Practical Nurse	6	100% Satisfied
2	Primary Care Provider	3	100% Satisfied
2	Registered Nurse	2	100% Satisfied
2	Licensed Practical Nurse	6	100% Satisfied

Staff satisfaction regarding layouts of the two clinical modules was 96%. Interestingly, clinical core team two rated their clinical module layout at 100% satisfaction, compared to 96% in clinical module one. The one dissatisfied primary care provider expressed concerns with staff privacy and the team room location saying, "I think it's risky in a way because there are two exam rooms behind the team room" (Primary Care Provider Interview Case 1, 2018). The risk that the primary care provider expressed pertains to the high patient workload and the proximity of two exam rooms behind the team room. The two exam rooms create the potential for 20 patients a day to walk past the team room door and overhear conversations. Furthermore, the constant staff circulation in conducting 169 daily patient appointments reduces the opportunities for the team room doors to be closed. Locating exam rooms directly behind a team room is not desirable for future planning of clinical module layouts.

The evidence in this sub-section aligns with the literature in establishing clear separation of patient and staff areas. Locating staff areas in-between patient exam rooms places the staff "on-stage" with limited privacy from passing patients. The "off-stage" design concept is facilitated in clinical module two by placing the exam rooms in front of the team room (Belknap & Lafferty, 2011; Taylor, 1999). The clear separation of staff and patient care areas results in a higher level of satisfaction between the two clinical modules. Future designs that separate staff and patient care areas may improve the functionality of the clinical module.

Table 6.9
Rooms Staff Deemed as Sharable Between Clinical Modules

MODULE	**STAFF ROLE**	**N**	**ROOM TYPES** (# of Staff that Identified the Room)
1	Primary Care Provider	4	Triage Room (3) Treatment Room (2)
1	Registered Nurse	2	Treatment Room (1)
1	Licensed Practical Nurse	6	None (4) Exam Room (1) Treatment Room (1)
2	Primary Care Provider	3	None (2) Treatment Room (1)
2	Registered Nurse	2	Treatment Room (2)
2	Licensed Practical Nurse	6	None (4) Treatment Room (1) Exam Room (1)

Staff deem the treatment room as the most important sharable room type between clinical modules. However, in this clinic, the location of the treatment room adjacent to clinical module one does not adequately support the two clinical core teams equally for patient care. Clinical module one saw more patients compared to clinical module two by nearly 5,000 patient procedures in 2016. The adjacency of the treatment room to clinical module one is a potential factor for the difference in patient procedures. The second factor is that a licensed practical nurse from clinical core team one controls the schedule for who uses the treatment room. The schedule ownership provides an advantage for staff on clinical core team one. Findings suggest that locating a treatment room in a sharable area with equal distances to both clinical modules and with equal responsibilities for scheduling provides a more functional environment to conduct patient procedures for the two clinical core teams.

Analysis from the floor plan take-off indicates an additional three types of sharable rooms in the clinic. The four room types include a (a) medical storage room, (b) clean linen room, (c) soiled linen rooms, and (d) an isolation exam room. Medical storage and clean and soiled linen rooms represent types of supply rooms for the clinic, affording the staff the capability to change out, replenish, and throw-out medical supplies used during a patient appointment. Direct observations of staff activities indicated the frequent use of these rooms by registered nurses and licensed practical nurses daily. The third shared room type in the clinic is the isolation exam room, a space that supports the clinic in monitoring patients who enter the clinic with infectious or contagious diseases. Observations over a five day visit revealed that staff do not use this room. Prior to the site visit, staff used the isolation room as a chiropractic treatment room. The healthcare organization leadership informed the staff that the room could not function as a chiropractic treatment room, and could only function as an isolation exam room in case of emergency. Consequently, the isolation room remains under-utilized and often unoccupied on a day-to-day basis. This finding illustrates that leadership prioritizes the sole use of isolation exam room to quarantine a contagious patient, which rarely happens in this clinic, but is available if needed. The MHS design guidance criteria imposes the isolation room requirement, while civilian criteria have no requirements for isolation exam room in primary care. This guidance is provided to align with nursing practices in managing contagious patients in a healthcare environment.

Findings from this section suggest which types of rooms are needed for a clinical module and which rooms can be shared between clinical modules. First, each clinical module should include exam rooms, team rooms, screening alcoves, patient toilets, and offices. Second, a treatment room, clean and soiled linen rooms can be shared between clinical modules. Establishing a sharable module between the two clinical modules facilitates equal accessibility to frequently used rooms for staff. Combining other frequently used rooms near the clinical modules, such as the point-of-care lab and immunization clinic, enhances staff workflow for patient care activities.

6.4 How the Team Rooms Influence Both Collaborative and Focused Work

Team rooms in the clinical modules are the only dedicated workspace for the clinical core team members including primary care providers, registered nurses, and licensed practical nurses. Private offices are limited to case managers and administrators in the clinical modules. Team rooms need to strike a balance in supporting both collaborative and focused work for staff activities (Gunn et al., 2015). Striking a balance between collaborative and focused work areas produces a higher functioning team (Sinksey et al., 2013). This sub-section analyzes staff opinions through three areas to evaluate collaborative and focused work in the team room: (a) co-locating staff in team rooms, (b) visibility to and from staff work areas, and (c) available private space to complete work that requires focus (Tables 6.10-6.12). In the first section, staff experiences are assessed on where collaboration takes place and how that space supports collaboration. The second section examines staff opinions on the ability to visually connect with team members in work areas. The final section gauges the team room's ability to support work that both requires focus and concentration as well as collaboration.

6.4A Collaborative Work Space: Shared for All Staff in Clinical Module

Collaboration among staff in patient care environments produce a higher functioning team (Sinksy et al., 2013). Colocation of staff with good visual sightlines increases the opportunities for staff to collaborate and communicate for patient care activities (Watkins Gandolf-Frietchen, Siddiqui, 2015; Taylor, Joseph, Keller, Quan, 2011). Findings examine the staff opinions on how the team room supports colocation and visibility of staff work areas.

Table 6.10

Staff Perceptions Concerning Colocating Staff in Team Rooms

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
1	Primary Care Provider	4	Strength (4)	"Just turn the chair around and we are within earshot of each other, and then we can communicate plans."
1	Registered Nurse	2	Strength (2)	"All of the decision making happens in there [team room]."
1	Licensed Practical Nurse	6	Strength (6)	"Always learning new things mostly through the providers."
2	Primary Care Provider	3	Strength (3)	"Bouncing ideas off other providers without having to go hunt them down throughout the clinic."
2	Registered Nurse	2	Strength (1)	"Collocation of staff and ease of collaboration."
2	Licensed Practical Nurse	6	Strength (6)	"You can ask the person across from you, behind you, and answer your questions."

The colocation of all provider sub-teams in a shared team room is perceived as a strength for both clinical core teams. Colocating clinical core teams in a shared space facilitates learning and collaborative decision making for patient care delivery. An open-office concept team room as illustrated in Figures 6.19 and 6.20 provides opportunities to collaborate naturally in a team environment (DuBose, Lim, Westlake, 2015; Quan, Joseph, Keller, 2009). One registered nurse expressed that the open-office team room “allows for good flow of information, accessibility to staff, and the ability to hear all the conversations” (Registered Nurse Case 1 Interview, 2018). The colocation of staff in a central team room further supports visual awareness of staff work areas for collaborative work.

Table 6.11
Staff Perceptions Concerning Visibility of Staff Work Areas

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
1	Primary Care Provider	4	Strength (4)	"Easy access to talk to anybody you need to."
1	Registered Nurse	2	Strength (2)	"I think [visibility] for individuals who work in the team room is really good."
1	Licensed Practical Nurse	6	Strength (6)	"Access to everybody and you can ask questions."
2	Primary Care Provider	3	Strength (3)	"Don't have to pick up a phone in order to talk to the people you need to talk to."
2	Registered Nurse	2	Strength (1)	"Accessibility to staff [in the team room]"
2	Licensed Practical Nurse	6	Strength (6)	"You can visually see everyone the whole time."
	Healthcare Administrator	2	Strength (2)	"Easy for management to find the staff."

Team rooms that house all the provider-sub teams allows for visibility to all team members’ workstations. This visibility enhances situational awareness, leading to increased staff collaboration for patient care. A primary care provider described visibility in the team room as “pretty good, you constantly see the whole team on a daily basis, you get used to the faces, which is very efficient for patient care” (Primary Care Provider Case 1 Interview, 2018). Locating staff workstations on the perimeter of the room allows individuals to rotate inward and instantly collaborate with fellow team members. At the same time, the collaborative environment also leads to potential distractions perceived by the staff. The potential distractions are examined in the following section.

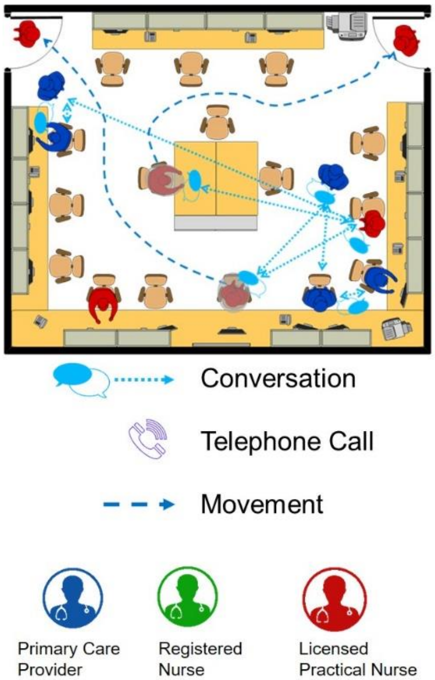


Figure 6.22: Clinical Module 1 Team Room Observation

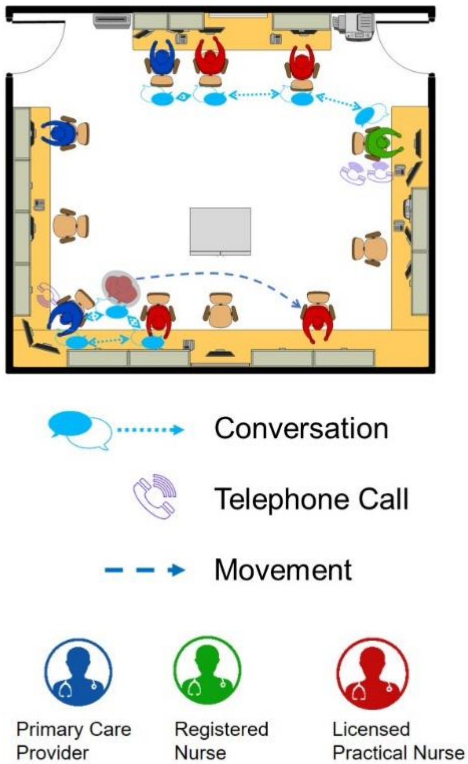


Figure 6.23: Clinical Module 2 Team Room Observation

6.4B Private Workspaces: Focused Activities

Patient care requires staff to complete work related activities that require focus and concentration on a daily basis (McGough et al., 2013). Cubicle dividers and private offices for clinical core team workspaces were eliminated from the original design after the MHS implemented the PCMH model in favor of a collaborative environment. Open concept team rooms for this clinic were created with limited private spaces for staff. In this sub-section, staff views were gauged on how the team room affords the ability to conduct work requiring focus and concentration. Direct observations of the team room vared used to cross reference staff perceptions shared in the interviews. Findings in this sub-section examine if staff use the team room or alternative rooms to complete work for private patient care activities.

Table 6.12

Staff Perceptions Regarding the Ability to Complete Focused Activities in the Team Room

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
1	Primary Care Provider	4	Weakness (2)	"A lot of conversation going on about dating practices and dresses and things that don't have anything to do with what we are trying to accomplish. I work from home through VPN when I need to focus on a task."
1	Registered Nurse	2	Weakness (2)	"Case Manager Office is a lot quieter than that [team] room."
1	Licensed Practical Nurse	6	Weakness (3)	"To really concentrate, I go to my exam room."
2	Primary Care Provider	3	Weakness (2)	"Hard to find on place to focus so I use an office in alternative building."
2	Registered Nurse	2	Weakness (2)	"Noisy [in the team room] so I go to the Case Manger Office because it is quiet."
2	Licensed Practical Nurse	6	Weakness (6)	"I work in my exam room when work requires silence."

According to staff, the excessive distractions caused by the high noise level in the team room undermines the ability for staff to completely focus. Figure 6.19 and 6.20 show that in five minutes multiple conversations occur simultaneously in the team room. Social conversations unrelated to patient care activities in the team room further contribute to excessive noise levels. One primary care provider preferred working from another building on the outpatient campus "because I forget my headphones far too often" (Primary Care Provider Case 1 Interview, 2018). The excessive noise level leads to staff searching for quiet places within and outside the clinic to conduct focused work. Finding alternative spaces outside of the team room reduces opportunities for collaboration and for team members to know where staff are located during patient care hours.

Findings suggest that the team room works well for collaboration, but poorly for focused work. The open-concept team room is a strength because of the colocation and visibility for team members. At the same time, staff report that the open-concept team room is a weakness to complete work-related activities that require focus. The literature advocates for striking a balance between private and collaborative work to foster a higher functioning clinical core team environment (Sinsky et al., 2013; Gunn et al., 2015). The team room needs to provide a balance satisfying both privacy and collaboration so staff can complete all necessary work in one room. Providing no private spaces within or adjacent to the team room hinders the ability for staff to effectively complete clinical activities and perform as a team.

6.5 Discussion

The evaluation of the clinic illustrates how the clinic environment enhances and/or hinders the staffs' ability to deliver team-based care. Findings from this case study have led to five design factors that enhance the delivery of team-based care that include (a) incorporating essential rooms in the clinical module, (b) clustering frequently used support rooms between clinical modules, (c) planning clinical modules to minimize travel distances, (d) balancing staff privacy with proximity to the waiting room, and (e) creating team rooms that support both collaborative and focused work.

First, incorporating essential rooms in the clinical module establishes the rooms required to create a functional team-based environment for patient care. This clinic indicates that the essential room types include (a) exam rooms, (b) a team room, (c) screening alcoves, (d) patient toilets, and (e) office space for the case managers. Each of these identified rooms offer a specific function for supporting the delivery of care. However, if screening equipment is added to each exam room, there is no longer a need for screening alcoves in each corridor. This means that instead of five room types there should be four types of for the team-based clinical module.

Second, clustering frequently used support rooms between the clinical modules improves clinic workflow. This begins through identifying what support rooms staff travel to frequently and what types of rooms need to be sharable. In this clinic, the point-of-care lab, triage, clean and soiled linen rooms, supply room, and treatment are recommended rooms to cluster between the clinical modules.

Third, plan clinical modules to minimize travel distances for the entire team. Licensed practical nurses travel the longest distances and conduct the most activities for patient care. As a result, their travel distances influence the workflow for primary care providers and other clinical core team members. Additionally, the two clinical modules in this clinic support efficient workflow by limiting average travel distances under 186 ft. per patient appointment, which was shown to represent dissatisfaction among licensed practical nurses. Therefore, reducing the licensed practical nurses' travel distances impacts the entire clinical core team's workflow.

Fourth, striking a balance between staff privacy and team room proximity to the exam rooms is necessary. This means that prioritizing shorter travel distances from the team room to exam rooms over staff privacy compromises the confidentiality of patient information. In addition, avoid patient circulation that passes by staff work areas and locating exams rooms too close to the team room. Therefore, establishing a clear separation between “on-stage” patient and “off-stage” staff areas, as shown in clinical module two, is a key design recommendation.

Lastly, creating team rooms that offer space for both collaboration and focused work. The open-concept team rooms enhance staff visibility and collaboration for the provider sub-teams, but at the same time causes distractions due to increase noise levels. The distractions force staff to seek alternative workspace to complete focused work, which hinder visibility and collaboration for staff working out of a team room.

Furthermore, the case shows that design decisions made for the PCMH implementation both enhance and hinder team-based care activities. The physical environment enhances team-based care through two main design factors: (a) team rooms that colocate all clinical core team members in the back of the clinic, and (b) location of the team room with proximity to the waiting room. Alternatively, the physical environment hindered team-based care with three design concepts: (a) inadequate allocation of screening alcoves for the clinical modules, (b) lack of private space to complete focused-work in the team room, and (c) placement of exam rooms behind the team room which compromises staff privacy. This evidence indicates a misalignment between design thinking and how staff actually use the clinic environment to deliver team-based care.

In conclusion, it takes extensive effort for healthcare planners and architects to design a clinical environment that supports team-based care. The efforts of the healthcare planners and architects require knowledgeable design factors that are keen to the staff activities for performing team-based care. Furthermore, including the staff perspective provides insights concerning how to plan and design primary care clinics for team-based care delivery. The five design factors discussed in this section produce evidence and recommendations that the MHS need to incorporate into the design guidance criteria.

CHAPTER SEVEN

FINDINGS- CASE 2

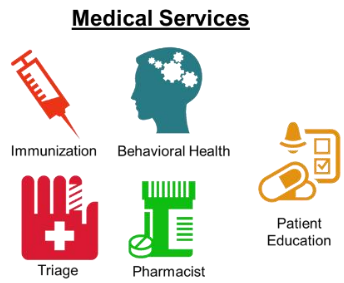
The second case selected for review is an embedded hospital clinic for the MHS. The clinic is in the southwestern region of the United States. This primary care clinic is located in the southwest region of the United States and occupies 22,562 gross square feet (GSF). The clinic is recognized as a level two National Committee for Quality Assurance (NCQA) PCMH facility. The effort to create this clinic was initiated in 2009, using a design-build project delivery method. In 2016, the construction of the clinic was completed and delivering patient care to beneficiaries began. The adoption of a PCMH model of care reduced the number of clinical modules from four to two and co-located staff in team rooms, which was intended to support a team-based environment. Additionally, staff occupation of the clinic created both strengths and weaknesses with the modifications for the layout due to staffing shortages and missing medical sections. The shift to a PCMH clinic presents an opportunity to evaluate how the changes to the clinic design made by planning and architecture team influence the delivery of team-based care.

The research design for this case study used a qualitative approach using a case study research strategy with ethnographic interviews and observations to collect data. The first data collection method used semi-structured interviews with healthcare planners and an architect to describe the planning and design intentions for the clinic. Next, on-site observation of clinic operations provided insight on how the clinic is used in practice.

Finally, semi-structured interviews obtained clinical staff perceptions of how the clinic layout is influencing the delivery of team-based care.

The findings presented for this case study are organized in five sections. Section 7.1 describes the background of the patient care environment, and presents an overview of the clinic layout, team staffing structure, and patient workload for the clinic and teams. Section 7.2 examines how the clinic environment influences workflow by soliciting staff perceptions on the following three design factors: (a) access to support rooms; (b) the proximity of the team room to the waiting room; and (c) sharable circulation pathways. Section 7.3 studies the functionality of the team-based clinical module. The layout of the team-based clinic modules are examined through staff opinions and floor plan analysis across three design factors: (a) types of rooms in the team-based clinical modules, (b) room size, and (c) module layout. Section 7.4 evaluates how team rooms influence collaborative and individual-focused work, using ethnographic observations of staff work patterns to examine: (a) colocation of staff, (b) visibility of staff workspaces, and (c) the space used for individual-focus work. Section 7.5 presents the findings and the design recommendations from the case. This clinic highlights how PCMH implementation influenced the delivery of team-based care in a soldier-centered clinic and importance of the clinic environment. The evidence from this study starts to build a database of strengths and weaknesses for clinic designs that support the PCMH model.

<u>7.1 Description of the Patient Care Environment</u>



Design Method	Design-Build (2009-2016)
Location	Southwest United States
Clinic Size	22,562 GSF
Business Hours	M-F 0800 to 1600

Total Encounters	**90,419 per year**	
Patient Encounters	55,454 per year	**61%**
Patient Teleconference (TCON)	34,965 per year	**39%**

Clinic averages 231 patients per day
MHS Standard is 193 patients per day (DoD, SPC 2017)

Figure 7.1: Case 2 Overview

Figure 7.2: Case 2 Floor Plan

The embedded hospital clinic is part of an outpatient wing that is attached to a traditional inpatient hospital. The outpatient wing is 322,000 square feet (sq. ft.) that offers primary care and specialty outpatient medical services. The outpatient wing contains the following types of medical services on the main level: (a) chiropractic, (b) pain clinic, (c) occupational therapy, (d) physical therapy, (e) orthopedics, (f) specimen collection, (g) family medicine clinic, (h) population health, (i) family medicine residency program, and (j) pediatrics (as indicated in Figure 7.2). The outpatient wing provides healthcare services to active duty military soldiers, their family members, and military retirees, which supports approximately 345,000 beneficiaries (www.crdamc.amedd.army.mil/pao/facts.aspx, 2017). The inpatient hospital is a 615,000 sq. ft. medical center with 122 beds and specialty acute-care clinics (www.hksinc.com/places/fort-hood-replacement-hospital/, 2018). The primary care clinic is a gateway portal for diagnosing patient specialty care needs for both outpatient and inpatient medical services.

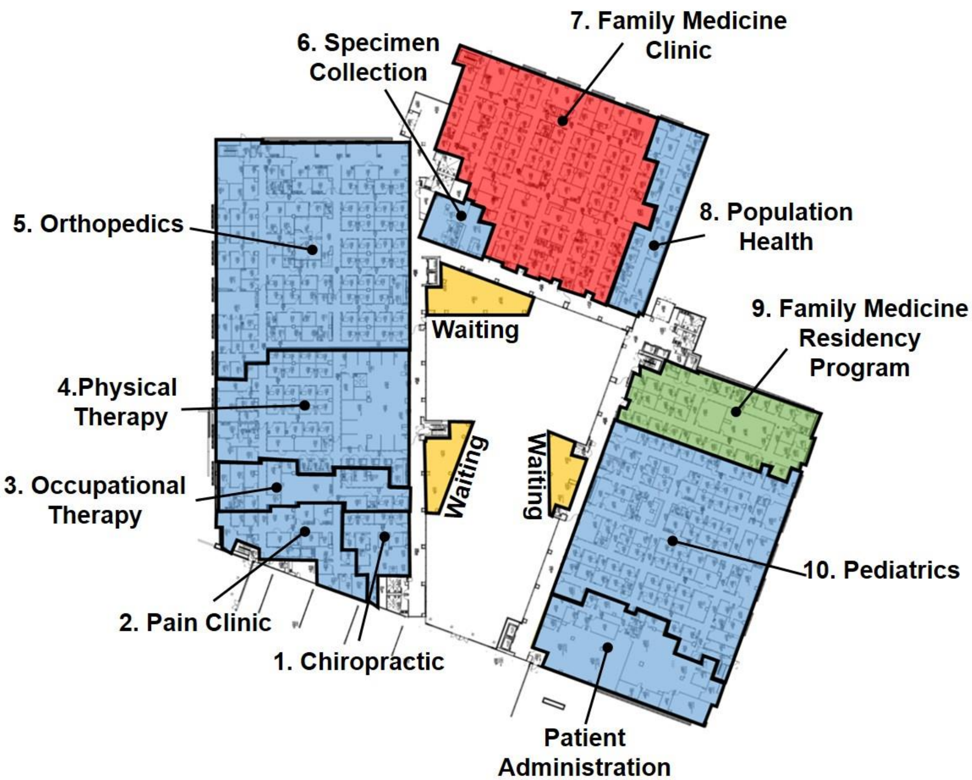


Figure 7.3: Outpatient Wing Floor Plan and Types of Medical Services

The family medicine clinic and Family Medicine Residency Program (FMRP) in the outpatient wing both support primary care services. This chapter concentrates on the family medicine clinic that includes 31 exam rooms that support patient care on a daily basis. The FMRP is an administrative area that contains a medical library, conference room, offices for FMRP instructors and residency students. FMRP staff and residency students perform daily patient care in the family medicine clinic.

The FMRP colocated in the outpatient wing is a unique program for the US Army. The FMRP and family medicine clinic serve as one of seven US Army graduate medical education programs for primary care. Family medicine is categorized as a specialty of primary care in the healthcare industry (Academy of American Family

Physicians, 2018). The FMRP provides a learning environment to train Army physicians in primary care. Residency students participate in clinical rotations with direct oversight from board-certified family physicians. The program includes 20 residency students who undertake a four-year program before becoming board certified primary care providers. Residency students spend one to four half days per week performing patient care in the clinic. Therefore, the half-day rotations influence the number of patients seen on a daily basis for the clinic.

Figure 7.4: Clinical Module Layout

Primary care is delivered using a team-based approach to patient care in which physicians, registered nurses, and licensed practical nurses work side by side as a team. Two clinical teams work in two separate clinical modules (indicated in red and green areas in Figure 7.4). The clinic provides patient care through two clinical teams that are independent of one another. The two clinical teams provide patient appointments for routine care, acute-care, procedures, wellness visits, and teleconference consultations. Ancillary services within the clinic include immunization, triage services, patient education, behavioral health and clinical pharmacist consults. Locations for the ancillary services are clustered in the clinic as indicated in purple for Figure 7.5. The inpatient hospital provides the clinic with ancillary services for radiology, pharmacy, emergency room (ER), and a full lab. The clinic provides direct access to the hospital lab through a pneumatic tube for staff to send out patient specimen samples.

Area	Space Allocation		%
Module 3	1,948	NSF	9%
Module 4	2,271	NSF	10%
Shared Area	1,512	NSF	7%
Clinical Support	1,288	NSF	6%
Ancillary Services	1,410	NSF	6%
Waiting Area	2,018	NSF	9%
Other	4,545	NSF	20%
Circulation	7,569	NSF	34%
Total	**22,562**	**GSF**	**100%**

Net to Gross Factor=**1.5**
MHS Net to Gross Factor is **1.4** (DoD SPC, 2016)

Figure 7.5: Clinic Layout

The triage section is a medical service co-located in the central area of the clinic. The triage services occur in five exam rooms offering space to screen walk-in patients during sick-call operations. The military prohibits soldiers from calling in sick for work without written documentation from a medical provider. This administrative requirement results in the creation of what is known as a sick-call service, accommodating soldiers needing unscheduled care at the beginning of the workday. The sick-call process allows the soldiers to receive initial patient care and meet work-related accountability protocols for the military. Non-military patients that utilize unscheduled walk-in appointment service go through the triage service in determining the level of care needed. As a result, the triage service acts as an urgent care, allowing patients instant access to medical services in the hospital.

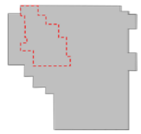
7.1A Description of Team-Based Clinical Modules

The team-based clinical modules in this embedded hospital clinic offer two different variations of clinical module with a T-shape and hybrid. A team-based clinical module, or a clinical module, is a group of spaces that contain exam rooms, team workspaces, and storage areas that support clinical core teams in delivering effective patient care (DuBose, Lim, Westlake, 2015; Whiteaker, 2015; Belknap & Lafferty, 2011; Taylor, Joseph, Keller, Quan, 2011). The two clinical modules support 53 staff members with 23 exam rooms in 4,397 Net Square Feet (NSF) (Figure 7.6 and 7.7). In the front of the clinic is the public waiting area, education alcove, and a public restroom that combined occupy 2,018 NSF. Clinical module three includes two private offices, one screening alcove, one patient toilet, one treatment room, two team rooms, and ten exam rooms. Clinical module four contains three patient toilets, an isolation exam room, an EKG room, two team rooms and 13 exam rooms.

Type of Room	# of Rooms	Average NSF	Average Guideline NSF
Exam Room	10	121	120
Treatment	1	186	120
Sub-Team Office	1	131	120
Team Room	1	318	120
Patient Toilet	1	55	60
Office	2	120	120
Alcove/Screening	1	16	60

Clinical Staff Team	Planned # of Staff	Actual # of Staff
Primary Care Provider	5	19*
Registered Nurse	4	2
Licensed Practical Nurse	9	7
Total	**18**	**28**

Teams are Segregated by Staff Type & Provider Sub-Team



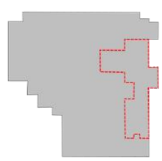
*Primary care providers are housed in separate administrative area

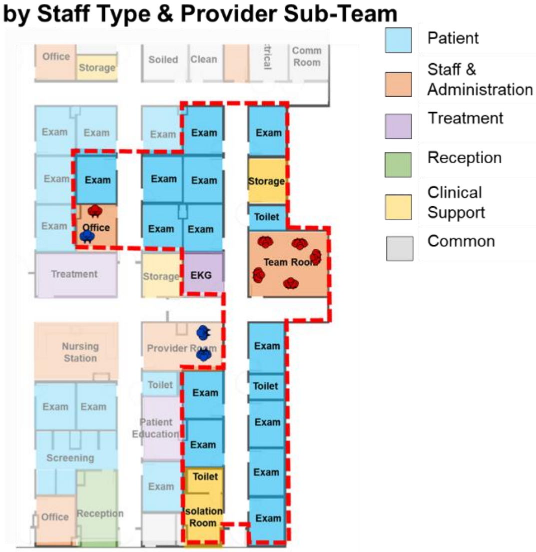
Figure 7.6: Clinical Module 3 Layout

Teams are Segregated by Staff Type & Provider Sub-Team

Type of Room	# of Rooms	Average NSF	Average Guideline NSF
Exam Room	13	121	120
Isolation Room	1	123	180
EKG Room	1	110	120
Patient Toilet	3	55	60
Sub Team Office	1	120	120
Storage Room	1	122	90
Team Room	1	345	120

Clinical Staff Team	Planned #	Actual #
Provider	6	17*
RN	4	2
LPN	9	6
Total	**18**	**25**





*Primary care providers are housed in separate administrative area

Figure 7.7: Clinical Module 4 Layout

Staff work areas in both clinical modules offer similar typologies. Clinical module three contains three types of staff work areas: (a) open office team room, (b) provider sub-team, and (c) private offices. The open office in the back of the clinical module houses five licensed practical nurses. The provider sub-team room houses one primary care provider and two licensed practical nurses in the centralized room for clinical module three. Clinical module three includes two private offices for primary care providers. Clinical module four includes two types of staff work areas: (a) open office team room, and (b) provider sub-team room. The open office houses five licensed practical nurses in the center of the clinical module. The provider sub-team room houses one primary care provider and one licensed practical nurse in a separate corridor.

The central area of the clinic houses five areas that include (a) staff work areas, (b) patient education room, (c) triage service, (d) screening alcoves, and (e) specialized residency spaces. Staff work areas consist of two spaces that support clinic huddles and the registered nurse team room. Daily clinic huddles occur in the central nursing station for the clinical core team leadership before individual team huddles in the clinical modules. The registered nurse team room location is between the two clinical modules, making it a central area to access.

The proximity of the five triage exam rooms and patient education room allows the registered nurses to have the main responsibility for performing the associated activities for those services. The patient education room provides a space to educate patients and family members on treatment plans for chronic conditions such as diabetes. Triage services, as previously discussed in this chapter, occur in five of the exam rooms in the center of the clinic. The screening alcoves contain height and weight equipment for both adult and pediatric patients for the entire clinic. All pediatric patient appointments start in the center of the clinic with the initial screening and then move into the exam rooms in the clinical modules. The preceptor room facilitates a counseling space for the FMRP instructors and residency students during the half-day clinic rotations. The digital equipment in the preceptor room and adjacent educational exam room allow the direct observation of residency students during medical appointments.

7.1B Description of Clinical Core Team Structure

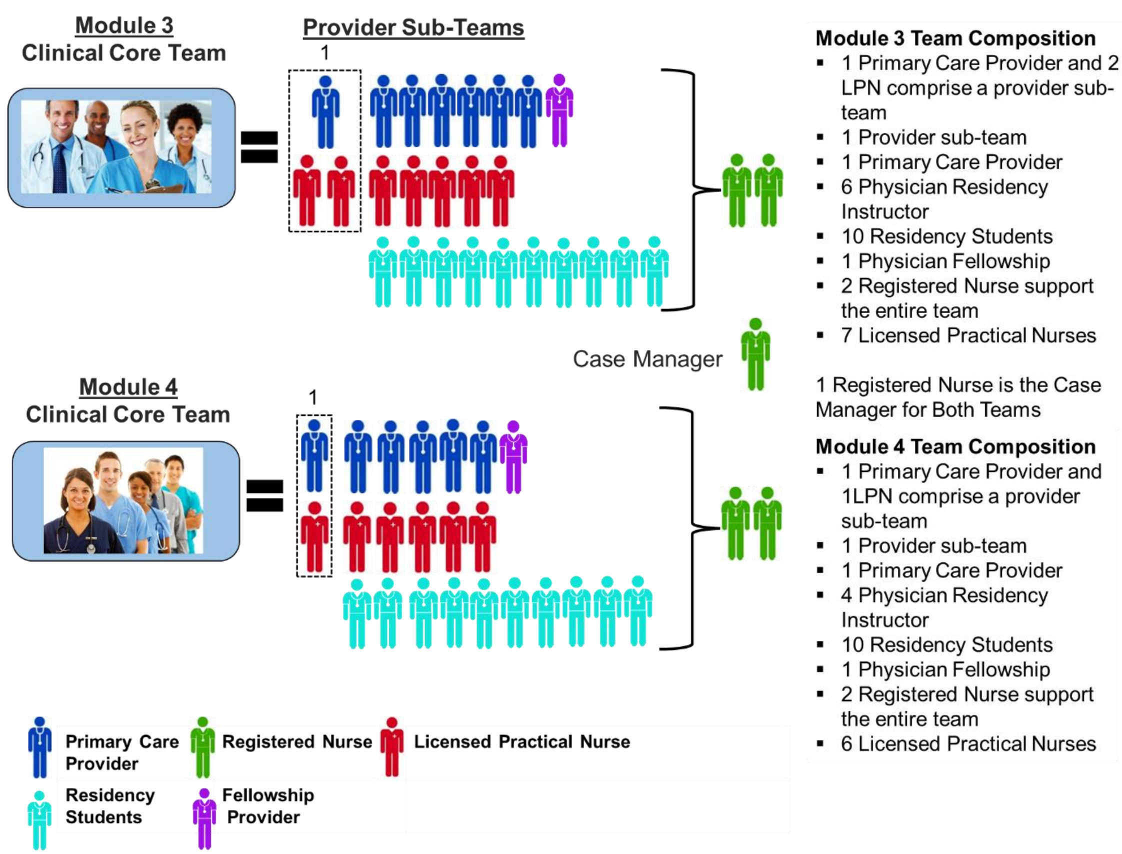


Figure 7.8: Case 2 Clinical Core Teams Composition (Bon Secours, 2017; Halos Daily, 2018)

Utilizing a team-based approach, each clinical core team is assigned to a team-based clinical module, which is led by the primary care providers and supported by nursing staff (Figure 7.8). Staff for the two clinical core teams consists of active duty military soldiers, government service members, and/or government-contracted employees. As previously discussed, this clinic is an FMRP, requiring physicians in residency to receive external medical training, which determines the availability for instructors and residency students to perform patient care activities. Clinical core team three includes 28 staff and team two contains 25 staff who are a combination of primary care providers, residency students, registered nurses, and licensed practical nurses.

Clinical core team three is comprised of one provider sub-team, one primary care provider, six primary care provider instructors, ten residency physicians, one primary care provider fellow, two registered nurses, and seven licensed practical nurses. The provider sub-team structure contains one primary care provider and two licensed practical nurses, housed in a provider sub-team room. An additional primary care provider is a full-time equivalent for the clinical core team, located in a private office. The one primary care provider fellow performs patient care on a rotating scheduling and is housed in a private office. The 16 residency instructors and students share workspace with the licensed practical nurses or work from the preceptor room in the center of the clinic. One residency instructor and three-to-four students perform patient care during their half day rotations. Two registered nurses are responsible for managing daily workflow, supervision of licensed practical nurses, patient triage services, and patient education. The registered nurses are co-located in the central team room with staff from clinical core four. Five licensed practical nurses in the team room act as floaters who support the different variations of primary care providers and residency students for patient care.

Clinical core team four is comprised of one provider sub-team, one primary care provider, four primary care provider instructors, ten residency physicians, one primary care provider fellow, two registered nurses, and six licensed practical nurse. The provider sub-team structure contains one primary care provider and one licensed practical nurses, housed in a provider sub-team room. An additional primary care provider is a full-time equivalent for the clinical core team, located in a private office outside of the clinical module. The one primary care provider fellow performs patient care on a rotating scheduling and works out of the team room when providing patient care. The 14 residency instructors and students share workspace with the licensed practical nurses or work from the preceptor room in the center of the clinic. One residency instructor and three-to-four students perform patient care during their half day rotations. Two registered nurses are responsible for managing daily workflow, supervision of licensed practical nurses, patient triage services, and patient education. The registered nurses are co-located in the central team room with staff from clinical core three. Five licensed practical nurses in the team room act as floaters who support the different variations of primary care providers and residency students for patient care.

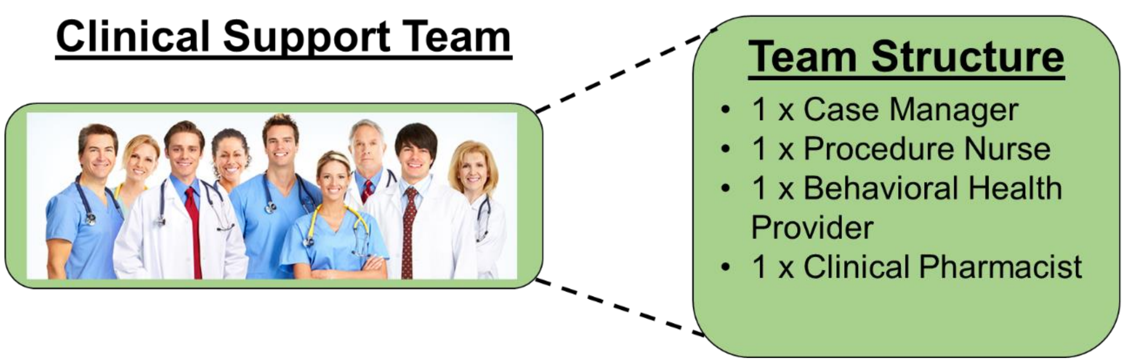


Figure 7.9: Clinical Support Team Structure (Red Alfa Neuorciencias, 2017)

The clinical support team consists of one case manager, one procedure nurse, one behavioral health provider, and one clinical pharmacist to support both clinical core teams. The case manager for both clinical core teams is a registered nurse, who is co-located in the registered nurse team room. The procedure nurse is responsible for scheduling, stocking supplies, and assisting primary care providers in the clinic's main treatment room (as indicated in Figure 7.9). The behavioral health provider and clinical pharmacist provide consultations for both clinical core teams and are located in private offices (as indicated in Figure 7.10).

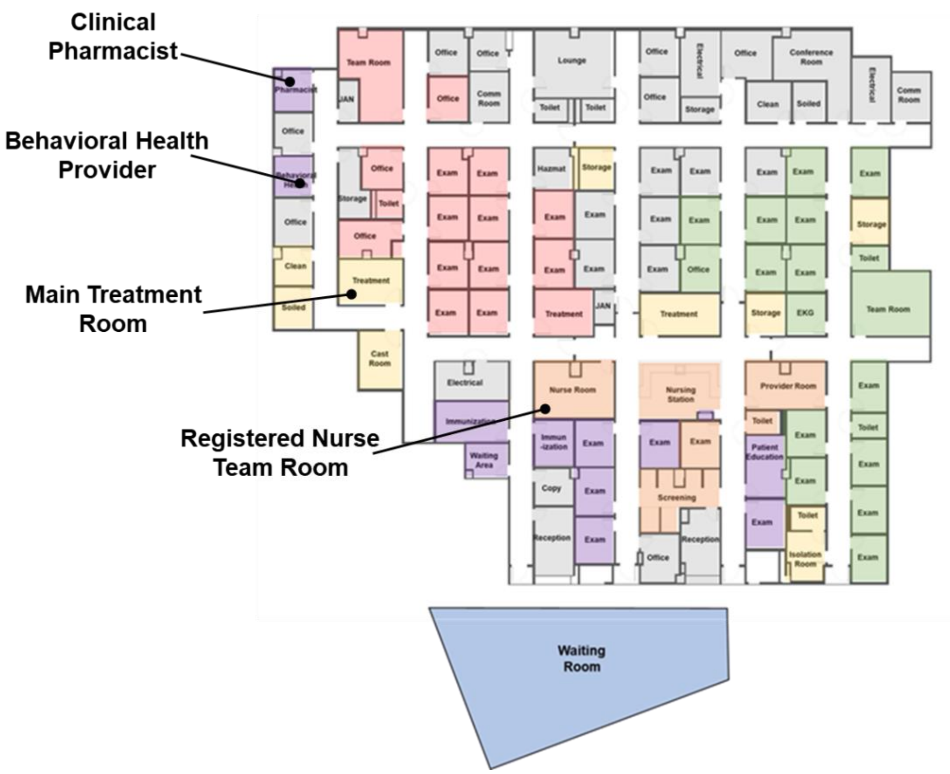
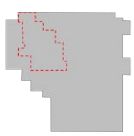


Figure 7.10: Clinical Support Team Workspaces

7.1C Description of Patient Workload

The annual patient workload for the clinic surpassed the standard benchmark established by the MHS due to the addition of a triage section. The MHS establishes patient workload standards based on available exam rooms accommodating ten face-to-face patient encounters for 240 days per year (DoD Space Planning Criteria, 2017). For this clinic in 2016, patient care took place five days a week, eight hours per day, accounting for 55,454 patient encounters. The annual patient workload exceeded the MHS expected 46,368 face-to-face patient encounters by approximately 9,000 patient encounters, which provides ample opportunities for resident students to gain hands on experiences. Patient teleconferences (TCONs) are not calculated in the annual patient encounter workload, but counted for an additional 34,965 patient encounters. Additionally, clinical core team three produced 30,996 face-to-face patient encounters, which accounted for 55% of the clinic workload.



Performance Metrics	MHS Planned	Actual #	Utilization (%)
# Exam Rooms		10	
Daily Exam Room Workload	8 Pts	13 Pts	
Annual Average Visit per Exam Room	2,016 Pts per room	3,100 Pts per room	**154%**
Annual Patient Workload	20,160 Pts for all rooms	30,996 Pts for all rooms	**154%**

Note:
* Pts= Patients
** Workload numbers are based on the annual patient workload, which was provided by the MHS.

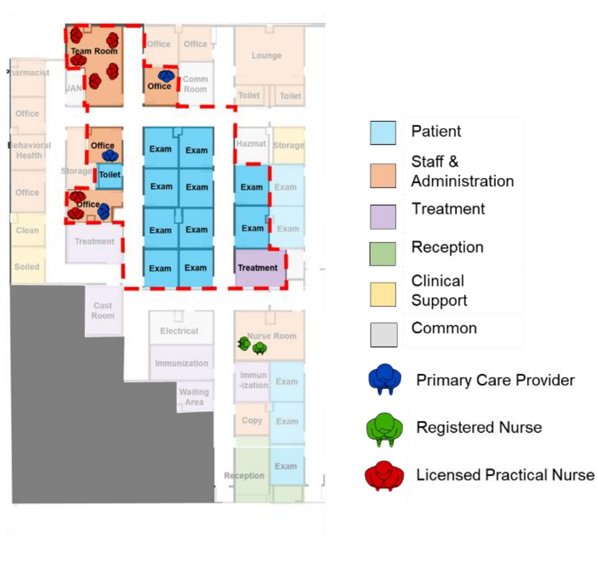
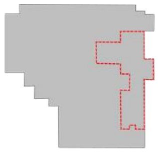


Figure 7.11: Clinical Module 3 Patient Workload Overview



Performance Metrics	MHS	Actual	Utilization (%)
# Exam Rooms		13	
Daily Exam Room Workload	8 Pts	8 Pts	
Annual Average Visit per Exam Room	2,016 Pts per room	1,881 Pts per room	94%
Annual Patient Workload	26,208 Pts for all rooms	24,458 Pts for all rooms	94%

Note:
* Pts= Patients
* Workload numbers are based on the annual patient workload, which was provided by the MHS.

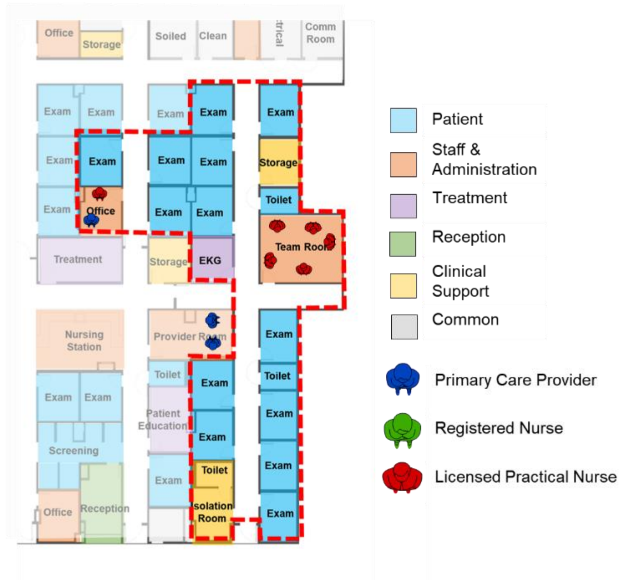


Figure 7.12: Clinical Module 4 Patient Workload Overview

7.1D Original Design Intentions

Design guidance criteria for the MHS establishes clear separation from staff and patient care areas in the clinic layout. The 2006 design guidance criteria for the MHS reinforced the replication of a clinic layout similar to a T-shape, as previously discussed in chapter two (as indicated in Figure 7.13). According to the interviews, the architect intended the clinic to "allow for the proper level of separation between patient and staff activities. Staff activities take place in the off-stage area that is away from the eyesight of the patient. The on-stage area is where patients and staff meet for the delivery of care" (Architect Interview Case 2, 2018). Staff work areas are located at the back of the clinic, while patient exam rooms are located in the middle. (as indicated in Figure 7.13). In the front of the clinic is a public waiting area that connects to the "on-stage" area that houses all of the exam rooms. The treatment zone that houses ancillary services and support rooms are located on the perimeter of the clinic.

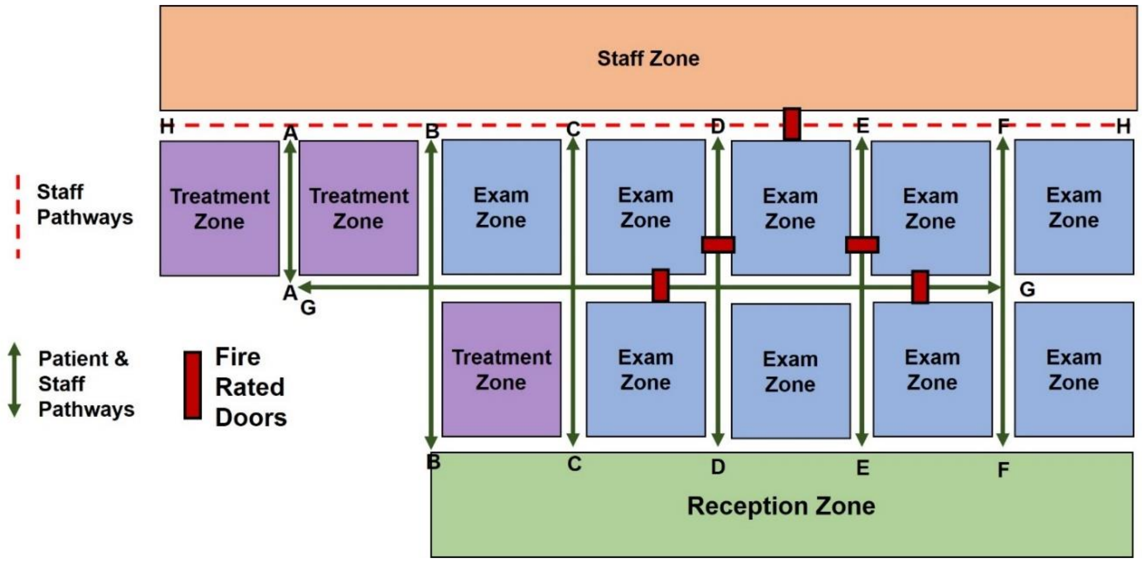


Figure 7.13: Original Diagram for Clinic Layout

The clinic corridors facilitated a spatial barrier between staff and patient care areas. Circulation pathways were broken up into six vertical and two horizontal corridors, as depicted in Figure 7.13. The healthcare planners established the six vertical corridors to allow for a "unidirectional workflow for patients from the entrance to exit, reducing patient/staff redundant movement throughout the clinic" (Parsons, 2010, pg. 1929). Healthcare planners intended for patients to enter through the central area of the clinic and be escorted by staff through the necessary steps to perform a routine patient appointment. The horizontal corridor (labeled G in Figure 7.13) provided a circulation pattern for staff and patients to access exam rooms and ancillary services off the vertical corridors throughout the clinic. The horizontal corridor located in the back of the clinic created a spatial barrier to staff privacy. Staff workflow in the "off-stage" area was semi-private with the horizontal corridor, allowing direct access to each of the vertical corridors. The long length of the corridors required five fire-rated doors in the clinic

(Figure 7.13). The fire-rated doors created additional spatial barriers between the on-stage areas that housed exam rooms.

A new approach for a primary care clinic was developed during the initial design phase, which planned to improve the workflow efficiency. The first step for the new approach created primary care provider rooms. Therefore, four primary care provider rooms, each sized at 300 NSF, were introduced into the clinic design to afford flexible workstations for the residency program (as indicated in Figure 7.14). The provider rooms intended to establish sharable workstations, allowing the residency students to rotate in and out of the room during clinical rotations. The first provider room was located in the rear of the clinic off the vertical corridor labeled B in Figure 7.14. The fourth provider room was located at the intersection of a horizontal corridor (G) and a vertical corridor (F). The remaining two provider rooms were centrally located off a corridor (G) and in between two vertical corridors (C and F). The two central provider rooms influenced the location of the nursing workspace in the clinic.

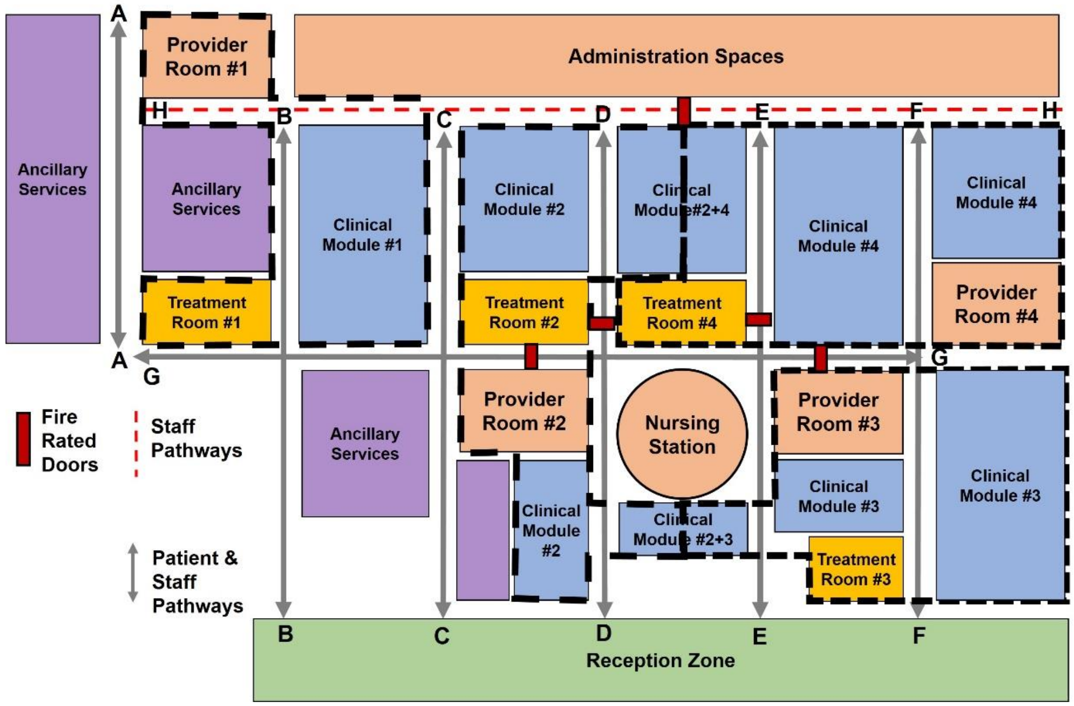


Figure 7.14: Modified Clinic Layout

The second step for the new primary care clinic created a focal point, in which the workflow centered around a central nursing station. Nursing staff, to include registered nurses and licensed practical nurses, were intended to be consolidated into a nurse station that resembled a traditional inpatient ward nurse station (Healthcare Planner Case 2 Interview, 2018). The central nurse station provided a work area that is in proximity to the waiting room, exam rooms, screening alcoves, and treatment rooms (Parsons, 2010). The six screening alcoves were placed in between the waiting room and nursing station to foster efficient workflow. The main treatment room for the clinic was placed directly across the central nurse station to enhance situational awareness for patient procedures in the room. The pneumatic tubing was co-located in the nursing station to provide the clinic direct access to the hospital lab and pharmacy. A blood draw/point-of-care lab was located adjacent to the nurse station to collect patient specimens in the clinic. The adjacent location reduced staff travel distance in transporting patient specimen samples to the pneumatic tubing for more in-depth analysis at the hospital lab.

Clinical modules were introduced to reduce unnecessary steps and travel distances for delivering patient care (as depicted in Figure 7.14). Clinical modules were located in front or behind each of the four provider rooms to align with a “unidirectional flow of patients” in the clinic (US Army Corps of Engineers, Carl R. Darnall Army Medical Center, Parsons, 2010). Each module contained eight to eleven exam rooms, one storage room, one treatment room, one patient toilet, and one provider room. All of the treatment rooms were located along the central horizontal corridor (G), with the exception of clinical module four. In clinical module four the isolation exam room served a dual purpose as a treatment room. The location of the treatment rooms created a level of separation from exam rooms in the clinical modules (US Army Corps of Engineers, Carl R. Darnall Army Medical Center, Parsons, 2010). Locating the treatment rooms in the horizontal corridor (G) was planned to decrease traffic around the room as the main traffic for modules occurred in the vertical corridors (A to F) (US Army Corps of Engineers, Carl R. Darnall Army Medical Center, Parsons, 2010).

Support rooms in the clinic were clustered away from the main vertical circulation corridors to reduce traffic in the clinic. Ancillary services included immunization, vision screening, behavioral health provider, clinical pharmacist, cast room, and non-stress testing as indicated in purple for Figure 7.14. Clinical support rooms included two pairs of clean and soiled linen rooms that supported the four clinical modules, as indicated in yellow for Figure 7.15. The support rooms are located along the horizontal corridors (G and H).

The MHS design guidance lacks information pertaining to clinical module layouts, resulting in provider rooms in both on-stage and off-stage areas of the clinic. The new design modifications to accommodate FRMP functions facilitated a hybrid clinic layout, resembling a physician-centric clinic, in which primary care providers are located in separate work areas from the nursing staff. Furthermore the central nursing station located all of the nurses in the middle of the on-stage area of the clinic. Therefore, the location of the nursing station afforded few opportunities for staff privacy. This type of configuration where staff are separating is inadequate for supporting team-based care environments.

7.1E PCMH Implementation

The adoption of the PCMH resulted in minimal design modifications to create clinical modules and team rooms. Provider rooms from the initial design were transformed into team rooms with no changes to size or layout of the rooms. The support rooms were left unaltered in the clinic during the transfer to a PCMH model. However, there were too many clinical modules in the original design to support the adoption of the PCMH model.

The major change from the adoption of the PCMH model was organizing the clinical staff into two clinical core teams. This modification resulted from the transition of a physician-centric to a team-based care model. The introduction of the team-based model expected primary care providers to work alongside nursing staff in team rooms.

The previous clinical modules were reduced from four to two to support the new clinical core teams as indicated in Figures 7.4 and 7.14. Additionally, dedicated private workspace for physician instructors and residency students were located in the original planned FMRP clinic. Nursing staff were separated among three team rooms in the clinic. Licensed practical nurses for clinical core team one were moved into provider room one. Registered nurses for both clinical core teams were co-located in the central provider room two. Licensed practical nurses for clinical core team four relocated to provider room four. Provider room three transitioned into a preceptor room to provide a space for counseling and monitoring residency students delivering patient care. The preceptor room established a space to promote a learning environment for residency students in the clinic.

The original workflow for the clinic was left unaltered in the PCMH implementation. The assumption at the time was that nursing staff would still primarily work from the central nurse station (Healthcare Planner Interview Case 2, 2018). The central nurse station provided proximity to both clinical modules, patient screening alcoves, and the clinic waiting room. The adjacency of the blood draw/point-of-care lab and pneumatic tubing offered nursing staff proximity to two frequently performed patient care activities, as discussed in chapter three.

7.1F User Occupancy

After construction for the clinic was completed, leadership altered spaces in the clinic to align with staffing, needed space for room equipment, and additional support rooms. First, staffing issues for the clinic left the blood draw/point-of-care lab, vision screening room, and cast room as unneeded services. Therefore, the blood draw/point-of-care lab was replaced with a patient education room due to staff shortages. In addition, the available access to the clinic's pneumatic tubing provided staff with the necessary equipment to send patient specimens to the lab. Second, the immunization room expanded into the vision screening room for more supply storage capacity. Third, the cast room transitioned into a residency preparation room for procedures located adjacent to a treatment room (Figure 7.15). The new configuration of a preparation room and treatment room made this area of the clinic the main patient procedure room. The treatment room in the center of the clinic was utilized as a secondary room for performing patient procedures.

Area	Space Allocation	%
Module 3	1,948 NSF	9%
Module 4	2,271 NSF	10%
Shared Area	1,512 NSF	7%
Clinical Support	1,288 NSF	6%
Ancillary Services	1,410 NSF	6%
Waiting Area	2,018 NSF	9%
Other	4,545 NSF	20%
Circulation	7,569 NSF	34%
Total	**22,562 GSF**	**100%**

Net to Gross Factor=**1.5**
MHS Net to Gross Factor is **1.4** (DoD SPC, 2016)

Figure 7.15: Clinic Layout

Clinical staff converted under-utilized rooms into private and shared offices throughout the clinic. The exam rooms and offices offer the same infrastructure and sizes to facilitate conversions of spaces. The single pediatric screening room for the entire clinic, located in the front area of the central module, transitioned into a private office for a primary care provider. In clinical module three, the adjacent non-stress test room converted into a provider sub-team room. The location created proximity for one primary care provider and two licensed practical nurses to their two assigned exam rooms. The staff referred to this new layout as a “pod configuration” that supports a single provider sub-team (as indicated in Figure 7.14). Staff replicated the “pod configuration” in clinical module four with one shared office and three exam rooms.

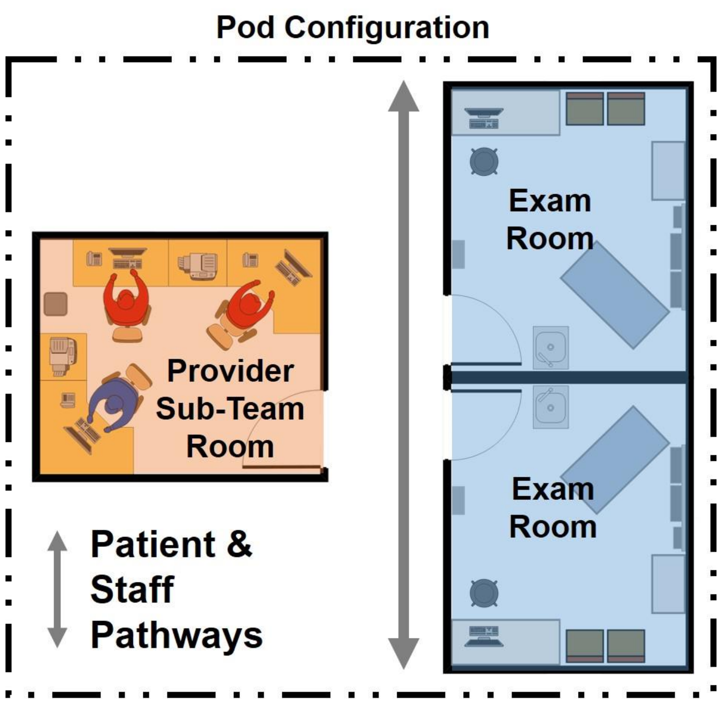


Figure 7.16: Pod Configuration

Clinical modules lacked direct access to the screening alcoves to collect patient initial height and weight. Staff altered the spaces in the clinical modules to provide direct access to screening alcoves. In clinical module three staff converted a crash cart alcove outside the previous non-stress test room into a height and weight screening alcove. Similarly, staff in in clinical module four colocated the height and weight equipment in the under-utilized isolation exam room. The isolation exam never served the dual purpose of a treatment room as planned in the design phases. The alteration in the clinical modules reduced unnecessary travel distances to the central area of the clinic that included six screening alcoves.

The six exam rooms located in the central module were repurposed to support triage service and a residency educational exam room. Patient triage provides exam space to screen walk-in patients during sick-call operations. The proximity of the registered nurse team room to the exam rooms facilitates this function for patient care. Sick-call operations occur in five of the six exam rooms located in the central module. The additional exam room is equipped with video recording capability to monitor residency students from the preceptor room. The video recording allows the instructors to review the medical appointment with the students to create a better learning atmosphere. The new clinic functions in the central module facilitated the staff constantly being on-stage for patient care. The new functions afforded limited privacy, as a result the central nursing station was left unoccupied and staff preferred to work out of the team rooms.

The FMRP clinical space was combined into the family medicine clinic. The FMRP has different MHS design guidance criteria and establishes a separate clinic. This resulted in the outpatient wing housing a primary care clinic with 37 exam rooms and a FMRP clinic with 12 exam rooms. Furthermore, the FMRP relied on the 22 support staff from the family medicine clinic to provide patient care. Separating the two clinics left 32 physician instructors and residency students without the necessary staff structure to perform patient care. Consequently, leadership merged the two clinics into one area to support patient care. The FMRP transitioned into a strictly administrative area for the outpatient clinic.

The chronological overview of the clinic shows how the functional requirements for the FMRP, PCMH implementation, and user occupancy altered the original design of the clinic. The analysis establishes three key alterations from the original design. First, additional rooms were added with the provider rooms and clinical modules to support the functional staffing requirements for a FMRP. The new provider rooms and clinical modules required minimal changes to accommodate the PCMH implementation, except for reducing the number of clinical modules. Second, the four original clinical modules were reduced, establishing two clear modules that incorporated team rooms. As a result, the team rooms established a space for nursing staff and primary care providers to work along-side each other to enhance patient care delivery. Lastly, the clinic occupancy converted rooms to align with staffing and medical services needed in the clinic. Leadership removed support rooms from the clinic due to staffing shortages and lack of storage space. Then staff converted under-utilized rooms into office spaces to support a pod configuration. As a result, the alterations established a new clinic and clinical module layout that are untested in understanding how the physical environment influences team-based care. Findings in the next three sections examine the themes that emerge from staff experiences of how the physical environment influences patient care.

7.2 Workflow Concerned with the Overall Clinic Design

The layout of a clinic directly influences the staff workflow for delivering patient care by creating shorter or longer travel distances when performing commonly performed patient care activities. Efficient clinic workflow is the ability to minimize staff travel distances and reduce unnecessary effort to deliver patient care (Thompson & Pelletier, 1959; Freihoefer et al, 2017). Staff perceptions of clinic workflow are evaluated through three themes: (a) accessibility to support rooms, (b) proximity of team room to waiting room, and (c) sharing of staff and patient corridors (Tables 6.1-6.4). The first sub-section on accessibility to support rooms examines how the staff feel about travel distances to frequently-used rooms for delivering care outside the clinical module. The second sub-section appraises the staff views for traveling from the team room to the waiting room to get new patients or escort patients out. The final sub-section examines staff opinions in sharing corridors with patients to deliver patient care.

7.2A Access to Support Rooms

Clustering the most frequently used areas outside the clinical modules nearby can enhance staff workflow for patient care. The proximity of support rooms to team rooms creates efficient workflow for staff in supporting patient care delivery (CADRE, 2015, Battisto et al., 2009; Boulder Associates, 2011). Support rooms located outside the clinical modules are usually ancillary services and clinical support rooms. Ancillary services include immunization, clinical pharmacist, behavioral health provider, triage section, and patient education as indicate in purple for Figure 7.13. Clinical support rooms consist of the medical storage, clean and soiled linen rooms, treatment rooms, and an isolation exam room as indicated in yellow for Figure 7.13. Findings in this sub-section evaluate staff views in traveling to frequently-used support rooms outside the clinical modules.

Table 7.1
Staff Perceptions of Support Rooms Most Frequently Used

STAFF ROLE	**MODULE**	**ROOM TYPES** (# of Staff that Identified the Room)
Primary Care Provider	5	Treatment Room (1) Immunization (1)
Registered Nurse	4	Supply Room (2) ER (3) Lab (1) Pharmacy (1)
Licensed Practical Nurse	8	Supply Room (2) Lab (1) ER (1)
Specialty Provider	2	Pharmacy (1)

The supply room and emergency room (ER) are the most frequently traveled-to support rooms outside the clinical modules. The supply room location, as previously discussed, is viewed as essential for enhancing staff workflow among the registered nurses and licensed practical nurses. Primary care providers' responses indicated that they don't travel to the supply room on a regular basis. The external travel requirements for the FMRP allow primary care providers to view travel distances outside the clinical modules as a non-issue.

Patients utilizing walk-in appointments for acute-care injuries influence staff workflow in the clinic. The triage services offered for walk-in sick-call operations see patients with acute-care injuries that exceed the medical scope of the clinic. Additionally, patients seeking faster access to medical care show up at the primary care clinic with routine and urgent care injuries. Therefore, registered nurses and licensed practical nurses escort the acute-care patients to the hospital emergency room. A registered nurse explained that “two to three times per day I escort patients to the emergency room, which is on the other side of the hospital” (Registered Nurse Interview Case 2, 2018). Findings indicate that including an urgent-care section in a primary care clinic increases access to care and improves staff workflow.

New technology advances, such as the pneumatic tubing, impact staff workflow when the equipment is down for maintenance or broken. Registered nurses and licensed practical nurses must travel to the hospital lab to drop off patient samples for evaluation when the pneumatic tubing is down for maintenance. The longer travel distances to the hospital lab consume valuable time for the licensed practical nurses to support primary care providers during medical appointments. Therefore, licensed practical nurses hand off lab samples to the registered nurses to drop off at the hospital lab. One registered nurse claimed to travel two to three times per day when the pneumatic tubing is down to drop off lab tests (Registered Nurse Interview Case 2, 2018). This evidence indicates the important role for the point-of-care lab in supporting patient care. Providing an adjacent or colocated point-of-care lab would reduce unnecessary trips outside the clinic, which enhances staff workflow for patient care.

The clinical pharmacist claims to travel to the hospital pharmacy frequently for face-to-face consultation. Interestingly, the clinical pharmacist has access to a wireless communication device, the hospital medication database, and a telephone to assist with consultation for patient care. Traveling to the hospital pharmacy allows the staff member to interact with other pharmacists and physically inspect new medication information. This initial finding indicates that technology is not a comprehensive measure for bridging spatial barriers to support staff communication and collaboration for patient care with specialty providers.

Major consideration for the proper size, spatial adjacency, and allocation of support rooms in the clinic are critical steps for the initial design. Findings from this sub-section establish two main design recommendations. First, clinics sized at over 22,000 GSF with no central support rooms hinder staff workflow. Therefore, repositioning the clinic supply room to a central area for all clinical staff to access can improve staff workflow. Alternatively, providing a supply room for each clinical module reduces unnecessary travel distances outside the clinical modules. Second, the colocation of a point-of-care lab and urgent care section create opportunities to improve staff workflow in an embedded hospital clinic. The colocation of an urgent care section in the clinic provides better access to care and contributes to reducing wait times in the hospital emergency room.

Table 7.2

Staff Perceptions Concerning Proximity of Team Room to Support Rooms

MODULE	**STAFF ROLE**	**N**	**PERCEPTION** (# of Staff that Support the Perception)	**EXAMPLE OF EVIDENCE**
3	Primary Care Provider	2	Weakness (1)	"It's a little bit inconvenient for the staff to get supplies."
3	Registered Nurse	2	Weakness (2)	"Supply room is in hallway A and requires further travel distances for supplies."
3	Licensed Practical Nurse	4	Weakness (3)	"I get my steps in and take a breather before I can come back from the bridge [lab drop off area]."
4	Primary Care Provider	3	Weakness (1)	"Treatment Room and Clinical Pharmacist are far away."
4	Registered Nurse	2	Weakness (2)	"Supply room is on team [3] side which is further away from our team [4] room."
4	Licensed Practical Nurse	4	Weakness (4)	"To get supplies that's a little bit of a trek"
	Healthcare Administrator		Weakness (1)	"We need two locations where they both have their own separate supply room."

The proximity of support rooms in the clinic is an overall weakness between the two clinical modules. Staff from both teams reported that the main supply rooms are located inconveniently to support the two clinical modules. The main supply rooms staff are referencing include the clean and soiled linen rooms located on the perimeter of the clinic as indicated in Figure 7.8. One licensed practical nurse described the process for getting supplies: “I have to go to two or three different rooms sometimes because our central location is not central for getting supplies” (Licensed Practical Nurse Case 2 Interview, 2018). In addition, the licensed practical nurses from clinical core team four are required to travel completely across the clinic to get supplies. Staff in clinical module three have a shorter travel distance, but still claim that the supply room locations are inconvenient for supporting patient care. A recommended solution discussed by the staff was to provide each clinical module with its own supply room.

Staff in clinical module three view the central location of the pneumatic tubing as a weakness. Staff routinely collect patient specimen samples during medical appointments, as discussed in chapter four. After the clinic was occupied, leadership determined to eliminate the blood draw/point-of-care lab requirement for the clinic due to the accessibility of the pneumatic tubing. The pneumatic tubing provides the entire clinic with a single location to send patient specimens to the hospital lab for testing. Traveling from clinical module three to the central pneumatic tubing creates longer travel distances for those staff members. One licensed practical nurse from clinical module three expressed the frustration with long travel distances: “I hate it because if we have to send labs or anything, we have to go over to the nursing station” (Licensed Practical Nurse

Interview Case 2, 2018). Staff in clinical module four and the registered nursing team room are located in proximity to the pneumatic tubing and don't view the travel distances as a weakness. Findings articulate that the central pneumatic tubing is not actually central to the entire clinic. As a result, the current location of the pneumatic tubing hinders staff workflow in clinical module three.

7.2B Proximity of Team Room to Waiting Room

A common staff activity for delivering patient care is performing a patient medical appointment, as discussed in chapter four. Each provider sub-team is expected to see 20 patients per day, which can result in a licensed practical nurses to travel 40 times from the team room to the waiting room to pick up and drop off a patient. Travel distances to support the 20 medical appointments should ideally be minimized to support staff workflow. This sub-section addresses staff travel distances for a routine patient appointment. Travel distances for staff are discussed based on their perceptions regarding traveling from the team room to the waiting room. These two rooms represent the starting and end points for a patient appointment as discussed in chapter four. The travel distance between these two rooms were calculated from the floor plan measurements. Findings in this sub-section examine the perceived strengths and weaknesses for travel distances that support routine patient appointments.

Table 7.3

Staff Perceptions Concerning Proximity of Team Room to Waiting Room

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
3	Primary Care Provider	2	Strength (2)	"Walking 50 steps to my exam room and my office is not a hard ship."
3	Registered Nurse	2	Strength (2)	"Equal access to both teams in the clinic."
3	Licensed Practical Nurse	4	Weakness (3)	"Don't even have time to go back to your desk when you are in the [team 3 room] because you are on a different hallway so you are always going back and forth."
4	Primary Care Provider	3	Strength (3)	"Pretty short distances from the team room to exam room."
4	Registered Nurse	2	Strength (2)	"I don't find the travel distances excessive in the clinic."
4	Licensed Practical Nurse	4	Strength (3)	"We don't have to go far to do weights and heights and kid's screening or anything like that."

The proximity of the team rooms to the waiting room is a strength for clinical module four and registered nurses. The licensed practical nurses, as established in chapter two, are the main staff members who travel from the team room to the waiting room on a regular basis. Staff working out of the team room in clinical module four only travel 66 feet (Ft) to reach the waiting room. Additionally, licensed practical nurses average 169 Ft per patient appointment, while primary care providers only average 70 Ft. per appointment in clinical module four. One licensed practical nurse explained that, “We are more centralized than most, closer to the preceptor room, and it’s easier for me to work with my provider and do patient teleconferences” (Licensed Practical Nurse Interview Case 2, 2018). Alternatively, the provider sub-team room in clinical module four requires the primary care provider to travel less than 20 Ft. per appointment. The registered nurses located in the central team room travel less than 58 Ft. to reach the waiting room and five exam rooms for patient triage services. One registered nurse discussed that travel distances from the team room to exam rooms are “convenient because I see patients in that hallway" (Registered Nurse Interview Case 2, 2018). The shorter travel distances from the team rooms to the waiting room link to positive satisfaction for all the staff roles.

The proximity of the team room to the waiting room in clinical module three is a strength and weakness for the staff. Primary care providers, who only travel from the team room to the exam room, claim that the workflow in clinical module three is a strength. Primary care providers who work out of the team room in clinical module three average 112 Ft. per patient appointment, which is still 42 Ft. more than primary care providers in clinical module four. Even with the longer travel distance from the team room to the exam rooms, primary care providers still view this as a strength. Alternatively, the primary care provider located in the provider sub-team room for clinical module three travels less than 20 Ft. per patient appointment. The primary care provider that uses the pod configuration explained that the travel distances are "perfect because our exam rooms are right across the hall, and we don't have to walk too far" (Primary Care Provider Interview Case 2, 2018). This evidence implies that primary care providers are satisfied with travel distances to the exam room that range from less than 20 Ft. to 112 Ft.

Licensed practical nurses in clinical module three viewed the proximity to the waiting room as a weakness. Licensed practical nurses are the main staff members who frequently travel to the waiting room, as established previously in chapter three. Clinical module three team room is the furthest staff work area in the clinic from the waiting room, requiring staff to pass through an ancillary service corridor. Each licensed practical nurse in the module travels on average 379 Ft. per patient appointment, which is 210 Ft. further than staff in clinical module four. For example, two licensed practical nurses described that they easily get in 10,000 daily steps before going home for the day. The longer travel distances in clinical module three attribute two issues. First, a single screening alcove supports ten exam rooms located across two corridors, increasing licensed practical nurses travel distances. In comparison to clinical module four, which screening alcoves are located at the front of the clinical module, the location of the screening increase travel distances for licensed practical nurses in clinical module three. Second, the team room location is 152 Ft. away from the waiting room. This forces the licensed practical nurses travel increased distances to support routine patient care activities. The evidence implies that licensed practical nurses are dissatisfied with distances over 152 Ft. for patient care activities.

Findings in this section highlight two design recommendations for future clinics. First, locating a team room too far away from the waiting room hinders staff workflow. The findings from this section suggest that the primary care provider’s travel distances were prioritized over the licensed practical nurses’, which illustrates their critical role for patient care. However, increasing travel distances for licensed practical nurses’ creates inefficient workflow for the clinical core team. Secondly, locating a screening alcove at the front of the clinical module reduces unnecessary staff travel distances for patient care, especially with supporting two corridors (Cahnman, 2011). Preferably, the allocation for screening alcoves in each clinical module should reinforce efficient workflow patterns for the staff. Identifying the workflow patterns and necessary steps for licensed practical nurses contributes to improving clinical core team workflow for the clinic and clinical modules.

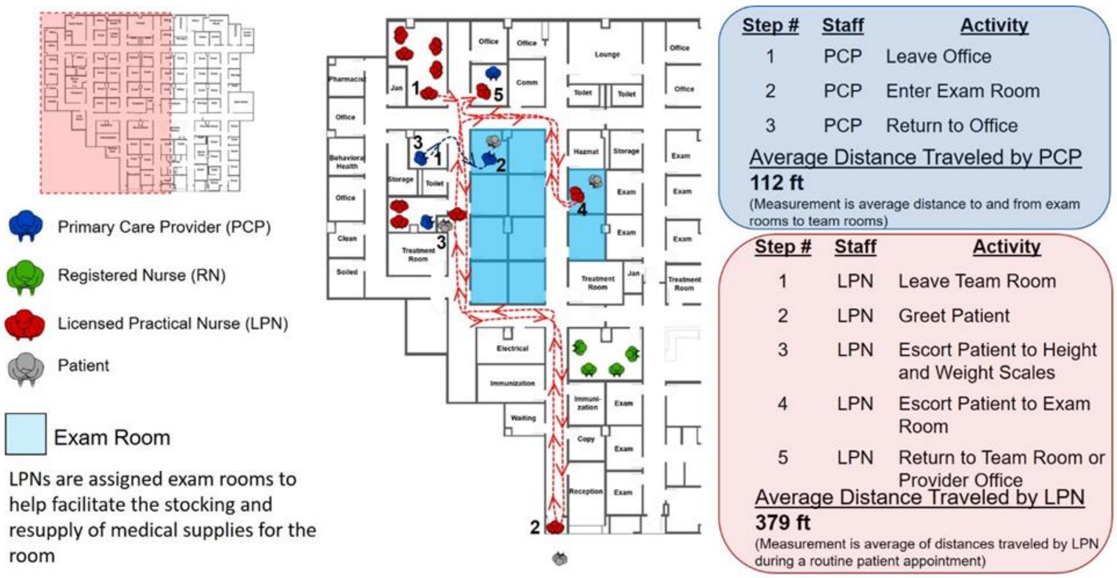


Figure 7.17: Clinical Module 3 Staff Workflow for Routine Patient Appointment

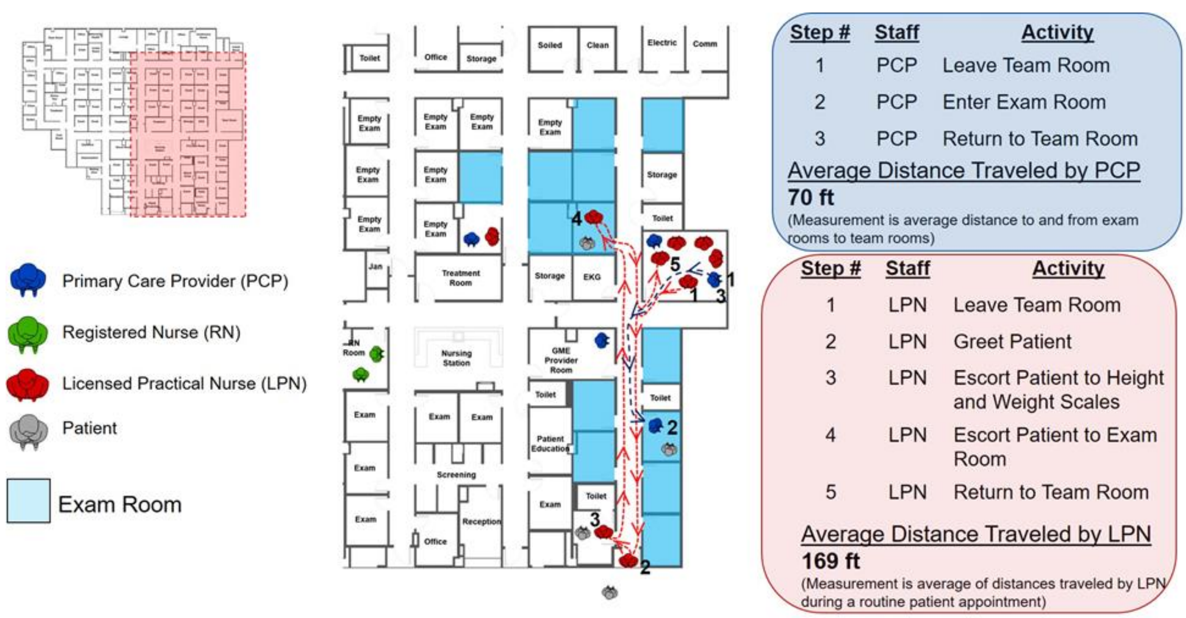


Figure 7.18: Clinical Module 4 Staff Workflow for Routine Patient Appointment

7.2C Shared Staff and Patient Corridors

Studying patient and staff movement through corridors during patient visits offers insight into workflow patterns. The prevailing view in the literature is that separating staff and patient corridors fosters staff privacy and the ability to move more fluidly in the clinic (Battisto et al., 2009; Karp et al., 2016; Freihoefer et al, 2017). In the MHS guidance criteria, staff and patients share corridors, which contradicts much of the recommendations in the literature. Findings in this section report on staff opinions with sharing corridors with patients.

Table 7.4

Staff Perceptions Concerning the Use of Shared Corridors

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
3	Primary Care Provider	2	Non-Issue (2)	"I'm not uncomfortable with sharing corridors with patients."
3	Registered Nurse	2	Non-Issue (2)	"No issue, if they are not talking about patient care or something."
3	Licensed Practical Nurse	4	Non-Issue (3)	"Sharing corridors with patients doesn't bother me."
4	Primary Care Provider	3	Weakness (2)	"Walking past doors is where it gets problematic, but putting the provider office, clinician office, in the back with four exam rooms up front works and is acceptable."
4	Registered Nurse	2	Weakness (2)	"It allows the patient a lot of opportunities for HIPAA violations."
4	Licensed Practical Nurse	4	Non-Issue and Weakness (2)	"I don't have an issue with sharing hallways with patients" "At times, it can be interruptive sharing corridors."
	Healthcare Administrator	2	Weakness (2)	"I think that's probably an issue for us. The staff always have to be very aware of what they are talking about for HIPAA."

The staff between the two clinical core teams offer mixed opinions on sharing corridors with patients. Staff from clinical module three claim that sharing corridors with patients is a non-issue. One primary care provider from clinical module three explained that “I don’t have a problem with that at all, because I feel like I can read people very well” (Primary Care Provider Case 2, Interview). At the same time, issues for clinical staff engaging in hallway conversations are mitigated with the proximity of team rooms to exam rooms that average 56 Ft. Furthermore, the team room is located at the back of the clinic, which is separated from patient care areas that offer more privacy. Interestingly, staff in the provider sub-team room are afforded a spatial barrier with the L-shape room. The L-shape layout of the provider sub-team room creates a three-foot spatial buffer between the door and staff workstation for privacy. As a result, the location and layout of the staff workspaces decrease opportunities for breaches in privacy while patients share the same pathways.

Across the staff roles in clinical module four, sharing corridors with patients is expressed as a weakness. The central location of the staff work areas allows patients to constantly pass near the team room doors, causing concerns about privacy. The location of the team room affords the opportunity for 40 patients per day to overhear conversations in the team room. One licensed practical nurse claimed that “sometimes I am interrupted by a patient while I am in the hallway, and I don’t like that” (Licensed Practical Nurse Case 2 Interview, 2018). Accordingly, the constant circulation of the five licensed practical nurses reduces the chances to simply close the door for privacy. At the same time, primary care provider instructors and residency students in the preceptor room need to have situational awareness of conversations as 50 patients per day walk past the preceptor room door. Consequently, the layouts of the staff workspaces in clinical module three don’t offer any spatial barriers to prevent breaches of privacy.

Findings in this section align closer with the stance taken in the literature for separating patient and staff corridors. Locating staff work areas too close to exam rooms or allowing patients to walk past doors presents concerns for privacy. At the same time, staff workspaces located behind exam rooms facilitates a spatial barrier that mitigates patients walking past open doors. Furthermore, evidence from the previous section indicates that locating team rooms in proximity to exam rooms is a strength, but one that compromises staff privacy. Therefore, the separation of staff and patient corridors contributes to a design solution that addresses the privacy concern (Battisto et al., 2009; CHD, 2016; Douma & Romer, 2015; Karp et al., 2016). Striking a balance with shorter travel distances and privacy is a desired design solution to adhere for with clinical modules layouts.

7.3 Functionality of the Team-Based Clinical Module

The design of clinical module influences the staff's ability to perform daily activities for patient care. Functionality for the clinical module captures how well programmatic elements such as type of room, size, location, and allocation of space in the clinical module support patient care (Prieser & Vischer, 2005). This section measures functionality through staff opinions across five areas: (a) types of rooms needed in a clinical module, (b) sizes of rooms in the clinical module, , (c) location of the team room, (d) layout of the clinical module, and (e) types of sharable rooms between two clinical core teams (Tables 7.5-7.9). The first sub-section gauges what room type staff deem the most important for a clinical module to support patient care. In the second sub-section, analyzes the size of the exam and team rooms and the available workspace per individual are analyzed. The third section reports on the location of the team room in the clinical module based on staff opinions. The fourth section rates the staff satisfaction with the clinical module layout. The final section classify rooms that should be sharable across the two clinical modules.

7.3A Types of Rooms in Clinical Modules

The MHS design guidance criteria does not clearly identify which types of rooms should be in a team-based clinical module. Identifying the rooms perceived to be important for the sub-provider teams is the first step toward defining the team-based clinical modules. This sub-section evaluates staff opinions on which room types are essential for inclusion in the clinical module.

Table 7.5

Rooms Staff Deem as Most Important in Clinical Modules

MODULE	STAFF ROLE	N	ROOM TYPES (# of Staff that Identified the Room)
3	Primary Care Provider	2	Supply Room (2) Team Room (1)
3	Registered Nurse	2	Treatment Room (2) Exam Room (1) Isolation Exam Room (1)
3	Licensed Practical Nurse	4	Exam Room (2) Supply Room (1)
4	Primary Care Provider	3	Exam Room (2) Treatment Room (2) Team Room (2) Supply Room (1)
4	Registered Nurse	2	Treatment Room (2) Supply Room (1) Isolation Exam Room (1)
4	Licensed Practical Nurse	4	Supply Room (2) Treatment Room (2) Exam Room (1)

Overall staff, between the two clinical core teams identified the treatment room as the most important room in a clinical module. The current location of the main treatment room is located on the perimeter of the clinic, providing convenient access for staff in clinical module three. However, staff in clinical module four and registered nurse team room have to travel across the clinic to reach the main treatment room, which indicates that staff expressed their opinions for a room type that is missing in the clinical module.

Furthermore, the clinic's status as FMRP may play a factor in the staff responses for a treatment as a necessary room type in a clinical module. The residency students are required to conduct a specific number of patient procedures for training and education purposes. As a result, staff perceptions in this clinic may be influenced by additional patient care requirements for the FMRP. This evidence implies that a FMRP may need a treatment room colocated in each clinical module.

Additional room types for a clinical module were identified as a supply room, exam room, team room, and isolation exam room. The second most identified room type for a clinical module was the supply room. Staff across the two clinical modules articulated the importance of the supply room in the previous section 5.2. Staff reinforce this stance by suggesting that the supply room be colocated in the clinical modules. The third most identified room type for a clinical module was the patient exam room. Exam rooms are a fundamental component for delivering patient care in a clinical module, validated by the staff opinions. The fourth room type for a clinical module that staff expressed is the team room. Interestingly, primary care providers that lack dedicated workspace in the current team rooms were the only staff to identify the team room component. This finding implies that primary care providers want available workspace in the team rooms. The last identified room type was an isolation exam room for a clinical module. The registered nurses, who perform triage services for the clinic, were the only staff to identify this space requirement for a clinical module. This finding points out that an isolation exam room aligns with triage services, and not in the clinical modules.

The floor plan analysis aligns with the staff opinions for room types for a clinical module, with the exception of two room types. The two room types are the screening alcoves and the patient toilet in a clinical module. First, the screening alcove allows staff to initially collect patient height and weight before entering the exam room. The current makeshift screening alcoves, as previously discussed, were adopted after the staff occupied the clinic. The planned screening alcoves are centralized in the front of the clinic, which establishes longer travel distances for staff to reach from the team rooms. This implies that centralized screening alcoves for both clinical modules create unnecessary travel distances for patient care.

Secondly, the patient toilet was not identified by staff for a clinical module. The terminology patient toilet is misleading as both staff and patients utilize this room throughout the day. At the same time, locating a patient toilet in the clinical module reduces staff travel outside the clinical modules. The patient toilet lacks identification from the staff, but plays an important role in reducing unnecessary travel outside the clinical modules. Therefore, including a patient toilet into a clinical module provides a functional role in supporting staff to delivery patient care.

Findings from this section signal that a functional clinical module consists of six room types: a treatment room, supply room, exam rooms, team room, screening alcove, and patient toilet. Each of the rooms supports the staff's ability to deliver self-sustaining patient care within a clinical module. The original design for the clinical modules included each of these room types, except for the screening alcove. The screening alcove provides a valuable first step for the patient care process in the clinical modules. In conclusion, developing a clinical module that includes the six-room types cultivates a functional team-based environment for patient care.

Type of Room	# of Rooms	Average NSF	Average Guideline NSF
Exam Room	10	121	120
Treatment	1	186	120
Sub-Team Office	1	131	120
Team Room	1	318	120
Patient Toilet	1	55	60
Office	2	120	120
Alcove/Screening	1	16	60

Clinical Staff Team	Planned # of Staff	Actual # of Staff
Primary Care Provider	5	19*
Registered Nurse	4	2
Licensed Practical Nurse	9	7
Total	**18**	**28**

*Primary care providers are housed in separate administrative area

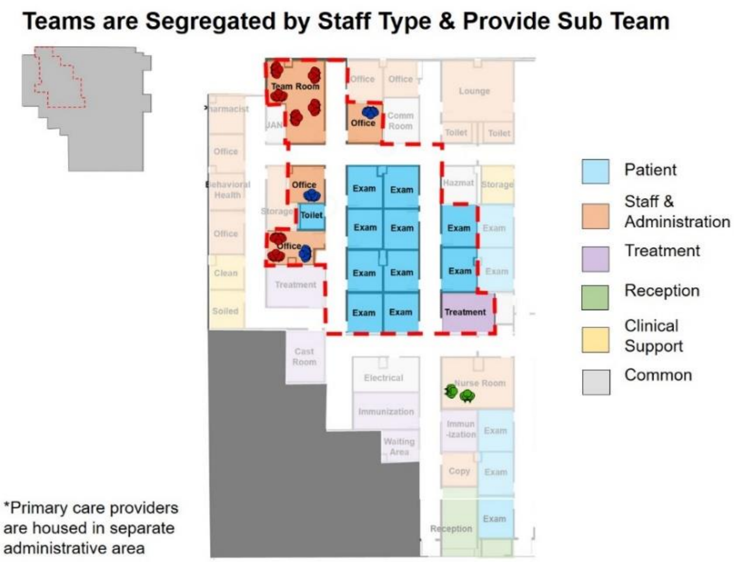


Figure 7.19: Clinical Module 3 Layout Overview

Teams are Segregated by Staff Type & Provide Sub Team

Type of Room	# of Rooms	Average NSF	Average Guideline NSF
Exam Room	13	121	120
Isolation Room	1	123	180
EKG Room	1	110	120
Patient Toilet	3	55	60
Sub Team Office	1	120	120
Storage Room	1	122	90
Team Room	1	345	120

Clinical Staff Team	Planned #	Actual #
Provider	6	17*
RN	4	2
LPN	9	6
Total	18	25

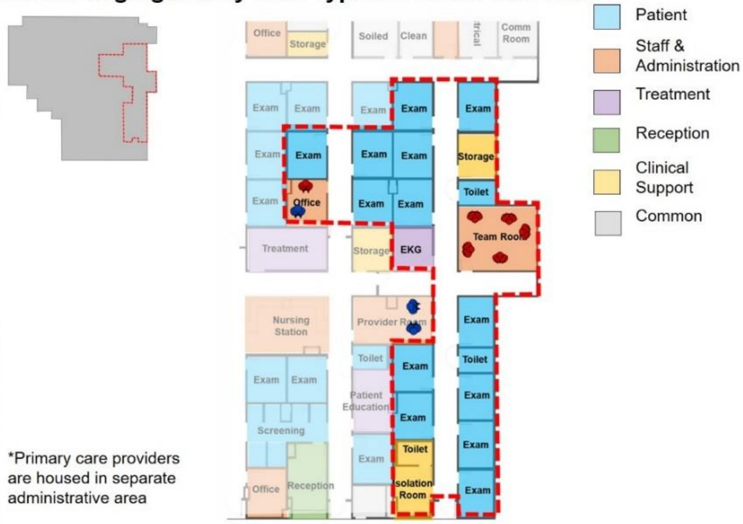


Figure 7.20: Clinical Module 4 Layout Overview

7.3B Room Sizes and Shapes: Exam Room and Team Room

The literature suggest that new team-based care activities reduce occupational stress from working as an individual in a private office and support patient care in the exam room. The colocation of staff in a shared workspace increases opportunities for collaboration shown to enhance the staff capabilities to deliver effective patient care (DuBose, Lim, Westlake, 2015; Gunn et al., 2015; Oandasan et al., 2009). A team-based approach in the exam room allows primary care providers to concentrate more, while the licensed practical nurse enters notes on the computer, which reduces workload demands for primary care providers (Chesluk & Holmboe, 2010; Shanafelt et al., 2016; Bodenheimer, 2011). The size and shape of exam and team rooms influence how team-based care activities occur (Herman Miller, 2011; Cahnman, 2011; Mahlum Architects, 2011; Capital Link, 2011; Center for Health Design, 2016). This sub-section analyzes the size of these two key rooms based on the number of staff and patients in a room. The first

sub-section analyzes the size of an exam room compared to the number of individuals in a room for an appointment. In the second sub-section, team room sizes are examined based on the available workspace per staff member. Staff perceptions are compared with the floor plan analysis to evaluate the size and shapes of the rooms.

Table 7.6
Staff Perceptions for the Size of Exam Rooms

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
3	Primary Care Provider	2	Weakness (1)	"Exam tables are big and bulky for patient care in the rooms."
3	Licensed Practical Nurse	4	Weakness (1)	"We had bigger exam rooms with computer screens and height/weight scales at my old clinic."

The size of the exam rooms provides limited space to accommodate team-based care activities. Exam room sizes and layouts are consistent between the two clinical modules (Figures 7.19 and 7.20). As discussed in chapter four, a team-based approach includes a minimum one primary care provider, one licensed practical nurse, and the patient occupying an exam room. Exam rooms average 121 NSF in the two clinical modules, providing 40 Sq. Ft. for three individuals in the room. One licensed practical nurse preferred the larger exam rooms from a previous clinic that allowed for measuring patients height and weight in the room, along with a large screen to aide with patient consultation. Another licensed practical nurse expressed that the exam rooms are “not really fit to have a lot of patients, a nurse, and a provider in the exam room” (Licensed Practical Nurse Interview Case 2, 2018). A primary care provider claimed that the “bulky exam table” combined with the small size of the exam rooms interfered with adjusting the table height to accommodate older and pediatric patients. This evidence hints that 40 sq. ft. for three individuals is potentially too small.

The clinic provides health services for both military retirees and soldier family members who bring additional individuals to a medical appointment. Military retirees bring supporting caregivers to medical appointments to enhance patient outcomes, decreasing the space available in an exam room (Omole et al., 2011; Rosland et al., 2011; McDaniel et al., 2005).. At the same time, medical appointments that include pediatric patients typically consist of an additional two to three individuals in the exam room as observed during the site visit. Consequently, the additional individuals in the exam room decrease the available space to perform team-based care activities in the exam room. Therefore, staff typically perform their patient care duties one at a time in the exam room for this clinic. Performing patient care activities with only one staff member in the exam room resembles the physician-centric approach. In addition, the licensed practical nurses misses out on potential valuable medical education experiences that may aid in future patient care in the clinic and for military operations overseas. Therefore, this type of approach undercuts the value for performing team-based care in the exam room.

This finding reveals that the size of the exam room are a limiting factor for performing team-based care. Alternatively, the Veteran Administration (VA), a sister organization to the MHS, increased the size of exam rooms to provide 42 sq. ft. per individual that supports team-based care activities (Veteran Administration, 2015). The floor plan analysis, staff opinions, and literature suggest increasing the size of exam rooms to accommodate the patient, family members, primary care provider, and a licensed practical nurse.

Site	Team	# of Exam Rooms	Exam Room Size	Average Sq. Ft. per Individual (Two Staff and One Patient)	Average Travel Distance to Team Room
Case 2	Module 3	10	121 NSF	40	56 ft

Figure 7.21: Clinical Module 3 Exam Room

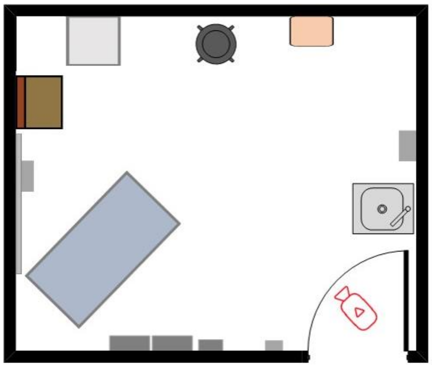


Figure 7.22: Typical Exam Room Layout for Clinical Module 3 & 4

Site	Team	# of Exam Rooms	Exam Room Size	Average Sq. Ft. per Individual (Two Staff and One Patient)	Average Travel Distance to Team Room
Case 2	Module 4	13	121 NSF	40	35 ft

Figure 7.23: Clinical Module 4 Exam Room

Table 7.7
Staff Perceptions for the Size of Team Rooms

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
3	Primary Care Provider	2	Weakness (1)	"Too many people to have one big room, very hard to tune people out."
3	Licensed Practical Nurse	4	Weakness (1)	"Team room large enough to provide space for the whole team, or make the desks smaller."

The size of the team rooms offers adequate workspaces for individual staff, except for staff in clinical module three. The team rooms outside of clinical module three house five staff, providing 56-69 sq. ft. per staff. The workspaces in these two team rooms align with the suggested 48-60 sq. ft. per staff workspace recommended in the literature (Belknap & Lafferty, 2011). Furthermore, the sitting arrangements and size of the workspaces increase opportunities for staff to have face-to-face interactions in the team room.

Staff in clinical module three claim the team room is too small for team huddles and too large for a licensed practical nurse workspace. Interestingly, the team room houses five licensed practical nurses, providing 64 sq. ft. per staff for workstations. This aligns with the available workspace documented in the other two team rooms. The major difference between the team rooms is the L-shaped layout. Consequently, the L-shaped configuration of the team room restricts the ability to support team huddles (as indicated in Figure 7.24). Additionally, staff working at the first three workstations, as indicated in Figure 7.24, block the circulation pathways and create excessive noise levels for staff working at the workstations in the back of the room. Therefore, the L-shaped team room influences the staff's opinion of the workspaces, compared to staff who work in the squared-shape team rooms.

The shape and size of the provider sub-team room offers limited workspace for the staff in clinical module three. As previously discussed in this chapter, the L-shaped layout provides staff with privacy from the patient corridor. At the same time, the L-shaped layout reduces the available work space for staff. This provider sub-team room is 131 NSF, which houses three staff. Furthermore, the shape and configuration of the room only provides 114 NSF of usable space. Therefore, staff only have 38 sq. ft. per staff workstation size, instead of 44 sq. ft. per staff with the 131 NSF room. As a result, the shape of the room influences where staff can locate their workstations, leaving minimal workspace in the provider sub-team room (as indicated in Figure 7.26).

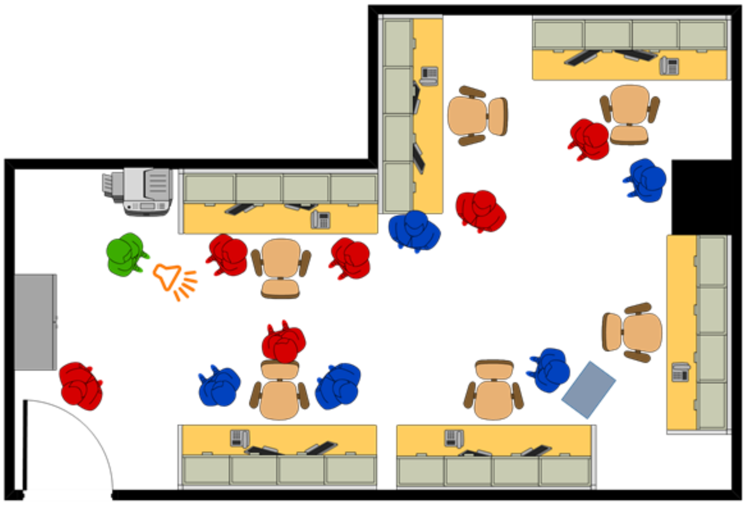


Figure 7.24: Clinical Module 3 Team Huddle

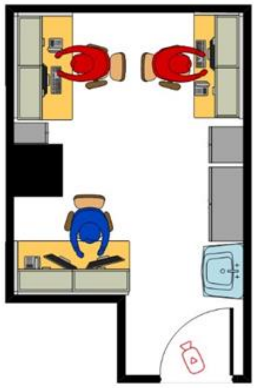
Site	Team	Team Room Size	# of Staff in Room	Team Room Sq Ft Per Staff	Team Room Location	Type of Team Room	Average Travel Distance to Waiting Room
Clinic 2	Module 3	318 NSF	5	64 NSF per Staff	Back	Housing Similar Staff Roles	152 ft

Clinical Staff Team	Actual #
Primary Care Provider	0
Registered Nurse	0
Licensed Practical Nurse	5
Total	**5**

Figure 7.25: Clinical Module 3 Team Room

Site	Team	Team Room Size	# of Staff in Room	Team Room Sq Ft Per Staff	Team Room Location	Type of Team Room	Average Travel Distance to Waiting Room
Case 2	Module 3	131 NSF	3	44 NSF per Staff	Central	Provider Sub-Team	118 ft

Clinical Staff Team	Actual #
Provider	1
RN	0
LPN	2
Total	**3**



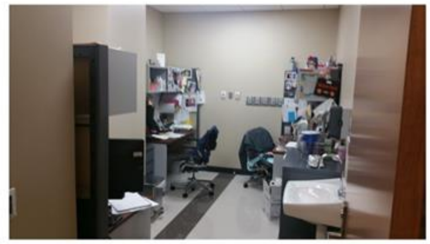


Figure 7.26: Clinical Module 3 Provider Sub-Team Room

Site	Team	Team Room Size	# of Staff in Team Room	Team Room Sq Ft Per Staff	Team Room Location	Type of Team Room	Average Travel Distance to Waiting Room
Case 2	Module 4	345 NSF	5	69 NSF per Staff	Central	Housing Similar Staff Roles	66 ft

Clinical Staff Team	Actual #
Primary Care Provider	4*
Registered Nurse	0
Licensed Practical Nurse	5
Total	**5**

*Primary care providers come in and out of the team room, but don't have assigned workstations

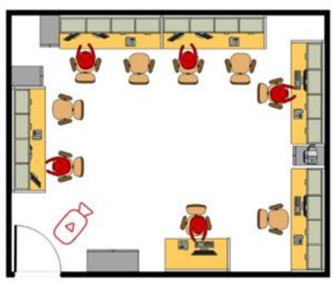


Figure 7.27: Clinical Module 4 Team Room

Site	Team	Team Room Size	# of Staff in Room	Team Room Sq Ft Per Staff	Team Room Location	Type of Team Room	Average Travel Distance to Waiting Room
Case 2	Shared	280 NSF	5	56 NSF per Staff	Central	Housing Similar Staff Roles	58 ft

Clinical Staff Team	Actual #
Provider	0
RN	5
LPN	0
Total	**5**

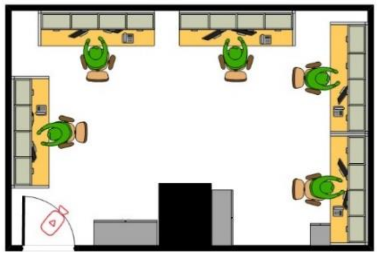


Figure 7.28: Registered Nurse Team Room

7.3C Layout of Clinical Modules

The previous sections illustrated the most important room types needed in a clinical module. This sub-section examines the staff opinions on how the current clinical module layout influences the delivery of team-based patient care. A clinical module should be organized to minimize travel distances for staff, while also ensuring patient privacy (Herman Miller, 2011; Battisto et al., 2009; Whiteaker, 2015; Farahmand et al., 2011; Taylor, 1999). The first sub-section evaluates staff perceptions based on the location of the team room. Then staff satisfaction with the clinical module layout is discussed. Lastly, staff opinions are then assessed to determine what types of rooms can be shared between the teams in different clinical modules.

Table 7.8

Staff Perception Concerning the Location of Team Room in the Clinical Module

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
3	Primary Care Provider	2	Strength (1)	“Perfect because our exam rooms are right across the hall, and we don’t have to walk too far.”
3	Registered Nurse	2	Strength (1) Weakness (1)	"In the center of both teams so it works." "For us finding staff members, it's hard."
3	Licensed Practical Nurse	4	Strength (4)	"Relatively close to our patient care areas."
4	Primary Care Provider	3	Strength (2)	"Conveniently placed spot, and it is near the preceptor room."
4	Registered Nurse	2	Weakness (2)	"Spread out in relation to my office versus the LPN team room."
4	Licensed Practical Nurse	4	Strength (3)	"Always know where the nurses are going to be."
	Healthcare Administrator	2	Strength & Weakness (1)	"Team [4] is ok cause it is kind of right up front and close to the waiting room. Team [3] is way in the back, kind of secluded. They are away from everybody so for them, it is bad situation."

Overall staff, between the two clinical modules, claim that the team room locations are a strength for the module layout. This clinic contains two types of team rooms in each clinical module that include a provider sub-team room and team rooms that separate staff based on their roles. First, the provider sub-team room, as previously discussed, offers an ideal location with proximity to exam rooms. One primary care provider elaborated on an ideal pod layout in a clinical module, saying “the layout is kind of a triangle, with a provider office and then two assigned exam rooms. Stacking two providers’ offices onto four exam rooms makes a nice hallway, which works well overall” (Primary Care Provider Case 2, 2018). Stacking the provider sub-team offices behind the exam rooms prevents patients from walking past open doors, creating a level of privacy for staff in a clinical module. Furthermore, locating exam rooms in the front of the clinical module fosters a efficient workflow with proximity to the waiting room for staff (Farahmand et al., 2011).

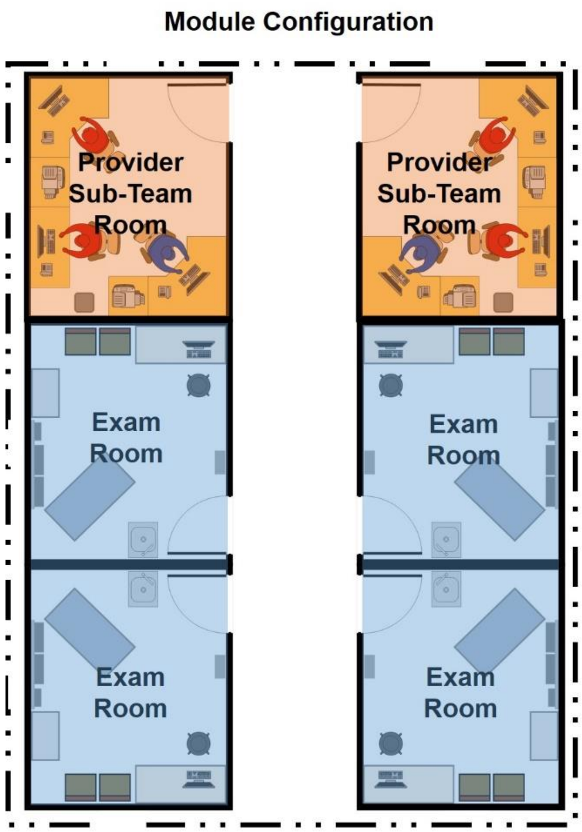


Figure 7.29: Recommended Clinical Module Configuration

Team rooms that separate staff by their roles is a strength and weakness for supporting team-based care. Staff identified the team room location as a strength because of the proximity to exam rooms. The weakness is expressed through prohibiting staff to possess situational awareness for team activities outside the team room. The separation of the registered nurses and licensed practical nurses prevents visual awareness of team member activities and face-to-face interactions. One registered nurse explained that there team rooms are "spread out in relation to my room, with considerable distance. My team is at least one doorway away and not just like right down the hallway. I wish that it was easier to check on the team" (Registered Nurse Interview Case 2, 2018). Consequently, registered nurses rely on wireless communication devices to collaborate and manage the separated licensed practical nurses. This evidence signals a limitation for team collaboration influenced by the physical environment. Limiting collaboration to wireless interactions reduces staff interactions, which is a weakness for the performance of a clincial team (Gunn et al., 2015; Oandasen et al., 2009). Accordingly, locating teams in the same work area or in proximity increases opportunities for face-to-face interactions that enhance the team's performance for patient care.

Table 7.9
Satisfaction with Clinical Module Layout

MODULE	STAFF ROLE	N	SATISFACTION
3	Primary Care Provider	2	50% Satisfied
3	Registered Nurse	2	100% Satisfied
3	Licensed Practical Nurse	4	50% Satisfied
4	Primary Care Provider	3	100% Satisfied
4	Registered Nurse	2	50% Satisfied
4	Licensed Practical Nurse	4	75% Satisfied

Staff satisfaction regarding layouts of the two clinical modules was 71%, with the main dissatisfaction coming from clinical module three. Staff claimed that the clinic was large with multiple hallways and "doesn't flow well or make sense; it feels more like office spaces" (Licensed Practical Nurse Case 2 Interview, 2018). The negative perception of the workflow caused a lower satisfaction rating for staff in clinical module three with 63% compared to 76% satisfaction in clinical module four. Among the lowest staff satisfaction ratings were the clinical module three licensed practical nurses, who travel the longest distances for patient care activities. As a result, the large clinic layout and separation of staff work areas produced lower satisfaction ratings among the staff, especially the licensed practical nurses.

Findings from this section signal that clinical modules with provider sub-team rooms and proximity of registered nurses' workspaces produces a functional layout. Staff expressed the strengths of the pod configurations for a clinical module. Furthermore, locating exam rooms in the front of the provider sub-team room facilitates staff privacy. Accordingly, a clinical module with two pod configurations that consists of four exam rooms, a patient toilet, screening alcove, supply room, and two provider sub-team rooms reduces traffic in the corridor for patient care. At the same time, moving registered nurses' workspaces directly behind the two provider sub-team rooms increases opportunities for visual awareness and face-to-face interactions with the proximity. The clinical module layout discussed in this section illustrates a clear separation of staff work areas and patient care areas. This points out that the existing hybrid layout is not conducive for delivering team-based care.

Table 7.10

Rooms Staff Deem as Shareable Between Clinical Modules

MODULE	**STAFF ROLE**	**N**	**ROOM TYPES** (# of Staff that Identified the Room)
3	Primary Care Provider	2	Treatment Room (2)
3	Registered Nurse	2	Supply Room (1) Treatment Room (1)
3	Licensed Practical Nurse	4	Treatment Room (2) Team Room (1) RN Team Room (1)
4	Primary Care Provider	3	Treatment Room (2) RN Team Room (1)
4	Registered Nurse	2	Supply Room (1) Team Room (1)
4	Licensed Practical Nurse	4	Treatment Room (3)

The treatment room is a shareable room type that is deemed as the most important by staff. Additionally, staff expressed that a treatment room is the most important room for a clinical module. Examining the number of procedures performed by the clinical core teams can reveal a more practical design solution. In this clinic, patient procedures in the treatment room accounted for 2% of the total workload in the clinic. Accordingly, establishing a shared treatment room located between the two clinical modules is a practical design solution. Furthermore, a shareable treatment room reduces the number of room types in a clinical module.

Staff identified other shareable room types as the supply room and a registered nurse team room. The supply room was identified as the second most sharable room type for a functional clinical module by the staff. This finding signals that a clinic supply room (90 NSF), located in a central area, and with smaller supply rooms (60 NSF) in the clinic modules addresses the staff views. The third most sharable room type was the registered nurse team room. A primary care provider expressed that the registered nurse team room "benefits the teams with covering the workloads on a daily basis" (Primary Care Provider Case 2 Interview, 2018). Therefore, locating the registered nurse team room in between the two clinical modules supports accessibility and fluid workflow for the staff.

The floor plan analysis highlights similar and different sharable room types from the staff in the clinic. The similar shareable room types consist of the treatment room, supply room, and registered nurse team room. The sharable room types include immunization, screening alcove, patient education room, clinical pharmacist, and behavioral health provider offices. Four of the sharable room types represent the ancillary services in the clinic that include immunization, patient education room, and specialty provider offices. Clustering these room types in the clinic reduces staff travel to one area of the clinic instead of multiple areas. The fifth room type that is currently shared among the clinical core teams are the six screening alcoves. As previously discussed, the screening alcoves are under-utilized by the clinical core teams. Accordingly, screening alcoves are a functional component for clinical modules, and directly influence the workflow patterns in the clinic. Therefore, locating the screening alcoves in a shareable area for two clinical modules is not ideal to support patient care.

Findings from the previous section and this section demonstrate the room types needed for a clinical module and a shareable module. First, the functional clinical module room types include exam rooms, smaller supply room, team room, screening alcove, and patient toilet. Secondly, functional shareable room types include a treatment room, registered nurses team room, and a supply closet that supports the two clinical modules.

Establishing a shareable module in-between the two clinical modules facilitates equal accessibility to frequently used rooms for staff. Combining other frequently used rooms, such as the patient education room, immunization clinic, and specialty provider's offices enhances staff workflow for patient care activities.

7.4 How the Team Rooms Influence Both Collaborative and Focused Work

Team rooms in the clinical modules are the only dedicated workspace for the clinical core team members including primary care providers, registered nurses, and licensed practical nurses. Private offices are limited to case managers and administrators in the clinical modules. Team rooms need to strike a balance in supporting both collaborative and focused work for staff activities (Gunn et al., 2015). Striking a balance between collaborative and focused work areas produces a higher functioning team (Sinksey et al., 2013). This sub-section analyzes staff opinions through three areas to evaluate collaborative and focused work in the team room: (a) co-locating staff in team rooms, (b) visibility to and from staff work areas, and (c) available private space to complete work that requires focus (Tables 7.11-7.13). In the first section, staff experiences are assessed on where collaboration takes place and how that space supports collaboration. The second section examines staff opinions on the ability to visually connect with team members in work areas. The final section gauges the team room's ability to support work that both requires focus and concentration as well as collaboration.

7.4A Collaborative Work Space- Shared for All Staff in Clinical Module

Collaboration among staff in patient care environments produce a higher functioning team (Sinksy et al., 2013). Colocation of staff with good visual sightlines increases the opportunities for staff to collaborate and communicate for patient care activities (Watkins Gandolf-Frietchen, Siddiqui, 2015; Taylor, Joseph, Keller, Quan, 2011). Findings examine the staff opinions on how the team room supports colocation and visibility of staff work areas.

Table 7.11
Staff Perceptions Concerning Colocating Staff in Team Rooms

MODULE	**STAFF ROLE**	**N**	**PERCEPTION** (# of Staff that Support the Perception)	**EXAMPLE OF EVIDENCE**
3	Primary Care Provider	2	Strength (2)	"Being in the same environment with my nurses facilitates communication."
3	Registered Nurse	2	Strength (2)	"Registered nurses in the same location works smoothly for patient care."
3	Licensed Practical Nurse	4	Strength (4)	"Little easier to talk to staff, when I can just swivel."
4	Primary Care Provider	3	Strength (3)	"Maximize work efforts and bouncing ideas off each other in the team room."
4	Registered Nurse	2	Strength (2)	"Communication wise, it's easy for us to make decisions."
4	Licensed Practical Nurse	4	Strength (4)	"Much easier to communicate."

The colocation of staff in team rooms is a strength for both clinical core teams. All staff members perceived that colocating staff members in the same physical environment enhanced collaboration and communication. An open office team room as illustrated in Figures 7.17-7.19 affords opportunities to naturally collaborate with team members (DuBose, Lim, Westlake, 2015; Quan, Joseph, Keller, 2009). One licensed practical nurse explained that the team room allows for “All of us to be together. I don’t have to go search for anybody, and ask questions out loud to get the information that I need.” (Licensed Practical Nurse Case 2 Interview, 2018). Furthermore, locating clinical staff workstations on the perimeter of the team rooms allows for daily team huddles to occur in the center of the room. As a result, housing similar staff roles together is a strength, while at the same time a weakness. For example, registered nurses were afforded the ability to ask a fellow registered nurses specific questions pertaining to their staff role, which is a strength for the colocation of similar roles. However, the separation of the teams based on staff roles limits collaboration and situational awareness for patient care activities. This evidence points out that the separation of team members based on their roles hinders visibility of staff work areas, which is a weakness for a team-based care environment.

Table 7.12
Staff Perceptions Concerning Visibility of Staff Work Areas

MODULE	**STAFF ROLE**	**N**	**PERCEPTION** (# of Staff that Support the Perception)	**EXAMPLE OF EVIDENCE**
3	Primary Care Provider	2	Weakness (1)	"It's average, nurses back here in the corner that we might not be able to see."
3	Registered Nurse	2	Weakness (2)	"Not very well, you don't know who is where or doing what."
3	Licensed Practical Nurse	4	Weakness (3)	"You can't really see, too many doors and hallways."
4	Primary Care Provider	3	Weakness (2)	"RNs are all the way over here and to find a nurse, you basically have to use Vocera [wireless communication device]."
4	Registered Nurse	2	Weakness (2)	"We can't see any patient care anywhere."
4	Licensed Practical Nurse	4	Weakness (3)	"It's not great because we're here, RN's are over there."
	Specialty Provider	2	Weakness(2)	"Not easy because there are not many wide open spaces and the long hallways."
	Healthcare Administrator	2	Weakness(2)	"You can't actually see if the rest of your team is out so you kind of get tunnel vision."

Staff claim that visibility outside the team room to additional team rooms is a weakness across the two clinical teams. Separation of staff roles into different team rooms hinders the situational awareness of team activities for patient care. One clinical staff member preferred the visibility in a prior clinic, saying "in my past clinic I would just look out the door and look down the hallway to see staff and patients" (Registered Nurse Interview Case 2, 2018). Additionally, a licensed practical nurse discussed the separation of teams as "It kind of segregates us a little bit". (Licensed Practical Nurse Interview Case 2, 2018). This implies that the segregation of staff compromises the potential performance of the team and patient care delivery.

The inability to colocate staff leads to the reliance on wireless communication devices to collaborate. Wireless communication devices, such as vocera, are used by clinical staff to overcome the spatial separation of team rooms. However, not all staff members are receptive in using the wireless communication devices. Consequently, staff preferring not to utilize the wireless communication devices travel unnecessary distances to conduct face-to-face communication with team members.

Spatial separation of clinical core teams hinders team collaboration for patient care activities. Furthermore, wireless communication devices should not be viewed as a bandage for separating staff into different rooms throughout the clinic. The proximity of team members in the same workspace demonstrates the enhancement for staff to communicate with other team members. Additionally, colocating clinical core teams in the same team room creates situational awareness of staff activities throughout the day. Therefore, designing team rooms that house the entire clinical core team or cluster staff workareas supports team-based care.

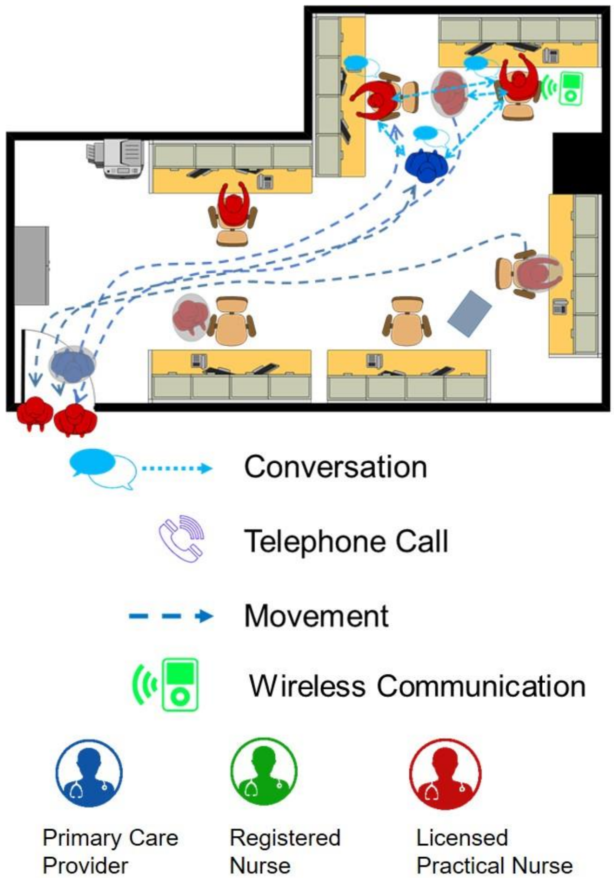


Figure 7.30: Clinical Module 3 Team Room Observation

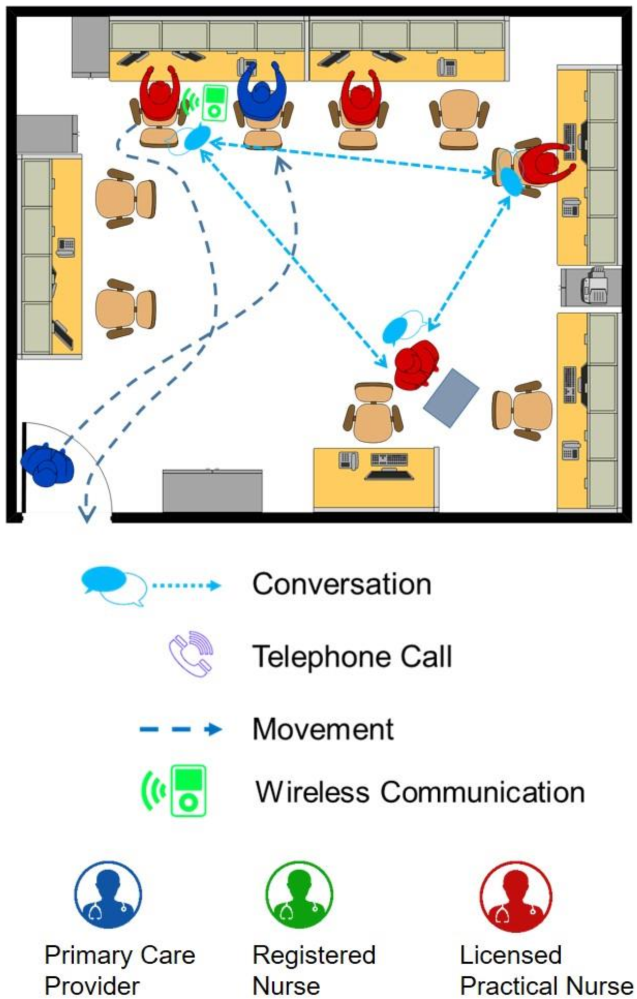


Figure 7.31: Clinical Module 4 Team Room Observation

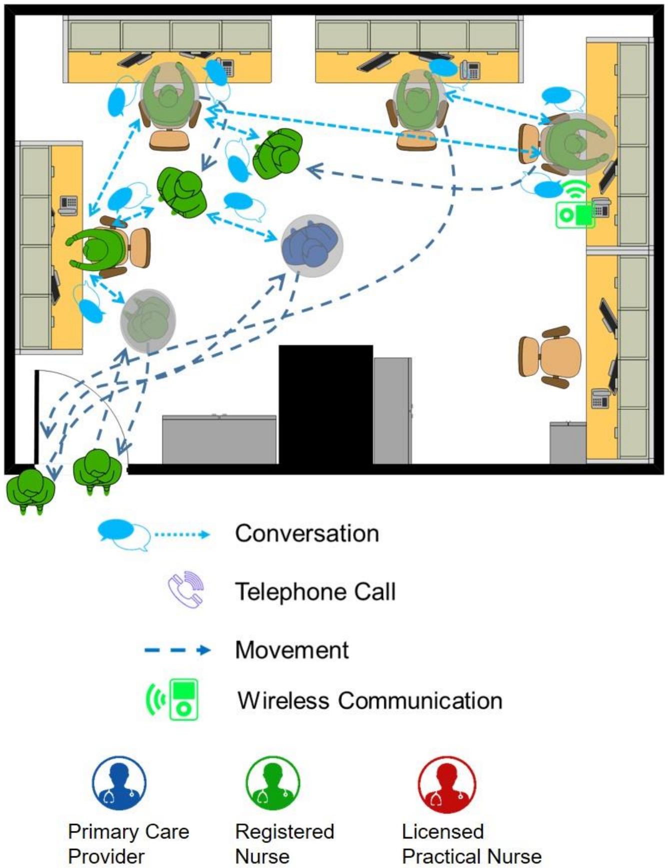


Figure 7.32: Registered Nurse Team Room Observation

7.4B Private Work Spaces: Focused Activities

Patient care requires staff to complete work related activities that require focus and concentration on a daily basis (McGough et al., 2013). Cubicle dividers and private offices for clinical core team workspaces were eliminated from the original design after the MHS implemented the PCMH model in favor of a collaborative environment. Open concept team rooms for this clinic were created with limited private spaces for staff. In this sub-section, staff views were gauged on how the team room affords the ability to conduct work requiring focus and concentration. Direct observations of the team room vared used to cross reference staff perceptions shared in the interviews. Findings in this sub-section examine if staff use the team room or alternative rooms to complete work for private patient care activities.

Table 7.13

Staff Perceptions Regarding the Ability to Complete Focused Activities in the Team Room

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
3	Primary Care Provider	2	Weakness (1)	"I work out of our pod office because I don't need to hear about other patients."
3	Registered Nurse	2	Weakness (1)	"I use a private office, because I have constant interruptions in here like right now [referencing the registered nurse team room]."
3	Licensed Practical Nurse	4	Weakness (2)	"There is a lot of coming and going with staff that cause more distractions."
4	Primary Care Provider	3	Weakness (2)	"Well less people bother me in my private office."
4	Registered Nurse	2	Weakness (2)	"A lot noise in our team room, so I use the PNR room because there is nobody in there."
4	Licensed Practical Nurse	4	Weakness (2)	"Easier for me to concentrate in my exam room."

Excessive distractions caused by the high noise level in the team room undermine the ability for staff to completely focus. Figures 7.22-7.24 illustrate that in five minutes multiple conversations occur simultaneously in the team rooms. Furthermore, wireless communication devices contribute to increased noise levels with staff conducting open-speaker conversations. One licensed practical nurse explained that “there is a lot of coming and going that causes distractions.” (Licensed Practical Nurse Case 2, Interview). As a result, the constant distractions in the team rooms lead staff to find alternative rooms to complete focused work. For example, a licensed practical nurse preferred to work in the exam room because “sometimes I do T-Cons [patient teleconferences] and things because it is quiet.” (Licensed Practical Nurse Case 2 Interview, 2018). Consequently, staff using alternative spaces outside the team room undermines the intended collaborative nature of the team room. Interestingly, staff working in the provider sub-team rooms lack complaints for completing focused work. This hints that the provider sub-team room offers both privacy and a collaborative environment for a team-based approach.

Separating clinical staff roles into different team rooms replicates the physical environment of a traditional physician-centric clinic. Primary care providers and residency students have dedicated workspace in the separate FMRP administrative area for the outpatient wing. Additionally, primary care providers converted under-utilized exam rooms into private offices with proximity to the exam rooms. The two described workspaces benefit the primary care providers and not the nursing staff. Therefore, the nursing staff have to hunt for primary care providers in notifying them of patient appointments. Furthermore, staff constantly use the wireless communication devices to contact the primary care providers. This type of environment fosters a hierarchical staffing model, which limits the capabilities for a team-based approach.

The team rooms work well for collaboration, but poorly for focused work. The open-concept team room is a strength because of the colocation and visibility for team members. At the same time, staff report the open-concept team room as a weakness for private work to complete activities that require focus. Alternatively, the provider sub-team room limits the number of staff in a room, fostering collaboration and the ability to complete focused work. Therefore, the provider sub-team room is a design solution that addresses the staff concerns for completing activities that require focus.

7.5 Discussion

The evaluation of the clinic illustrates how the physical environment enhances and hinders the staff ability to delivery team-based care. Findings from this case study have led to five design factors that enhance the delivery of team-based care: (a) incorporating essential rooms in the clinical module, (b) create the right size clinic, (c) provide space for urgent care services, (d) cluster clinical core team workspaces, and (e) accommodate family and team members in the exam room.

First, incorporating essential rooms in the clinical module establishes the rooms required to create a functional team-based environment for patient care. This clinic indicates that the essential room types include (a) treatment room, (b) exam rooms, (c) supply room, (d) team room, (e) screening alcoves, and (f) patient toilets. Each of these identified rooms offer a specific function for supporting the delivery of care. However, if screening equipment is added to each exam room, there is no longer a need for screening alcoves in each corridor. This means that instead of six room types there should be five types of for the team-based clinical module.

Second, creating the right size clinic naturally enhances the staff workflow in delivering patient care. Clinics sized at 22,000 GSF require additional fire-rated doors that influence staff workflow and visibility. Furthermore, the larger size of this clinic adds to staff travel distances to reach support rooms that include ancillary services and clinical support rooms. As a result, the size of the clinic hinders the staff ability to deliver efficient patient care. The size of the clinic that creates a functional layout to support team-based care is recommended under 20,000 GSF.

Third, providing a space for urgent care service within the clinic improves access to care for patients. Evidence from this clinic indicates that patients want immediate access to care without waiting long wait times in the emergency room. Accordingly, patients use the triage service in the clinic to receive the desired access to urgent care. At the same time, the patients' medical needs exceed the work scope for a primary care clinic. This results in clinical staff spending extra time to escort the patients across the hospital to the emergency room. Therefore, adding an urgent care service to the primary care clinic offers patients access to care, while eliminating unnecessary staff travel distances to the emergency room. Furthermore, adding the service allows the emergency room to focus on trauma and reduce patient wait times. The addition of an urgent care services aligns with the clinic's objective to serve as a gateway into the larger healthcare network.

Fourth, clustering clinical core team workspaces affords staff visibility and proximity to increase collaboration. The provider sub-team room is a micro-scale design solution to support collaboration and focused work. However, the clinical core team needs a macro-scale design solution that supports team-based activities and collaboration. Therefore, creating an open-team room behind the provider sub-team rooms offers a space to accommodate team huddles, collaborative activities, and yet still allows visibility to the clinical module. At the same time, the new team room is located in the "off-stage" area that affords staff privacy from patients.

Lastly, accommodating family and team members in the exam room supports a team-based care approach. The trend of patients bringing extra family members to appointments limits available space in the exam room. The team-based approach in the exam room further limits the available space in the exam room for patient care. At the same time, collocating screening equipment to collect patients' height and weight reduces the space for patient care in an exam room sized at 121 NSF. Therefore, increasing the size of the standard exam room creates more functional sized rooms that align with team-based care activities. The VA, a sister organization to the MHS, increased the standard exam room size to 125 NSF to accommodate the functions of team-based care (Veterans Administration, 2015). Additionally, increasing the size of the exam rooms creates more opportunities for patient care activities in the exam room instead of the treatment room.

Furthermore, the case shows that design decisions made for the PCMH implementation both enhance and hinder team-based care activities. The physical environment enhanced team-based care through two main design factors: (a) team rooms that colocate all clinical core team members, and (b) location of the team room with proximity to the waiting room. Alternatively, the physical environment hindered team-based care with three design factors: (a) misaligned placement of screening alcoves for the clinical modules, (b) lack of private space to complete focused work in the team rooms, and (c) creating a centralized nursing station. This evidence indicates a misalignment between design thinking and how staff actually use the clinic environment to deliver team-based care.

In summary, the five design factors discussed in this section produce evidence based knowledge for primary care clinics. Including the staff opinions and experiences to evaluate a team-based environment established practical design factors that can enhance patient care delivery. The findings from this chapter contribute in developing a database for evaluations of MHS primary care clinics, which can inform new design guidance criteria for the organization.

CHAPTER EIGHT

FINDINGS- CASE 3

The third case selected for review is an embedded-hospital clinic for the MHS. This clinic is located in the northeastern region of the United States and occupies 13,139 gross square feet (GSF) and is recognized as a level two National Committee for Quality Assurance (NCQA) PCMH clinic. The effort to create this clinic was initiated in 2005, using a design-bid-build project delivery method. In 2015, the construction of the clinic was completed and delivering patient care to beneficiaries began. The original design of the clinic resembled a physician-centric clinic, which provided primary care providers with private offices in proximity to exam rooms. The PCMH implementation called for the removal of private offices and the introduction of team rooms. Therefore, private offices were converted into 11 team room configurations to minimalize construction cost. The new team room configurations established team rooms that housed two to five staff in one room. The shift to a PCMH clinic presents an opportunity to evaluate how the changes to the clinic design influence the delivery of team-based care.

The research design for this case study used a qualitative approach using a case study research strategy with ethnographic interviews and observations to collect data. The first data collection method used semi-structured interviews with healthcare planners and an architect to describe the planning and design intentions for the clinic. Next, on-site observation of clinic operations provided insight on how the clinic is used in practice. Finally, semi-structured interviews obtained clinical staff perceptions of how the clinic layout is influencing the delivery of team-based care.

The findings presented for this case study are organized in five sections. Section 8.1 describes the background of the patient care environment, and presents an overview of the clinic layout, team staffing structure, and patient workload for the clinic and teams. Section 8.2 examines how the clinic environment influences workflow by soliciting staff perceptions on the following three design factors: (a) access to support rooms; (b) the proximity of the team room to the waiting room; and (c) sharable circulation pathways. Section 8.3 studies the functionality of the team-based clinical module. The layout of the team-based clinic modules are examined through staff opinions and floor plan analysis across three design factors: (a) types of rooms in the team-based clinical modules, (b) room size, and (c) module layout. Section 8.4 evaluates how team rooms influence collaborative and individual-focused work, using ethnographic observations of staff work patterns to examine: (a) colocation of staff, (b) visibility of staff workspaces, and (c) the space used for individual-focus work. Section 8.5 presents the findings and the design recommendations from the case. This clinic highlights how PCMH implementation influenced the delivery of team-based care in a soldier-centered clinic and importance of the clinic environment. The evidence from this study starts to build a database of strengths and weaknesses for clinic designs that support the PCMH model.

8.1 Description of the Patient Care Environment

Design Method Design-Bid-Build (2005-2015)
Location Northeast United States
Clinic Size 13,139 GSF
Business Hours M-F 0800 to 1600

Total Encounters	**36,478 per year**	
Patient Encounters	19,172 per year	**53%**
Patient Teleconference (TCON)	17,306 per year	**47%**

Clinic averages 108 patients per day
MHS Standard is 190 patients per day (DoD, SPC 2017)

Medical Services

Figure 8.1: Case 3 Overview (Ewing Cole, 2018)

The embedded hospital clinic is part of an outpatient wing attached to a traditional inpatient hospital. The outpatient wing is 50,695 square feet (sq. ft.) that offers primary care, optometry, ophthalmology, physical therapy, and orthopedics services. The inpatient hospital is 134,000 sq. ft. with 18 beds and specialty acute-care services (Ewing Cole, 2015). The outpatient wing provides healthcare services to active duty military soldiers, their family members, and military retirees. The primary care clinic is a gateway to the medical mall and inpatient hospital. The medical mall for the hospital contains five medical services that include (a) immunization, (b) pharmacy, (c) lab, (d) radiology, and (e) emergency room.

The primary care clinic supports two residency programs for the US Army. The two residency program are for the US Army physician assistants (PA) and nurse practitioner (NP) programs. The residency program provides a learning environment to train Army PA's and NP's in primary care. Residency students participate in clinical rotations with direct oversight from board-certified PA's and NP's. The residency program at this clinic includes three students that perform patient care alongside primary care providers in the clinic. Therefore, primary care providers and residency students spend extra time reviewing treatment plans for patient appointments, which influences staff workflow in the clinic.

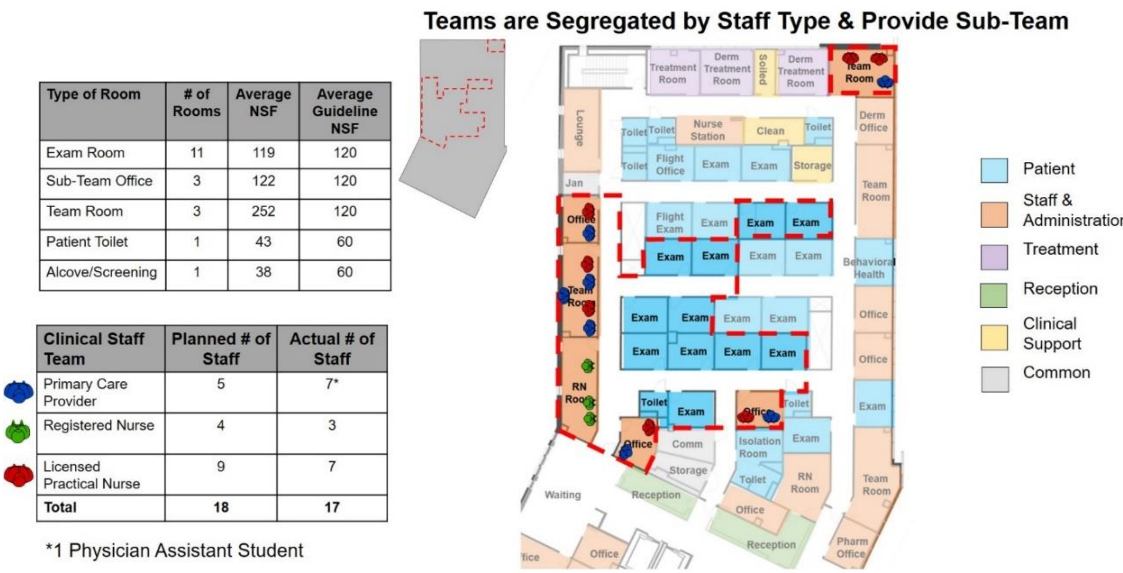
Primary care is delivered using a team-based approach to patient care in which physicians, registered nurses and licensed practical nurses work side-by-side as a team. Two clinical teams work in two separate clinical modules (indicated in red and green areas in Figure 8.2). The clinic provides patient care through two clinical teams that are independent of one another. The two clinical teams provide patient appointments for routine care, acute care, procedures, wellness visits, and teleconference consultations. Ancillary services within the clinic include dermatology, flight exams, patient education, behavioral health and clinical pharmacist consults. Locations for the ancillary services are located throughout the clinic as indicated in purple for Figure 8.3. The inpatient hospital provides the clinic with the previously discussed medical mall.

Figure 8.2: Case 3 Clinical Module Layout

Figure 8.3: Support Rooms in the Clinic

8.1A Description of Team-Based Clinical Modules

The team-based clinical modules in this embedded hospital clinic offer two slightly different variations. A team-based clinical module is a group of spaces that contain exam rooms, team workspaces, and storage areas that support clinical core teams in delivering effective patient care (DuBose, Lim, Westlake, 2015; Whiteaker, 2015; Belknap & Lafferty, 2011; Taylor, Joseph, Keller, Quan, 2011). The two clinical modules support 31 staff members with 19 exam rooms in 4,535 Net Square Footage (NSF) (Figure 8.4 and 8.5). In the front of the clinic is the public waiting area, reception desks, and public restrooms that occupy 1,736 NSF. Clinical module five includes six team rooms, one screening alcove, one patient toilet, and eleven exam rooms. Clinical module six contains five team rooms, one patient toilet, one screening alcove, and eight exam rooms.



Type of Room	# of Rooms	Average NSF	Average Guideline NSF
Exam Room	11	119	120
Sub-Team Office	3	122	120
Team Room	3	252	120
Patient Toilet	1	43	60
Alcove/Screening	1	38	60

Clinical Staff Team	Planned # of Staff	Actual # of Staff
Primary Care Provider	5	7*
Registered Nurse	4	3
Licensed Practical Nurse	9	7
Total	18	17

*1 Physician Assistant Student

Figure 8.4: Clinical Module 5 Layout

Teams are Segregated by Staff Type & Provider Sub Teams

Type of Room	# of Rooms	Average NSF	Average Guideline NSF
Exam Room	8	121	120
Patient Toilet	1	43	60
Sub-Team Office	4	201	120
RN Room	1	219	120

Clinical Staff Team	Planned #	Actual #
Primary Care Provider	5	6*
Registered Nurse	4	2
Licensed Practical Nurse	9	6
Total	18	14

Figure 8.5: Clinical Module 6 Layout

8.1B Description of Clinical Core Team Structure

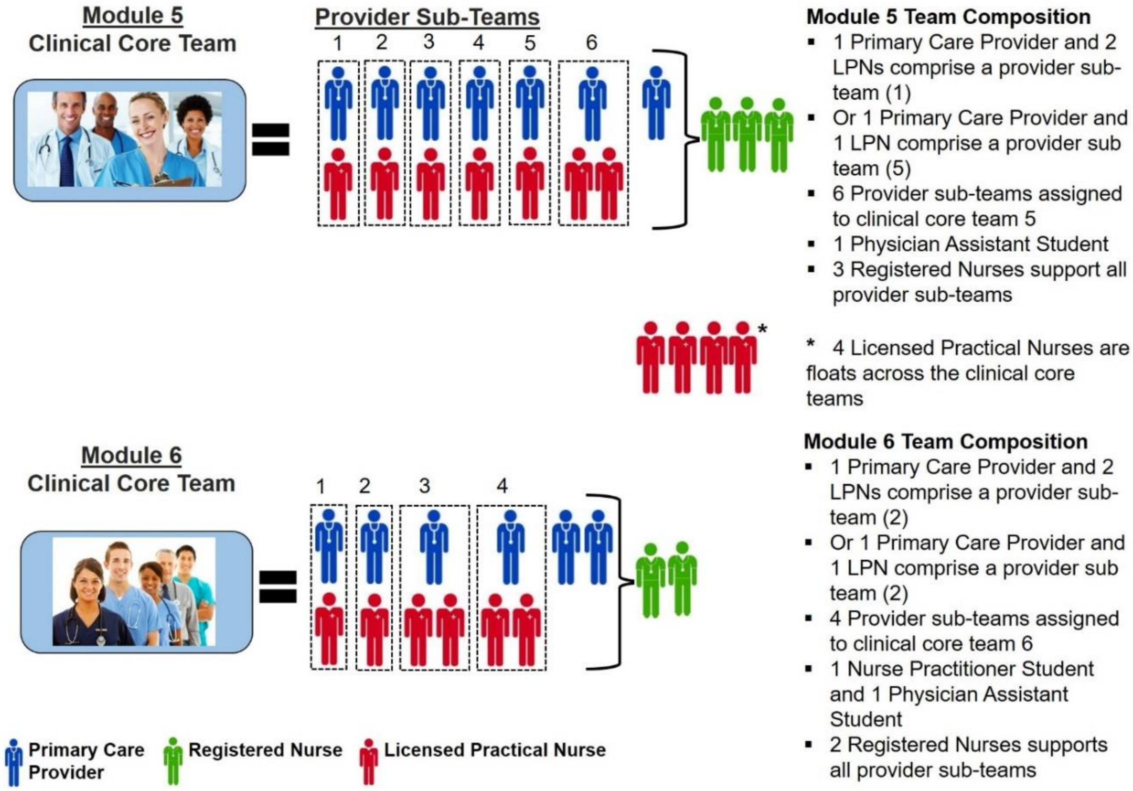


Figure 8.6: Case 3 Clinical Core Teams Composition (Bon Secours, 2017; Halos Daily, 2018)

Utilizing a team-based approach, each clinical core team is led by the primary care provider and supported by nursing staff (Figure 8.6). Staffing for the two clinical core teams consists of active duty military soldiers, government service members, and/or government contracted employees. Clinical core team five includes 17 staff and team six contains 14 staff who are a combination of primary care providers, residency students, registered nurses, and licensed practical nurses.

Clinical core team five is comprised of five provider sub-teams, one residency student, and three registered nurses. The provider sub-team structure contains one primary care provider and one or two licensed practical nurses. Three provider sub-teams work out of provider sub-team rooms located throughout the clinical module. The other two provider sub-teams are collocated in a provider sub-team room on the perimeter of the clinical module. Three registered nurses are responsible for managing daily workflow, supervision of licensed practical nurses, and patient education. The registered nurses are colocated in a separate team room in the front of the clinical module.

Clinical core team six is comprised of four provider sub-teams and two registered nurses. The provider sub-team structure contains one primary care provider and one or two licensed practical nurses. All four of the provider sub-teams are housed in separate provider sub-team rooms on the perimeter of the clinical module. Two registered nurses are responsible for managing daily workflow, supervision of licensed practical nurses, and patient education. The registered nurses are colocated in a shared office at the front of the clinical module. In addition, four licensed practical nurses located in a separate shared office act as floaters for both clinical core teams.

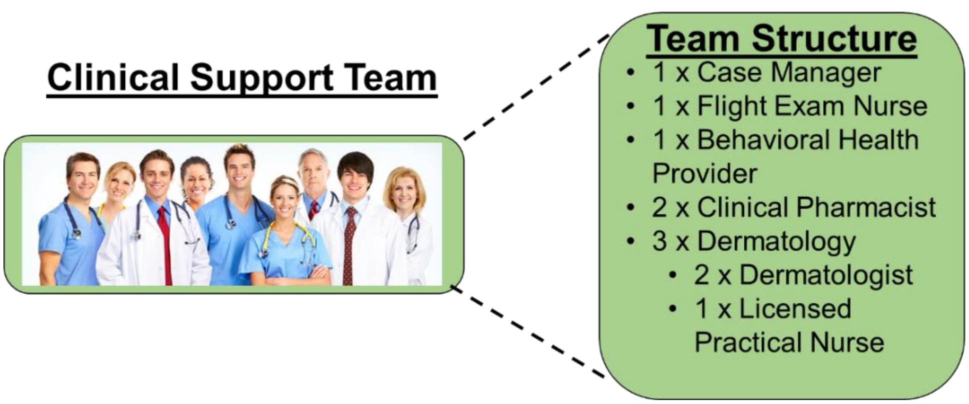


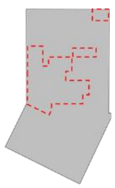
Figure 8.7: Clinical Support Team Structure (Red Alfa Neuorciencias, 2017)

The clinical support team consists of one case manager, one population health nurse, two clinical pharmacists, one behavioral health provider, two dermatologists, one dermatology licensed practical nurse, and one flight exam nurse. The case manager for both clinical core teams is a registered nurse, who is located in an office adjacent to the waiting room. The flight exam nurse provides specialized flight physicals in exam room and private office (as indicated in Figure 8.7). The behavioral health provider and two clinical pharmacists provide consultations for both clinical core teams. The behavioral health provider is located in a private office on the perimeter of clinical module six (as indicated in Figure 8.7). The two clinical pharmacists share an office located in between clinical module six and the waiting room. The dermatology section supports two dermatologists and one licensed practical nurse. The two dermatologists share an office located behind clinical module six. The dermatologist licensed practical nurse shares a team room with staff from clinical module five in the back of the clinic. The dermatology workspaces allow staff to have proximity to an exam room and two treatment rooms in the clinic.

8.1C Description of Patient Workload

The annual patient workload for the clinic fell under the standard benchmark established by the MHS. The MHS establishes patient workload standards based on every exam room, accounting for ten daily face-to-face patient encounters for 240 days per year (DoD Space Planning Criteria, 2017). Patient care took place five days a week, eight hours per day, accounting for 36,478 patient encounter in 2016 for the entire clinic. Therefore, the annual patient workload for face-to-face patient encounters missed the

MHS benchmark by approximately 15,000 patient encounters. Alternatively, patient teleconferences (TCONs) are not calculated in the annual patient encounter workload, but counted for an additional 17,306 patient encounters. Furthermore, clinical core team five produced 54% of face-to-face patient encounters, while clinical core team six produced 52% of the total patient teleconferences. This means that half of the adult patients are using TCONs to gain access to patient care.



Performance Metrics	MHS Planned	Actual #	Utilization (%)
# Exam Rooms		11	
Daily Exam Room Workload	10 Pts	4 Pts	
Annual Average Visit per Exam Room	2,304 Pts per room	941 Pts per room	41%
Annual Patient Workload	25,344 Pts for all rooms	10,346 Pts for all rooms	41%

Note:
* Pts= Patients
** Workload numbers are based on the annual patient workload, which was provided by the MHS.

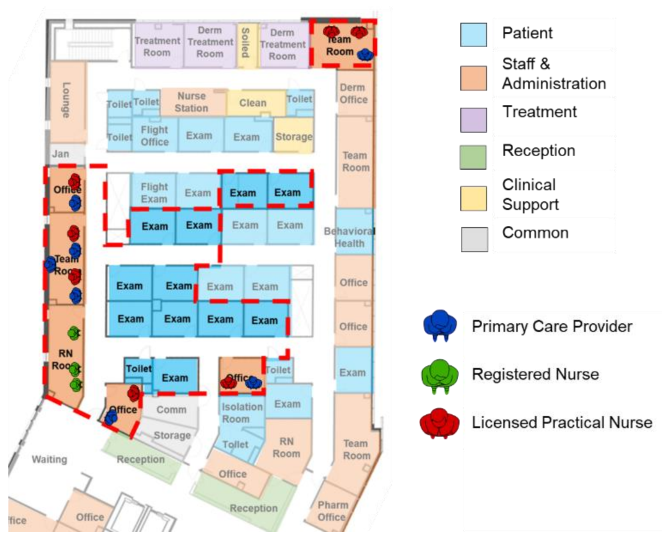
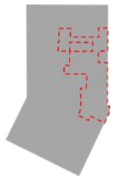


Figure 8.8: Case 3 Clinical Module 5 Patient Workload Overview



Performance Metrics	MHS	Actual	Utilization (%)
# Exam Rooms		8	
Daily Exam Room Workload	10 Pts	4 Pts	
Annual Average Visit per Exam Room	2,304 Pts per room	1,103 Pts per room	**48%**
Annual Patient Workload	18,432 Pts for all rooms	8,826 Pts for all rooms	**48%**

Note:
* Pts= Patients
** Workload numbers are based on the annual patient workload, which was provided by the MHS.

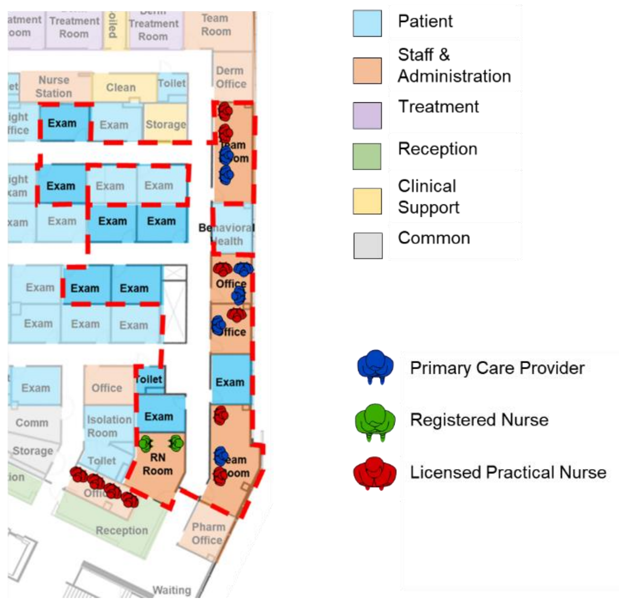


Figure 8.9: Case 3 Clinical Module 6 Patient Workload Overview

8.1D Original Design Intentions

MHS design guidance criteria prior to 2005 did not address a team-based approach for primary care. Furthermore, the original design of the clinic predated the incorporation of a T-shaped clinic layout that clearly separates staff and patient areas. Instead the clinic design resembled a traditional physician-centric clinic. The architect for the clinic says of the location of staff workspaces, “Ultimately we wanted to locate the clinical staff in an area that provided efficiency” for patient care (Architect Case 3 Interview, 2018). The architect implied that the staff offices would be in close proximity to the exam rooms. Therefore, private offices for the clinical staff were located on the perimeter of the clinic, while exam rooms were located in the central area of the clinic (indicated in Figure 8.10). The proximity of 12 private staff offices to the 23 exam rooms fostered the desired efficiency for the clinic layout.

Figure 8.10: Case 3 Original Clinic Layout

The original clinic layout supported three main sections to support patient care. The clinic was split right down the middle between the two main sections (as indicated in Figure 8.10). The first main section was for pediatric services and located on the left side of the clinic. The pediatric services contained eleven exam rooms, six offices, one screening alcove, and one patient toilet. The second main section was an internal medicine service located on the right side of the clinic, which provides primary care for adults 18 years or older The internal medicine service consisted of ten exam rooms, six offices, one screening alcove, and one patient toilet. The two main sections in the clinic each occupied a treatment room located in the back of the clinic. The last section was allocated for dermatology, located behind the internal medicine section in the clinic. The dermatology section included one exam room, one office, and one treatment room (as indicated in purple for Figure 8.10).

Support rooms were located throughout the clinic to support patient care delivery. The back horizontal corridor supports the treatment rooms as previously discussed. Additionally, two main support rooms were located in the front of the clinic that included an isolation exam room and immunization room. First, the isolation exam room is located in the front of the clinic that is accessible through a third vertical corridor. Accordingly, the third vertical corridor links the patient waiting area to the isolation exam room and an administration space that houses licensed practical nurses who are floaters in the clinic. Second, the immunization room is located at the front of the clinic on the internal medicine side of the clinic. The location of the immunization room allowed patients to receive necessary medical shots, such as the flu shot, either before or after a medical appointment.

The circulation pathways for the original clinic design mirrored a physician-centric model (indicated in Figure 8.11). The two main entrances for the clinic established vertical corridors for that were shared between staff and patients to access patient care rooms. Patient care rooms, such as exam and treatment rooms, were located off four horizontal corridors. The first three horizontal corridors contained spaces for all of the exam rooms in the clinic. The fourth horizontal corridor contained three treatment rooms, the nurse station, clean and soiled linen rooms, and a non-stress test room. As a result, staff privacy is compromised as patients walk directly past staff workspaces before arriving to the exam rooms.

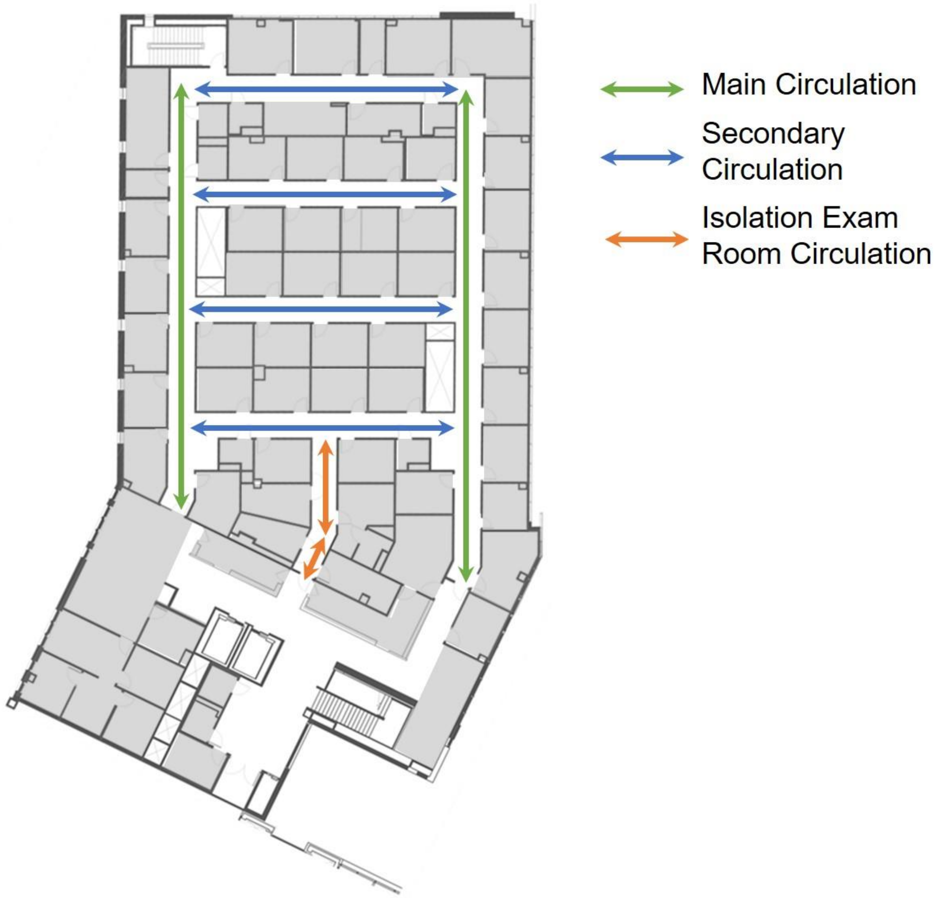


Figure 8.11: Case 3 Circulation Patterns

The location of the clinic to the attached hospital established a medical mall for outpatient services. The architect for the clinic explained that “the overall concept was to create a medical mall concept for the main level of the hospital with a variety of outpatient services and primary care clinic at the end of the hallway” (Architect Case 3 Interview, 2018). The medical mall provided a centralized location that linked outpatient care services together, including primary care, lab, immunization, radiology, pharmacy, and emergency room. Furthermore, a central stair case directed patients from the parking lot to the main floor that housed the primary care clinic and medical mall. As a result, the layout promoted the primary care clinic as a gateway to outpatient services and the larger hospital network.

In 2006, the construction project for the new outpatient wing came to a halt due to Government funding restrictions (USACE Standard Form 330, 2015). Consequently, the design phase for the new outpatient wing stopped at the 65% design phase. In 2009, the project received new government funds to complete the 100% design solution (Healthcare Planner Case 3 Interview, 2018). At the same time, the MHS adopted the PCMH model without providing guidance for new design requirements for the physical environment. This meant that not only was the project designed prior to 2006 design guidance criteria, but also before the PCMH implementation.

8.1E PCMH Model Adoption

The PCMH model implementation resulted in additional design modifications to create clinical modules and team rooms that took effect in 2011. The new outpatient wing started construction in 2010, allowing limited changes, due to inadequate construction funds, to convert the clinic layout for a team-based approach. Therefore, the design team converted and combined existing clinic spaces to align with the guidance from the newly published MHS PCMH Guide (MHS, 2011). The architect for the clinic explained that the original clinic design created “A lot of boxes compared to the private sector, which allowed for toggling back and forth of those boxes’ functions” (Architect Case 3

Interview, 2018). The boxes are the offices and exam rooms sized at 120 NSF, which allows for interchangeability of spaces for the designers and healthcare leadership.

Figure 8.12: Case 3 PCMH Implementation

Combining private offices into team rooms supported the new requirements for PCMH implementation (as indicated in Figure 8.12). The main goal was to create team spaces that promoted staff collaboration in the clinic. One healthcare planner described that “We doubled up office spaces to maximize administration space without reducing or increasing the clinic footprint.” (Healthcare Planner Interview Case 3, 2018). As a result, the original 13 private offices became four team rooms, two shared offices, one private office, and one consult room (MHS Presentation, 2012). The four team rooms were intended to support four staff members that included one primary care provider, one registered nurse, and two licensed practical nurses (Healthcare Planner Interview Case 3, 2018). However, registered nurses were taken out of the team rooms and colocated in a shared office space in the clinical modules. This initiative was intended to assist the registered nurses with patient teleconferences (Healthcare Planner Interview Case 3, 2018). As a result, the team rooms supported two primary care providers and two licensed practical nurses that established the provider sub-teams. The converted spaces required minimal changes for the clinic layout, and at the same time supported staff workflow with proximity of workspaces to exam rooms.

The new design modifications resulted in pod configurations embedded in the clinical modules. As previously discussed, the clinic was split in half to support the two main sections. This resulted in ready-made clinical modules to align with the team-based care approach. Furthermore, the conversion of private offices into team rooms facilitated a pod configuration within the clinical modules. The pod configuration established one team room in proximity to four exam rooms in the clinical modules. Therefore, clinical module five included three team rooms that supported eleven exam rooms, while clinical module six contained three team rooms with ten exam rooms (as indicated in Figure 8.13 & 8.14).

Figure 8.13: Pod Configurations in the Clinical Module 5

Figure 8.14: Pod Configurations in the Clinical Module 6

The PCMH implementation introduced new requirements for housing the clinical support team. The new requirements established the integration of a behavioral health provider, clinical pharmacist, and a case manager in the clinic (as indicated in Figure 8.8). Therefore, offices were converted into clinical support offices. First, the behavioral health provider office was located in the one available office in the clinic, providing accessibility for both clinical core teams. Second, the clinical pharmacist office was located outside the clinic behind the pediatric section waiting room. The placement of the clinical pharmacist office was intended to reduce travel distances to the hospital pharmacy and primary care clinic. Third, the case manager office was located in between the internal medicine section and the waiting room. This location allowed patients to schedule appointments with the case manager outside the clinic. Additionally, staff in the clinic could easily escort patients to the case manager office after a medical appointment.

MHS restriction for modifications during construction limited the ability to convert the clinic into a team-based care environment. Accordingly, two main modifications occurred in converting spaces to accommodate the functions of a PCMH model. First, private staff offices were combined to create team rooms and improve the staff's ability to collaborate. Second, office spaces were converted to accommodate the integration of the clinical support team in the clinic. The original support rooms in the clinic received no modifications in the updates to the clinic. As a result, the clinic layout replicated a physician-centric model with team rooms on the perimeter of the clinic. This meant that there was no clear separation of patient and staff areas. Therefore, the clinic layout was not representative of the T-shape layout predominately exemplified in MHS design guidance criteria.

8.1F User Occupancy

After construction for the clinic was completed, leadership altered spaces in the clinic to align with new medical service functions. The healthcare leadership made four alterations for new medical services that influenced the clinic layout. First, the leadership incorporated a separate flight physical service into the clinic. The flight physical service occupied two exam rooms originally allocated for clinical module five. Second, the non-stress test room was removed from the clinic and replaced as office space. These two changes resulted in staff from clinical module five occupying the new office space along with reallocating two exam rooms from clinical module six. At the same time, clinical module six gained an exam room from clinical module five. Third, the dermatology section was given an additional treatment room to accommodate the high volume of patient procedures. As a result, this left one treatment room to be shared among the two clinical core teams. Finally, the immunization section relocated to an external space in the medical mall for the hospital. Subsequently, the registered nurses moved into the vacant immunization room and converted their prior office space into an exam room. The conversion of the office space into the exam rooms allowed clinical module six to include eleven exam rooms.

Figure 8.15: After User Occupancy Clinic Layout

The healthcare leadership repositioned staff in the clinic to provide more accommodating workspaces. The leadership made three distinct alterations for staff workspace in the clinic. First, the three registered nurses in clinical module five moved into the team room across the hallway. This resulted in the provider sub-team moving into the prior registered nurse office space. Second, one office space and two exam rooms from clinical module six were reallocated to clinical module five. This reallocation of spaces was completed due to an extra primary care provider in clinical module five. Last, the one consult room and one exam were turned into two provider sub-team rooms. The two provider sub-team rooms each housed one primary care provider and one licensed practical nurse for clinical module six. Furthermore, this meant that clinical module six went from eleven to eight exam rooms after all of the modifications.

The leadership outfitted the exam rooms with additional screening equipment to reduce unnecessary traffic in the corridors. The exam rooms were outfitted with height and weight equipment to allow for all screening activities to occur in the rooms. This initiative reduced patient traffic in front of the two clinical modules. As a result, the two screening alcoves for the clinical modules are under-utilized to support patient care activities in the clinic.

The chronological overview of the clinic shows how PCMH implementation and user occupancy altered the original design of the clinic. The analysis establishes three key modifications from the original design. First, private offices were converted into team rooms to enhance collaboration. Second, the proximity of the team rooms and exam rooms established pod configurations within the clinical modules. Lastly, the clinical module layouts were altered to accommodate the addition and subtraction of medical services. Therefore, the alterations established a new clinical module layouts that are untested in understanding how the physical environment influences team-based care. Findings in the next three sections examine the themes that emerge from staff experiences of how the physical environment influences patient care.

8.2 Workflow Concerned with the Overall Clinic Design

The layout of a clinic directly influences the staff workflow for delivering patient care by creating shorter or longer travel distances when performing commonly performed patient care activities. Efficient clinic workflow is the ability to minimize staff travel distances and reduce unnecessary effort to deliver patient care (Thompson & Pelletier, 1959; Freihoefer et al, 2017). Staff perceptions of clinic workflow are evaluated through three themes: (a) accessibility to support rooms, (b) proximity of team room to waiting room, and (c) sharing of staff and patient corridors (Tables 8.1-8.4).The first sub-section on accessibility to support rooms examines how the staff feel about travel distances to frequently-used rooms for delivering care outside the clinical module. The second sub-section appraises the staff views for traveling from the team room to the waiting room to get new patients or escort patients out. The final sub-section examines staff opinions in sharing corridors with patients to deliver patient care.

8.2A Access to Support Rooms

Clustering the most frequently used areas outside, yet nearby the clinical modules nearby can enhance staff workflow for patient care. The proximity of support rooms to team rooms creates efficient workflow for staff in supporting patient care delivery

(CADRE, 2015, Battisto et al., 2009; Boulder Associates, 2011). Support rooms located outside the clinical modules are ancillary services and clinical support rooms. Ancillary services include the point-of-care lab, audiology, radiology, and immunization as indicated in purple for Figure 8.10. Clinical support rooms consist of the medical storage, clean and soiled linen rooms, treatment room, isolation exam room, and an overflow exam room as indicated in yellow for Figure 8.10. Findings in this sub-section evaluate staff views in traveling to frequently-used support rooms outside the clinical modules.

Table 8.1
Staff Perceptions of Support Rooms Most Frequently Used

MODULE	**N**	**ROOM TYPES** (# of Staff that Identified the Room)
Primary Care Provider	4	Emergency Room (2) Radiology (1) Lab (1) Treatment Room (1)
Registered Nurse	4	Lab (3) Emergency Room (1) Radiology (1) Pharmacy (1)
Licensed Practical Nurse	6	Lab (6) Radiology (3) Pharmacy (3) Immunization (1)
Specialty Provider	2	Lab (1) Pharmacy (1) Emergency Room (1)

The lab is the most frequently traveled to support room, especially with the licensed practical nurses. A lab offers support in conducting initial specimen testing to determine patient illnesses during a medical appointment. Furthermore, licensed practical nurses primarily complete the task of dropping off the lab test after the initial patient screening occurs. At the same time, this stance aligns with the licensed practical nurses claiming a weakness for proximity to the lab. Similarly, registered nurses identified the lab as the most frequently traveled to support room. This finding illustrates the importance of a lab in supporting the delivery of patient care.

Clinical staff identified the pharmacy, radiology, and emergency room as additional frequently visited support rooms. The three identified support rooms are located in the medical mall for the inpatient hospital. As previously stated the medical mall and hospital are undergoing a renovation project. Therefore, staff escort the patients to these support rooms so they don't get lost in the hospital. Additionally, patients with urgent care injuries who come to the clinic are escorted to the emergency room located on the opposite side of the hospital. The hospital renovation project is influencing staff workflow for patient care. The completion of the renovation project may lead to different results than currently represented.

The findings from this sub-section align with the previous section on efficient workflow in the clinic. Clustering frequently used support rooms in the clinic reduces staff travel distances for supporting patient care (Battisto et al., 2009). The findings signal that the lab is a critical function for supporting staff workflow in the clinic. Accordingly, colocating a scaled-down lab in the clinic enhances staff workflow, especially for the licensed practical nurses.

Table 8.2

Staff Perceptions Concerning Proximity of Team Room to Support Rooms

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
5	Primary Care Provider	2	Weakness (1)	"Treatment room is so far away from our nurses and everybody else feels like it's almost unsafe to put a sick patient back there, because there's no direct eyes on the room."
5	Registered Nurse	2	Strength (2)	"The distances are fine outside the clinic."
5	Licensed Practical Nurse	4	Weakness (3)	"Having a lab test right within our clinic is optimal."
6	Primary Care Provider	2	Non-Issue (2)	"I don't have to go to the supply room in the clinic."
6	Registered Nurse	2	Strength (2)	"I don't think the distances are bad outside of the clinic."
6	Licensed Practical Nurse	2	Weakness (1)	"When you're one per doc, it's very difficult to get to the lab and back in a timely manner."
	Specialty Provider	2	Strength (1)	"It's fine, the lab is just down the hall."

The proximity of support rooms inside and outside the clinic lead to mixed opinions. Staff identified both strengths and weakness for proximity of support rooms for the clinic. First, primary care providers claim a neutral stance on the proximity to support rooms. This is credited with the role of primary care providers, as the main priority is to focus on patient care in the exam room. Secondly, registered nurses and specialty providers claim that the proximity of support rooms is a strength. The location of their workspaces in the front of the clinic cuts down on travel distances to support rooms located in the medical mall of the hospital. One registered nurse described the proximity to support rooms in the medical mall as being “one minute away, two minutes tops” (Registered Nurse Case 3 Interview, 2018). Furthermore, these staff roles don’t have the added stressors of conducting 20 patient appointments per day. Therefore, the registered nurses and specialty providers don’t claim a weakness for the proximity to support rooms.

The licensed practical nurses across the two clinical modules claim that proximity to support rooms is a weakness for the clinic. Specifically, the licensed practical nurses identified the proximity to the medical mall as a weakness. One licensed practical nurse explained that challenge with the proximity to the medical malls as, “I feel like we’re in two separate buildings. I don’t like it because I feel like it delays patient care.” (Licensed Practical Nurse Case 3 Interview, 2018). Additionally, the current medical mall and hospital are undergoing a construction renovation project. As a result, the staff are required to travel through alternative areas instead of a direct path to support rooms in the medical mall. Following the completion of the renovation, staff may alter their opinions with regards to proximity to support rooms. However, the licensed practical nurses claimed that colocating a point-of-care lab in the clinic would improve the workflow for patient care.

The direct observations of the clinic revealed an additional weakness with the colocation of isolation exam rooms in primary care clinic. The observations identified the reasoning why isolation exam rooms are under-utilized in this primary care clinic. First, staff knowledge on a patient’s condition is limited to information willingly provided during the scheduling of a medical appointment or by identify the patient’s condition for a walk-in appointment. Second, patient’s that neglect to inform or unknowingly describe their exact condition present an obstacle to identifying highly contagious virus symptoms. Therefore, lacking the knowledge of the symptoms causes the patient to be processed through the normal steps for a routine patient appointment (as indicated in Figures 8.16 & 8.18). As a result, patients with a highly contagious virus are placed in a standard exam.

Staff then conduct the standard patient screening activities and discover the highly contagious virus. The next step for the staff is to notify the clinic leadership of the patient's condition and quarantine the area around the exam room.

Furthermore, the patient is not moved to the isolation exam room to help prevent exposing other individuals to the contagious virus. Instead, the isolation exam room is left vacant in anticipation of a potential patient with a contagious virus. This leaves the placement of an isolation exam room in a primary care clinic in conflict with the actual operations performed for a patient identified with a contagious virus. This finding demonstrates that locating an isolation exam room in a primary care clinic seems to misalign with how patient care for a patient with a contagious virus is performed.

The proximity of support rooms hinders the staff workflow for delivering patient care. This section illustrates two main themes for proximity to support rooms for the clinic. First, the separation of ancillary services, such as the immunization and lab, require licensed practical nurses to travel outside the clinic. Consequently, this creates added stressors of rushing to the support room in the medical mall and then returning back to the clinic for the next patient appointment. Second, the isolation exam room is an under-utilized space in the clinic for patient care. The under-utilization of the isolation exam room implies that there are limited benefits for placing this room in primary care clinics. Interestingly, the community-centered clinics for the MHS don't provide a specialized isolation exam room. This finding points out the misalignment of the MHS design guidance criteria requiring this type of space in primary care clinics.

8.2B Proximity of Team Room to Waiting Room

A common staff activity for delivering patient care is performing a patient medical appointment, as discussed in chapter four. Each provider sub-team is expected to see 20 patients per day, which can result in a licensed practical nurses to travel 40 times from the team room to the waiting room to pick up and drop off a patient. Travel distances to support the 20 medical appointments should ideally be minimized to support staff workflow. This sub-section addresses staff travel distances for a routine patient appointment. Travel distances for staff are discussed based on their perceptions regarding traveling from the team room to the waiting room. These two rooms represent the starting and end points for a patient appointment as discussed in chapter four. The travel distance between these two rooms were calculated from the floor plan measurements. Findings in this sub-section examine the perceived strengths and weaknesses for travel distances that support routine patient appointments.

Table 8.3

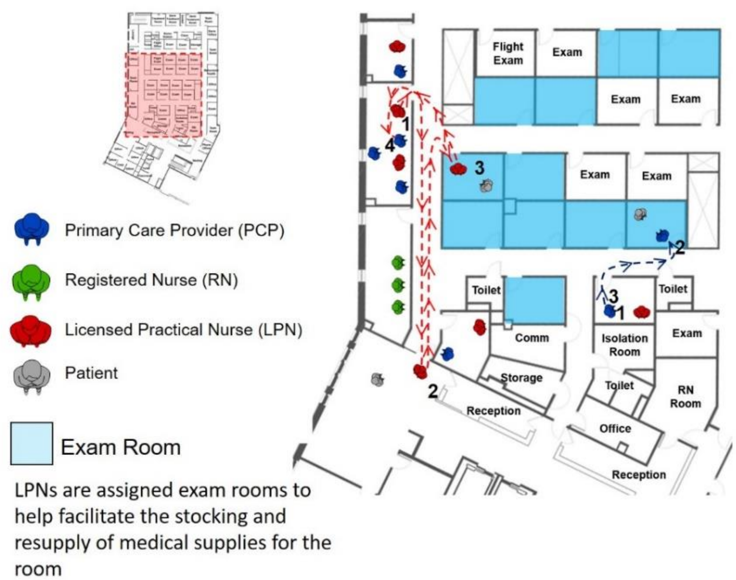
Staff Perceptions Concerning Proximity of Team Room to Waiting Room

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
5	Primary Care Provider	2	Strength (1)	"No, my exam rooms are just down the hall and turn the corner."
5	Registered Nurse	2	Strength (2)	"It's easy for me to get in and out of patients rooms."
5	Licensed Practical Nurse	4	Strength (4)	"Good, not very far walk from our office to our exam rooms."
6	Primary Care Provider	2	Strength (2)	"Exam rooms are a few paces away."
6	Registered Nurse	2	Strength (2)	"I don't have a problem with the distances."
6	Licensed Practical Nurse	2	Strength (2)	"Exam room to the waiting room is actually close."

The proximity of the team rooms to the waiting room is a strength between the two clinical modules. Team rooms are broke up into five provider sub-team rooms in clinical module five and four rooms in clinical module six. Staff average travel distances for a patient appointment range from 26 ft. to 293 ft. across the nine provider sub-team rooms. The primary care providers have the shortest travel distances that range from 26 ft. to 107 ft. for patient appointments. One primary care provider claimed that travel distances inside the clinical module are “more than adequate” (Primary Care Provider Case 3 Interview, 2018). These claims are credited with the fact that primary care providers mainly travel from the team room to the exam room and back to the team room.

On the other hand, licensed practical nurses travel the longest distances in the clinical module for patient care. Licensed practical nurses’ travel distances range from 86 ft. to 293 ft. between the two clinical modules. One licensed practical nurse jokingly claimed that “I don’t like the distances for me because I don’t get enough steps in for the day” (Licensed Practical Nurse Case 3 Interview, 2018). The “steps” reference expresses the individuals desire to complete the recommended 10,000 daily steps to promote a healthy life-style (Locke & Basset, 2004; Choi, Pak, Choi, 2007). Furthermore, patient initial vital screening occurs in the exam rooms instead of the corridor, which reduces unnecessary steps for the licensed practical nurses.

The findings illustrate that locating the provider sub-team rooms in proximity to the waiting room enhances staff workflow. Furthermore, the findings illustrate that primary care providers’ travel distances are prioritized over the licensed practical nurses travel distances. At the same time, licensed practical nurses claim the travel distances inside the clinical modules as strength. This hints that travel distances for medical appointments that range from 86 ft. to 293 ft. are acceptable for licensed practical nurses.



Step #	Staff	Activity
1	PCP	Leave Office
2	PCP	Enter Exam Room
3	PCP	Return to Office

Step #	Staff	Activity
1	LPN	Leave Team Room
2	LPN	Greet Patient
3	LPN	Escort Patient to Exam Room
4	LPN	Return to Team Room or Provider Office

Figure 8.16: Clinical Module 5 Staff Workflow for Routine Patient Appointment

Staff Role	Average Distance Traveled
PCP	72 ft
LPN	86 ft

Staff Role	Average Distance Traveled
PCP	26 ft
LPN	157 ft

Staff Role	Average Distance Traveled
PCP	69 ft
LPN	139 ft

Staff Role	Average Distance Traveled
PCP	107 ft
LPN	193 ft

Staff Role	Average Distance Traveled
PCP	96 ft
LPN	293 ft

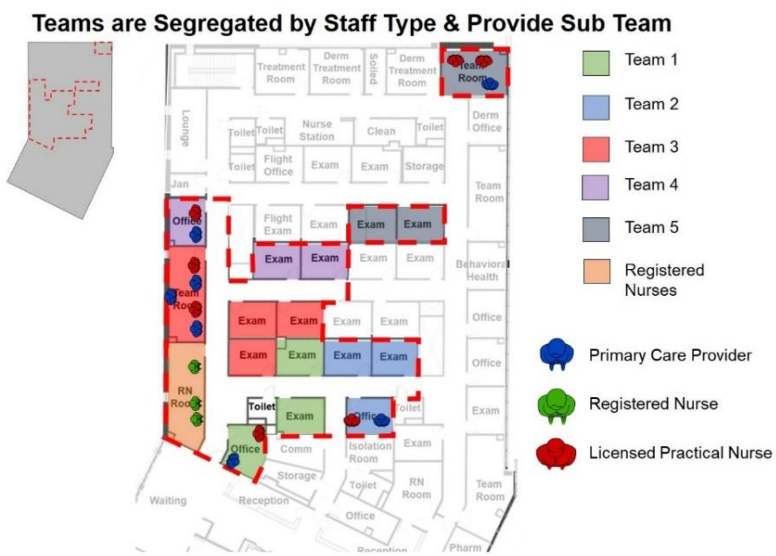


Figure 8.17: Clinical Module 5 Staff Travel Distances for Routine Patient Appointment

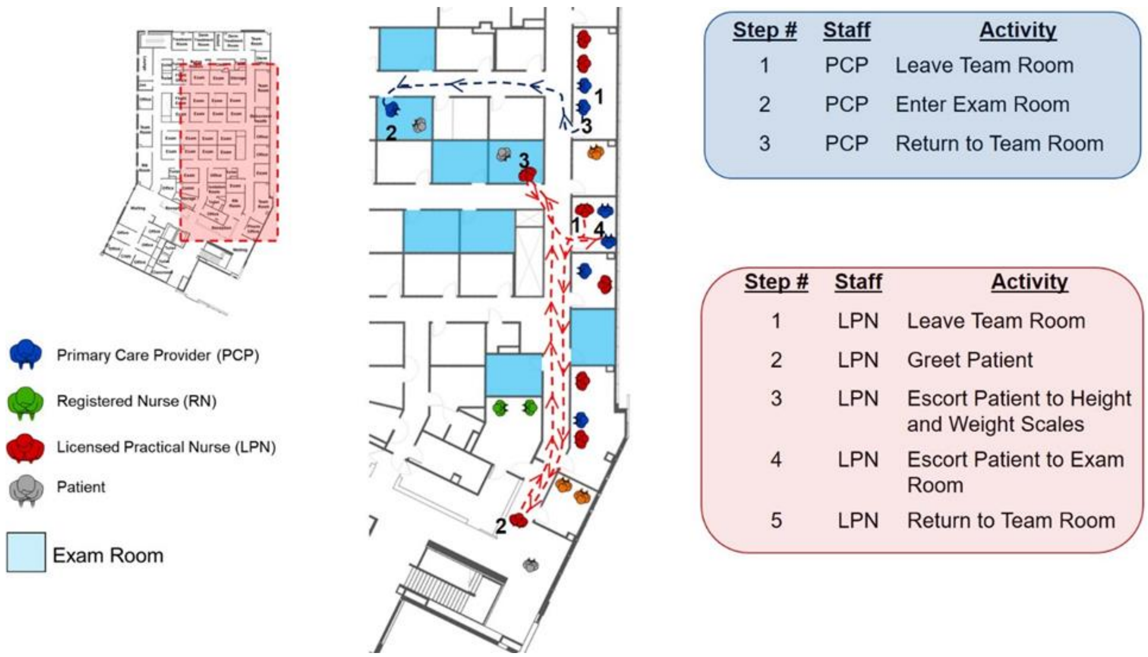


Figure 8.18: Clinical Module 6 Staff Workflow for Routine Patient Appointment

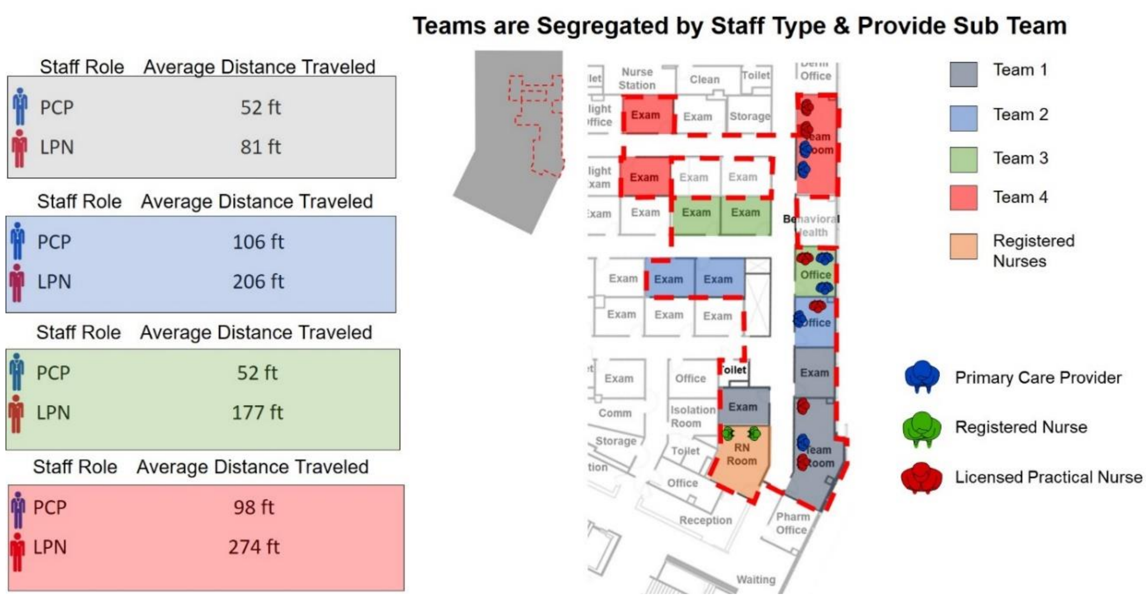


Figure 8.19: Clinical Module 6 Staff Travel Distances for Routine Patient Appointment

8.2C Shared Staff and Patient Corridors

Studying patient and staff movement through corridors during patient visits offers insight into workflow patterns. The prevailing view in the literature is that separating staff and patient corridors fosters staff privacy and the ability to move more fluidly in the clinic (Battisto et al., 2009; Karp et al., 2016; Freihoefer et al, 2017). In the MHS guidance criteria, staff and patients share corridors, which contradicts much of the recommendations in the literature. Findings in this section report on staff opinions with sharing corridors with patients.

Table 8.4
Staff Perceptions Concerning the Use of Shared Corridors

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
5	Primary Care Provider	2	Strength (2)	"I don't mind seeing the patients before I get to actually physically lay hands on them."
5	Registered Nurse	2	Non-Issue (2)	"It doesn't bother me."
5	Licensed Practical Nurse	4	Non-Issue (3)	"It doesn't really bother me much."
6	Primary Care Provider	2	Strength (2)	"I use that experience to assess their GAIT."
6	Registered Nurse	2	Strength (2)	"Keeps you connected with the patients"
6	Licensed Practical Nurse	2	Non-Issue (2)	"I think it's a normal process to share the hallway with patients."
	Healthcare Administrator		Weakness (1)	"Potentially can be an issue especially with the staff doors open."

All staff between the two clinical modules claim that sharing corridors with patients is a non-issue and a strength for patient care. Staff collaborate less frequently in the corridors with the location of provider sub-team rooms and exam rooms (Figures 8.17 & 8.19). Furthermore, staff articulate that sharing corridors with patients enhances the delivery of care through two conditions. First, sharing corridors with patients allows primary care providers to assess the physical conditions of the patient before entering the exam room. One primary care provider explained that sharing corridors “Allows me to use that as a teaching experience [for residency students], plus I have an open friendly relationship with my patients” (Primary Care Provider Case 3 Interview, 2018). Second, registered nurses view that sharing corridors with patients creates a more patient-friendly environment. One registered nurse claimed that “I don’t mind it at all, because we are kind of almost like a family.” (Registered Nurse Case 3 Interview, 2018). This evidence counters the current stance in the literature for separating patient and staff corridors.

One interesting weakness was identified with the shared corridors. The weakness is related to how patients walk past staff work areas in the clinic. Patients walking past staff work areas in the clinic afford opportunities to hear confidential information regarding patient care. Similarly, the physician-centric clinic layout discussed in chapter two created the same lack of staff privacy in work areas (Whiteaker, 2015). This evidence implies locating staff offices in patient corridors hinders the workflow for staff in the clinic.

Findings in this section indicate that patient and staff shared corridors is not detrimental for clinic workflow. The proximity of the provider sub-team rooms to exam rooms and waiting room facilitate infrequent disruption for staff workflow. However, locating staff work areas in patient corridors creates opportunities for breaches in staff privacy. As a result, striking a balance with staff privacy and proximity to waiting rooms enhances the staff workflow in the clinic. .

8.3 Functionality of the Team-Based Clinical Module

The design of clinic influence the staff's ability to perform daily activities for patient care. Functionality for the clinical module captures how well programmatic elements such as size, location, and allocation of space in the clinical module support patient care (Prieser & Vischer, 2005). This section measures functionality through staff opinions in five areas: (a) types of rooms needed in a clinical module, (b) sizes of rooms in the clinical module, , (c) location of the team room, (d) satisfaction with the clinical module layout, and (e) types of sharable rooms between clinical core teams (Tables 8.5-8.9). The first sub-section gauges what room types staff deem the most important for a clinical module to support patient care. In the second sub-section, analyzes the size of the exam and team rooms and the available workspace per individual in the spaces. The third section evaluates the location of the team room in the clinical module based on staff opinions. The fourth section rates the staff satisfaction with the clinical module layout. The final section. The final section classify rooms that should be sharable across the clinical modules.

8.3A Types of Rooms in Team-Based Clinical Modules

The MHS design guidance criteria does not clearly identify which types of rooms should be in a team-based clinical module. Identifying the rooms perceived to be important for the sub-provider teams is the first step toward defining the team-based clinical modules. This sub-section evaluates staff opinions on which room types are essential for inclusion in the clinical module.

Table 8.5
Rooms Staff Deem as Most Important in Clinical Modules

MODULE	STAFF ROLE	N	ROOM TYPES (# of Staff that Identified the Room)
5	Primary Care Provider	2	Treatment Room (2) Exam Room (1) Immunization (1) Provider Office Space (1)
5	Registered Nurse	2	RN Team Room (1) Treatment Room (1) Exam Room (1) Supply Room (1) Patient Education Room (1)
5	Licensed Practical Nurse	4	Supply Room (1) Exam Room (3) Team Room (2) Treatment Room (2) Isolation Exam Room (1)
6	Primary Care Provider	2	Exam Room (1) Case Manager Room (1) Provider Sub-Team Room (1)
6	Registered Nurse	2	Exam Room (2) Treatment Room (2) Supply Room (1)
6	Licensed Practical Nurse	2	Supply Room (2) Exam Room (1)
	Healthcare Administrator	2	Exam Room (1)

All staff, regardless of team or role, identified exam rooms as the most important room in the clinical module. The exam is considered a foundational element in establishing a functional clinical module layout to support patient care. Therefore, providing immediate access to exam rooms is a priority for designing a clinical module. Additionally, across the staff roles direct access to a treatment room and supply room were identified as the second most important rooms for a clinic module.

Interestingly, the original clinic design supported each clinical module with a separate treatment room. At the same time, one primary care provider explained that "Based on the volume and the nature of the medicine we do here, I think a shared treatment room is adequate. Plus, real estate is always tight" (Primary Care Provider Case 3 Interview, 2018). This finding demonstrates that staff are reluctant to share treatment rooms among the clinical modules, but this is a pragmatic solution based on the clinic workload.

Furthermore, this points out that the number of treatment rooms in a clinic needs to be based on the workload for annual patient procedures. This evidence counters the current MHS guidance, which bases the number of treatment rooms based on the number of exam rooms in the clinic (MHS SPC, 2017). For example, for every increment of 16 exam rooms the clinic receives an additional treatment room, which for this clinic is two. However, the daily workload of two patient procedures for this clinic should only require one treatment room, instead of the recommend two. As a result, this documents how to reduce the allocation of spaces for a primary care clinic.

The second most identified room type for a clinical module was the supply room. The current supply room is located in the last horizontal corridor in the back of the clinic. Accordingly, the small size (13,000 GSF) of the clinic offers staff on both clinical core teams accessibility to the supply room. Additionally, only the registered nurses and licensed practical nurses articulate the importance of the supply in the clinical module. One licensed practical nurse claimed that "I don't think a shared supply room is unreasonable, I think that's fine." (Licensed Practical Nurse Case 3 Interview, 2018). This finding illustrates that in a clinic sized under approximately 13,000 GSF, clinical modules can share a supply room.

The floor plan analysis aligns with staff opinions for room types for a clinical module, with the exception of three room types. The three room types are the provider sub-team rooms, screening alcoves, and the patient toilet in a clinical module. First, the provider sub-team room's significance for establishing a functional clinical module is implied through staff responses in the different sections of this chapter. Secondly, the screening alcoves are positioned in the front of the clinical modules to provide staff with accessibility to height and weight equipment for patient vitals. However, the leadership provided each exam room with height and weight equipment, resulting in the under-utilization of screening alcoves. This finding implies that colocating screening equipment in the exam room reduces spaces needed for a clinical module. Lastly, the patient toilets were not identified by staff for a room type in a clinical module. The terminology patient toilet is misleading as both staff and patients utilize this room throughout the day. Locating a patient toilet in the clinical module reduces staff travel outside the clinical modules. This points out that a patient toilet in a clinical module is significant for establishing a functional clinical module.

Findings from this section imply that a functional clinical module consists of four room types. The four room types for a clinical module include an exam room, supply room, provider sub-team room, and patient toilet. Each of the rooms supports the clinical core team's ability to deliver self-sustaining patient care in a clinical module. At the same time, a shareable supply room in a relatively small clinic, sized at 13,000 GSF, supports a functional clinical module. Furthermore, colocating screening equipment in the exam room reduces room types for a clinical module. This stance counters the current MHS design guidance recommendation, but streamlines the staff workflow in the clinical modules. Similarly, the patient toilet is overlooked in the literature for a room type that establishes a functional clinical module. In conclusion, developing a clinical module that includes the four-room types cultivates a functional team-based environment for patient care.

Type of Room	# of Rooms	Average NSF	Average Guideline NSF
Exam Room	11	119	120
Sub-Team Office	3	122	120
Team Room	3	252	120
Patient Toilet	1	43	60
Alcove/Screening	1	38	60

Clinical Staff Team	Planned # of Staff	Actual # of Staff
Primary Care Provider	5	7*
Registered Nurse	4	3
Licensed Practical Nurse	9	7
Total	18	20

*1 Physician Assistant Student

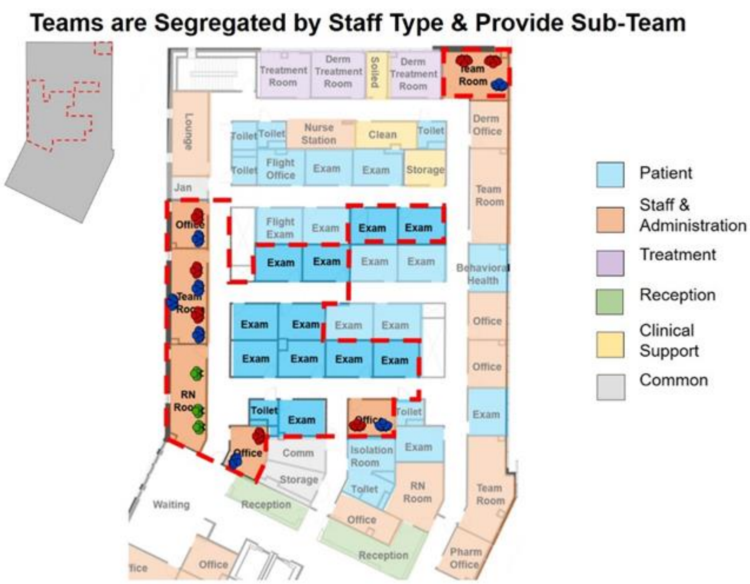


Figure 8.20: Clinical Module 5 Layout Overview

Type of Room	# of Rooms	Average NSF	Average Guideline NSF
Exam Room	8	121	120
Patient Toilet	1	43	60
Sub-Team Office	4	201	120
RN Room	1	219	120

Clinical Staff Team	Planned #	Actual #
Primary Care Provider	5	6*
Registered Nurse	4	2
Licensed Practical Nurse	9	5
Total	**18**	**13**

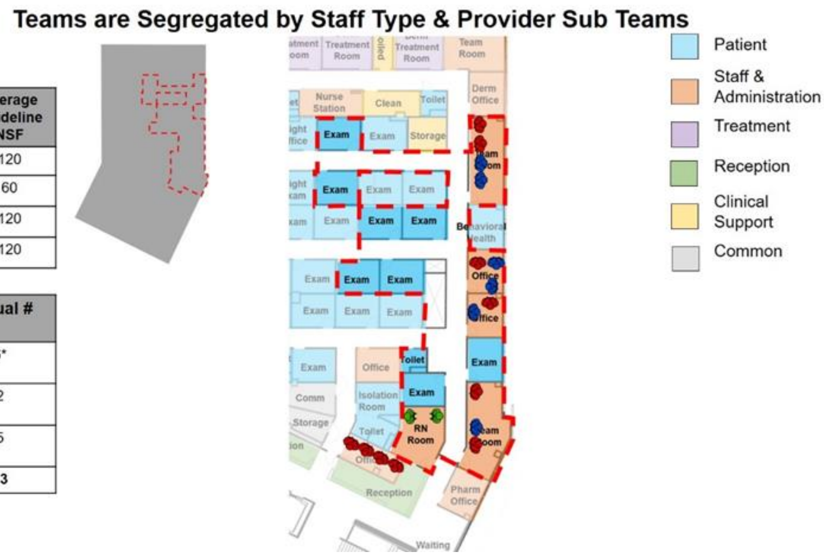


Figure 8.21: Clinical Module 6 Layout Overview

8.3B Room Sizes and Shapes: Exam Room and Team Room

The literature suggest that new team-based care activities reduce occupational stress from working as an individual in a private office and support patient care in the exam room. The colocation of staff in a shared workspace increases opportunities for collaboration shown to enhance the staff capabilities to deliver effective patient care (DuBose, Lim, Westlake, 2015; Gunn et al., 2015; Oandasan et al., 2009). A team-based approach in the exam room allows primary care providers to concentrate more, while the licensed practical nurse enters notes on the computer, which reduces workload demands for primary care providers (Chesluk & Holmboe, 2010; Shanafelt et al., 2016; Bodenheimer, 2011). The size and shape of exam and team rooms influence how team-based care activities occur (Herman Miller, 2011; Cahnman, 2011; Mahlum Architects, 2011; Capital Link, 2011; Center for Health Design, 2016). This sub-section analyzes the size of these two key rooms based on the number of staff and patients in a room. The first

sub-section analyzes the size of an exam room compared to the number of individuals in a room for an appointment. In the second sub-section, team room sizes are examined based on the available workspace per staff member. Staff perceptions are compared with the floor plan analysis to evaluate the size and shapes of the rooms.

Table 8.6
Staff Perceptions for the Size of Exam Rooms

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
5	Licensed Practical Nurse	2	Weakness (2)	"I would make them slightly bigger, it doesn't take very long for you and your patient to feel very claustrophobic."
6	Primary Care Provider	2	Weakness (1)	"Exam room is a little bit larger and should be able to treat someone."

The size of the exam room provides limited space to accommodate team-based activities. Exam room sizes and layouts are consistent between the two clinical modules (Figures 8.22 and 8.23). Exam room sizes and layouts are consistent across the two clinical modules. As discussed in chapter three, a team-based approach includes at a minimum one primary care provider, one licensed practical nurse, and the patient occupying an exam room. Exam rooms average 120 NSF in the two clinical modules, providing a limited 40 sq. ft. for each of the three individuals to occupy. Additionally, equipment for collecting patients' vitals are colocated in the exam room, reducing available space in the exam rooms.

In clinical module five, medical appointments offer care to pediatric patients, which typically consist of an additional two to three individuals in the exam room, as observed during the site visit. In clinical module six, military retirees bring supporting caregivers to medical appointments to enhance patient outcomes (Omole et al., 2011; Rosland et al., 2011; McDaniel et al., 2005).. Direct observations revealed that staff typically perform their patient care duties one at a time in the exam room. This approach under-cuts the value for performing team-based care in the exam room. At the same time, the one on one approach adds more work related activities for the primary care provider, which the team-based care model is intended to reduce.

This finding reveals that the size of the exam rooms are a limiting factor for performing team-based care. Alternatively, the Veteran Administration (VA), a sister organization to the MHS, increased the size of exam rooms to provide 42 sq. ft. per individual who supports team-based care activities (Veteran Administration, 2015). The floor plan analysis, staff opinions, and literature suggest increasing the size of exam rooms to accommodate the patient, family members, primary care provider, and a licensed practical nurse.

Site	Team	# of Exam Rooms	Exam Room Size	Average Sq. Ft. per Individual (Two Staff and One Patient)	Average Travel Distance to Team Room
Case 3	Module 5	11	119 NSF	40	35 ft

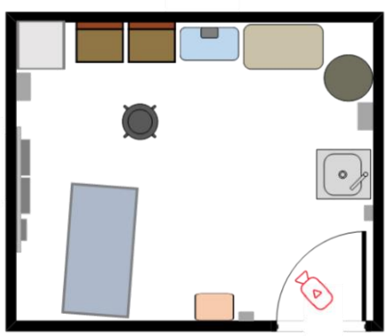


Figure 8.22: Clinical Module 5 Exam Room

Site	Team	# of Exam Rooms	Exam Room Size	Average Sq. Ft. per Individual (Two Staff and One Patient)	Average Travel Distance to Team Room
Case 3	Module 6	8	121 NSF	40	39 ft

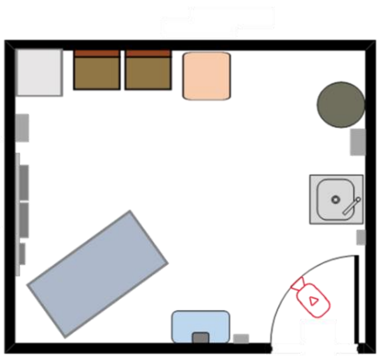


Figure 8.23: Clinical Module 6 Exam Room

Table 8.7
Staff Perceptions for the Size of Team Rooms

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
5	Primary Care Provider	2	Weakness (2)	"Our room is long and awkward, square space rooms are a little bit better."
5	Licensed Practical Nurse	2	Weakness (1)	"I think a consultation space should be built into our office."

The shape of the team rooms influences the functionality of the space for team-based care activities. The 11 team rooms between the two clinical modules represent two typologies: (a) provider sub-team rooms, and (b) team rooms that house similar staff roles. First, the nine provider sub-team rooms range in sizes from 119 to 294 NSF, providing 43-98 Sq. Ft. per staff (Figures 8.24 and 8.25). The workspaces in these provider sub-team rooms, with the exception of one room, align with the suggested 48-60

Sq. Ft. per staff workspace in the literature (Belknap & Lafferty, 2011). However, the narrow width, approximately 9 Ft., limits space for staff circulation in the room. One primary care provider expressed that the room is “Long and awkward, I prefer squared space rooms as they provide just a little bit more maneuverability in the rooms.” (Primary Care Provider Case 3 Interview, 2018). This finding demonstrates that shape of the room influences staff experiences for performing patient care.

Second, the shape of registered nurses team rooms influences the ability to perform patient education (as indicated in Figure 8.26 and 8.27). In this clinic, registered nurses perform patient education in their team rooms. The team rooms range in size from 219 sq. ft. to 262 sq. ft., providing 87 sq. ft. to 110 sq. ft. per staff member. A major difference between the two rooms is the shape of the room and an adjacent space for patient education, outfitted with a round table (as indicated in Figure 8.27). In clinical module five, the registered nurse team room is long and narrow, approximately 9 sq. ft. by 25 sq. Ft.. As a result, one registered nurse explained that during patient education sessions “The other nurse brings in a patient, and the patients are sitting directly behind me. They potentially could look right at everything I’m doing. If I call a patient on the phone they’ll hear everything I’m saying, so I usually wait until they’re finished with a patient” (Registered Nurse Case 3 Interview, 2018). Alternatively, clinical module six, a squared-shaped room, separates the consultation space and staff workstations with cubicle dividers, offering a layer of privacy. Therefore, the rectangular shape limits the flexibility of arranging office furniture to provide staff registered nurses privacy for patient consultation.

The evidence in this section reveals that the shape of team rooms influences the staff's ability to perform patient care activities. Team rooms with three or more staff in nine ft. wide and 25 ft. long rooms interfere with staff maneuverability for patient care. Additionally, the narrow width of the team room hinders staff privacy, especially with registered nurses performing patient education task. Therefore, avoiding narrow and long shaped team rooms will improve staff maneuverability and privacy for patient care activities.

Site	Team	Team Room Size	# of Staff in Room	Team Room Sq Ft Per Staff	Team Room Location	Type of Team Room	Average Travel Distance to Waiting Room
Case 3	Module 5	119 – 233 NSF	2-5	47- 87 NSF per Staff	Front	Provider Sub-Team	8-123 ft

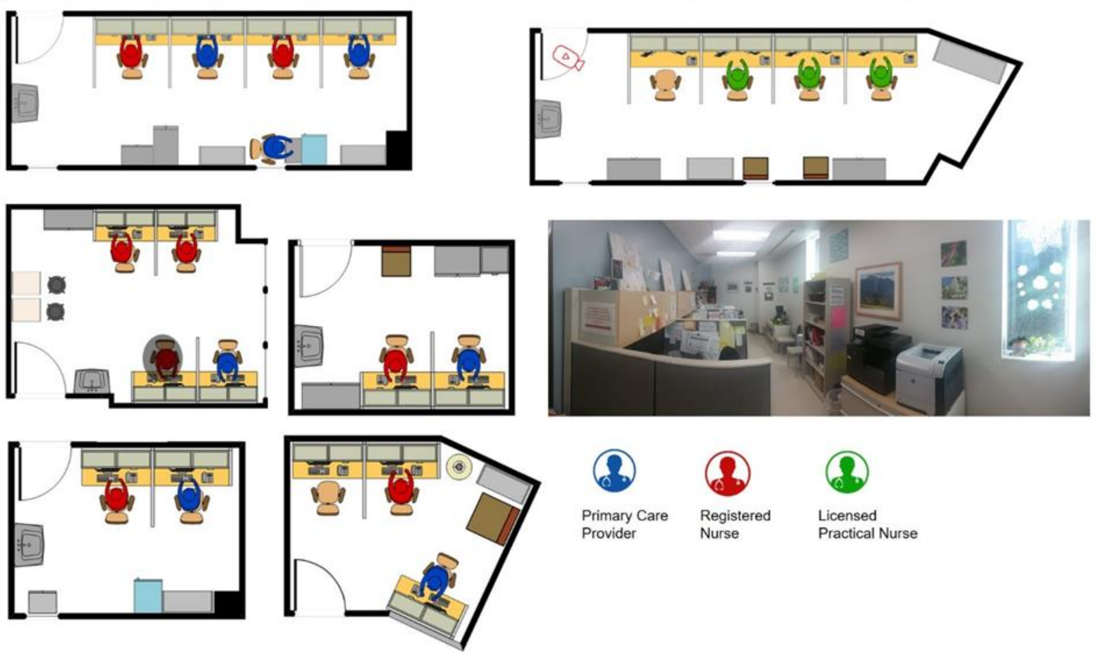


Figure 8.24: Clinical Module 5 Team Rooms

Site	Team	Team Room Size	# of Staff in Room	Team Room Sq Ft Per Staff	Team Room Location	Type of Team Room	Average Travel Distance to Waiting Room
Case 3	Module 6	125 – 294 NSF	2-4	43- 110 NSF per Staff	Side	Provider Sub-Team	12-90 ft

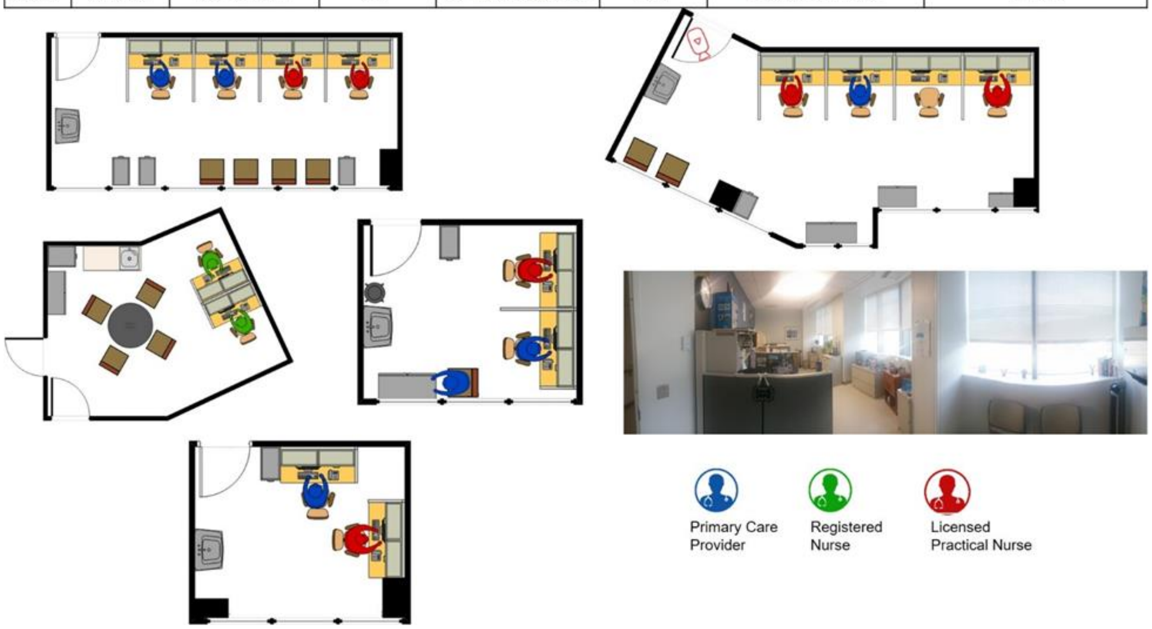


Figure 8.25: Clinical Module 6 Team Rooms

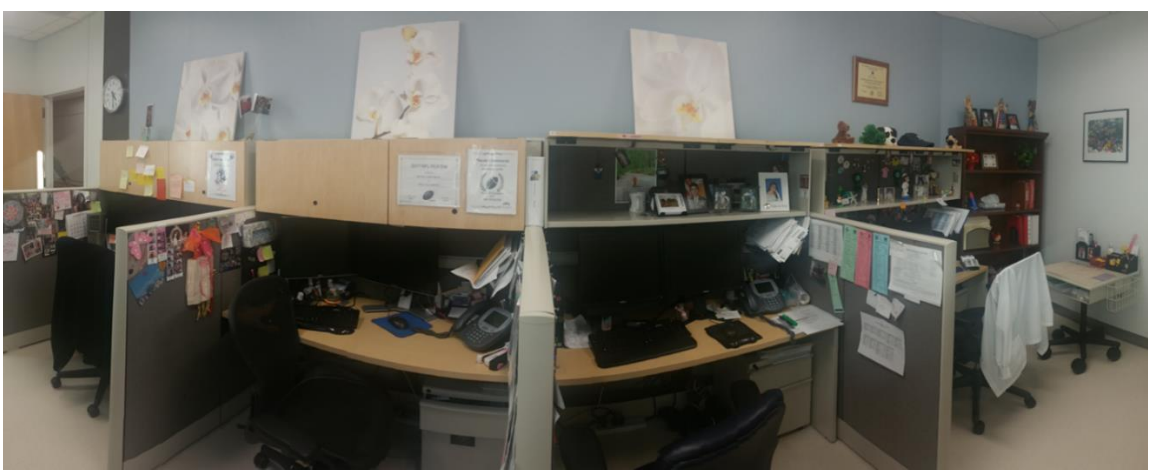


Figure 8.26: Clinical Module 5 Registered Nurse Team Room View from Patient Seating

Figure 8.27: Clinical Module 6 Registered Nurse Team Room

8.3C Layout of Clinical Modules

The previous sections illustrated the most important room types needed in a clinical module. This sub-section examines the staff opinions on how the current clinical module layout influences the delivery of team-based patient care. A clinical module should be organized to minimize travel distances for staff, while also ensuring patient privacy (Herman Miller, 2011; Battisto et al., 2009; Whiteaker, 2015; Farahmand et al., 2011; Taylor, 1999). The first sub-section evaluates staff perceptions based on the location of the team room. Then staff satisfaction with the clinical module layout is discussed. Lastly, staff opinions are then assessed to determine what types of rooms can be shared between the teams in different clinical modules.

Table 8.7

Staff Perception Concerning the Location of Team Room in the Clinical Module

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
5	Primary Care Provider	2	Weakness (2)	"I like being on the other side of the clinic because of the view and the reception for my cellphone."
5	Registered Nurse	2	Strength (2)	"Location itself is fine with easy access to the front desk."
5	Licensed Practical Nurse	4	Strength (3)	"Pretty close to my exam rooms."
6	Primary Care Provider	2	Strength (2)	"My shared office is directly across from my exam rooms."
6	Registered Nurse	2	Weakness (2)	"They're located well except for our office, we've got the two doorways, and don't have windows."
6	Licensed Practical Nurse	2	Strength (2)	"I think it's appropriate with locality for us and our patients and registered nurses are right here."
	Specialty Provider	2	Strength & Weakness (1)	"Usually get the patients after they meet with the doc, but patients just randomly feel they can just barge in."

Overall the staff expressed that the provider sub-team room's locations are a strength for the clinical module layout. The layout of provider sub-team rooms on the perimeter of the clinic and exam rooms in the interior enhance staff accessibility to support patient care. One licensed practical nurse expressed that "I'm a fan of symmetry. [Clinical core team five] is just colocated on one side and you have [clinical core team six] colocated on the other side" (Licensed Practical Nurse Case 3 Interview, 2018). As a result, the symmetry allows staff to know where to find other clinical core team members during patient care activities.

Staff identified two areas that represent a weakness for the clinical module layout. The two weaknesses deal with staff work spaces in the clinical module. First, primary care providers in clinical module five claimed that workspaces in clinical module six offer better views and access to cellphone reception. One primary care provider expressed dissatisfaction with the workspace, saying, "I have a tiny window, and I communicate with my cellphone. My cellphone doesn't pick up in here, and that hinders my family's ability to reach me if something happens" (Primary Care Provider Case 3 Interview, 2018). This evidence indicates that access to cellphone reception is a potential threat for dissatisfaction with physical environment. Second, registered nurses and specialty provider workspaces are located in front of the clinic adjacent to the waiting room. The location of the two workspaces establishes a spatial barrier with the clinic and creates privacy concerns. One registered nurse in clinical module six explained that "Patients knock on the door and come in because they want to ask a question, which is fine, but it's a boundary issues with office out here." (Registered Nurse Case 3 Interview, 2018). Therefore, locating staff workspaces in the front of the clinic limits privacy and places the staff "on-stage" at all times.

Findings in this section signal that the location of staff workspaces need to prioritize a separation from patient areas in the clinic. In addition, staff work areas need to support views outside the clinic, which can result in better access to cellphone reception. Similarly, the literature aligns with both of these findings for the location of staff workspaces (Battisto et al., 2009). The findings in this section imply that symmetry with the clinic module layout is positive design attribute. As a result, providing symmetrical clinical modules with off-stage staff workspaces supports a functional clinical module layout for patient care.

Table 8.9
Satisfaction with Clinical Module Layout

MODULE	STAFF ROLE	N	SATISFACTION
5	Primary Care Provider	2	50% Satisfied
5	Registered Nurse	2	50% Satisfied
5	Licensed Practical Nurse	4	25% Satisfied
6	Primary Care Provider	2	100% Satisfied
6	Registered Nurse	2	100% Satisfied
6	Licensed Practical Nurse	2	50% Satisfied

Staff satisfaction regarding layouts of the two clinical modules was 75%. Interestingly, clinical core team six rated their clinical module layout at 83% satisfaction, compared to 43% in clinical module five. Potential contributing factors for the difference between the two clinical core teams include views to outside, cellphone reception, patient type, and collaboration. The first two factors, views to outside and cellphone reception, are discussed in the previous section. The second factor, patient type, relates to the difference in only seeing pediatric patients and adult patients. One primary care provider described that "we only have 20 minutes with each patient, and you have a list of 30 things that parents want a child to get seen for" (Primary Care Provider Case 3 Interview, 2018). This is a confounding variable that is unrelated to the clinical module layout, but one that needs to be noted.

Lastly, staff in clinical module five identified a lack of huddle space for the team as a reason for dissatisfaction. One licensed practical nurse explained their dissatisfaction, saying, "I feel like the only time we're all really able to as a team to get together and communicate is during the clinic huddle. So I feel like the team just our team, doesn't ever have a special spot that we could all just get together and chat." (Licensed Practical Nurse Case 3 Interview, 2018). At the same time, staff in clinical module six have a similar lack of huddle space. However, clinical module six workspaces have bigger windows that provide access to views outside the clinic. This finding hints that views to outside the clinic and access to daylight potentially influence the level of collaboration in workspaces.

The evidence in this section reveals that access to daylight and views to outside from staff workspaces indirectly improves staff satisfaction levels. Furthermore, providing staff workspaces with access to cellphone reception enhances staff satisfaction levels for the clinical module layout. These findings illustrate that the amenities or supporting design elements alter the staff satisfaction level with relationship to the layout of the clinic (Battisto et al., 2009). Therefore, providing staff workspaces with access to daylight and views to outside are important design factors that improve staff satisfaction ratings.

Table 8.10

Rooms Staff Deem as Sharable Between Clinical Modules

MODULE	STAFF ROLE	N	ROOM TYPES (# of Staff that Identified the Room)
5	Primary Care Provider	2	Treatment Rooms (2) Isolation Exam Room (1) Supply Room (1) Immunizations Room (1) Equipment Storage (1)
5	Registered Nurse	2	Education Room (1) Treatment Room (1) Supply Room (1)
5	Licensed Practical Nurse	4	Supply Room (3) Treatment Room (2) Isolation Exam Room (1) Equipment Storage (1)
6	Primary Care Provider	2	Treatment Room (2) Supply Room (1) Equipment Storage Room (1)
6	Registered Nurse	2	Supply Room (1) Huddle Space (1) Equipment Storage (1)
6	Licensed Practical Nurse	2	Treatment Room (1) Supply Room (1)
	Healthcare Administrator	2	Treatment Room (2) RN Team Room (1)

Staff deem the treatment room the most important shareable room type between clinical modules. As previously discussed, the treatment is currently shared among the two clinical modules. The shared treatment room creates a practical solution based on the number of patient procedures performed in the clinic. The evidence counters the current MHS design guidance criteria for allocating treatment rooms based on the number of exam rooms per clinic. Therefore, this finding reinforces the need for the MHS to establish a workload formula for distributing the number of treatment rooms per clinic instead of the number of exam rooms.

In addition, staff deem the supply room the second most important shareable room type between clinical modules. At the same time, the supply room is identified as a critical room type located in a clinical module. This suggests that the size of the clinic plays a role in determining rooms in and shared between clinical modules. Therefore, smaller-sized clinics at approximately 13,000 GSF can share supply rooms between two clinical modules.

Analysis from the floor plan take-off illustrates one additional type of sharable room in the clinic. The nursing station located in the back horizontal corridor represents an additional sharable room type in the clinic. Direct observations revealed that space was unoccupied throughout the site visit, and signals why staff overlooked the room type in the interviews. This finding indicates that a nursing station located too far away from the exam rooms is under-utilized in this case.

Findings from the previous section and this section demonstrate the room types needed for a clinical module and shareable room types in the clinic. First, the functional clinical module room types include exam rooms, provider sub-team rooms, and patient toilets. These room types reduce unnecessary room types and spaces for a clinical module. Second, functional shareable room types in the clinic include a treatment room and supply rooms. In this clinic the size of the clinic establishes shareable room types instead of creating a sharable module, as discussed in previous chapters. Furthermore, the findings from this clinic illustrate that in a small-sized clinic shareable room types need to be located in the back or front of the clinic. Combining other frequently used rooms, such as a point-of-care lab, enhances staff workflow for patient care activities.

8.4 How the Team Rooms Influence Both Collaborative and Focused Work

Team rooms in the clinical modules are the only dedicated workspace for the clinical core team members including primary care providers, registered nurses, and licensed practical nurses. Private offices are limited to case managers and administrators in the clinical modules. Team rooms need to strike a balance in supporting both collaborative and focused work for staff activities (Gunn et al., 2015). Striking a balance between collaborative and focused work areas produces a higher functioning team (Sinksey et al., 2013). This sub-section analyzes staff opinions through three areas to evaluate collaborative and focused work in the team room: (a) co-locating staff in team rooms, (b) visibility to and from staff work areas, and (c) available private space to complete work that requires focus (Tables 6.10-6.12). In the first section, staff experiences are assessed on where collaboration takes place and how that space supports collaboration. The second section examines staff opinions on the ability to visually connect with team members in work areas. The final section gauges the team room's ability to support work that both requires focus and concentration as well as collaboration.

8.4A Collaborative Work Space: Shared for All Staff in Clinical Module

Collaboration among staff in patient care environments produce a higher functioning team (Sinksy et al., 2013). Colocation of staff with good visual sightlines increases the opportunities for staff to collaborate and communicate for patient care activities (Watkins Gandolf-Frietchen, Siddiqui, 2015; Taylor, Joseph, Keller, Quan, 2011). Findings examine the staff opinions on how the team room supports colocation and visibility of staff work areas.

Table 8.11
Colocating Staff in the Team Room

MODULE	STAFF ROLE	N	PERCEPTION	EXAMPLE OF EVIDENCE
5	Primary Care Provider	2	Weakness (2)	"Having a nurse in this room is just easier if we're able to communicate and the dynamics of the room would be a little bit better."
5	Registered Nurse	2	Strength (2)	"I share the room with two other registered nurses, we can bump things off of each other."
5	Licensed Practical Nurse	4	Strength (3)	"Now that we're side-by-side, it does make it a lot easier to communicate."
6	Primary Care Provider	2	Strength (2)	"Our room does to the extent that we're all in there together."
6	Registered Nurse	2	Weakness (2)	"Ideally, it would be nice to share an office with the doc and the LPN that I'm working with because then I could actually hear everything about the patient that's going on."
6	Licensed Practical Nurse	2	Strength (2)	"Absolutely, it's just me and the doctor."

The colocation of provider sub-teams in different rooms is an overall strength for both clinical core teams. Colocating provider sub-teams in individual rooms makes communication “easier” among team members to support patient care. One licensed practical nurse expressed that the provider sub-team room works the best because “The providers and anybody that works with the provider are right there next to them.” (Licensed Practical Nurse Case 3 Interview, 2018). Therefore, provider sub-team rooms enhance staff collaboration more for patient care delivery.

At the same time, provider sub-team rooms separate registered nurses into different rooms, hindering team collaboration. The colocation of registered nurses allows for collaboration among their specific staff roles and functions for patient care. However, registered nurses are assigned to two primary care providers for each clinical core team. The spatial separation of the clinical core team diminishes the ability to effectively collaborate. This evidence indicates that planning for registered nurses' workspaces needs to prioritize the immediate adjacency to provider sub-team rooms to enhance team-based collaboration.

Table 8.12
Staff Perceptions Concerning Visibility of Staff Work Areas

MODULE	STAFF ROLE	N	PERCEPTION (# of Staff that Support the Perception)	EXAMPLE OF EVIDENCE
5	Primary Care Provider	2	Weakness (2)	"These are like alley spaces with another wall before you can talk to your nurse."
5	Registered Nurse	2	Weakness (1)	"I don't really know what's going on with the flow of the patient care during the day."
5	Licensed Practical Nurse	4	Strength (1/4) Weakness (1/4)	"Eye contact with my doc, is just leaning back in my chair and they are right there." "My visibility is hindered and I have to walk down the hall and go say hey."
6	Primary Care Provider	2	Strength (1) Weakness (1)	"Good visibility with my immediate team." "Other physicians are in other offices, so I would have to go down the hallway to connect with them."
6	Registered Nurse	2	Weakness (2)	"Completely hindered with no windows and there's no way for us to kind of look down the hallway."
6	Licensed Practical Nurse	2	Weakness (2)	"You really never know what anybody's doing or if anybody really needs anything."
	Specialty Provider	2	Weakness(2)	"I either call them ahead of time, or I'll get up and walk to their office."
	Healthcare Administrator	2	Weakness(1)	"Very individualized in rooms, and you're going directly from A to B in between patient appointments."

Team rooms that separate staff into different rooms hinder visibility to all team members' workspaces. The restricted visibility obstructs staff situational awareness, leading to increased circulation to the different workspaces to find staff. One registered nurse described the weakness with having separate workspaces, saying "We have to look in and out of offices, which sometimes hinders patient care. So you're walking and looking for people sometimes" (Registered Nurse Case 3 Interview, 2018). In addition, a specialty provider claimed that "I cannot visually connect with my staff member if I'm here in my office. But it doesn't hinder care, because I'm constantly out of my office, and I go to visit them at their space" (Specialty Provider Case 3 Interview, 2018). However, if staff members are constantly circulating the clinic, this reduces the opportunities for other staff members to find them. Therefore, the separation of the staff workspaces hinders the ability to visually connect and increases staff circulation in the clinic.

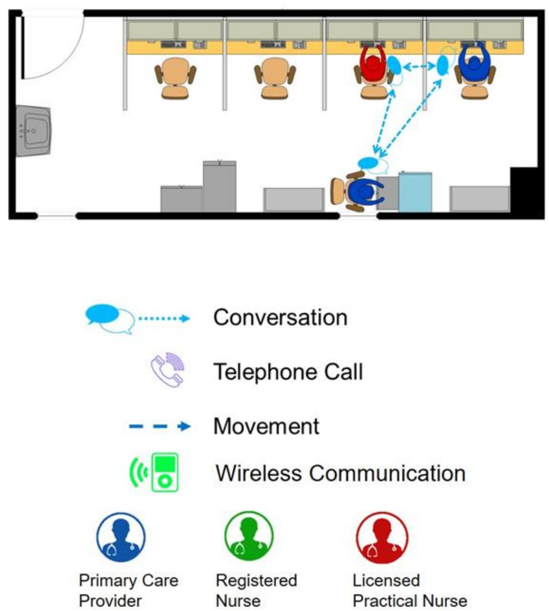


Figure 8.28: Clinical Module 5 Team Room Observation

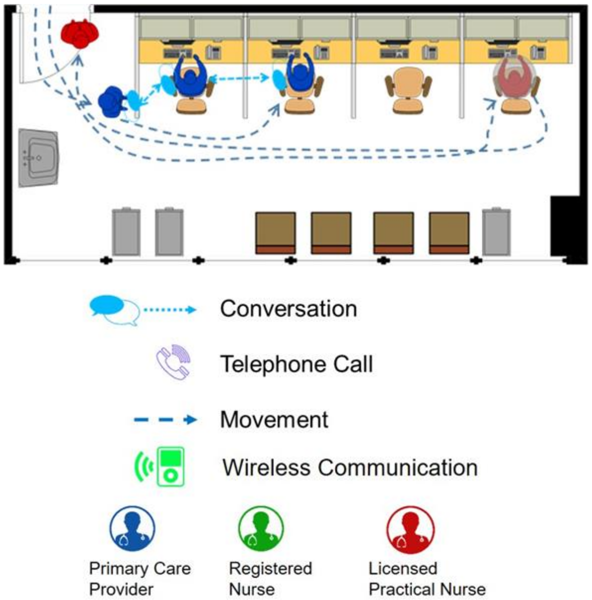


Figure 8.29: Clinical Module 6 Team Room Observation

8.4B Private Work Spaces: Focused Activities

Patient care requires staff to complete work related activities that require focus and concentration on a daily basis (McGough et al., 2013). Cubicle dividers and private offices for clinical core team workspaces were eliminated from the original design after the MHS implemented the PCMH model in favor of a collaborative environment. Open concept team rooms for this clinic were created with limited private spaces for staff. In this sub-section, staff views were gauged on how the team room affords the ability to conduct work requiring focus and concentration. Direct observations of the team room vared used to cross reference staff perceptions shared in the interviews. Findings in this sub-section examine if staff use the team room or alternative rooms to complete work for private patient care activities.

Table 8.13

Staff Perceptions Regarding the Ability to Complete Focused Activities in the Team Room

MODULE	**STAFF ROLE**	**N**	**PERCEPTION** (# of Staff that Support the Perception)	**EXAMPLE OF EVIDENCE**
5	Primary Care Provider	2	Strength (2)	"Team room is a quiet space."
5	Registered Nurse	2	Strength (2)	"I have privacy back here, I'm in a cubby cubicle."
5	Licensed Practical Nurse	4	Strength (4)	"It's quiet, there's not too much distraction."
6	Primary Care Provider	2	Strength (1) Weakness (1)	"Where we keep our LPNs is the primary place to focus." "There can be some crosstalk that isn't conducive to strictly our business."
6	Registered Nurse	2	Strength (2)	"Access all of their current encounters on lots of different computer data in our room."
6	Licensed Practical Nurse	2	Strength (2/2)	"My room is quitter, less traffic."

Separate team rooms that support two to four staff provide the ability to complete focused activities. Figures 8.25 and 8.26 show that staff are afforded privacy with cubicle partition walls, sized at 48" wide x 47" tall. Furthermore, the cubicle partitions limit the staff ability to speak across the room, decreasing excessive noise-related distractions. One licensed practical nurse described the provider sub-team room conditions as "quiet, there's not too many distractions in our room" (Licensed Practical Nurse Case 3 Interview, 2018). As a result, the provider sub-team room supports privacy and the ability for staff to complete focused work.

Interestingly, staff in one of larger team rooms in clinical module six point out social conversations as a distractions. Furthermore, the team rooms occupy spaces with a glass exterior wall on the perimeter of the room. As previously discussed, one potential reason for staff dissatisfaction in clinical module five over clinical module six pertained to the access to views and daylight. This finding reinforces that views to the exterior and access to daylight are potential causes for increased collaboration, even if the collaboration is social in nature.

The separate team rooms work well for collaboration and privacy, but poorly for visibility among the clinical core team members. The separate provider sub-team rooms are a strength because of the colocation and privacy for team members. At the same time, staff report a lack of situational awareness for clinical core team activities with the separate team rooms. This aligns with the literature for striking a balance between private and collaborative work to foster a higher functioning clinical core team environment (Sinsky et al., 2013; Gunn et al., 2015). However, in this clinic design, clinical core teams are separated into different rooms, limiting staff visibility. The literature advocates for staff visibility as a method to increase collaboration and the team’s performance for patient care (Watkins Gandolf-Frietchen, Siddiqui, 2015; Taylor, Joseph, Keller, Quan, 2011; Saaty-Tafoya, Malkin, Wingler, 2003) Therefore, planning for clinical core team workspaces needs to account for the team’s proximity, visibility, and privacy for supporting team-based care environments. This means that clustering staff workspaces behind patient care areas that allow for both visibility and privacy is an ideal environment for enhancing the delivery of patient care.

8.5 Discussion

The evaluation of the clinic illustrates how the physical environment enhances and hinders the staff ability to deliver team-based care. As a result, the evidence from this case establishes six design factors that enhance the delivery of team-based care. The six design factors include (a) incorporating essential rooms in the clinical module, (b) establish the right fit for support rooms, (c) separate staff and patient care areas, (d) provide access to outdoor views and daylight, (e) cluster clinical core team workspaces, and (f) accommodate family and team member in the exam room.

First, defining the types of rooms in a clinical module aids in establishing a functional team-based environment for patient care. The evidence from this clinic indicates that functional room types for a clinical module include: (a) exam rooms, (b) supply room, (c) provider sub-team rooms, and (e) patient toilet. Each of these identified rooms offer a specific function for a team-based environment. Furthermore, the evidence from this clinic supports the colocation of screening equipment into the exam room, which demonstrates that screening alcoves are unnecessary room requirement for a clinical module.

Second, establishing the right fit for allocation of support rooms in the clinical module improves clinic workflow. This begins through identifying the three key design factors (a) the size of the clinic, (b) patient procedure workload, and (c) necessary support rooms for patient care. The size of the clinic determines shareable support room types between the clinical modules, like the supply room. Identifying the workload for patient procedures, instead of the number of exam rooms, ensures the right allocation of treatment rooms in the clinic. Finally, the point-of-care lab is a necessary support room for primary care clinics to improve staff workflow for patient care. Therefore, planning for these three design factors at the beginning of the design enables the physical environment to enhance the delivery of patient care.

Third, separating staff and patient care areas reduces breaches in both staff privacy and the confidentiality of patient information. This means that locating staff workspaces adjacent to the patient waiting room hinders staff privacy. In addition, designers should avoid patient circulation that passes along staff workspaces to mitigate further breaches in staff privacy. As a result, establishing a clear separation between "on-stage" patient and "off-stage" staff areas is a key design recommendation.

Fourth, provide staff with access to outdoor views and daylight in workspaces. The literature aligns with this strategy for developing workspaces that reinforce team-based environments (Battisto et al., 2009). In addition, locating staff near windows hints at improved cellphone reception, allowing staff to stay connected with family members. This design recommendation strengthens staff satisfaction ratings with the physical environment. As a result, higher satisfaction ratings for staff lead to a higher quality of patient care and better health outcomes (Bodenheimer & Sinsky, 2014; Goni, 1999; Bower et al., 2003; Richardson et al., 2016).

Fifth, clustering clinical core team workspaces affords staff visibility, privacy and proximity to increase collaboration. The provider sub-team room is a micro-scale design solution to support collaboration and focused work. However, the clinical core team needs a macro-scale design solution that supports team-based activities and collaboration. Therefore, creating an open-team room behind the provider sub-team rooms offers a space to accommodate team huddles, collaborative activities, and yet still allows visibility to the clinical module. At the same time, the new team room is located in the "off-stage" area that affords staff privacy from patients.

Lastly, accommodating family and team members in the exam room supports a team-based care approach. The trend of patients bringing extra family members to appointments limits available space in the exam room. The team-based approach in the exam room further limits the available space in the exam room for patient care. At the same time, colocating screening equipment to collect patient's height and weight reduces the space for patient care in an exam room sized at 120 NSF. Therefore, increasing the size of the standard exam room creates more functional size rooms that align with team-based care activities. The VA, a sister organization to the MHS, increased the standard exam room size to 125 NSF to accommodate the functions of team-based care (Veterans Administration, 2015). Additionally, increasing the size of the exam rooms create more opportunities for patient care activities in the exam room instead of the treatment room.

Furthermore, the case shows that design decisions made for the PCMH implementation both enhance and hinder team-based care activities. The physical environment enhanced team-based care through two main design factors: (a) establishing provider sub-team rooms, and (b) proximity of provider sub-team rooms to exam rooms and the waiting room. Alternatively, the physical environment hindered team-based care with three design factors: (a) allowing patients to walk past staff workspaces, (b) limited visibility of staff workspaces, and (c) locating staff workspaces adjacent to the waiting room. This evidence indicates a misalignment between design thinking and how staff actually use the clinic environment to deliver team-based care.

In conclusion, the six design factors recommended in this section illustrate evidence-based design knowledge for primary care clinics. This evidence creates a larger database of evidence when combined with the two previous cases, which supports the MHS in becoming world leaders in designing evidence-based primary care environments. Finally, this chapter points out the significances of engaging the different staff roles to understand how the physical environment influences the delivery of patient care.

CHAPTER NINE

CROSS-CASE SYNTHESIS AND DESIGN RECOMMENDATIONS

The purpose of this chapter is to understand the commonalities and differences across the three clinic environments and how the team-based clinical modules influence the delivery of team-based care. The three cases are important in analyzing the different design factors, while at the same time demonstrating the significance for establishing standardized primary care clinics. Furthermore, the synthesis facilitates a strategy for developing design recommendations that are rooted in evidence-based practice methods. This approach establishes a clear and transparent strategy to replicate in future evaluation of MHS facilities.

The data presented in this chapter describes the environmental conditions of the clinics, team-based clinical modules, exam rooms, and team rooms across the cases. The environmental conditions for each of the four areas are evaluated based on floor plan take-offs along with staff opinions and experiences for delivering patient care. The analysis utilizes a user-centered strategy in developing evidence-based design recommendations for PCMH clinics. At the same time, this study creates a database of evidence-based design factors for MHS primary care clinics.

The findings in this chapter are discussed in five sections. Section 9.1 describes the key differences of the three patient care environments, clinical core team staffing, and medical services offered across the cases. Section 9.2 studies how the overall clinic layout influences staff workflow by examining two planning factors: (a) access to support rooms; and (b) sharable circulation. Section 9.3 examines the environmental conditions of the team-based clinical module on functionality through five design factors: (a) types of rooms; (b) size and shape of rooms, (c) travel distances inside the clinical module, and (d) layout of the clinical module. Section 9.4 reviews the sizes and shapes of two key rooms in the clinical module: (a) exam room and (b) team room. Section 9.5 presents an overview of recommendations to update the design guidance criteria for the MHS.

9.1 Description of the Physical Environmental Conditions

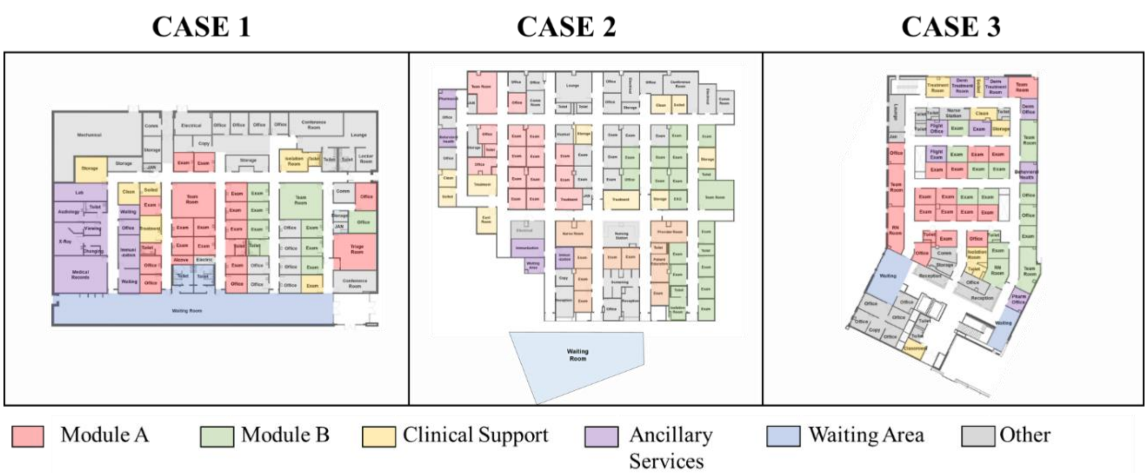


Figure 9.1: Layout of the Clinics Font

Table 9.1

Overview of the Clinics

	CASE 1	CASE 2	CASE 3
Type of Clinic	Soldier-Centered Clinic	Embedded-Hospital Clinic	Embedded-Hospital Clinic
As Built Date	2014	2016	2015
Clinic Size	18,611 GSF	22,562 GSF	13,139 GSF
Total Number of Exam Rooms	19	23	18
# of Primary Care Providers	11	17	10
Average Patient Encounter Per Primary Care Provider	19 Patients Per Day	14 Patients Per Day	8 Patients Per Day
Medical Services	1.Immunization 2.Point-of-Care Lab 3.Triage Room 4.Radiology 5.Audiology	1.Immunization 2.Behavioral Health 3.Clinical Pharmacist 4.Triage Rooms 5.Patient Education	1.Behavioral Health 2.Clinical Pharmacist 3.Patient Education 4.Dermatology 5.Flight Physical

The three cases are representative of clinics that adopted the PMCH model in the middle of designing the physical environment. The integration of a team-based model of care created new spatial requirements and design factors. As a result of these new requirements, three different interpretations as to how to create team-based primary care environments were designed. The planners and architects for each of the clinics attempted to create team-based clinical modules within the space constraints defined by the timing of the project, while still acknowledging past space planning criteria from 2006. Furthermore, the team-based clinical module was not a standardized unit in this criteria. Among each of the cases, the patient population, clinical staff model, and medical services further guided how patient care was delivered. Studying the similarities and differences among the three clinics is needed to understand how the physical environment shapes the team-based environment.

The two different types of primary care clinics determined the patient population receiving medical care in the clinic. Case one, which represents a soldier-centered clinic, provides primary care for active duty military soldiers. In comparison, case two and three, which represent clinics embedded within hospitals, offer primary care services to active duty military soldiers, their family members, and military retirees. As such, the MHS embedded-hospital clinics have a patient population similar to external civilian primary care clinics. At the same time, the soldier-centered clinic focuses on a patient population unique to the MHS.

The number of available clinical staff in each of the three cases influence the daily patient workload. In case one, the majority of staff are primarily active duty military soldiers, and consequently they are required to participate in additional military training at times. The additional military training directly impacts the daily staffing of the clinic. As a result, individual staff work hours for patient care vary on a daily basis. On the other hand, case two is a graduate medical education (GME) program that includes 10 physician residency instructors and 20 residency students, which accounts for 55% of the total staff in the clinic. Additionally, the GME instructors and students only spend half days in the clinic, due to other medical education requirements, which influences the patient workload. In case three, clinical staff are assigned to either a pediatric or internal medicine clinical core team. The different types of patients seen by the two clinical care teams in case three impacts the daily patient volume.

The allocation of staff members also varied across the six clinical core teams included in this study. The standard provider sub-team structure, one primary care provider and one-to-two licensed practical nurses, varied in and across each clinical core team. The variations in the staff allowed for the examination of different sizes of clinical care teams and team-based clinical modules. At the same time, the different types of staffing variations in a team lent to studying how different staff roles and activities shape ones perception of what works best in the team-based clinic environment.

Medical services offered in the cases are determined by the type of the clinic. The soldier-centered clinic, which is a stand-alone facility, colocates additional support rooms that typically include radiology, immunization, and point-of-care lab. The two embedded-hospital clinics rely on support rooms located in the adjacent inpatient hospital. This accurately reflects the MHS 2006 space planning criteria (SPC), which emphasizes a physician centric clinic design. The spatial relationship of these medical services to the clinical modules presented an opportunity to evaluate the most frequently utilized support rooms for patient care.

The difference across the three cases provide an opportunity to evaluate different design factors to understand what works best for team-based care environments. Furthermore, the variations across the cases provide initial evidence suggesting how to start developing a standardized clinical module layout. Therefore, this cross-synthesis includes data from three clinics to uncover how planning and design decisions support or hinder patient care delivery.

9.2 Clinic Design

The layout of a clinic directly influences the staff ability to deliver patient care and is discussed in two sections. The first section, access to support rooms that includes both ancillary support and clinical support room examines the locations and adjacency of rooms located outside the team-based clinical modules that are used frequently to support patient care. The second section discussed the circulation pathways of patients and staff to understand how movement and flow through the clinic influences the ability for staff to efficiently deliver effective patient care. Design recommendations are discussed for both of the sections to illustrate changes for the MHS design guidance criteria.

9.2A Access to Support Rooms

Data from the three cases shows clustering the most frequently used support rooms outside the clinical modules nearby can enhance staff workflow for patient care. Support rooms located outside the clinical modules are ancillary services and clinical support rooms. Ancillary services, discussed in the first sub-section, across the cases are indicated in Figure 9.2, which offer three variations of locations in the clinic: (a) clustering of rooms on one side of the clinic near the waiting area, (b) mix of front and back, and (c) scattered. Clinical support rooms, reviewed in the second sub-section, across the cases include medical storage, clean and soiled linen rooms, treatment room, isolation exam room, and an overflow exam room as indicated in yellow for Figure 9.3.

Access to Ancillary Services

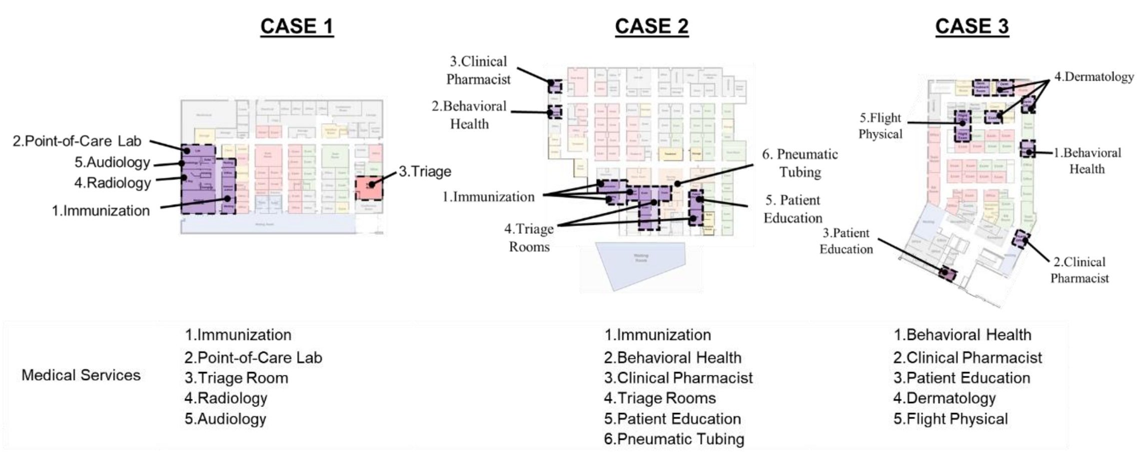


Figure 9.2: Layout of Ancillary Services

The type of clinic and access to healthcare services adjacent to the clinic are major factors in determining which ancillary services are located in the primary care clinic. For example, the soldier-centered clinic offers different types of ancillary services from the two embedded-hospital clinics due to being a standalone facility. The soldier-centered clinic, case one, is a part of an outpatient medical campus that shares ancillary services with additional facilities on the campus. The pharmacy and behavioral health provider, for example, are located across the street in supporting buildings for the medical campus. This primary care clinic supports the medical campus with ancillary services that include immunization, radiology, audiology, and a point-of-care lab. These ancillary services are clustered together on the perimeter of the clinic, creating a well-organized area that is easily accessed from the team-based clinical module. Staff across the three clinics identified the point-of-care lab as the most frequently used support room outside the clinical modules. This finding hints at the importance of a point-of-care lab in a primary care setting with close proximity to the clinical modules.

The lack of a point-of-care lab section in the third clinic long travel distances to access this ancillary service creates inefficient staff workflow for patient care. The ancillary services that include a lab, pharmacy, immunization, and radiology are located in the adjacent medical mall of the inpatient hospital. Staff expressed dissatisfaction with the lack of a point-of-care lab in the primary care clinic. One licensed practical nurse explained the dissatisfaction by saying “when you’re one per doc [primary care provider], it’s very difficult to get to the lab and back in a timely manner” (Licensed Practical Nurse Case 3 Interview, 2018). At the same time, findings from case one indicate satisfaction with colocating a point-of-care lab in a primary care clinic. This evidence indicates that the point-of-care lab is a vital support room that should be located in the clinic since it is a frequently used service.

Pneumatic tubing is used to transport specimens to the hospital lab for case two, but impacts staff workflow when the equipment is down for maintenance or out-of-order. The staff have to walk the specimens to the hospital lab. This occurrence requires staff to travel to the hospital lab to drop-off patient samples, which consumes valuable time for registered nurses and licensed practical nurses. One registered nurse claimed to travel two to three times per day when the pneumatic tube is down to drop off lab tests (Registered Nurse Interview Case 2, 2018). Findings from the three cases demonstrate the point-of-care lab as a frequently used support room in primary care clinics. This means that establishing a centralized location for the point-of-care lab can enhance staff workflow in the clinic.

Specialty providers are decentralized in the two cases that include them, which limits convenient access for the clinical core teams. In case two, the clinical pharmacist and behavioral health provider are located in the back of the clinic, creating unnecessary distances to reach their workspaces. One primary care provider noted that the "clinical pharmacist [is] far away", which implies dissatisfaction with the location of the rooms (Primary Care Provider Case 2 Interview, 2018). Likewise, behavioral provider reported dissatisfaction with his or her office location by saying "it can be problematic for my elderly patients that can't walk long distances; my office is probably the longest walk for each of [the clinical core teams]" (Specialty Provider Case 2 Interview, 2018). This evidence signals that moving the specialty provider's workspaces to a centralized location to the team-based clinical modules improve access.

In case three, the behavioral health provider and clinical pharmacists' spaces are scattered in the clinic. First, the clinical pharmacist's office is located adjacent to the waiting room and in front of clinic. The location offers instant access for staff in clinical module six, which allows those staff to drop patients off after a medical appointment (Specialty Provider Case 3 Interview, 2018). At the same time, the clinical pharmacist pointed out that the office location is a hindrance, saying "patients just randomly feel they can just barge in" (Specialty Provider Case 3 Interview, 2018). However, the behavioral health provider is located centrally in the clinic, which offers better access for both clinical core teams. The behavioral health provider claimed that his or her office location supported patient care by saying "I think my room's location is perfect, right in the middle of the clinic" (Specialty Provider Case 3 Interview, 2018). Therefore, locating the specialty provider's offices in a central area with the point-of-care lab starts to cluster frequently used support rooms outside the clinical modules.

A triage section in the primary clinic has emerged as new unique service that is not identified in the space planning criteria. The triage section provides space to screen and care for walk-in patients for sick-call operations within 24 hours. The military prohibits soldiers from calling in sick for work without written documentation from a medical provider. This administrative requirement results in the creation of what is known as a "sick-call" service to accommodate soldiers needing unscheduled care at the beginning of the workday. The sick-call process allows soldiers to receive initial patient care and meet work-related accountability protocols for the military. For example, soldiers who accidentally fall and twist an ankle or hurt their knee would come to the triage section for patient care. Triage sections were included in case one and two, which offered in different locations in the clinic.

In case one, the triage section only provides patient care for soldiers assigned to a clinical core team that is located on the other side of the clinic. The separation from the clinical core team hinders staff accessibility to provide situational updates on patient care activities. One registered nurse expressed their dissatisfaction claiming that "there is definitely a detachment for those staff members who work in the triage room" (Registered Nurse Case 1 Interview, 2018). This evidence hints that locating a triage section separate from the supporting clinical module hinders situational awareness of patient care activities in the clinic. This evidence expresses that a more central location for the triage section, which would be adjacent to the clinical module, improves access for staff to a frequently used room outside the clinical module.

In case two, the triage section is centralized in the clinic providing better access for staff. Additionally, the triage section is located in front of the clinic, which enhances the movement of patients in and out of the clinic. The five rooms dedicated to the triage section provides more space for registered nurses to initially screen patients compared to the one room in case one. The evidence from the two cases signals that the centralized location of the triage section increases access to care, while improving staff workflow for patient care.

In conclusion, ancillary services that are located in a central area in the clinic improves accessibility for staff for patient care support. Clustering the most frequently used support rooms facilitates efficient workflow. This is accomplished by clustering a point-of-care lab, specialty provider's offices, and a triage section in a central area of the clinic. First, the point-of-care lab is deemed as the most utilized space outside the clinical modules, which implies a necessary support room type in all typologies of primary care clinics. Second, a central location for specialty provider's office space is needed to create equal access for clinical core teams in the clinic. Last, the integration of a triage section in primary care clinics improves access to patient care for patients, while meeting the unique requirements for solider sick-call operations. The central location of the triage section can enhance situational awareness for two or more clinical core teams in a primary care clinic. These three design recommendations are applicable to all primary care clinic typologies in the MHS, and may improve the team-based environment for patient care.

Clinical Support Room Layout

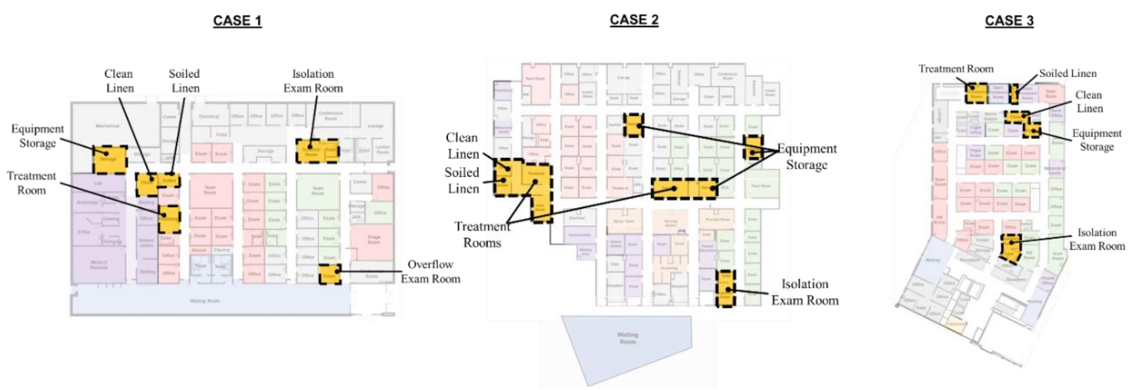


Figure 9.3: Layout of Clinical Support Rooms

The staff are dissatisfied across the three cases with the location of the clinical support rooms in the clinic. Each of the cases offer similar types of clinical support rooms including medical storage, clean and soiled linen rooms, treatment rooms, and isolation exam rooms. However, case one lacks a patient education room, yet offers an extra exam room for patient overflow in the clinic. As a result, two themes emerge from the cases concerning the location of the clinical support rooms: (a) proximity to treatment and clean/soiled linen rooms, and (b) under-utilized isolation exam rooms.

First, the clean/soiled linen rooms are scattered throughout the clinic, which hinders staff workflow. Staff use the term supply room interchangeable when referencing the clean/soiled linen rooms across the cases, however the staff identified the clean room as the more commonly used supply room. Therefore, the term supply room is utilized to describe the clean room in this chapter. The supply room in case two is located on the perimeter of the clinic, which requires staff to travel unnecessary distances for medical supplies. A licensed practical nurse described the process for getting supplies in case two, saying "I have to go to two or three different rooms sometimes because our central location is not central for getting supplies" (Licensed Practical Nurse Case 2 Interview, 2018). Similarly, case one and three require one clinical core team to travel across the clinic to retrieve supplies for patient care. This finding points out that centralized supply rooms in the clinic reduce staff travel distances. Additionally, establishing a smaller decentralized supply room in each clinical module further minimizes unnecessary travel outside of the clinical module. This evidence demonstrates that the location of supply rooms influence efficient staff workflow in the clinic.

The treatment room is deemed the most sharable room type across all the cases, but are decentralized in the clinics, limiting the ability share the room among the clinical core teams. In case one the treatment room is located adjacent to clinical module one, which leads to their staff controlling the scheduling for the room, and requiring staff in clinical module two travel across the clinic. In case three, the treatment room is located in the back of the clinic, limiting visibility for staff to manage the activities in the room. A primary care provider expressed dissatisfaction with the location of the treatment room, saying “the treatment room is so far away from our nurses and everybody else feels like it’s almost unsafe to put a sick patient back there, because there’s no direct eyes on the room” (Primary Care Provider Case 3 Interview, 2018). This evidence hints at safety concerns for the treatment room located in the back of the clinic.

In case two, the main treatment room is located on the perimeter of the clinic, requiring a licensed practical nurse to work-out of the room during clinic hours. Additionally, staff in clinical module four travel across the clinic to utilize the space. There are secondary treatment rooms that are utilized for specialty procedures in the clinic, but were observed as having limiting usage. Furthermore, the residency students in case two converted the unused cast room into an on-call room to provide closer proximity to the treatment room from their workspaces. This evidence demonstrates that a centralized treatment room offers better access for sharing a room type across the clinical modules. Furthermore, locating the treatment room in a central area affords accessibility for staff in transferring patients from the triage section, which reduces staff and patient travel distances in the clinic.

Second, direct observations across the cases demonstrated the under-utilization of isolation exam rooms in primary care settings. The MHS deals with a soldier patient population that travel internationally in efforts to support the defense of the United States. The decision to incorporate the isolation exam room is intended to aid the management of patients with highly contagious virus, which may have been encountered through a recent international trip. However, staff knowledge on a patient's condition is limited to information willingly provided during the scheduling of a medical appointment or by identifying the patient's condition for a walk-in appointment. This evidence hints at the misalignment of isolation exam room requirements in primary care settings.

In case three, a patient with an unknowing contagious virus was processed through a normal routine patient appointment. This process resulted in the contagious patient remaining in a standard exam room to mitigate the spread of the virus, and left the isolation exam room unused for the intended purpose. Similarly, the isolation exam rooms in case one and two were left vacant during site observations. In case two, the isolation exam room is used as a screening room to collect patients initial height and weight vitals. Additionally, the community-based clinic analyzed in the first phase of this study lacked an isolation exam room. The findings from multiple cases demonstrate that locating an isolation exam room in a primary care seems to misalign with how patient care is performed for a patient with a contagious virus. This information implies that the isolation exam room is not a necessary room requirement for all primary care clinics in the MHS.

The analysis for access to clinical support rooms reveals staff workflow efficiency is enhanced through centralized spaces, while at the same time reducing unnecessary room types in the clinic. Centralizing the clean/soiled and treatment room align with previous study performed on the MHS (Battisto et al., 2012). However, rethinking the mandatory requirement for isolation exam rooms can reduce the spatial allocation for an unnecessary room type in a primary care setting. Furthermore, isolation exam room types are not standard in civilian primary care clinics (Vickery, Nyberg, Whiteaker, 2015). The evidence demonstrated in this sub-section illustrates the significance for clustering clinical support rooms in a primary care clinic to improve staff workflow.

Design Recommendations for the Overall Clinic

The MHS needs to develop a new inter-clinic module diagram that clusters frequently used and non-frequently used support rooms in the clinic (as shown in Figure 9.4). The findings from the three cases demonstrates which support rooms are best recommended for the two zones that include frequently and non-frequently used support rooms. In addition, a second diagram is recommended to illustrate a layout of the frequently used support rooms in the clinic (Figure 9.5). These two diagrams contribute towards developing a well-organized clinic layout for the MHS.

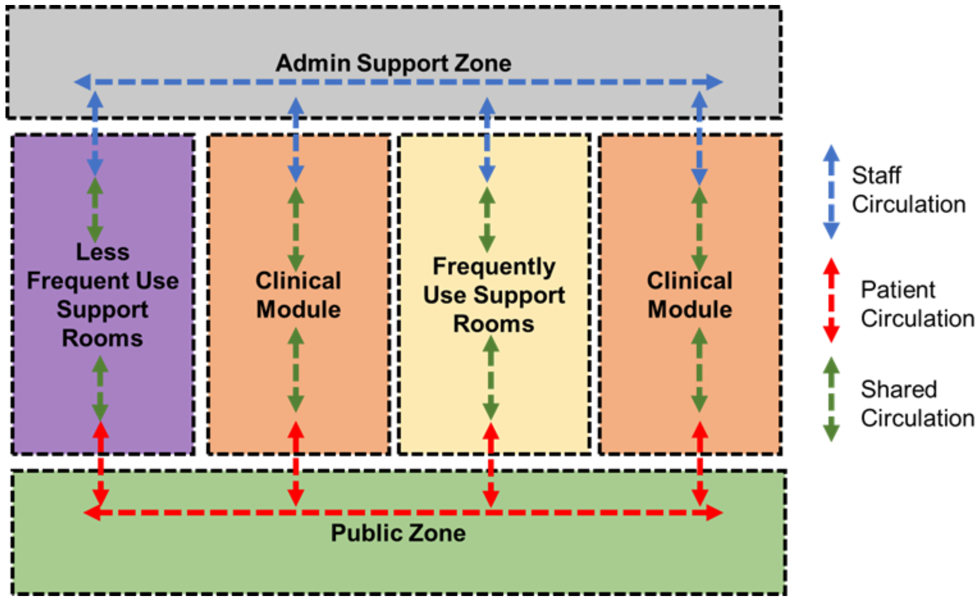


Figure 9.4: Inter-Clinic Diagram

First, non-frequently used support rooms including pharmacy, radiology, and audiology should be clustered on either perimeter of the clinic. Additionally, support rooms that support flight physicals or dermatology in the clinic can be grouped into this zone. Moving these sections to the perimeter of the clinic establishes clear organization of spaces.

Second, clustering the most frequently used support rooms in between the clinical modules promotes access for the clinical care teams (Figure 9.5). The findings from the three cases reveal that the most-frequently used support rooms include (a) point-of-care lab, (b) soiled/clean linen room, (c) treatment room, (d) specialty provider offices, and (e) triage section. Locating these room types in a central area between the clinical modules reduces unnecessary staff travel distances for patient care. Clinics with more than two clinical modules should still locate the frequently used rooms in the center of the clinic.

Additionally, including a triage section in the central location aligns with the MHS function of screening walk-in patients, while increasing accessibility to patient care. Furthermore, the literature indicates that combining urgent-care and primary care is an emerging trend that enhance patient care delivery for civilian primary care clinics (Roenius and Buckley, 2018). Lastly, colocating an immunization section with a point-of-care lab allows for similar medical equipment to be shared across the two sections.

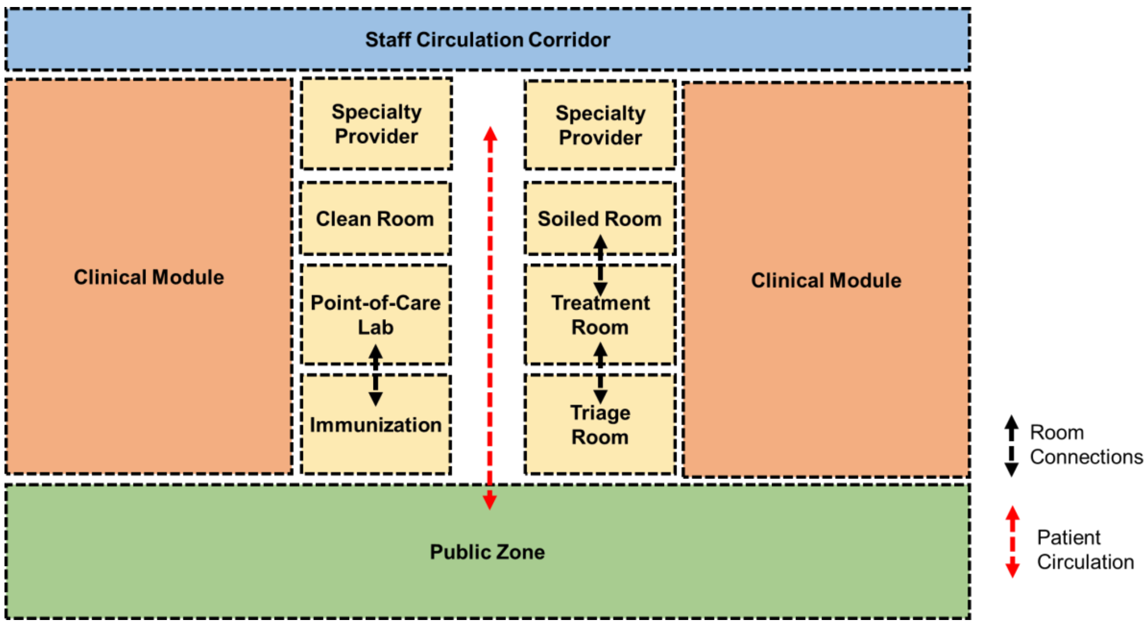


Figure 9.5: Proposed Layout for Frequently Used Rooms

9.2B Circulation Pathways: Shared Staff and Patient Corridors

Studying patient and staff movement through corridors during patient visits offers insights into workflow patterns. The prevailing view in the literature is that separating staff and patient corridors fosters staff privacy and the ability to move more fluidly in the clinic (Battisto et al., 2009; Karp et al., 2016). Across the cases, staff and patients share corridors, which contradicts much of the recommendations in the literature. The findings in this sub-section analyze the circulation pathways and staff perceptions to develop design recommendations for the overall clinic layout.

Figure 9.8: Patient Circulation

The shared circulation pathways afford staff with limited privacy, as patients are capable of walking past staff work areas. The clinical staff are frequently moving in and out of staff workspaces to meet the demands for patient care delivery. Each provider sub-team from the cases, which includes one primary care provider and one to two licensed practical nurse, sees a range of patients from seven to twenty-four per day. This means that the team room doors are opening and closing at a minimum 16 times per day to perform patient care activities, which doesn't account for additional staff trips to get supplies for patient care. Additionally, staff leave doors open to workspaces due to the frequent movements for patient care, which signals more opportunities for patients to overhear private conversations. A registered nurse in case two claimed that staff workspaces should be separate from patient corridors, saying "it allows the patient a lot of opportunities for HIPAA violations" (Registered Nurse Case 2 Interview, 2018). The healthcare administrator in case three expressed the concern with the shared circulation, saying "potentially [shared circulation] can be an issue especially with the staff doors open" (Healthcare Administrator Case 3 Interview, 2018). This evidence signals that existing circulation pathways compromise the ability to maintain patient privacy laws published through the Health Insurance Portability and Accountability Act (HIPAA) of 1996.

Furthermore, locating staff workspaces in the shared corridor leads to noise related distractions to complete work that requires focus and concentration. In case one, a registered nurse an office in the front of the clinic desired to move towards the back of the clinic, saying "move my office down the hall further because it does get a little loud with people you know clamoring in and out from the waiting room" (Registered Nurse Case 1 Interview, 2018). This evidence reveals that shared circulation pathways may produce noise related distractions for staff workspaces. Additionally, locating staff workspaces in patient corridors replicates the issues depicted from the physician-centric clinic layout discussed in chapter two. The noise related distractions and staff privacy issues reinforce the literature for establishing separate circulation pathways.

However, the majority of staff across the cases viewed that sharing corridors with patients is either a strength or non-issue for supporting patient care. The primary care providers in case three took advantage of the shared corridors by assessing the patient's conditions, one provider stated that "I don't mind seeing the patients before I get to actually physically lay hands on them" (Primary Care Provider Case 3 Interview, 2018). This implies that the examination of the patient starts in the corridors of the clinic. In case one and two staff across the different roles reported that sharing corridors with patients is a non-issue. One primary care provider from case one explained that "I don't think that it matters much to share hallways with patients" (Primary Care Provider Case One Interview, 2018). This signals that staff engage in limited conversations regarding patient care in the clinic corridors. The evidence indicates that staff view sharing corridors with patients as not detrimental for clinic workflow.

The findings point out that sharing circulation pathways in the three cases establish trade-offs in supporting the delivery of patient care. The staff utilize the shared circulation pathway to check patient's conditions prior to entering the exam room, which enhances the time allotted for staff to visual inspect the patient. At the same time, staff limit engagements for patient care conversations in the shared corridors due to awareness of HIPAA policies. However, allowing patients to travel past staff workspaces reveals violations for privacy of patient information and noise related distractions. These findings demonstrate the need to establish spatial barriers through the layout of clinic to support privacy for staff workspaces.

Design Recommendations Regarding Circulation Pathways

The separation of circulation pathways is an unnecessary requirement when staff workspaces are spatial separated from patient care areas. The findings illustrate that locating staff workspaces in corridors that patients travel past compromises the privacy of confidential information. This demonstrates the justification for spatially separating patient and staff areas in the clinic, which the literature advocates for in recent clinic designs. At the same time, establishing two separate circulation pathways for patients and staff is unnecessary with the clinic layout. Therefore, the design strategy that spatially separates staff work areas from patient circulation corridors is recommended.

A design strategy that locates staff workspaces in the back of the clinic, while keeping patient care areas in the front of the clinic creates a layout that reinforces HIPAA policies. This type of spatial layout allows for shared circulation pathways in the clinic, countering the stance in the current design literature. The shared circulation pathways supports the staff's ability to examine patient conditions prior to entering the exam room. Additionally, this recommended layout requires less space for the overall clinic compared to the on-stage/off-stage clinical module layout (Nyberg, 2015). Furthermore, the separation of staff and patient areas aligns with the current MHS intra-clinic diagram. The clear separation of patient and staff areas indicates how the physical environment enhances the delivery of patient care.

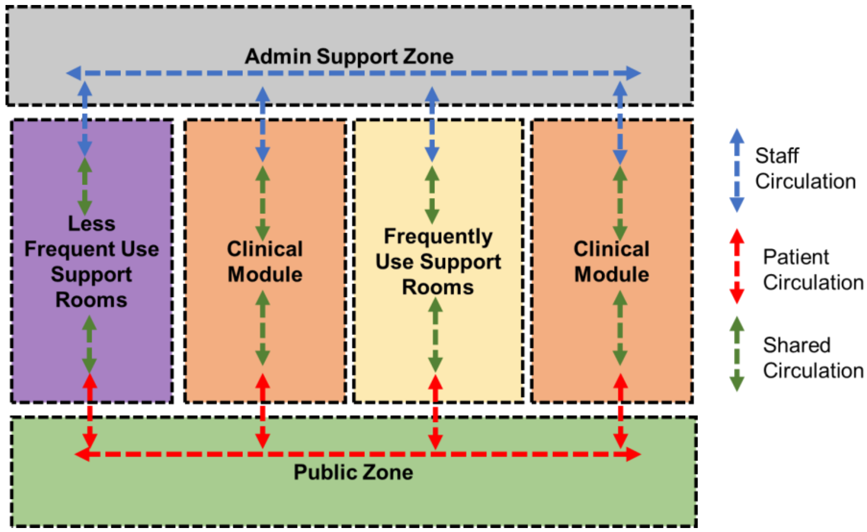


Figure 9.7: Separate Staff and Patient Circulation

9.3 Clinical Module Design

The organization and layout of a clinical module represents a critical component in how the clinic environment influences the delivery of team-based care. Programmatic elements such as the size, location, and allocation of spaces are important for developing a functionally clinical module. This section analyzes the clinical module layout through five areas: (a) room types, (b) travel distances inside the clinical module, (c) satisfaction with the clinical module layout, and (d) allocation of exam room space. The first sub-section establishes room types essential for supporting patient care. In the second sub-section, evaluates travel distances to determine the most efficient location of the team room in the clinical modules The third section compares the staff satisfaction ratings of the clinical module layout to provide further evidence for a functional clinical module design. The final section describes the spatial allocation of exam rooms in a clinical module.

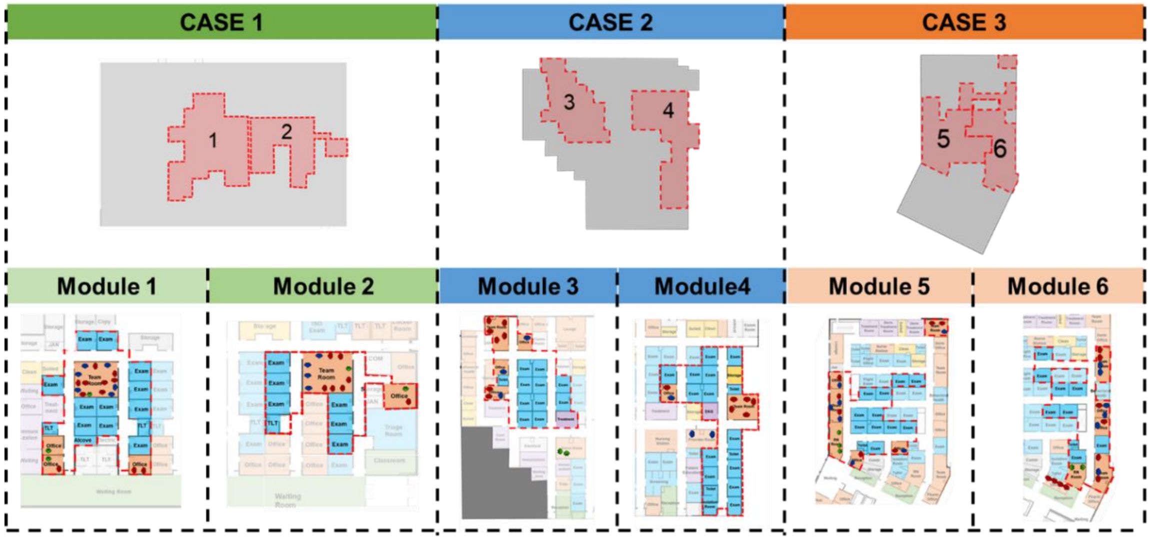


Figure 9.8: Clinical Module Layouts

9.3A Types of Rooms in the Team-Based Clinical Module

The MHS space planning criteria lacks the identification of room types for a team-based clinical module. The exam patient area in the current space planning criteria, which starts to identify room types for a clinical module, accounts for 13 room types that can potentially be included in a clinical module. Therefore, this section examines the floor plans of the three cases for evidence-based recommendations for room types for a clinical module. Staff opinions and direct observations are utilized to evaluate the evidence from the floor plans. This approach leads to evidence-based room types essential for a clinical module to support patient care delivery.

Table 9.2

Room Types for a Clinical Module

	CASE 1				CASE 2				CASE 3			
	MODULE 1		MODULE 2		MODULE 3		MODULE 4		MODULE 5		MODULE 6	
	Actual Rooms	Staff Identified (N=12)	Actual Rooms	Staff Identified (N=11)	Actual Rooms	Staff Identified (N=8)	Actual Rooms	Staff Identified (N=9)	Actual Rooms	Staff Identified (N=8)	Actual Rooms	Staff Identified (N=6)
Exam Room	11	12	6	11	10	3	13	3	11	5	8	4
Alcove Screening	2		1		1				1		1	
Patient Toilet	2		1		1		3		1		1	
Treatment Room				2	1	2	1	6		6		2
Isolation Exam Room					1		1	1		1		
Team Room	1		1	2	1	1	1	2	1	3	1	1
Private Office	1				2					1		
Shared Office	2		1									1
Sub-Team Office					1		1		5		4	
Supply Room						2	1	3		2		3

Across the six clinical modules four room types emerge to support the delivery of patient care. The four room types include (a) exam rooms, (b) team rooms, (c) patient toilets, and (d) supply room. The floor plan analysis indicates that the screening alcove is additional room type for a clinical module. However, clinical staff responses lacked the identification of screening alcove and a patient toilet for room types in a clinical module. Furthermore, staff identified treatment and supply rooms as room types need for a clinical module. Direct observations and related interview questions from staff signal which room types create a functional environment for clinical modules.

The exam rooms and team room(s) are the backbone for creating a clinic module that functionally supports patient care delivery. The exam rooms establish the intersection for staff and patients to receive care in a clinical module, making this room type a critical function for patient care. Furthermore, staff across the cases deemed the exam room as the most important room types for a clinical module. This finding points out that staff value room types that support patient care for a functional clinical module.

At the same time, the team room offers staff dedicated workspace within the clinical module, which allows staff to complete collaborative and focused work. The observations across the cases revealed that staff spend a majority of their time working in the team room. However, the team room received limited identification as one of the most important room types in a clinical module. This evidence hints at a potential dissatisfaction with team room configurations for a team-based environment.

Furthermore, staff and patients need access to a patient toilet in the clinical module. The general observations from the cases indicated that staff members utilize patient toilet in the clinical module. The utilization of the patient toilet reduces staff travel outside of the clinical module. Additionally, the patient toilet provides staff and patients with a functional room to collect specimen samples. Locating the patient toilet in the clinical module allows staff to maintain visual awareness of patient activities during routine patient appointments. As a result, the patient toilet provides a functional room type that reduces unnecessary travel outside of the clinical module for patients and staff.

The supply room provides staff direct access to a room that supports the delivery of patient care. A supply room references the clean linen room from the staff perspective. The floor plan analysis reveals that supply rooms are scattered throughout the clinic. Staff from case one and three favored the supply room location due to the small size of the clinics and proximity to workspaces, saying “relatively small clinic makes distances pretty good [to the supply room]” (Licensed Practical Nurse Interview Module 1, 2018). However, staff from case two were dissatisfied with the location of the supply room, saying “to get supplies that’s a little bit of a trek” (Licensed Practical Nurse Interview

Module 4, 2018). Furthermore, the literature and current MHS space planning criteria advocate for a centralized supply room in the clinic to support patient care (Battisto et al., 2012; MHS SPC, 2017). This evidence reveals that the supply rooms are decentralized from the clinical modules, which requires staff to travel unnecessary distances to support patient care. Therefore, locating a smaller sized, approximately 60 to 90 NSF, supply room in each clinical module offers a more functional environment for patient care.

The collection of patient's vitals for height and weight in a screening alcove is a required activity for patient appointments. In case two, the staff established make shift screening alcoves in under-utilized spaces due to the lack of the room type in the clinical modules. This points out that the screening alcove a significant room type for a functional clinical module. However, in case three screening equipment was colocated in the exam room, which made the justification for screening alcoves unnecessary to support patient care. Similarly, the community-based clinic in the first phase of the study colocated screening equipment in the exam room. This evidence implies that a screening alcove is an unnecessary room type for a functional clinical module.

Table 9.3
Procedure Workload per Clinical Module

	CASE 1		CASE 2		CASE 3	
	Module 1	**Module 2**	**Module 3**	**Module 4**	**Module 5**	**Module 6**
Annual Patient Procedures	6,307	120	1,320	947	252	322
Number of Treatment Rooms	1		3		1	
Daily Patient Procedures	26*	1	3	3	1	1

Staff across the cases perceived the treatment room as a functional room type for a clinical module. The workload data for the treatment room indicates the under-utilization of the room compared to the other room types in a clinical module. For example, all of the modules except module one, perform less than three patient procedures per day. Clinical module one is the exception as one primary care physician performed high volumes of vasectomy procedures in the clinic and across the street in the adjacent primary care clinic, which increased the annual numbers of procedures. This helps to explain the approximately 26 daily procedures performed for primary care providers in clinical module one. At the same time, all clinical staff across the cases deemed the treatment room as the most sharable room type for a clinic. The staff opinions and evidence from the floor plans take-off reveals the treatment rooms offer a more functional role as a sharable room type. Therefore, the evidence demonstrates that a treatment room is better shared across clinical modules.

In summary, room types to support a functional clinical module environment include four types: (a) exam rooms, (b) team room, (c) supply room, and (d) patient toilet. Each of the room types supports the clinic core team's ability to deliver self-sustaining patient care within a clinical module. Furthermore, the evidence aligns with the literature stance for clinical module room types (Belknap & Lafferty, 2011; VA, 2015; DoD SPC, 2017; Taylor et al., 2011; Capital Link, 2011; DuBose, Lim, Westlake, 2015; Vickery, 2012). Therefore, the findings in this sub-section establish four-room types, noted above, that cultivate a functional team-based environment for patient care.

Design Recommendations for Team-Based Clinical Modules

The findings underscore the importance of establishing a new section in the MHS space planning criteria for a clinical module that defines necessary room types. The four recommended room types include (a) exam rooms, (b) team room, (c) supply room, and (d) patient toilet. These room types contribute to reducing the variations of rooms in a clinical module to only the most essential to streamline patient care delivery.

9.3B Travel Distances Inside the Clinical Module

The most frequent activity for delivering patient care is conducting a medical appointment. This makes understanding staff travel distances inside a clinical module a key factor. Across the three cases, each provider sub-team saw a range of seven to twenty-four patients per day, which requires staff to travel outside the team room 14 times per day at a minimum. The layout of the clinical module can either aid or hinder staff workflow through the travel distances for patient care. This sub-section analyzes the travel distances for each staff role in a provider sub-team for a routine patient appointment. Additionally, this section examines the travel distances from the team room to the exam rooms and waiting room, which represent the most common traveled distances for patient care. Findings in this sub-section establish the location of the team room to create a functional clinical module layout.

Table 9.4
Travel Distances in the Clinical Modules

		CASE 1		CASE 2		CASE 3	
		Module 1	**Module 2**	**Module 3**	**Module 4**	**Module 5**	**Module 6**
Primary Care Provider	Average Travel Distance Per Patient	64 Ft.	52 Ft.	112 Ft.	80 Ft.	70 Ft.	78 Ft.
	Evaluation Indicator	Strength	Strength	Strength	Strength	Strength	Strength
Licensed Practical Nurse	Average Travel Distance Per Patient	141 Ft.	186 Ft.	379 Ft.	169 Ft.	174 Ft.	185 Ft.
	Evaluation Indicator	Strength	Weakness	Weakness	Strength	Strength	Strength
Team Room Average Distance to:	Exam Room	32 Ft.	26 Ft.	56 Ft.	40 Ft.	35 Ft.	39 Ft.
	Evaluation Indicator	Strength	Strength	Strength	Strength	Strength	Strength
	Waiting Room	66 Ft.	66 Ft.	152 Ft.	66 Ft.	61 Ft.	37 Ft.
	Evaluation Indicator	Strength	Strength	Weakness	Strength	Strength	Strength

The staff role on a provider sub-team determines the average travel distance for a routine medical appointment. Primary care providers travel distances inside the clinical module are the shortest of all staff ranging from 52 Ft. to 112 Ft. for routine patient appointments. This evidence implies that travel distances for primary care providers are prioritized as they represent the leader of a provider sub-team. The licensed practical nurses travel the furthest distances inside the clinical module ranging from 141 Ft. to 379 Ft. for routine patient appointments. This signals that role of the licensed practical nurse is to collect the patient from the waiting room and escort the patient to the exam room. The registered nurses' travel patterns for medical appointments don't occur on a regular basis, limiting the need to understand their travel distances in the clinical modules.

Across all the cases, primary care providers are satisfied with travel distances inside the clinical modules. The primary care providers mainly travel from the team room to exams and back to the team room, which ranges in the cases from seven to twenty-four times per day. In case three, a primary care provider claimed satisfaction with the travel distances, saying “exam rooms are a few paces away” (Primary Care Provider Case 3, 2018). A primary care provider in case two explained that the travel distances are “perfect because our exam rooms are right across the hall, and we don’t have to walk too far” (Primary Care Provider Interview Case 2, 2018). This points out that primary care providers prefer close proximity to their exam rooms, which reinforces the design of a physician-centric clinic. The physician-centric clinic prioritizes primary care providers’ travel distances, while at the same time compromising staff privacy. This means that locating exam rooms too close to the team rooms hinders the ability to maintain privacy of confidential information. Therefore, consideration of distances from the team room to exam rooms needs to protect staff privacy without hindering primary care provider’s workflow.

The travel distances for licensed practical nurses in the clinical modules points out efficient and inefficient workflow for patient care. Licensed practical nurses across the cases perceived efficient workflow with average travel distances that range from 141 Ft. to 185 Ft. per patient appointment. A major contributing factor for the staff satisfaction was demonstrated by allocating screening alcoves in each corridor for the clinical module or by colocating screening equipment in the exam room. This reduced licensed practical nurses unnecessary travel distances in the clinical module, leading to the enhancement of staff workflow.

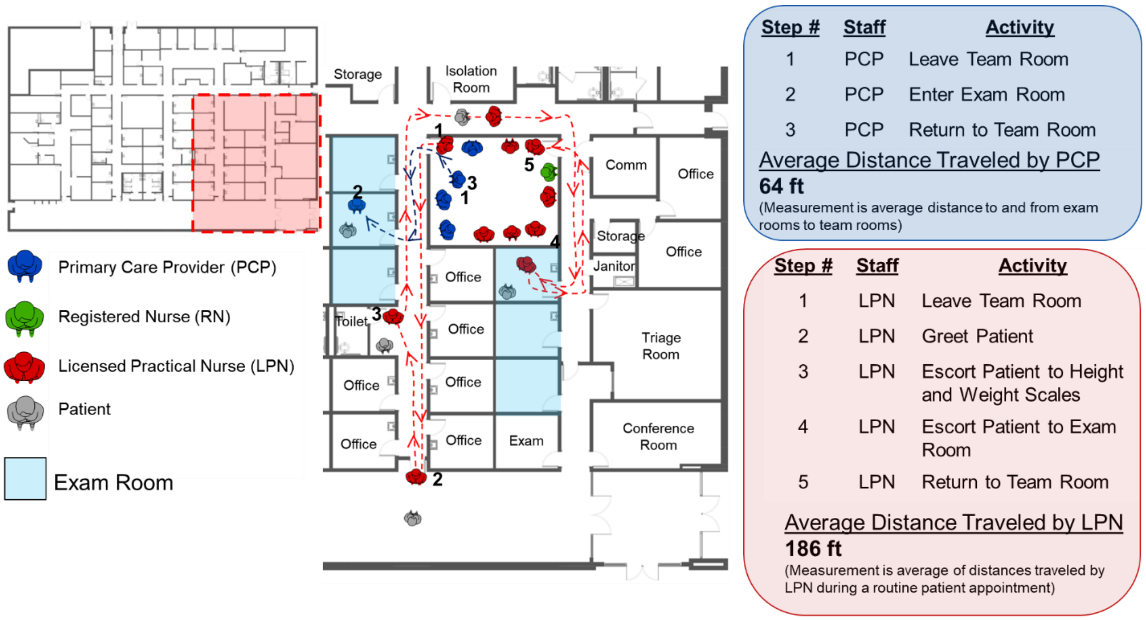


Figure 9.9: Clinical Module 2 Lack of Screening Alcove

Furthermore, the lack of a screening alcove in each corridor created inefficient workflow for the licensed practical nurses. One licensed practical nurse in clinical module two expressed that "we have to weigh the patient and then walk around [the team room] to these other exam rooms. [I] wish we just had one hallway for patient care" (Licensed Practical Nurse Interview Module 2, 2018). In clinical module three, licensed practical nurses travel the furthest average distance of 379 Ft. in all three cases. This issue is exemplified by requiring staff to pass through an ancillary service corridor before reaching the waiting room, and allocating one screening alcove for two corridors that support patient care. Two licensed practical nurses from clinical module three described that they easily get in 10,000 daily steps before going home for the day. Therefore, the licensed practical nurses are dissatisfied with the allocation of screening alcoves and travel distances from the team room to the waiting room that are over 152 Ft. The inefficient workflow for the licensed practical nurses affects the potential workflow for each provider sub-team and the collective clinical care team.

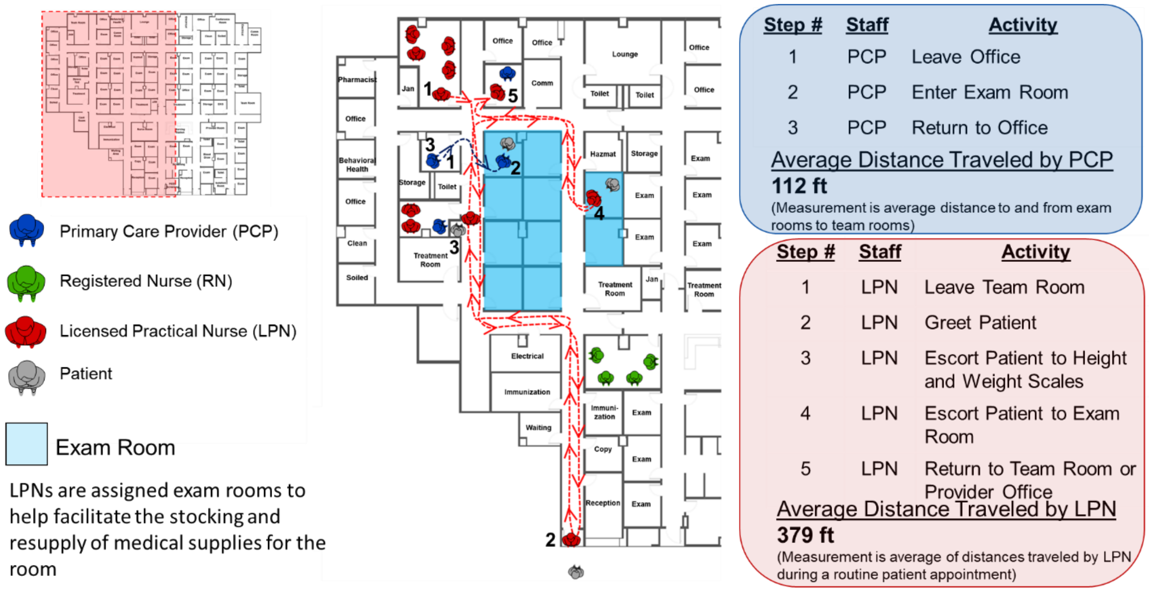


Figure 9.10: Clinical Module 3 Excessive Travel Distances

Findings in this section reveal two design factors to enhance staff workflow for patient care activities in the clinical modules. First, requiring screening alcoves in a clinical module is unnecessary with the colocation of height and weight equipment in the exam room. The colocation of screening equipment in the exam room creates efficient staff workflow for the clinical core team. Second, locating the team room from the waiting with travel distances that ranges 60 Ft. to 70 Ft. improves the workflow of the clinical core team. This range of distances from the team room to the waiting room provides ample space for exam rooms to be located in front of the team room. These two design strategies create efficient staff workflow in a clinical module for a team-based care environment.

Design Recommendations for Travel Distances

Establish travel distances from the team room to the waiting room that range from 60 Ft. to 70 Ft. for efficient staff workflow. Travel distances that fall between 70 Ft. and 151 Ft. may lead to less than efficient travel distances for patient care, but requires further analysis to determine the workflow efficiency. However, travel distances that exceed 151 Ft. from the team room to the waiting room will establish inefficient staff workflow for patient care delivery based on staff perspectives. Therefore, corridors that staff travel down for patient care exceeding 151 Ft. should be avoided.

9.3C Layout of Clinical Module

The previous sub-sections illustrated the necessary room types, sizes, and efficient travel distances for developing a functional clinical module. This sub-section analyzes how the clinical module layouts influence the delivery of patient care. A clinical module should be organized to support efficient travel distances through the right allocation of spaces, while maintaining staff privacy (Herman Miller, 2011; Battisto et al., 2009; Whiteaker, 2015; Farahmand et al., 2011; Taylor, 1999). The first sub-section examines the staff satisfaction of the six clinical module designs in understanding which layout is the best for a team-based care environment. The second sub-section evaluates the allocation of exam rooms across the clinical modules to establish a functional clinical module environment that supports patient care.

Satisfaction with the Clinical Module Layout

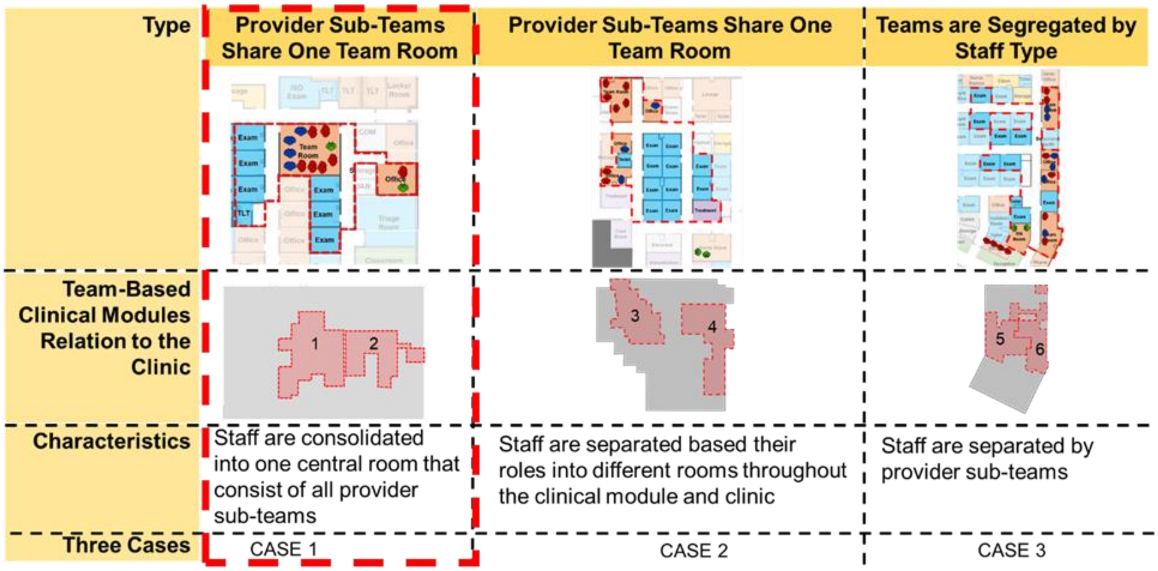


Figure 9.17: Clinical Module that Represents the Best Layout

Table 9.5
Staff Satisfaction with the Clinical Module Design

	MODULE 1		MODULE 2		MODULE 3		MODULE 4		MODULE 5		MODULE 6		TOTAL	
	N	SATISFACTION	N	SATISFACTION	N	SATISFACTION	N	SATISFACTION	N	SATISFACTION	N	SATISFACTION	N	SATISFACTION
Primary Care Provider	4	75%	3	100%	2	50%	3	100%	2	50%	2	100%	16	81%
Registered Nurse	2	100%	2	100%	2	100%	2	50%	2	50%	2	100%	12	83%
Licensed Practical Nurse	6	100%	6	100%	4	50%	4	75%	4	25%	2	50%	26	73%
TOTAL	12	92%	11	100%	8	63%	9	78%	8	38%	6	83%		

The centralized team room located in the back of the clinical modules one and two received the highest satisfaction ratings among the six modules. The centrally located team room provided staff with efficient travel distances, colocation of team members and more privacy for confidential information. A licensed practical nurse from case one described the team location as a “fairly good place, with a central location for patients and staff that just works” (Licensed Practical Nurse Case 1, 2018). This evidence points out that the separation of staff and patient areas along with travel distances are indicators for staff satisfaction.

At the same time, clinical module two received 100% satisfaction rating compared to clinical module one's 96% satisfaction rating due to two exam rooms located behind the team room. The one dissatisfied primary care provider expressed the concerns for privacy with the team location saying, "I think it's risky in a way because there are two exam rooms behind the team room" (Primary Care Provider Interviewer Case 1 Interview, 2018). This evidence supports claims made earlier that high volume workload in a primary care clinic presents chances for patients to overhear confidential information when walking past open doors for staff areas. Therefore, locating the exam rooms directly behind a team is not desirable for a functional clinical module layout.

Prioritizing staff privacy over proximity of the team room location to the waiting room leads to staff dissatisfaction. In clinical module three the team room for the licensed practical nurse is located in the back of the clinical module with exam rooms in front, but requires staff to travel 152 Ft. to reach the waiting room. One licensed practical nurse complained about the excessive travel distances from the team room to the waiting room saying "I don't even have time to go back to my desk when you are in the [team room] because you are on different hallways [always] going back and forth" (Licensed Practical Nurse Case 2 Interview, 2018). Additionally, a healthcare administrator elaborated on the dissatisfaction with the team room location in clinical module three, saying "team [4] is ok because it is kind of right up front and close to the waiting room. Team [3] is way in the back, kind of secluded. They are away from everybody so for them, it is a bad situation" (Healthcare Administrator Case 2 Interview, 2018). At the same time, one licensed practical nurse claimed satisfaction with the location of the team room, saying "it's positioned properly because the room is out of the way for patients" (Licensed Practical Nurse Case 2 Interview, 2018). This evidence reveals that staff want a team room to offer privacy and proximity to the waiting room. Therefore, striking a balance between staff privacy and proximity to the waiting room is a future design recommendation.

Registered nurses were dissatisfied with the separation of the clinical core teams in both case two and three. In case two, the registered nurses for both teams care colocated in a central room that separates them from primary care providers and licensed practical nurse. One registered nurse provided insights with the problem of separating clinical core teams by saying "we are spread out in relation to my [team] room, with considerable distance. My team is at least one doorway away and not just like right down the hallway. I wish that it was easier to check on the team" (Registered Nurse Case 2 Interview, 2018). Similarly, registered nurses in case three were separated from the provider sub-teams, especially in clinical module six were they are located in front of the clinic. A registered nurse from clinical module six described the dissatisfaction of their team room location, saying "[the other team rooms] are located well except for our office, we've got the two doorways, and don't have windows" (Registered Nurse Case 3 Interview, 2018). The lack of visibility and situational awareness of clinical core team activities points out dissatisfaction for registered nurses in a team-based environment.

This evidence implies that registered nurses workspaces need visibility of provider sub-team work areas.

The findings in this sub-section signal the importance's of establish the team room location first in designing a clinical module. The location of the team room needs to strike a balance with staff privacy and proximity to the waiting room. At the same time, registered nurses want visibility of provider sub-team work areas to maintain situational awareness of patient care activities throughout the day. Positioning the team room in the back of the clinical module with exam rooms in the front establishes staff privacy. Additionally, ensure excessive travel distances of 152 Ft. are avoided with the team room location proximity to the waiting room. The evidence from the staff satisfaction ratings demonstrate that a centralized team room in the back of the clinical module is an optimal location for a team-based care environments.

Design Recommendations for the Clinical Layout of the Module

Design the clinical module around a centralized team room in the back of the clinical module to support staff privacy and proximity to the waiting room. The location of the team room in the back of the clinical module reinforces an off-stage environment. This means staff are capable of freely collaborating on patient treatment plans without concerns of patients overhearing private conversations. Furthermore, the location of the team room needs to occur first in the initial planning and design phases to support a functional clinical module.

Locating the team room in the back of the clinical module fosters an on-stage/off-stage design concept. The exam rooms are located in front of the team room, which prevents patients from wondering into staff areas (as indicated in Figure 9.12). At the same time, staff have access to off-stage areas and move freely around the clinic out of the eye-sight of patients. This establishes an on-stage/off-stage environment without adding more square footage for circulation space as depicted with the Veteran Administration clinical module.

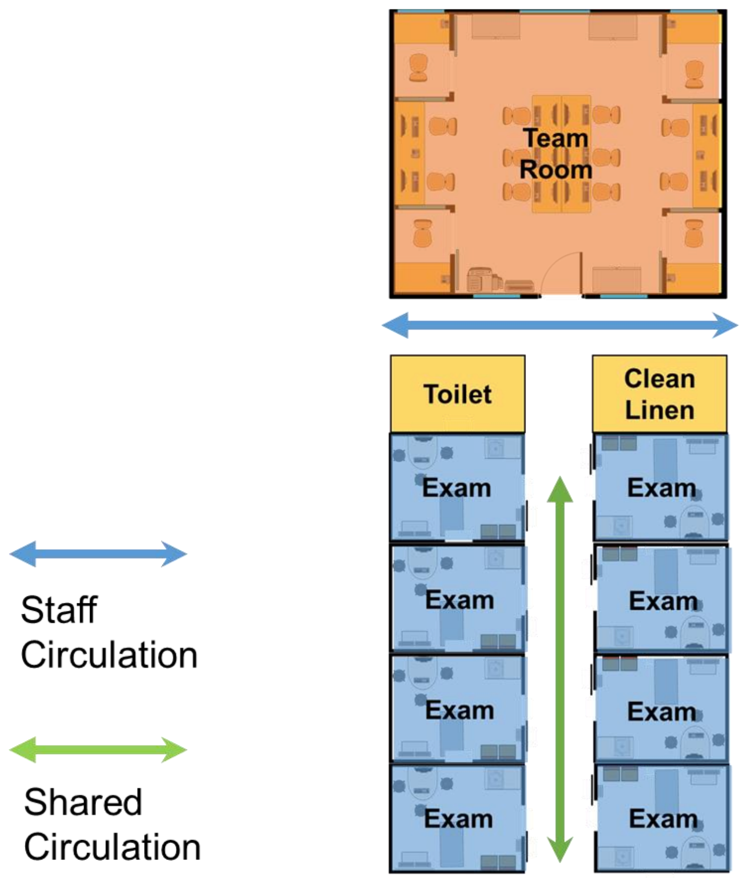


Figure 9.12: Proposed Clinical Module Layout

Shared office spaces for registered nurses and case managers need visibility of the team room to maintain situational awareness of staff activities. This implies that staff spaces not a part of the clinical module are located behind the team room. Creating a staff administrative zone with additional offices, building support rooms, and break-rooms organizes these room types in a cluster for the clinic layout. Establishing a cluster similar room types decreases inefficient staff workflow for patient care.

Furthermore, the staff offices can enhance visibility by establishing glass walls or ribbon windows similarly to the recommendation for the team room design. The glass walls or windows enhance the visibility outside of staff workspaces. This allows staff to make better connections for situational awareness and collaborative engagements in a team-based environment (Zimring and DuBose, 2017; DuBose et al., 2015).

9.3D Allocation of Exam Rooms

Table 9.6

Allocation and Utilization Rates for Exam Rooms

	CASE 1		**CASE 2**		**CASE 3**	
	Module 1	**Module 2**	**Module 3**	**Module 4**	**Module 5**	**Module 6**
Annual Face-to-Face Patient Encounters (240 Days)	40,205*	11,051	30,996	24,458	10,346	8,826
Number of Primary Care Providers	6	4	8	8	6	4
Average Patient Encounter per Day for a Primary Care Provider	28	12	16	13	7	9
Utilization Rate (40 min appointment for 8 hour days)	233%	100%	133%	108%	58%	75%
Actual Number of Exam Rooms	11	6	10	13	11	8
Daily Exam Room Workload	13	8	13	8	4	4
Exam Room Utilization Rate	134%	80%	154%	94%	41%	48%

* Total patient workload includes patients screened in the triage room

Across the cases primary care providers are sharing exam rooms, except for case three. In case three, primary care providers are allocated two dedicated exam rooms for patient care delivery, which aligns with the 2006 MHS design guidance criteria. However, the analysis indicates that sharing exam rooms with multiple provider sub-teams increases the utilization rate for the primary care providers and exam rooms. This aligns with the previous study conducted by the MHS suggesting that primary care providers should share exam rooms (Zimring and DuBose, 2017).

At the same time, the primary care provider utilization rate suggest patient care appointments occur in less time than the standard MHS 40 minute appointment. Factors that are potentially influencing the length of a medical appointment include patient type, travel distances, and staff structuring for provider sub-teams. Patient types such as pediatrics, soldiers, and military retirees impact the duration of a standard medical appointment. This suggest that the MHS design guidance criteria should establish standard appointment times based on the type of patient.

The analysis of staff travel distances from the team room to the waiting room adds a guideline in determining the proper allocation of exam rooms for a clinical module. For example, efficient staff travel distances in a clinical module are recommend in a range of 60 Ft. to 70 Ft. to support patient care. Additionally, integrating the recommended 60 NSF patient toilet, supply room, and staff corridor reduces the available 60 Ft. to approximately 49 Ft. This means that exam room's sizes that range from 125 NSF to 140 NSF can fit four to eight rooms in a clinical module. This recommended allocation of rooms advocates for primary care providers to share exam rooms, but still maintain clear boundaries between the team-based clinical modules.

Furthermore, the staffing structure for the provider sub-team plays an important role in exam room utilization. Provider sub-teams with one primary care provider and one licensed practical nurse influence the workflow efficiency for patient care delivery. Incorporating two licensed practical nurses allows the provider sub-team to screen patients efficiently, while also supporting necessary trips to the point-of-care lab in the clinic. Therefore, the staffing structure for provider sub-teams with one primary care provider and two licensed practical nurses is a necessary component for achieving optimal utilization rates for exam rooms in team-based clinical modules.

Table 9.7
MHS Workload Formula for Exam Room Allocation

	CASE 1		**CASE 2**		**CASE 3**	
Annual Clinic Patient Encounters	51,257		55,445		19,172	
Primary Care Providers	10		16		10	
Actual Number of Exam Rooms	17		23		19	
MHS Exam Room Allocation (based on workload formula in SPC 2017)	22		28		8	
	MODULE 1	**MODULE 2**	**MODULE 3**	**MODULE 4**	**MODULE 5**	**MODULE 6**
Annual Patient Encounters	40,205	11,051	30,966	24,458	10,346	8,826
Primary Care Providers	6	4*	8**	8**	6	4
Actual Number of Exam Rooms	11	6	10	13	11	8
MHS Exam Room Allocation (based on workload formula in SPC 2017)	17	5	15	12	4	4

* Number of primary care providers varies due to military training requirements

** Residency instructors and students account for 1/2 of a primary care provider

The analysis of the MHS patient workload formula for allocation of exam rooms is based on cumulative patient encounters for the entire clinic. For example, case two annual patient encounters were 55,455, and when using the current MHS workload formula would result in the allocation of 28 exam rooms. This means that splitting the number of exam rooms evenly among the two clinical modules would produce14 exam rooms for each module. As a result, clinical module four is under-allocated one exam room, while clinical module five is provided two additional exam rooms that surpass the workload formula requirements. This demonstrates that the current workload formula is misaligned with the delivery of team-based care. Instead, utilizing the workload formula for each team-based clinical module would result in better alignment with the allocation of exam rooms in team-based clinical modules. The evidence in this sub-sections signals that the current MHS formula for exam room allocation is misaligned with the delivery of team-based care. The misalignment creates unnecessary exam rooms for team-based clinical modules. Instead, establishing consistent staff sizes for provider sub-teams, advocating for efficient travel distances, and using the current exam room allocation formula for each team-based clinical module is a better strategy for allocation of exam rooms. Furthermore, these recommendations reinforce sharing exam rooms among provider sub-teams within a team-based clinical module.

Design Recommendations for Allocation of Exam Rooms

The findings indicates the MHS should establish three planning factors for determining the allocation of exam rooms: (a) exam allocation based on team-based clinical modules patient workload, (b) determining average appointment lengths based on the patient type, (c) efficient travel distances from the team room to the waiting room, and (d) standard staffing structure for team-based clinical modules. These four planning factors should improve staff workflow and create a functional team-based clinical module for patient care delivery.

9.4 Room Sizes and Shapes: Exam Room and Team Room

New team-based care activities reduce occupational stress from working as an individual in a private office and support patient care in the exam room. The size and shape of exam and team rooms influence how team-based care activities occur (Herman Miller, 2011; Cahnman, 2011; Mahlum Architects, 2011; Capital Link, 2011; Center for Health Design, 2016). This section analyzes the size of the rooms based on staff activities that support a team-based care environment. The first sub-section evaluates the different sizes of the exam room based on the number of staff, patients, and family members occupying the space. In the second sub-section, team room sizes are examined based on the available workspace per staff member. The findings reveal new design recommendations for sizes of rooms to support team-based care.

9.4A Exam Room Sizes for Team-Based Care

Table 9.8
Exam Room Sizes

			EXAM ROOM SIZE				
	# of Staff	**# of Patient**	**120 NSF** (Available Space per Individual in Sq. Ft.)	**125 NSF** (Available Space per Individual in Sq. Ft.)	**130 NSF** (Available Space per Individual in Sq. Ft.)	**140 NSF** (Available Space per Individual in Sq. Ft.)	**150 NSF** (Available Space per Individual in Sq. Ft.)
Physician-Centric	1	1	60	63	65	70	75
Team-Based	2	1	40	42	43	47	50
Team-Based w/Caregiver	2	2	30	31	33	35	38
Team-Based w/Family	2	3	24	25	26	28	30

The small size of the exam room provides limited capacity to support the evolving demands of team-based care. The size of the exam rooms are relatively consistent at 120 NSF across the three cases and representative of the MHS design guidance. As discussed in chapter four, a team-based approach includes a minimum one primary care provider, one licensed practical nurse, and the patient occupying the room. This approach reduces stressors for primary care providers and facilitates a learning environment for licensed practical nurses. A learning environment for licensed practical nurses influences potential health outcomes for military operations overseas, which is a strategic goal for the MHS.

The current exam room size only offers a range of 24 Sq. Ft. to 60 Sq. Ft. of available space, which lacks the exam table and traditional medical equipment that occupies the space. A licensed practical nurse from case three described the current size of exam rooms by saying “I would make them [exam rooms] slightly bigger, it doesn’t take very long for you and your patient to feel very claustrophobic” (Licensed Practical Nurse Interview Module 5, 2018). This evidence indicates that the size of the exam room is too small to accommodate necessary medical equipment, one staff member, and a patient. Increasing the number of staff or patients in the room restricts the capacity to deliver effective team-based care.

At the same time, the role of the exam room is moving beyond a team-based approach for patient care. Patients are bringing additional family members and caregivers to medical appointments, which reduces available space for patient care (Omole et al., 2011; Rosland et al., 2011; McDaniel et al., 2005). Additionally, the size and weight of the average American is increasing, further limiting space in the exam room (Rosenthal et al., 2017; Alston and Okrent, 2017). Lastly, the exam room is transitioning to more universal space that accommodates screening equipment, telemedicine, and patient consults (VA, 2015; Battisto et al., 2009; Herman Miller, 2011). Therefore, the limited size of 120 NSF exam room hinders the ability to deliver effective patient care.

The evidence reveals that the size of exam rooms are a critical factor for delivering team-based care for a modern era. The Veteran Administration, increased the size of exam rooms from 120 NSF to 125 NSF, providing 42 Sq. Ft. per individual to support team-based care activities. Additionally, the VA replaced traditional doors with sliding doors to offer more available space in the exam room for patient care activities. At the same time, the MHS design guidelines already include a bariatric exam room that is sized for 150 NSF, which offers a rather large 50 Sq. Ft. per individual for a team-based approach of three individuals in the room. This evidence points out that an acceptable exam room size ranges from 125 NSF to 150 NSF to support emerging activities for effective patient care delivery.

Design Recommendations for Exam Rooms

Establish new exam room templates that support new patient care trends through four design factors: (a) accommodate staff, patients, and family members, (b) create a universal patient care room to accommodate patient exam, consult, patient education, and telemedicine, (c) replace traditional doors with sliding doors, and (d) Incorporate screening equipment in the exam room. Exam room sizes that range from 125 NSF to 140 NSF provide the ability to integrate these three design factors to improve the delivery of patient care.

The Veteran Administration (2015) offers an initial exam room template that the MHS can readily adopt into the current design guidance. Future evaluations of the size of the exam rooms for the MHS can analyze staff and patient satisfaction in MHS community-based clinics. The community-based clinics are leased facilities that allows for different size exam rooms. For example, the community-based clinic studied in the first phase offered a range of exam room sizes from 119 NSF to 142 NSF. Performing this type of evaluation on the exam room supports the MHS movement in becoming evidence-based leaders for future exam room designs.

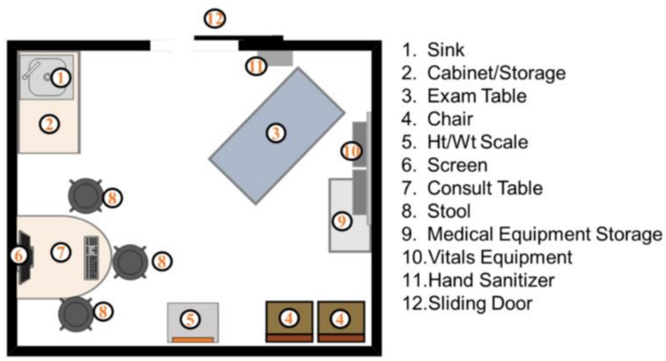


Figure 9.13: Exam Room Template (VA, 2015)

9.4B Team Room Size and Shape

Table 9.9

Team Room Sizes and Shapes

Case	**Module**	**Team Room Size** (Net Square Feet)	**Team Room Shape**	**# of Staff**	**Room Size per Staff** (Square Feet)	**Evaluation Indicator**
1	1	468	Squared	15	31	Weakness
	2	480	Squared	11	44	Weakness
2	3	131	L-Shaped	3	38	Weakness
	3	318	L-Shaped	5	64	Weakness
	3/4	280	Squared	5	56	Strength
	4	245	Squared	5	69	Strength
3	5	262	Rectangle	3	87	Weakness
	5	233	Rectangle	5	47	Weakness
	5	221	Squared	4	55	Strength
	5	120	Squared	2	60	Strength
	5	119	Squared	2	60	Strength
	5	128	L-Shaped	2	64	Weakness
	6	294	Rectangle	3	98	Strength
	6	257	Rectangle	4	64	Strength
	6	219	Rectangle	2	110	Strength
	6	128	Squared	3	43	Weakness
	6	125	Squared	2	63	Strength

The size and shape of the team room directly affect the ability to conduct collaborative and focused-work for patient care. The three cases provide 17 different team room sizes that range from 119 NSF to 480 NSF, which expresses a non-standardized approach for the tea, room design. Assuming all staff are in the team room at one time, theses rooms offer a wide range of space for staff workstations that include 31 Sq. Ft. to 110 Sq. Ft. per staff. Additionally, the shape of the team rooms include squared, rectangle, and L-shaped that influence the ability to collaborate, focus on work, and move freely around the room. As a result, the size and shape of team rooms point out strengths and weakness for the current configurations.

The team rooms that range in size from 245 NSF to 480 NSF does not support both collaborative and focused work for staff in case one and two. In case one, staff prefer the colocation of the entire clinical team to enhance collaboration, saying "[this] allows for good flow of information, accessibility to staff, and the ability hear all the conversations" (Registered Nurse Case 1 Interview, 2018). However, clinical staff from case one illustrate challenges of the open office team room with noise related distractions, stating "[It's] hard to find one place to focus so I use an office in alternative building" (Primary Care Provider Case 1 Interview, 2018). This illustrates that the restricted size of individual staff workstations ranging from 31 Sq. Ft. to 44 Sq. Ft. hinders the ability to complete focused work.

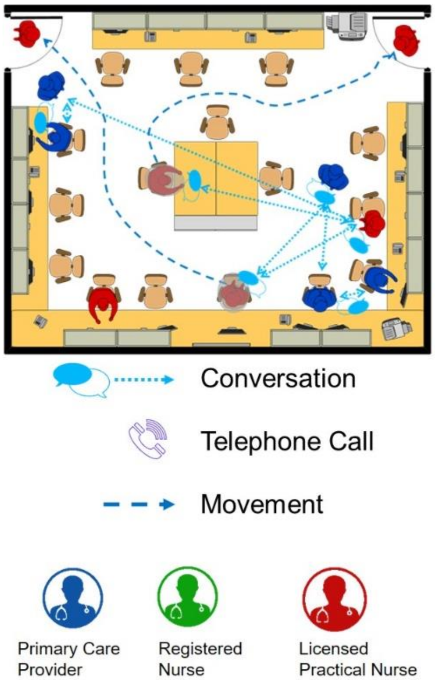


Figure 9.14: Clinical Module 1 Team Room Observation

Similarly, staff from case two identified the same strengths and weaknesses for the open office team room. The team rooms in case two housed five to ten staff members during the course of a typical day, which created a range of 56 Sq. Ft. to 69 Sq. Ft. per workstation for rooms sized over 245 NSF. One primary care provider described the satisfaction with the size of the team rooms by saying “being in the same environment with my nurses facilitates communication” (Primary Care Provider Case 2 Interview, 2018). This evidence points out that individual workstations that range from 56 Sq. Ft. to 69 Sq. Ft. per individual provides adequate space for collaboration. At the same time, a registered nurse expressed that the large open office created excessive noise, saying “a lot of noise in our team room, so I use the [treatment room] because there is nobody in there” (Registered Nurse Case 2 Interview, 2018). The evidence illustrates the open team rooms that range in size from 245 NSF to 481 NSF promote a team-based environment, but lack a private area to complete focused work. This means that providing large open team rooms with no private work areas which is not conducive for the delivery of patient care.

Team rooms that house provider sub-teams that include two to three individuals offer privacy for focused work. These team rooms range in size from 119 NSF to 294 NSF, which provides 38 Sq. Ft to 98 Sq. Ft. per staff workstation. In case three, staff reported that the provider sub-team room size provides the colocation of two to three staff, while affording necessary privacy to complete focused work. One licensed practical nurse illustrated that the provider sub-team room is “quiet, there’s not too much distraction” (Licensed Practical Nurse Case 3 Interview, 2018). This implies that the smaller number of staff in these provider sub-team rooms improves privacy and the ability to complete focused work for patient care.

At the same time, staff expressed that the separation of the entire team hinders visibility and situational awareness for patient care activities. One registered nurse expressed dissatisfaction with the lack of visibility from the team room, saying “I don’t really know what’s going on with the flow of the patient care during the day” (Registered Nurse Case 3 Interview, 2018). The evidence reveals that the smaller provider sub-team rooms work for privacy, but restricts visibility of patient care activities for the team. This signals that smaller team rooms prioritize privacy, but limits visibility of staff activities for patient care. As a result, team rooms need to strike a balance between spaces that allow for visibility, while offering staff privacy at individual workstations.

Furthermore, the shape of the team rooms influence the functionality of space for team-based care. In clinical module five, the rectangular shape and narrow width of the team rooms, approximately 9 Ft., limits the space for staff circulation in the room. One primary care provider expressed that the room is “long and awkward, I prefer squared space rooms as they provide just a little bit more maneuverability in the rooms.” (Primary Care Provider Case 3 Interview, 2018). Furthermore, team huddles occur in the back hallway of the clinic due to shape of the team room. One licensed practical nurse explained their dissatisfaction, saying, “I feel like the only time we’re all really able to as a team to get together and communicate is during the clinic huddle. So I feel like the team just our team, doesn’t ever have a special spot that we could all just get together and chat.” (Licensed Practical Nurse Case 3 Interview, 2018). This indicates that the rectangular shaped team rooms provide the inability to conduct collaborative conversations for the entire clinical care team. The evidence expresses that long and narrow rectangular shaped team rooms hampers an environment for team-based care.

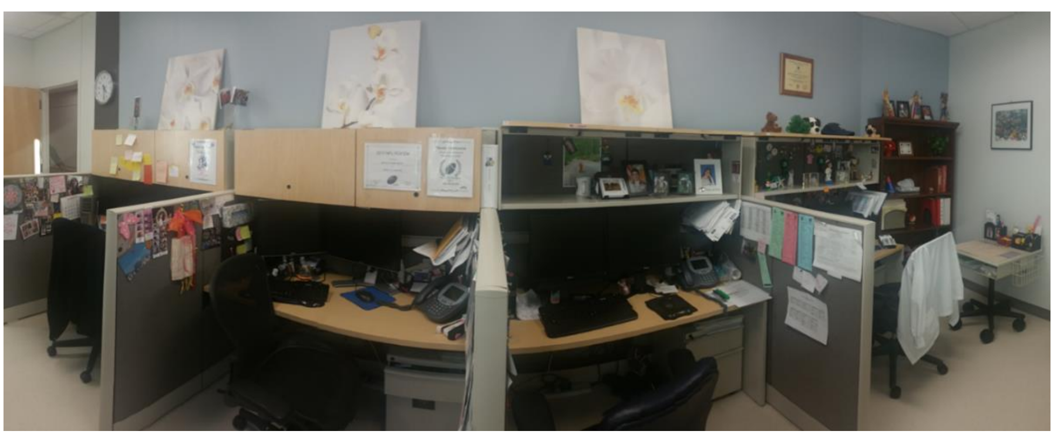


Figure 9.15: Clinical Module 5 Registered Nurse Team Room View from Back Wall

Similarly, the L-shape team room in case two limits staff visibility and collaboration, especially for team huddles that occur in the morning with the entire staff. The direct observations of this team room demonstrated how staff members positioned in the back of room are unaware of who is entering the room. Additionally, staff members positioned in the back of the team room during team huddles had restricted visibility of the registered nurse in the front, which has the potential to influence information heard in the huddle. This evidence demonstrates that the L-shaped room influences the staff ability to collaborate and maintain situational awareness of activities in the room. Therefore, a squared-shaped team room supports a team-based care environment more than rectangular and L-shaped team rooms.

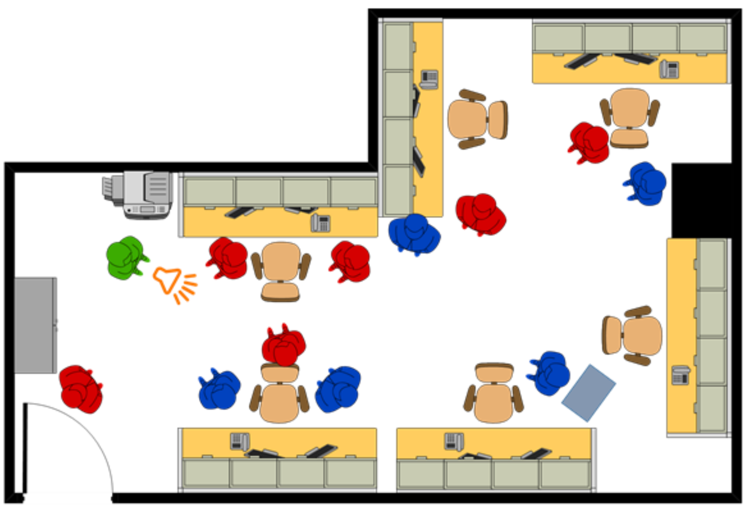


Figure 9.16: Clinical Module 3 Team Huddle

The evidence in this sub-section demonstrates how the size and shape of the team rooms influences a team-based care environment. Open-concept team rooms that support five to fifteen staff members provide ample space for staff collaboration, but restrict the ability to complete work that requires focus and concentration. The provider sub-team rooms that house two to three staff members afford privacy, while at the same time limiting collaboration and visibility of staff for the clinical core team. This means that the team room needs to balance an environment for collaboration and privacy to complete staff activities that demand concentration. Therefore, a team room that provides a collaboration space in the middle and private workstations on the perimeter fosters a team-based environment.

Design Recommendations for Team Rooms

Create team rooms that offer space for collaboration and focused work by: (a) establishing the size of the team room based on the number of occupants, (b) providing private workstations on the perimeter, (c) establishing collaboration space in the middle of the room, and (d) support visibility outside the team room. These design strategies may improve a team-based care environment, which can influence the staff perceptions of the physical environment. Improving the environmental conditions for the staff team room can improve the staff satisfaction levels resulting potential better health outcomes for patient care.

First, establish the size of the team room based on the number of staff in the room. The findings in this sub-section illustrate that team rooms that house 11 to 15 staff create cramped workstations, and lead to excessive noise. Provider sub-team rooms that housed three to four offered staff privacy, but restricted visibility of staff activities. Open team rooms that housed five to ten staff demonstrated ample space with a range of 56 Sq.Ft. to 69 Sq. Ft. per individual workstation. The literature supports this evidence with establishing a range of 48 Sq. Ft. to 60 Sq. Ft. per individual workstation (Belknap and

Lafferty, 2011). Therefore, team rooms that house five to ten staff with a range of 48 Sq. Ft. to 60 Sq. Ft. is a design recommendation for the MHS. The five to ten staff should include one to three primary care providers, one registered nurse, and two-to-six licensed practical nurses. This recommended team room size creates a staff workspace that is spacious for supporting a team-based environment.

Second, provide private workstation on the perimeter of the team room to support staff with work that requires focus and concentration. These private workstations should offer a range of space from 24 Sq. Ft. to 30 Sq. Ft. for individuals to complete work in privacy. The smaller size helps to prevent staff members from occupying the spaces as their full-time workstation. Additionally, make the walls glass to reduce noise related distractions and increase visibility of staff locations (Watkins et al., 2016). Locating the private workstations at the corners of a squared-shaped team room offers accessibility to the four workstations, while increasing staff situational awareness of activities in the team room.

Third, establish a collaboration space in the central area of the team room. This spatial arrangement allows staff to engage in collaborative interactions by turning their chairs inwards. Furthermore, a central collaboration space supports the clinical core team's ability to perform daily team huddles. The central area creates a team-environment that supports collaboration and privacy with workstation located on the perimeter of the clinic.

Finally, enhance visibility outside the team room with glass walls or windows on the ends of the team room. This is accomplished by creating glass walls or ribbon windows that are located on the walls adjacent to the patient and staff only corridors. Enhancing visibility from the team room improves the staff's situational awareness of team member's activities for patient care. However, making the entire wall glass may lead to a 'fish-bowl' affect that creates dissatisfaction among the staff (Goodrich, 1982). Therefore, the utilization of glass walls or ribbon windows need to avoid providing too much visibility, which limits staff privacy in the team room.

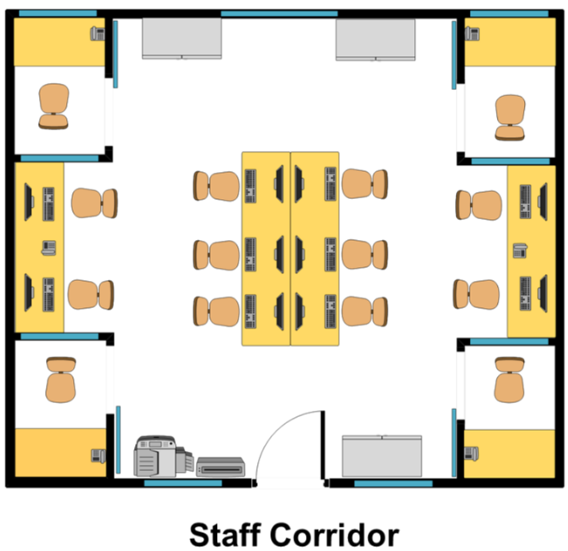


Figure 9.17: Proposed Layout for a Team Room

9.5 Discussion

The cross-case synthesis supports five design recommendations to improve team-based care in PCMH primary care clinics: (a) establish standardized clinical modules, (b) create new team room template, (c) update exam room templates, (d) separate staff and patient care areas (e) cluster frequently-used and non-frequently used support rooms. Considering these five design recommendations into the MHS design guidance criteria will help support a team-based clinical module.

First, primary care clinics should be designed around standardized clinical modules. The standardization of the clinical module occurs by defining room types and allocation of spaces that include: (a) one team room, (b) one patient toilet, (c) one supply room, and (d) four to eight exam rooms. Additionally, the number of exam rooms in a clinical module is determined by the travel distances less than 50 Ft. from the team room door, along with sizes of rooms in the clinical module. This facilitates a well-organized clinical module that offers designers and planners flexibility with the layout of the clinic. Furthermore, the literature advocates for well-organized clinical modules that are standardize to improve the delivery of patient care (Battisto et al., 2012). This design recommendation contributes to reducing the capability of the physical environment in hindering the delivery of patient care.

Second, create a new team room template that supports both collaborative and focused work for a team environment. The team room should support a clinical core team that supports five to ten staff members. Then determine the size of the room by providing adequate workspace for each staff member that ranges from 48 Sq. Ft. to 60 Sq. Ft. in a squared-shaped room. Provide shared private workstations on the perimeter of the room, which allows the central area to support collaborative work. The size of the private workstations should range from 24 Sq. Ft. to 30 Sq. Ft. to minimalize staff using the space as a dedicated workstation. Lastly, use glass for private workstation and team room perimeter walls to increase visibility to staff and patient care areas. This allows staff to enhance their situational awareness of activities in the clinic and clinical module. The new team room template addresses a current gap in the MHS design guidance criteria that is lacking recommendations that support a team-based environment.

Third, update the exam room template to support colocation of screening equipment in the exam room. The recommended size of exam rooms range from 125 NSF to 140 NSF, which allows the space to accommodate more equipment. The VA, a sister organization to the MHS, increased the standard exam room size to 125 NSF to support team-based care (VA, 2015). This provides an initial blue-print for the MHS to immediately integrate into the MHS design guidance. Future evaluations of exam rooms can offer a better understanding in the optimal size to support patient care in the MHS.

Fourth, separate patient and staff areas through the layout of spaces in the clinic. The design recommendation is accomplished by locating staff workspaces in the back of the clinic, while patient areas are located in the front. Additionally, providing a patient toilet and supply room in each clinical module creates a spatial barrier from staff work areas. This organization of spaces keeps patient circulation away from staff work areas limiting potential breaches for confidential information. Furthermore, this recommended layout reinforces an on-stage/off-stage design concept, without increasing circulation space for patient care delivery (Nyberg, 2015; Taylor, 1999).

Fifth, cluster the most frequently used support rooms in between the clinical modules. The evidence from the cases reveals that frequently used support rooms include: (a) point-of-care lab, (b) soiled/clean linen room, (c) treatment room, (d) specialty provider offices, (e) immunization and (g) triage section. The addition of a triage section in primary care clinics aligns with military protocol for soldiers, while providing patient accessibility to urgent-care services. This aligns with emerging trends in civilian primary care clinics (Roenius and Buckley, 2018). Locating these room types in central module enhances staff workflow for patient care delivery.

Bundle non-frequently used support rooms and administrative spaces on the perimeter of the clinic to enhance the organization of the clinic. The evidence from the cases point out that these additional spaces are currently influencing the staff workflow for patient care. This clustering of spaces fosters boundaries for space allotted to clinical modules, which promotes efficient staff workflow.

In conclusion, these five recommendations advocate for design guidance that support a team-based environment. The current guidance creates primary care clinics' based on the number of exam rooms, which still resembles a physician-centric model of care. Providing new design guidance that focuses on the clinical module establishes a supportive team-based environment for patient care. Furthermore, the findings in this chapter illustrate an evidence-based design process for the MHS to potentially replicate in future evaluations of primary care clinics. Replicating the evaluation of additional primary care clinics can result in further insights on how the physical environment hinders or supports the delivery of patient care.

CHAPTER TEN

CONCLUSION AND DISCUSSION

This dissertation examined how the clinic environment influences the delivery of team-based care in the Military Health System. The study explored environmental factors related to clinic workflow efficiency, clinical module functionality, and the ability to perform collaborative and focused work to delivery effective team-based care. The study integrated a two phase research strategy that utilized a case study approach with ethnographic data collection methods exploring the (a) staff roles and activities for delivering team-based care and (b) how team-based clinical modules support or hinder team-based care delivery as perceived by staff. Tables 10.1 and 10.2 illustrate the research questions and the major findings from this study.

Table 10.1
First Phase of the Research Study

RESEARCH QUESTION	**MAJOR FINDING**
1. What are the clinical staff roles and activities for delivering patient care in a team-based clinical module?	The PCMH model in the MHS uses a primary care provider led team-based approach that helps to share the burden of patient care. The medical team is comprised of primary care providers, registered nurses, licensed practical nurses, and specialty providers. Each of these different staff positions perform a variety of patient care activities in a clinical module to support effective patient care delivery.
a. Who is on the clinical team and what role do they play in delivery care?	The clinical team in MHS primary care clinics include two sub-teams including the clinical core team and the clinical support team. The clinical core team is a primary care provider lead team that provides direct patient care within team-based clinical modules. The clinical core team includes two-to-three provider sub-

	teams and one-to-two registered nurses. The provider sub-teams consist of one primary care provider and two licensed practical nurse who is responsible for supporting patient care appointments. The registered nurses are team leaders responsible for triaging patients, patient teleconferences, and managing the daily work schedule for the clinical core team. The clinical support team includes specialty providers and case managers that engage with the clinical core teams in supporting specialty care for patients. Specialty providers in the cases included clinical pharmacist and behavioral health providers that offered expertise and a gatekeeper into the large healthcare system. The case managers consist of registered nurses and licensed practical nurses who are responsible for monitoring and coordinating patient appointments that occur in acute-care specialty facilities.
b. What are the clinical activities performed by staff in the clinical module and how often do they occur?	Team-based environments support a variety of activities that range from performing medical appointments to conducting daily team huddles for patient care. The four activities that staff perform the most frequently include (a) review of medical charts and notes, (b) medical exam, (c) telephone consults, and (d) dropping off patient lab test.
c. Where do the activities occur in the clinical module?	Team rooms are the most frequently used in the clinic for patient charting, documentation, teleconferences, and consults with primary care providers. In addition, the care teams are delivering patient care in the exam rooms throughout the day, which represent the second most frequently used space in the clinic.

Table 10.2

Second Phase of the Research Study

RESEARCH QUESTION	**MAJOR FINDING**
2. How does the design of the team-based clinical module support or hinder the delivery of team-based care?	The design of the clinical modules can either support or hinder the delivery of team-based care due to travel distances, the layout, and access to staff work spaces for both collaborative and focused work related to patient care.
a. How are primary care environments planned and designed in the Military Health System to support team-based care?	Primary care clinics were originally planned around prior physician-centric practices rather than a team-based approach. After the MHS modifications during the adopted the PCMH model, team rooms and clinical modules were not included in the design guidance criteria.
b. What are the strengths and weaknesses of three different team-based clinical modules for delivering team-based primary care?	The cases illustrate that clinical modules separating patient and staff areas are strengths for team-based care. Decentralized supply rooms and having patients walk past staff offices were weaknesses for patient care delivery. Additionally, the separating clinical core teams into different offices rather than a shared office restricted staff visibility and collaborative work. At the same time, open concept team rooms created noise related distractions compromised staffs' ability to complete work that requires concentration.
c. How could the team-based clinical module improve to support future needs for team-based care?	Cluster four to eight exam rooms around a team room. Locate the team room in furthest away from the patient waiting area to facilitate staff privacy. Locate a patient toilet and supply room to create a spatial barrier to enhance staff privacy in the team room. Then plan for staff travel distances from the team room to the waiting room that are ideally 60 Ft. to 70 Ft. to foster efficient staff workflow. Exam rooms should be dedicated to the overall clinical core team and not

	individual providers to maximize the productive use of space.
d. How is the team room used and what are the environmental requirements with regard to the room?	The team room is utilized for collaborative and focused work to support patient care. The environment needs to strike a balance to support both collaborative and focused work. This is accomplished by (a) limiting the number of the staff to six-to-ten in the room, (b) providing staff spaces that range from 48 Sq. Ft.-to-60 Sq. Ft. per staff member, (c) designing square rooms, (d) providing private workstations on the perimeter of the room, (e) creating collaborative space in the center of the room, and (f) incorporating glass walls and windows to enhance visibility within and on the exterior walls of the team room.

10.1 Discussion of Major Findings

Clinical staff who operate in team-based environments perform a wide-range of activities for patient care delivery, placing immense burden on the physical environment to support the different staff roles and activities associated with team-based care. Furthermore, primary care is rapidly changing with the integration of family members in a medical appointment, inclusion of specialty providers and additional medical equipment for patient care. As a result, multiple design recommendations are offered in the literature to accommodate these functions for delivering effective patient care. The findings from this study validate and identify gaps with design factors for establishing a PCMH environment that include (a) on-stage/off-stage layout, (b) standardize clinical modules, (c) open-staff workspaces, (d) specific sizes of exam rooms, and (e) urgent-care in primary care clinics. Examining how these five design recommendations influence the delivery of care is an integral component for crafting a supportive team-based environment.

First, the on-stage/off-stage design concept allows the separation of patient areas and staff workspaces. The literature offers different design recommendations for interpreting this simple concept that was based on the layout of a Disney theatrical performance (Taylor, 1999; McGough et al., 2003). The central focus for the concept is to provide staff an area that is located away from the patient, offering a layer of privacy for staff. This design concept led to a layout that clearly separates staff and patient circulation by including additional space for dedicated orridors (VA, 2015; ZGF Architects, 2016).

At the same time, the on-stage/off-stage layout centralizes an open team room surrounded by exam rooms with separate entrances for staff and patients (Nyberg, 2015). The literature demonstrates that staff improve workflow efficiency and increase visibility to cut down on time hunting for team members (Harvey et al., 2008; Mayne and Dellenbach, 2014; Friehoefer et al., 2017). However, the literature lacks evidence in understanding how this layout protects staff conversations regarding confidential information. This implies that the on-stage/off-stage layout prioritizes workflow efficiency over the privacy of staff conversations in a centralized team room.

The findings from this study point out that locating exam rooms too close to staff work areas breaches staff privacy. Primary care clinics involve high volume patient workload in which a single provider typically encounters an average of 20 patients per day. This means that using two exam rooms to see 20 patients per day results in the opening and closing of doors 40 times per day for rooms. The number of times doors adjacent to the team room open and close increases even more with eight to ten exam rooms in a clinical module, affording additional opportunities for breaches of staff privacy.

Furthermore, the evidence in this study found that open team rooms supporting 10 or more staff members leads to excessive noise regarding confidential information. This illustrates the significance of separating patient and staff areas in the clinical environment. The race-track clinical module advocates this concept by establishing a centralized team room with glass walls and a circulation corridor in between the exam rooms. However, this layout still permits patients to walk past the constantly opening and closing doors of staff work areas, which may not be always closed due to the high volume workload associated with primary care. A balance between efficient staff workflow and privacy is a fundamental design strategy for team-based environments.

Incorporating the on-stage/off-stage design concept is recommended by locating staff workspaces in the back of the clinic, while patient areas are located in the front. This spatial configuration for a clinical module keeps patient circulation away from staff work areas limiting potential breaches of staff privacy. Furthermore, the recommended layout integrates efficient travel distances for staff from the team room to the waiting room. The proposed clinical module in this study balances staff privacy and efficient workflow for patient care delivery.

Second, clinical modules that are well-organized and standardized enhance the clinic environment in supporting patient care. The literature advocates that clustering room types that include a team room, exam rooms, storage rooms, and clinical support rooms into a standardized clinical module supports flexible clinic layouts during the initial design phases (Belknap and Lafferty, 2011; Capital Link, 2011; Quan et al., 2011; Boulder Associates, 2011; VA, 2015; Taylor et al., 2011). The standardization of team-based clinical modules offers clinical core teams similar types of rooms for a single clinic. Additionally, the literature uses the terms “pods” and “modules” interchangeably to define this spatial construct, which produces different room types and design approaches for team-based environments. Team-based clinical modules exist with limited evaluations of how these room types, sizes, and layouts influences patient care delivery.

The findings from this study demonstrate how non-standardize clinical modules hinder patient care; and establish necessary room types and standard terminology for a team-based environment. The evidence from the study signal four room types necessary for a clinical module that include (a) team room, (b) exam rooms, (c) patient toilet, and (d) supply room. This finding illustrates what staff deem the most important room types for a clinical module. In addition, the staff responses revealed each “pod” should include an individual provider sub-team room and two dedicated exam rooms. The provider sub-team room houses one primary care provider and one to two licensed practical nurses in a shared office environment. This means that two to four pods are joined to establish a clinical module that includes a patient toilet and supply room. Therefore, the findings contribute to the current literature by describing standardized room types and terminology for a team-based care environment.

Third, open-staff workspaces enhance a team-based environment through increased staff visibility and engagements for collaborative work. The design concept emerged to move physicians out of private offices and into a team space, which improved opportunities for staff face-to-face engagements (Oandasan et al., 2009; Gunn et al., 2015; Mayne and Dellenbach, 2014; Agee, Steinberg, and Day, 2016; Sinsky et al, 2013). However, the literature is limited in understanding how staff complete work that requires focus and concentration in an open workspace (Gunn et al., 2015; Karp et al., 2016; DuBose et al., 2015; Oandasan et al., 2009). The open-staff workspaces illustrate how the physical environment influences the ability for both collaborative and private work to support patient care activities.

The findings in this study align with the limited literature in providing both private and collaborative workspace in the team room. The design literature recommends private workstations located to adjacent open staff workspaces to decrease distractions for private work (Quan et al., 2011; Capital Link, 2011; Mayo, 2006). The evidence in this study replicates this stance by establishing a collaborative area in the center of the team room, and private workstations on the perimeter. In addition, the literature recommended that individual workstations should range from 48 Sq. Ft. to 60 Sq. Ft., which provides ample space in the team room for staff (Belknap and Lafferty, 2011). This study found that team rooms that offered 56 Sq. Ft. to 69 Sq. Ft. per workstation resulted in staff satisfaction. This evidence demonstrates that the literatures recommendation is adequate in developing the proper size of a team room.

At the same time, the literature advocates that the number of staff in a team room range from four to seven staff members, which reduces opportunities for noise related distractions (Hubble, 2011; DuBose et al., 2015, Gunn et al., 2015). The findings from this study indicated that a team room which supports a range of five to ten staff decreases noise-related distractions. This finding further supports the recommendations from the current literature in developing an adequate team room that supports both collaborative and focused work.

Fourth, the new activities for team-based care are altering the functional size of the exam rooms. The evidence in this study points out that the standard 120 NSF exam room limits the capability for a team-based approach. This means that only one staff member is in the exam room with the patient at a time. This diminishes learning opportunities for licensed practical nurses in the MHS, who can directly apply these learned experiences in military operations. Interestingly, the Veteran Administration (VA), sister organization to the MHS, increased the size of their standard exam room from 120 NSF to 125 NSF, providing more space for team-based activities. Mounting evidence indicates a movement callings for an increase in exam room size.

In addition, the study reveals that the different patient types justify the need to increase the size of the exam room. For example, pediatric appointments may need to support one to two adults and one to three children, which consumes space for the provider sub-team in the exam room. Patients who are military retirees are often accompanied by a caregiver during standard medical appointments as observed in this study. These findings signal more support for increasing the size of the exam room to accommodate more family members and a team-based approach for patient care in the exam room.

Increasing the size of the exam room transitions the room into a universal space that accommodates more patient care activities and complies with current literature that suggests best practices for transforming exam rooms into universal spaces that support patient care, education consults, and telemedicine appointments (Herman Miller, 2011; Battisto et al., 2009; CADRE, 2015; Nyberg, 2015; Saaty-Tafoya, Malkin, and Wingler, 2013; Watkins, Gandolf-Frietchen, and Siddiqui, 2015). However, the MHS currently requires different spaces for these functions, which increases the overall allocation room types in the clinic. The evidence from the three case signal that consolidating these functions can reduce the allocation of rooms in the clinic. For example, screening equipment consolidated into the exam room can save space in the clinical modules. At the same time, increasing the size of exam room to accommodate patient education and telemedicine decrease the need for additional space in the clinic for those services. Both the literature and the evidence from this study agree on the need to increase the size of the exam room to accommodate team-based care, more family members, and consolidate patient care activities.

Finally, emerging evidence indicates that combining primary care and urgent-care improves access to care for patients. The triage sections in two of the cases accommodate walk-in appointments and treatment for medical conditions that are not emergencies, but still require care within 24 hours. This provides a unique service for the MHS, which is not identified in the existing space planning criteria. The literature hints that combining the two services is a potential way to increase access to patient care and monetary incentives (Roenius and Buckley, 2018). Additionally, the literature lacks an explanation of the clinic environment layout between these two medical sections. In response, this study offers early design recommendations for integrating an urgent care section into a primary care clinic. Future studies need to examine the spatial requirements of this emerging trend.

In summary, these five design factors validate existing knowledge and contribute new design recommendations to enhance a team-based environment. The new design recommendations foster the physical environment as a vessel for delivering effective patient care. At the same time, the findings in the study reveal that a user-centered approach produces practical design recommendations that align with and identify gaps in the current literature. Future studies that integrate a user-centered approach will allow a deeper understanding of how the physical environment can influences the delivery of patient care, while creating more evidence for future design recommendations.

10.2 Study Implications

This study reveals both theoretical and practical design implications for the architecture community. The theoretical application occurs through a place-based framework that advocates for a user-centered approach. The practical design implications are shaped with the integration of the study evaluation framework and a team-based design strategy checklist (Appendix E). Exploring and describing this unique relationship of patient care and the physical environment fosters better health outcomes for individual, organizations, and communities.

The place-based theoretical framework establishes a user-centered approach to evaluate the physical environment (Canter, 1977). The framework demonstrates that evaluating the physical environment without understanding the user roles and activities creates an ill-informed description of the phenomenon being studied. In addition, the framework signals that the term user advocates for the description of the different staff roles for healthcare environments. Obtaining the perceptions of the physical environment through the varying staff roles adds credence to user-centered theories (Vischer, 2009; Canter, 1977). This study expresses the justification for integrating user-centered theories for describing and explaining how the physical environment impacts the users.

At the same time, this study utilized an evaluation framework which measures standard outcomes over multiple sites, which then inform practical design recommendations for the clinic environment. The team-based design strategy checklist offers a designer these practical recommendations in a straight forward tool. Future studies that study PCMH clinic environments with the same framework offer new insights and validation for design strategies recommended through the checklist.

Furthermore, the findings revealed that integrating new models of care without describing staff roles and activities establishes a misalignment with the clinic environment. This misalignment with the clinic environment hinders the ability to achieve the full effectiveness of a new model of care. Encouraging planners and designers to engage with the all the staff roles affords the opportunity to transform the clinic environment for efficient workflow, spaces for both collaborative and focused work, and functional rooms for a team-based clinical module. This type of approach is directly applicable to healthcare organizations looking to improve patient care with emerging models, which provides evidence to inform better design strategies for the physical environment.

The implications of this study indicate that evaluations of the physical environment offer both theoretical and practical knowledge. The study illustrates the significance of applying user-centered theories to inform research that examines the physical environment. Similarly, an evaluation framework signals the importance of linking design thinking to measurable goals/objectives of the physical environment. Therefore, this study contributes two frameworks along with a practical design strategy checklist that is applicable for future investigations of the physical environment and team-based care.

10.3 Study Limitations

The research design for this study was influenced by the qualitative approach, ethnographic data collection, MHS organization, and floor plan layouts. Each of these factors were addressed through all the stages of the study to reduce potential threats to validity. However, these four factors that influence the research design created limitations for study's findings and generalizations. Addressing these limitations is important to understand threats to validity.

First, a qualitative study presents limitations based on the research methodology. The nature of a qualitative research study advocates for the collection of subjective opinions and experiences from a participant. This study utilized self-reported interviews as a primary data source, which offers in-depth understanding of the staff perspective of the relationship between the physical environment and team-based care. The limitation of the self-reported interviews lies with the inability to describe causation of how the physical environment influences team-based care. Due to this limitation, the findings in this study are limited by individuals' social, cultural identities, and prior experiences of team-based care environments.

Second, ethnographic data collection tools rely on the researcher as valid instrument to collect the data. An ethnographic researcher must become a seasoned interviewer to produce a valid research study. This validation was accomplished through two experiences prior to the second phase of this research study, which included interviews with 44 clinical staff in a primary care clinic. This approach facilitated the acquisition of valuable interview skills that involved probing and exploring individuals' responses while performing the interview.

An additional limitation were external factors that influence participant responses. During site visits for case one and two the federal government was at the potential point of shutting down operations, which meant that staff members' job status were in jeopardy. This influenced the staff's conversations and mental focus away from patient care. External factors may have influenced clinical staff mind-set and willingness to engage in conversations with the researcher.

The collection and analysis of interview data demands a systematic process to reduce threats to validity. This was accomplished by creating a standard protocol for conducting the interviews and analyzing the data. The protocol for conducting the interview ensured that each participant was provided a floor plan and asked a standard series of questions. This allowed for a cross-comparison of the clinic, clinical module, and staff roles among the three cases. The analysis of the interview data used a systematic process by transcribing participant's responses, coding those responses, and analyzing the results for each case separately. This was followed up with the creation of story boards to represent initial findings from the single case.

In addition, data saturation and selection of multiple data sources curtailed threats to validity. The collection of 58 clinical staff interviews with different roles fostered the saturation of data, which addresses potential concerns for construct validity (Singleton and Straits, 2011). The clinical staff interviews were then triangulated with additional data sources that included observations, photographs, archival documents, and floor plan take-offs (Creswell, 2014). This technique of data saturation and triangulation focused on mitigating threats to construct and internal validity in a qualitative study.

A third limitation is that cases in this study are representative of the MHS and may not have transferability to external organizations. The MHS has specific terminology, staffing model, staff roles, and operations for a team-based care environment. This limits the generalizability of the study findings to external healthcare organizations, but aids in documenting general knowledge for team-based care environments. Therefore, applying the design recommendations to external healthcare organizations should proceed with caution as different staff roles and activities may influence the shape of the physical environment for team-based care.

Finally, the team-based clinical module layouts include variances across the clinic floor plans. Choosing team-based clinical module layouts with no variances across multiple cases offers more generalizable knowledge for that specific layout. However, the variances across the team-based clinical modules describe common themes that are relatable to all team-based care environments. This makes the findings in this study applicable for future evaluation of team-based care environments.

10.4 Recommendations for Future Studies

This study evaluated how the physical environment influences the delivery of team-based care through staff opinions and experiences. The primary objective for the study was the development of a user-centered research approach that advocates for the voices of staff representing the different clinical staff roles. This approach resulted in a theoretical and performance-based framework to inform future studies of the physical environment. The secondary objective was to evaluate multiple clinical module layouts for the MHS to understand strengths and weakness for the different design strategies. This resulted in design recommendations for planning and designing future MHS team-based environments. Additionally, this study offers the MHS an evaluation methodology for team-based environments, which enhances the organization's goals of becoming leaders in evidence-based practice. This section of the study points out three recommendations for future studies that pertain to the MHS, but are adaptable for external healthcare organizations.

First, continue to repeat the current study to develop more evaluations of team-based care environments. This study only represents three cases from a potential of 431 primary care clinics .The large number of primary care clinics offers the MHS an opportunity to evaluate multiple floor plan configurations, which results in a database of evidence for the physical environment. This type of database would clearly establish the MHS as a leader in the evidence-based design practice, and garner public trust with a federal government organization. Additionally, performing this study prior to the planning and design of new primary care clinics provides insights for aligning the physical environment with the delivery of patient care. This reveals a systematic process to evaluate team-based care environment that results in enhancing the staff ability to delivery effective patient care.

Second, evaluate the spatial configuration of team and exam rooms that support a team-based care environment. The MHS offers a wide range of different sizes and layouts for both team and exam rooms to explore this topic. For example, the community-based clinic in the first phase included exam rooms that ranged from 119 Sq. Ft. to 142 Sq. Ft., which provides a single case to evaluate the size of the exam room. The provider sub-team, which is one primary care provider and one licensed practical nurse, can be given scenarios for multiple patient appointment activities using a think-aloud interview in the different sized exam rooms. In addition, a video recording of the activities can illustrate the workflow patterns that occur in the exam room to support patient care. Similarly, a study of the team room size and layout can result in a deeper understanding of the physical environment conditions. This type of study allows the findings to emerge from staff related to how they perform as a team in the physical environment, while producing optimal room configurations to support a team-based care environment.

Lastly, perform a heuristic evaluation of layouts for healthcare facilities with architects. Architects rely on intuition, which is informed by prior experiences to create new design solutions. This results in multiple variations for a single type of physical environment, which is evident in this study. However, there is powerful knowledge that is obtainable from these intuitions by collecting 10 to 50 architect's evaluations of multiple floor plan configurations. Analyzing the different perspectives from the architects can lead to heuristic guidelines for designing future healthcare environments.

In summary, the three recommended studies advocate for knowledge that is actively made through the opinions and experiences of the users. The user-centered approaches establish physical environments that align with the activities and staff roles associated with the model of care. The physical environment offers a large laboratory to understand how designs strategies support or hinder the staff's ability to deliver patient care. In particular, the MHS presents a unique opportunity to study and evaluate multiple design strategies for healthcare environments. These recommended studies are transferable to external healthcare organizations looking to examine how the physical environment influences the delivery of patient care from the user perspective.

10.5 Conclusion

In a new era of healthcare, primary care is at the forefront of transitioning from a physician-centric model to a team-based model of care to improve health outcomes. This means that across the country, healthcare organizations are rapidly adopting a team-based model known as the Patient-Centered Medical Home (PCMH). The adoption of the PCMH has occurred without fully understanding the staff roles, associated activities, and the relationship to the physical environment. Instead, healthcare organizations are utilizing physician-centric environments that hinder the delivery of team-based care. One way for healthcare organizations to reshape the physical environment is to engage with clinical staff to understand their opinions and experiences towards evaluating the physical environment. Therefore, the study's primary objective is to evaluate the strengths and weaknesses of existing clinical module designs for one of the world's largest healthcare organizations through a user-centered approach.

Findings from this study reveal that clinic environments that were originally planned for a physician-centric model and later adapted to PCMH model during design phases are hindering a team-based environment. Clinical staff, regardless of their role and activities, express dissatisfaction with the lack of a well-organized clinical module. This lack of organized clinical modules creates inefficient workflow for staff and the inability to complete both collaborative and focused work for patient care. However, ethnographic interviews and observations with the different staff roles produced design recommendations that separate staff and patient areas, define standard room types for clinical modules, create a range of optimal team and exam room sizes, establish efficient travel distances in the clinical module, and provides space for both collaborative and focused work. These design recommendations align the physical environment with the delivery of team-based care in the MHS.

Benefits of this study demonstrate that evaluating the physical environment through staff perceptions can result in practical design recommendations. In addition, the study illustrates an evaluation framework for current and future team-based environments, which can lead to a database of evidence for design thinking. The study points out new knowledge for healthcare architecture by way of the study's findings and design recommendations for team-based clinical modules. The MHS should consider adopting the design recommendations from this study into the next version of their space planning criteria. Lastly, the MHS needs to continue the process of evaluating healthcare environments to learn from prior design factors that will result in better staff satisfaction and health outcomes.

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APPENDICES

Appendix A

IRB Approval Letters

Pilot Study IRB Approval Letter

CLEMSON
RESEARCH COMPLIANCE

July 25, 2017

Dr. Dina Battisto
Clemson University
School of Architecture
2-321 Lee Hall
Clemson, SC 29634

OFFICE OF
RESEARCH COMPLIANCE

Clemson University
Clemson Centre
391 College Avenue,
Suite 406
Clemson, SC
29631

P 864-656-1525

RE: IRB2017-158: Task Analysis of Patient-Centered Medical Home Environments to Improve Functionality and Operational Efficiency

Dear Dr. Battisto,

The Clemson University Office of Research Compliance reviewed the protocol referenced above using exempt review procedures and a determination was made on July 25, 2017 that the proposed activities involving human participants qualify as **Exempt under category B2** in accordance with federal regulations 45 CFR 46.101.

No further action or IRB oversight of the protocol is required except in the following situations:

1. Substantial changes made to the protocol that could potentially change the review level. Researchers who modify the study purpose, study sample, or research methods and instruments in ways not covered by the exempt categories will need to submit an expedited or full board review application.
2. Occurrence of unanticipated problem or adverse event; any unanticipated problems involving risk to subjects, complications, and/or adverse events must be reported to the Office of Research Compliance immediately.
3. Change in Principal Investigator (PI)

All research involving human participants must maintain an ethically appropriate standard, which serves to protect the rights and welfare of the participants. This involves obtaining informed consent and maintaining confidentiality of data. Research related records should be retained for a minimum of three (3) years after completion of the study.

The Clemson University IRB is committed to facilitating ethical research and protecting the rights of human subjects. Please contact us if you have any questions and use the IRB number and title when referencing the study in future correspondence.

Sincerely,

NPatin

Nalinee D. Patin, CIP
IRB Administrator

IRB Number: IRB00000481
FWA Number: FWA00004497

www.clemson.edu/research/compliance

Dissertation Study IRB Approval Letter

CLEMSON
RESEARCH COMPLIANCE

August 15, 2017

Dr. Dina Battisto
Clemson University
School of Architecture
2-321 Lee Hall
Clemson, SC 29634

OFFICE OF
RESEARCH COMPLIANCE

Clemson University
Clemson Centre
391 College Avenue,
Suite 406
Clemson, SC
29631

P 864-656-1525

RE: IRB2017-284: The Effectiveness of the Clinical Team Pod for Delivering Team-Based Care in the Patient-Centered Medical Home Clinics

Dear Dr. Battisto,

The Clemson University Office of Research Compliance reviewed the protocol referenced above using exempt review procedures and a determination was made on August 15, 2017 that the proposed activities involving human participants qualify as **Exempt under category B2** in accordance with federal regulations 45 CFR 46.101.

No further action or IRB oversight of the protocol is required except in the following situations:

1. Substantial changes made to the protocol that could potentially change the review level. Researchers who modify the study purpose, study sample, or research methods and instruments in ways not covered by the exempt categories will need to submit an expedited or full board review application.
2. Occurrence of unanticipated problem or adverse event; any unanticipated problems involving risk to subjects, complications, and/or adverse events must be reported to the Office of Research Compliance immediately.
3. Change in Principal Investigator (PI)

All research involving human participants must maintain an ethically appropriate standard, which serves to protect the rights and welfare of the participants. This involves obtaining informed consent and maintaining confidentiality of data. Research related records should be retained for a minimum of three (3) years after completion of the study.

The Clemson University IRB is committed to facilitating ethical research and protecting the rights of human subjects. Please contact us if you have any questions and use the IRB number and title when referencing the study in future correspondence.

Sincerely,

NPatin

Nalinee D. Patin, CIP
IRB Administrator

IRB Number: IRB00000481
FWA Number: FWA00004497

www.clemson.edu/research/compliance

Appendix B

MHS Approval and Site Letters

Department of Army Research Study Sponsorship

DEPARTMENT OF THE ARMY
OFFICE OF THE SURGEON GENERAL
7700 ARLINGTON BOULEVARD
FALLS CHURCH VA 22042-5140

DASG-ZB 25 September 2017

MEMORANDUM THRU: COL Michael D. Brennan, Commander, U.S. Army Health Facility Planning Agency/G9

SES, Chief of Staff 26 Oct 2017

MEMORANDUM FOR: MG Robert D. Tenhet, Major General, U.S. Army Deputy Surgone General and Deputy Commanding General (Support)

Approved

SUBJECT: Research Sponsorship

Name of Researcher: MAJ William Lewis
Title of Protocol: Understanding the Relationship between Clinic Design and Team-Based Care: Case Study of Patient-Centered Medical Home Clinic Team Pod's
Protocol Number: IRB2017-158 and IRB2017-284
Date of Protocol: 15 August 2017

1. References:

a. Title 32 Code of Federal Regulations, Part 219, Protection of Human Subjects

b. Department of Defense (DOD) Instruction 3216.02, Protection of Human Subjects and Adherence to Ethical Standards in DOD-Supported Research

c. Army Regulation 70-25, Protection of Human Subjects in Research

2. Approval. I hereby approve the request for support described below.

3. Scope.

a. I give permission for United States Army Medical Department to provide sponsorship to the above referenced research.

b. MAJ William Lewis is a Long Term Health Education & Training (LTHET) student that is assigned to the Army Medical Department Student Detachment (ASD). He is pursuing a PhD through Clemson University in South Carolina in the field of healthcare architecture. The program curriculum requires that MAJ Lewis conduct a research study to obtain his degree.

c. The purpose of MAJ Lewis' research study will focus on how the clinical team pod design contributes or impedes to team-based care in Patient-Centered Medical Home (PCMH) clinics. The study proposes a data collection approach that includes photographs, interviews, and observations of clinical staff perspectives for the design of the clinical pod. The interviews and observations of the clinical staff will not occur in

DASG-ZB
SUBJECT: Research Sponsorship

rooms while patients care is conducted or interfere with daily operations. Additionally, no patient information will be collected during the duration of this study. Findings from the study will be translated into practical planning and design guidance for future Military Health System facilities.

4. Conditions of approval for research involving human subjects: If this activity is research involving human subjects, this approval is provided on the condition of, and with the understanding that, the researcher's institution will:

a. Provide to my command any human research protection program-related support necessary to implement and oversee the above referenced activity.

b. Obtain and comply with the terms of its Federal Assurance for the Protection of Human Research Subjects for this DOD supported research involving human subjects (if applicable).

c. Inform me via my point of contact below regarding any relevant unanticipated problem involving risk to subjects or others, or serious or continuing noncompliance.

d. Obtain publication clearance review from my command before publishing or otherwise releasing findings from this research to members of the public (e.g., via abstracts).

5. Affirmation. By endorsing this request, I affirm I have determined the above-referenced activity is mission critical and will be worth the time/cost of Army support. I acknowledge that my office assumes responsibility for ensuring the portion of the activity supported by my area of responsibility meets all applicable regulatory requirements.

6. Points of Contact (POC's). The action officers are LTC John Evans, Deputy Commander, USAHFPA/G9, john.m.evans.mil@mail.mil and MAJ William Lewis, Medical Service Corps Officer, wblewis@clemson.edu, 337-424-0444.

ROBERT D. TENHET
Major General, U.S. Army
Deputy Commanding General
and Deputy Commanding General
(Support)

4 Encl
1. IRB 2017-158 Approval Letter
2. IRB 2017-284 Approval Letter
3. Walkthrough Interview Questions
4. Clinical Staff Interview Questions

Department of Army Human Research Protections Administration Approval Letter-Pilot

DEPARTMENT OF THE ARMY
OFFICE OF THE SURGEON GENERAL
7700 ARLINGTON BOULEVARD
FALLS CHURCH, VA 22042

REPLY TO
ATTENTION OF

DASG-HRPO 13 Sep 2017

MEMORANDUM FOR MAJ William Lewis; Email: wblewis@g.clemson.edu

SUBJECT: Research Protections Administrative Review (RPAR) for Protocol "Task Analysis of Patient-Centered Medical Home (PCMH)," Protocol Number: IRB2017-158, PI: Dina Battisto, Ph.D

1. Review Outcomes

The Army Research Protections Office (AHRPO) RPAR of the above referenced protocol is complete, and AHRPO concurs with the Clemson University regulatory determination for the protocol. RPAR review is required to ensure that Department of Defense (DOD) supported research involving human subjects is compliant with DOD requirements in DOD Instruction (DODI) 3216.02. DoD-supported research involving human subjects is defined as research involving human subjects for which the Department of Defense is providing at least some of the resources, including but not limited to funding, facilities, equipment, personnel (investigators or other personnel performing tasks identified in the research protocol), access to or information about DoD personnel for recruitment, or identifiable data or specimens from living individuals. It includes both DoD-conducted research involving human subjects (intramural research) and research conducted by a non-DoD institution. DOD is supporting the above referenced activity by providing access to DoD personnel for recruitment and facilities.

2. Requirements

Substantive Changes to the Protocol: The AHRPO must review and accept the IRB's determination when substantive modifications are made to this research protocol and any modifications that could potentially increase risk to subjects, before the changes are implemented to ensure compliance with the DODI 3216.02. Substantive modifications include a change in principal investigator, change or addition of an institution, elimination or alteration of the consent process, change to the study population that has regulatory implications (e.g., adding children, adding active duty population, etc.), significant change in study design (i.e., would prompt additional scientific review), or a change that could increase risks to subjects.

Notification: The investigator should immediately notify the AHRPO of the occurrence of any of the following:

- When the IRB used to review and approve the research changes to a different IRB;
- The knowledge of any pending, on-going or completed compliance inspection/visit by the Food and Drug Administration (FDA), Office for Human Research Protections of the U.S. Department of Health and Human Services, or other government agency

Department of Army Human Research Protections Administration Approval Letter-Pilot (continued)

DASG-HRPO
SUBJECT: Research Protections Administrative Review (RPAR) for Protocol "Task Analysis of Patient-Centered Medical Home (PCMH)," Protocol Number: IRB2017-158, PI: Dina Battisto, Ph.D

concerning this research; the issuance of inspection reports, FDA Form 483, warning letters, or actions taken by any regulatory agencies including legal or medical actions;

- Suspension or termination of this research study by the IRB, the institution, the sponsor, or any regulatory agency;
- Substantiated unanticipated problems involving risks to subjects or others related to this research study; and
- Substantiated serious or continuing noncompliance related to this research study.

3. Other Considerations

If your activity will collect or elicit individuals' attitudes, opinions, behavior and related demographic, social, and economic data, then the activity may be subject to review and approval in accordance with DOD Instruction (DODI) 1100.13, DOD Surveys, and/or DODI 8910.01, Information Collection and Reporting. You may find more information about the Army Survey Approval process at the following: https://sslweb.hqda.pentagon.mil/ari/ and https://sslweb.hqda.pentagon.mil/ari/pdf/InstructionsforArmySurveyReviewandApprovalforWeb.pdf. Such approval is separate and distinct from AHRPO review and approval. If required, please forward a copy of their approval when obtained.

4. Caution

Do not construe this AHRPO memorandum as IRB approval, DOD Institutional approval, or other DOD support agreement. This review confirms only that the above reference project is deemed by AHRPO to be compliant with the requirements identified in the DODI 3216.02.

5. Point of Contact

The AHRPO Point of Contact for any questions regarding this memorandum is Martha Alvarado, at 703-681-0647 or jeffrey.r.rollins2.civ@mail.mil.

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Jeffrey Rollins, BA, CCRP, CIP
Research Ethics and Compliance Officer
Army Human Research Protections Office

Department of Army Human Research Protections Administration Approval Letter-Dissertation

DEPARTMENT OF THE ARMY
OFFICE OF THE SURGEON GENERAL
7700 ARLINGTON BOULEVARD
FALLS CHURCH, VA 22042

REPLY TO
ATTENTION OF

DASG-HRPO

15 February 2018

MEMORANDUM FOR Mr. William Lewis, 104 Deerwater Run, Chapin, SC, 29036, wblewis@clemson.edu

SUBJECT: Research Protections Administrative Review (RPAR) for Protocol "The Effectiveness of the Clinical Team Pod for Delivering Team-Based Care in the Patient-Centered Medical Home Clinics," PI: Dina Battisto, PhD; Co-Investigator: William Lewis, PhD Candidate

1. Review Outcomes

The Army Research Protections Office (AHRPO) RPAR of the above referenced protocol is complete for an additional research site, Keller Army Community Hospital (KACH), West Point, NY, and AHRPO concurs with the Clemson University Office of Research Compliance, Institutional Review Board regulatory determination for the protocol. RPAR review is required to ensure that Department of Defense (DOD) supported research involving human subjects is compliant with DOD requirements in DOD Instruction (DODI) 3216.02. DoD-supported research involving human subjects is defined as research involving human subjects for which the Department of Defense is providing at least some of the resources, including but not limited to funding, facilities, equipment, personnel (investigators or other personnel performing tasks identified in the research protocol), access to or information about DoD personnel for recruitment, or identifiable data or specimens from living individuals. It includes both DoD-conducted research involving human subjects (intramural research) and research conducted by a non-DoD institution. DOD is supporting the above referenced activity by assisting with recruitment of subjects, providing access to military facilities, and by providing archival de-identified data on the patient-centered medical home clinics. This approval covers Fort Drum, CRDAMC, and KACH.

2. Requirements

Substantive Changes to the Protocol: The AHRPO must review and accept the IRB's determination when substantive modifications are made to this research protocol and any modifications that could potentially increase risk to subjects, before the changes are implemented to ensure compliance with the DODI 3216.02. Substantive modifications include a change in principal investigator, change or addition of an institution, elimination or alteration of the consent process, change to the study population that has regulatory implications (e.g., adding children, adding active duty population, etc.), significant change in study design (i.e., would prompt additional scientific review), or a change that could increase risks to subjects.

Notification: The investigator should immediately notify the AHRPO of the occurrence of any of the following:

Department of Army Human Research Protections Administration Approval Letter-Dissertation (continued)

DASG-HRPO
SUBJECT: Research Protections Administrative Review (RPAR) for Protocol "The Effectiveness of the Clinical Team Pod for Delivering Team-Based Care in the Patient-Centered Medical Home Clinics," PI: PI: Dina Battisto, PhD; Co-Investigator: William Lewis, PhD Candidate

- When the IRB used to review and approve the research changes to a different IRB;
- The knowledge of any pending, on-going or completed compliance inspection/visit by the Food and Drug Administration (FDA), Office for Human Research Protections of the U.S. Department of Health and Human Services, or other government agency concerning this research; the issuance of inspection reports, FDA Form 483, warning letters, or actions taken by any regulatory agencies including legal or medical actions;
- Suspension or termination of this research study by the IRB, the institution, the sponsor, or any regulatory agency;
- Substantiated unanticipated problems involving risks to subjects or others related to this research study; and
- Substantiated serious or continuing noncompliance related to this research study.

3. Other Considerations

If your activity will collect or elicit individuals' attitudes, opinions, behavior and related demographic, social, and economic data, then the activity may be subject to review and approval in accordance with DOD Instruction (DODI) 1100.13, DOD Surveys, and/or DODI 8910.01, Information Collection and Reporting. You may find more information about the Army Survey Approval process at the following: https://sslweb.hqda.pentagon.mil/ari/ and https://sslweb.hqda.pentagon.mil/ari/pdf/InstructionsforArmySurveyReviewandApprovalforWeb.pdf. Such approval is separate and distinct from AHRPO review and approval. If required, please forward a copy of their approval when obtained.

4. Caution

Do not construe this AHRPO memorandum as IRB approval, DOD Institutional approval, or other DOD support agreement. This review confirms only that the above reference project is deemed by AHRPO to be compliant with the requirements identified in the DODI 3216.02.

5. Point of Contact

The AHRPO Point of Contact for any questions regarding this memorandum is Martha Alvarado, at 703-681-5702 or martha.s.alvarado.civ@mail.mil.

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Date: 2018.02.15 11:35:29 -05'00'

Martha Alvarado, MPH, CIP
Research Ethics and Compliance Officer
Army Human Research Protections Office

CF: KACH HPA
CRDAMC HPA

2

Appendix C

Data Collection Tools and Protocols

First Phase Archival Data Collection Protocol

Data Request for Operational & Facility Data

Hello, my name is William Lewis, and I'm a PhD student at Clemson University in the Planning, Design, and the Built Environment program. I am currently conducting research to study the operational efficiency of the clinical team pod for supporting the delivery of team-based care in Patient-Centered Medical Home (PCMH) Clinics. I am contacting you to ask for help with gathering background information on the (insert clinic name) to understand the basic operational context of (insert clinic name). This study has the potential to improve the overall design and operational efficiency of the clinical team pod in delivering team-based care. Listed below is the information that is being requested:

Operational Data

1. Types of medical services offered by the clinic
2. The different types of medical appointments
3. Hours of operation
4. Number of patient encounters per month for the last fiscal year
5. Number of staff by position (physician, nurse practitioner, physician assistant, registered nurse, licensed practical nurse, medical technician, and specialist providers (behavioral health, nutritionist, dietitian, pharmacist) and full-time equivalent (FTE) that work in the (insert clinic name).
6. A copy of the clinical operations (CONOPS) or policies that inform the delivery of care for the clinic.

Facility Data

1. Floor plans of the (insert clinic name) ideally in an editable format (i.e. DWG).
2. Date(s) of renovation projects and types of renovations.

Thank you for your support. Please let me know if you have any questions or concerns.

William Lewis
PhD Student
Clemson University
337-424-0444

First Phase Recruitment Letter

Interview: E-mail and Verbal Recruitment Script

Hello, my name is William Lewis, and I'm a PhD student at Clemson University in the Planning, Design, and the Built Environment program. I am currently conducting research to understand the daily activities of clinical staff in a Patient-Centered Medical Home (PCMH) clinic as primary care has shifted to a team model. I am interested in your experiences as a PCMH clinical staff member. I will be conducting initial interviews to understand the daily clinical staff activities for the clinic, clinical team pod, and examination room. I would like to establish an interview date and time in the upcoming week to understand your perceptions on the daily clinical activities that you perform. Your participation will involve an interview that will last 30 minutes of the OIC/NCOIC and 15 minutes for all other clinical staff. The findings from this study has the potential to improve the overall design and functionality of the PCMH clinic through a greater understanding of daily activities and workflow patterns of the various clinical staff. This research has no known risks.

Thank you for your support and Please let me know if you have any questions or concerns.

William Lewis
PhD Student
Clemson University
337-424-0444

First Phase Walkthrough Interview Consent Form

Understanding the Clinical Staff Activities and Workflow Patterns of a PCMH Clinic

Invitation to Participate In Walkthrough Interviews
Information About Being in a Research Study

Description of the Study

Welcome to a study aimed to understand the daily activities of clinical staff in a Patient-Centered Medical Home (PCMH) clinic. Over the last decade, primary care has shifted from a physician-centered to a patient-centered model that leverages teams of multi-disciplinary clinical staff. The shift to the patient-centered care model has changed how clinical staff use equipment, rooms, and various technologies for delivering care. The Military Health System has transitioned existing and new clinics into nationally recognized PCMH clinics. The aim of this study is to understand the Patient-Centered Medical Home (PCMH) care delivery model to better plan and design future PCMH clinics.

You are invited to participate in this research study that is being conducted by Dr. Dina Battisto and William Lewis of Clemson University. Dr. Battisto is Associate Professor of Architecture at Clemson University. William Lewis is a PhD student in the Planning, Design, and the Built Environment at Clemson University, running this study with the help of Dr. Battisto.

We are interested in your experiences to understand the activities and workflow patterns of the clinical staff. Your participation in this voluntary interview will involve answering questions to describe your job-related activities and workflow patterns as it relates to the clinic, clinical team pod, and examination room. You may be asked to participate in one or all of the following interviews:

Walkthrough Interview of the Clinic:

The clinic Officer-In-Charge (OIC) and Non-Commissioned Officer-In-Charge (NCOIC) will be asked to be separately participate in a 30-minute walkthrough interview of the clinic. The purpose of the interview is to gain an understanding of the activities and workflow patterns that occur in the overall clinic.

Walkthrough Interview of the Clinical Team Pod:

The purpose of the interviews with the clinical team pod staff is to gain insight as to: who is on the clinical team; commonly performed activities for each team member; how their team performs the activities; what rooms the team uses and frequency of use; and where the activities occur. Interviews will last approximately 15 minutes in duration.

Walkthrough Interviews in an Examination Room:

The purpose of the interviews is to capture the clinical staff activities and workflow patterns during a typical patient visit in the examination room using a talk-aloud method. You will be asked to re-enact a typical medical appointment while discussing the step-by-step process verbally. Interviews will last approximately 15 minutes in duration.

Risks and Discomforts

There are no known risks for you in participating in this research study. We will not ask for any personal identifiers such as your name, address, or phone number. The investigators have every expectation for the full effectiveness of security measures. Only the investigators directly involved in this study will have access to the interviews.

Possible Benefits

This study has the potential to improve the overall design and functionality of the PCMH clinic through a greater understanding of daily activities and workflow patterns of the various clinical staff.

Protection of Privacy and Confidentiality

We will not ask for your name or contact information. You answers to interview questions are strictly confidential. We will do everything we can to protect your privacy confidentiality. We will not tell anyone outside of the research team that you were in this study or what information we collected about you in particular.

Choosing to Be in the Study

You do not have to be in this study. You may choose not to take part and you may choose to stop taking part at any time. You will not be punished in any way if you decide not to be in the study or to stop taking part in the study.

Contact Information

If you have any questions or concerns about this study or if any problems arise, please contact William Lewis at (337) 424-0444 or Dr. Dina Battisto at (864) 656-3900.

If you have any questions or concerns about your rights in this research study, please contact the Clemson University Office of Research Compliance (ORC) at 864-656-0636 or irb@clemson.edu. If you are outside of the Upstate South Carolina area, please use the ORC's toll-free number, 866-297-3071.

Thank you for agreeing to take part in this research effort! We know that your time is valuable and we greatly appreciate your assistance with this project.

Co-investigator (primary contact)
William Lewis
Planning, Design, and the Built Environment
Clemson University
2-103 Lee Hall
Clemson, SC 29634-0511
wblewis@clemson.edu
(337) 424-0444

Principle Investigator
Dina Battisto, Ph.D.
School of Architecture
2-231 Lee Hall
Clemson, SC 29634-0511
dbattis@clemson.edu
(864) 656-3900

First Phase Clinic Walkthrough Interview Worksheet

DATE:

TIME:

OIC ☐

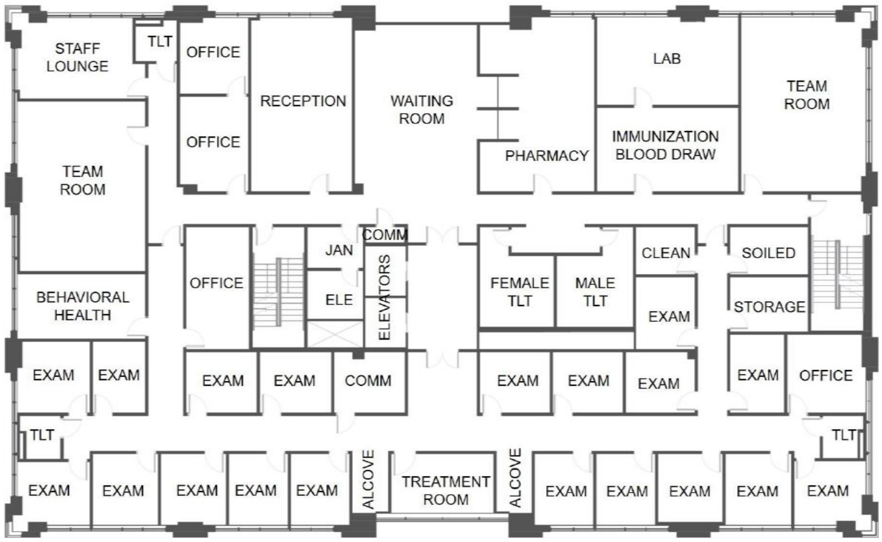
NCOIC ☐

Key:
TLT= Toilet

COMM= Communication Closet

ELE= Electric Room

JAN= Janitor Closet



CLINIC WALKTHROUGH QUESTIONS

1. Describe the overall organization and layout of the clinic.
2. Describe the process that a patient goes through for a typical medical appointment; starting from the check-in process and ending with the patient discharge.
3. Briefly describe the roles of the different clinical staff in providing patient care (PCM, team nurse, ancillary nurse, and specialist)?
4. Describe the process that a (PCM, team nurse, ancillary nurse, and specialist) goes through for a typical medical appointment; starting from the arrival of a new patient and ending with the patient discharge.
5. Describe the 5 most commonly performed activities inside the clinical pod for members of the clinical teams in delivering care? Where do those activities take place?
6. What activities do the members of the clinical team perform outside of the clinical pod to deliver patient care?
7. Describe how examination rooms are assigned to the different primary care teams?

First Phase Team-Based Clinical Module Worksheet

DATE:

TIME:

PCM ☐

TEAM NURSE ☐

ANCILLARY NURSE ☐

SPECIALIST ☐

Key:
TLT= Toilet

COMM= Communication Closet

ELE= Electric Room

JAN= Janitor Closet

TEAM POD WALKTHROUGH QUESTIONS

1. What is your role on the clinical care team?
2. Who else is apart of your clinical care team?
3. Where is your assigned workspace in your team pod?
4. What are your 5 most commonly performed activities for the delivery of patient care? What is the frequency of those activities in your typical day?
5. What spaces in the clinical team pod do you use most frequently? How often are those spaces used during your typical day.
6. What spaces do you most frequently use that are located outside of your clinical team pod? Why? How often are those spaces used during your typical day?

First Phase Exam Room Worksheet

Exam Room_Worksheet

DATE:

TIME:

Room #:

PCM ☐

TEAM NURSE ☐

ANCILLARY NURSE ☐

SPECIALIST ☐

1. Soap Dispenser
2. Sink
3. Examination Table
4. Sharps Container
5. Otoscope
6. Ear Scope
7. Manual Blood Pressure Cuff
8. Medical Storage Chest
9. Vital Machine
10. Chairs
11. Workstation
12. Computer
13. Clinical Staff Chair

Please walk me through a typical patient visit from start to finish:

Task	Who is Involved	Where that Occurs	What is Needed to Complete the Task	Planning Space/Needs

Archival Data Collection Protocol

Role of the Physical Environment on Team-Based Primary Care in the Military Health System

Data Request for Operational & Facility Data

Hello, my name is William Lewis, and I'm a PhD student at Clemson University in the Planning, Design, and the Built Environment program. I am currently conducting research to study understand how the team-based clinical module is used for delivering care in Patient-Centered Medical Home Clinics. I am contacting you to ask for help with gathering background information on the (insert clinic name) to understand the basic operational context of (insert clinic name). This study has the potential to improve the overall design in supporting the delivery of team-based care. Listed below is the information that is being requested:

Operational Data

1. Types of medical services offered by the clinic
2. The different types of medical appointments
3. Hours of operation
4. Number of patient encounters per month for the last fiscal year
5. Number of staff by position (physician, nurse practitioner, physician assistant, registered nurse, licensed practical nurse, medical technician, and specialist providers (behavioral health, nutritionist, dietitian, pharmacist) and full-time equivalent (FTE) that work in the (insert clinic name).
6. A copy of the clinical operations (CONOPS) or policies that inform the delivery of care for the clinic.

Facility Data

1. Floor plans of the (insert clinic name) ideally in an editable format (i.e. DWG).
2. Date(s) of renovation projects and types of renovations.

Thank you for your support. Please let me know if you have any questions or concerns.

William Lewis
PhD Student
Clemson University
337-424-0444

Dissertation Study Archival Data Analysis Terms

Military Health System Workload Formula

The MHS currently uses a workload formula to establish the number of exam rooms allocated for a new primary care clinic design (DoD Space Planning Criteria, 2017).

Number of Operating Days per Year = 240 days

Annual Exam Room Workload per Exam Room = 2,304 Patient Encounters per Room

GME Annual Exam Room Workload per Exam Room = 2,016 Patient Encounters per Room (GME= Graduate Medical Education Program)

1. MHS Daily Exam Room Workload:

(Annual Exam Room Workload)/ (Days of Operation)

Example:

(2,304 Patient Encounters per Room*)/ (240 Days of Operation) = 9.6 Patients

*Numbers are rounded up to the nearest whole number when equal or greater than .5

*MHS Annual Patient Encounters per Room= 2,304 Patients

*GME Annual Patient Encounters per Room= 2,016 Patients

2. MHS Annual Patient Workload:

(Annual Exam Room Workload)(Number of Exam Rooms)

Example:

(2,304 Patient Encounters per Room*) x (13 Exam Rooms)= 29,952 Annual Patient Encounters per Clinical Team

*MHS Annual Patient Encounters per Room= 2,304 Patients

*GME Annual Patient Encounters per Room= 2,016 Patients

3. Clinical Team Annual Exam Room Workload:

(2016 Annual Number of Patient Encounters)/ (Number of Exam Rooms)

Example:

(40,205 Annual Encounters)/ (13 Exam Rooms) = 3,092 Patients per Room

4. Clinical Team Daily Exam Room Workload:

(2016 Annual Exam Room Workload)/ (Number of Operating Days)

Example:

(3,092 Patient Encounters per Room) / (240 Days) = 13 Patients per Day

5. Utilization Factor between MHS Planning Benchmark and Actual Utilization

(Clinical Team Daily Exam Room Workload)/ (MHS Daily Exam Room Workload)

Example:

(13 Patients per Day)/(10 Patients per Day) = +30%

(Clinical Team Annual Exam Room Workload)/ (MHS Annual Exam Room Workload)

Example:

(3,092 Patients per Room)/ (2,304 Patients per Room) = +34%

Floor Plan Analysis

(A) Net Square Feet (NSF): "Net Square Feet is the area of an individual room or the usable floor area that is assigned to a function in an open area. Net square feet for each room is measured from the inside finished surface of surrounding partitions or enclosing elements and from the outline of the floor area for a space in an open area. Net areas do not include partitions or structural elements such as columns or column enclosures, or circulation or access spaces" (MHS Space Planning Criteria, 2015, Chapter 130, Pg. 4).

(B) Clinical Module Net Square Feet (NSF): The clinical module net square feet is the area of rooms or usable floor space that are assigned to designated rooms that are allocated to the clinical teams to support patient care activities. The clinical module net square feet is measured by combining all of the designated room's net square feet. Circulation areas in the clinical module are not included in the calculation. (MHS Space Planning Criteria, 2015)

(C) Ancillary Services Net Square Feet (NSF): Ancillary service rooms are spaces that support the clinical teams in providing patient care, including pharmacist office, behavioral health office, immunization, immunization waiting area, laboratory, audiology, radiology, medical records, flight exams, dermatology, and other administrative areas that support these functions. The clinical module net square footage is the area of rooms or usable floor space that are assigned to ancillary services areas. The ancillary service net square feet is measured by combining all of the assigned room's net square feet. Circulation areas in the ancillary service areas are not included in the calculation.

(D) Clinical Support Net Square Feet (NSF): Clinical support rooms are designated as spaces that support the clinical teams in providing patient care and consist of: storage rooms, supply rooms, treatment rooms, clean linen room, soiled linen room, isolation exam room, isolation exam bathroom, shared exam rooms, and any additional administrative areas. The clinical support net square feet is the area of rooms or usable floor space that are assigned to clinical support areas. The clinical support net square footage is measured by combining all of the assigned room's net square feet. Circulation areas in the ancillary service areas are not included in the calculation.

(E) Waiting Area Net Square Feet (NSF): Waiting area spaces are classified as the waiting room and public toilets located in the clinic. The waiting area net square feet is the area of rooms or usable floor space that is assigned to the clinic. The waiting area net square footage is measured by combining all of the assigned room's or spaces net square footage. Circulation areas are included in the waiting rooms share the same space. Otherwise, circulation areas are not included in the waiting area net square feet calculation.

(F) Circulation Area Net Square Feet (NSF): Circulation area is classified as the hallways or corridors used in the clinic for egress. The circulation area net square footage is measured by combining all of the hallways or corridors of usable space net square feet.

(G) Other Area Net Square Feet (NSF): Other area net square footage includes the following spaces; common and service spaces; enclosed mechanical spaces; vertical circulation spaces including elevators, stairs, and escalators, shafts, and stacks; and any other areas which make up the remaining clinic footprint.

(H) Clinic Gross Square Footage (GSF): "Clinic Gross Square Footage is the aggregate area of all enclosed floor areas and supporting structure and certain unenclosed areas which support the function of the clinic. The clinic gross square footage includes all the spaces as well as the area of the exterior wall and structure; common and service spaces not assigned to a department; enclosed mechanical spaces; vertical circulation spaces including elevators, stairs, and escalators, shafts, and stacks; and any other areas which make up the entire clinic" (DoD Space Planning Criteria, 2015, Chapter 130, Pg. 4)

(I) Team Room Net Square Feet per Staff: The team room net square footage is all of the usable floor space within a team room. Net areas do not include partitions or structural elements such as columns or column enclosures, or circulation or access spaces. The team room net square footage is then divided by the total number of staff that occupy the team room:

(Team Room NSF) / (# of Staff that Occupy the Room)

Example: (600NSF) / (15 Staff) = 40 NSF per Staff

(J) Building Net to Gross Factor (BNTG): The MHS uses a benchmark of 1.4 BNTG factor for all new construction projects for primary care clinics. A 1.55 BNTF factor is used for primary care clinic projects that are classified as renovations. The BNTG factor for each of the cases is calculated with the following formula:

(Clinical Gross Square Footage) / (Clinical Module(s) NSF) + (Clinical Support NSF) + (Ancillary Services NSF) + (Waiting Area NSF)

Example:

(11,500 GSF) / (3,000 Module A) + (2,500 Module B) + (1,000 Clinical Support) + (2,000 Ancillary Support) = 1.35 BNTG Factor

(K) Average Travel Distance from Exam Room to Team Room: Measures the distance in feet from the center of the team room door to the center of the exam room door. If a team room utilizes two doors, the door closet to the exam room is measured to calculate the travel distance. The average distance is then taken from all of the measurements from the team room to the exam room.

(L) Average Travel Distance for Licensed Practical Nurses per Patient Visit: Measures the distances in feet that are required by a licensed practical nurse to travel for a routine patient appointment. The following measurements are taken in the identified steps:

1. Center of Team Room Door to Center of the Waiting Room Door for the Clinical Module
2. Center of the Waiting Room Door to Height/Weight Alcove center
3. Or if height and weight alcove are not included in the module us the average distance from the center of the waiting room door to the center of the exam rooms door).
4. Average distance from the center of the exam room door to the center of the team room door

(M) Average Travel Distance for Primary Care Provider per Patient Visit: Measure the distances in feet that are required by a primary care provider to travel for a routine patient appointment. The following measurements are taken in the identified step:

(N) Average distance from the center of the nearest team room door to the center of designated exam room doors and then multiplied by two.

Invitation to Participate In Interviews

Role of the Physical Environment on Team-Based Primary Care in the Military Health System

Information About Being in a Research Study

Description of the Study

Welcome to a study aimed to evaluate how the team-based clinical module is used for delivering care in a Patient-Centered Medical Home (PCMH) clinic. Primary care in the United States has shifted from a physician-centered approach to a multidisciplinary, team-based approach. This new approach has resulted in many day-to-day changes in the care delivery process including how clinical staff collaborate; interact with patients; and use space, equipment and various technologies. The US Army has transitioned existing and new primary care clinics into nationally recognized PCMH clinics. A team-based clinical module is emerging as a spatial concept that provides each team with the resources needed for delivering care.

You are invited to participate in this research study that is being conducted by Dr. Dina Battisto and William Lewis of Clemson University. Dr. Battisto is Associate Professor of Architecture at Clemson University. William Lewis is a PhD student in the Planning, Design, and the Built Environment at Clemson University, running this study with the help of Dr. Battisto.

We are interested in your perspective to understand how the clinic and team-based clinical modules support the ability to deliver patient care. Your participation in this voluntary interview will last approximately (10 minutes for staff and 20 minutes for healthcare administrators) in duration.

Risks and Discomforts

There are no known risks for you in participating in this research study. We will not ask for any personal identifiers such as your name, address, or phone number. The investigators have every expectation for the full effectiveness of security measures. Only the investigators directly involved in this study will have access to the interviews.

Possible Benefits

You may not benefit directly from participating in the study, but this study has the potential to improve the overall design for the team-based clinical module in supporting patient care.

Protection of Privacy and Confidentiality

We will not ask for your name or contact information. You answers to interview questions are strictly confidential. The interviews will be audio recorded and transferred to an external storage device for transcription. Audio recordings will be retained for a period of 5 years after the completion of the study. (Insert Clinic Name) will not have access to the audio recordings or interview data. The results of this study may be published in scientific journals, professional publications, or educational presentations; however, no individual participant will be identified.

Choosing to Be in the Study

You do not have to be in this study. You may choose not take part and you may choose to stop taking part at any time. You will not be punished in any way if you decide not to be in the study or to stop taking part in the study.

Contact Information

If you have any questions or concerns about this study or if any problems arise, please contact William Lewis at (337) 424-0444 or Dr. Dina Battisto at (864) 656-3900.
If you have any questions or concerns about your rights in this research study, please contact the Clemson University Office of Research Compliance (ORC) at 864-656-0636 or irb@clemson.edu. If you are outside of the Upstate South Carolina area, please use the ORC's toll-free number, 866-297-3071.

A copy of this form will be given to you.

Thank you for agreeing to take part in this research effort! We know that your time is valuable and we greatly appreciate your assistance with this project.

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Clinical Staff Interview Protocol

Role of the Physical Environment on Team-Based Primary Care in the Military Health System

Description of Clinical Staff Interviews

The purpose of the interviews is to capture the clinical staff perceptions in understanding how the clinical team modules design supports the delivery of team-based care. The interviews will be a semi-structured format and engage participants in a face-to-face interview during low clinical staff usage periods. Data collection for the interviews will be through field notes and audio recordings. The collection of data for field notes will be on a pre-printed worksheet that consist of interview questions and a floor plan. Each participant will be given a facility floor plan to identify and mark areas that are associated with interview question responses. Audio recording data collection will be through a MP3 recorder and transferred to an external storage device for transcription. Interviews will occur in staff work areas such as the team room, empty examination rooms, staff lounge, or offices. Interviews will not occur in rooms while patients are being examined or treated by clinical staff. Clinical staff interviews will not collect any information regarding patient treatment or medical information.

Clinical staff participants for each clinical module will consist of 2-4 primary care providers, 2 registered nurses, 4-6 licensed practical nurses.

Participants for the overall clinic will consist of up to 2 specialty providers.

A total of up to 30 clinical staff will be interviewed for each site.

Clinical Staff Interview Worksheet Instructions

- Read the participant the consent form for the interviews
- Inform the participant that for ease of conversation during the interview that an audio-recorder can be used. If participant declines to have the interview recorded then prepare to take hand notes.
- Identify the date, clinic name, staff role, start and end time of the interview
- For each participant interview the researcher will have a copy of the questions and two blank floor plans of the clinic
- Provide the participant with a pen and blank floor plan of the clinic.

- Instruct the participant that they can draw and make any necessary comments related to the design on the floor plan during the interview
- Read the participant the first question and make necessary notes as needed.
- On closed-ended questions that use a 4 point-Likert scale circle the participant's response.

Interview Questions

1. What is your role in (insert clinical name)?
   a. Primary care provider: _________________(Insert title of individual and identification as one of the following: a Physician, Nurse Practitioner, or Physician Assistant)
   b. Registered nurse: _________________(Insert title of individual)
   c. Licensed practical nurse: ________________(Insert title of individual)
   d. Specialty provider: ____________________(Insert title of individual and identification as one of the following: a Dietitian, Clinical Pharmacist, Physical Therapist, Behavioral Health)

2. Which clinical team are you assigned to for delivering care or are you assigned to multiple teams?
3. Do you have any prior experience working in primary care? What were the name of the facilities that you work at?

4. Do you have specific rooms assigned to your clinical team for patient care? (If so mark the boundaries on floor plan assigned to your team)

5. Where do you go to perform work that requires focus and concertation?

6. Where in your team area do you to collaborate with fellow staff members for preparation for patient care? How does that space support collaborative team work?

   a. Where do you go for team huddles?
   b. Where do you go for discussion/consult for patient visits?

7. How do you feel about the ability to visual connect with fellow staff members in your team area?

8. How do you feel about the location of your team room in the clinic and in your team area?

9. How do you feel about your travel distances in your team area to deliver team-based care?

10. Which rooms need to be directly available in your team area to support team-based care? Which rooms should be shared among teams in the clinic?

11. How do you feel about your travel distances outside of your team area for patient care activities?
    a. What types of areas do you travel to outside the clinical module?
    b. How frequent do you have to make those trips outside your team area to support patient care activities?

12. How do you feel about sharing corridors with patients to deliver patient care?

13. On a scale of 1-4, 1 being very dissatisfied and 4 being very satisfied, how satisfied are you with the overall clinic design in supporting a team-based approach for patient care?

1	2	3	4
Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied

14. On a scale of 1-4, 1 being very dissatisfied and 4 being very satisfied, how satisfied are you with your team-based clinical module design in supporting a team-based approach for patient care?

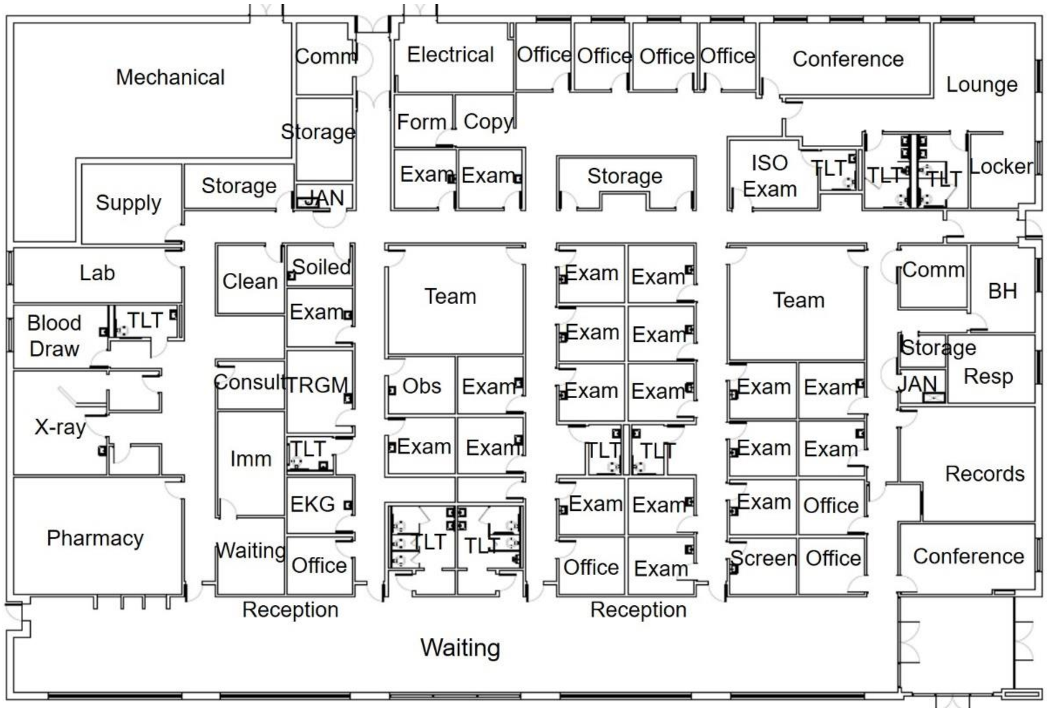
1	2	3	4
Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied

15. What space works best in you team area for supporting the delivery of team-based care?

16. If you could change one space to better support the delivery of team-based care in the clinic what would it be?

(Insert Floor Plan for PCMH Clinic)—Example

Bowe Soldier Centered Medical Home



Healthcare Administrator Interview Protocol

Role of the Physical Environment on Team-Based Primary Care in the Military Health System

Description of the Healthcare Administrator Interview Protocol

The purpose of the interviews is to capture the healthcare administrator perceptions in understanding how the clinical team modules design supports the delivery of team-based care. The interviews will be a semi-structured format and engage participants in a face-to-face interview during low clinical staff usage periods. Data collection for the interviews will be through field notes and audio recordings. The collection of data for field notes will be on a pre-printed worksheet that consist of interview questions and a floor plan. Each participant will be given a facility floor plan to identify and mark areas that are associated with interview question responses. Audio recording data collection will be through a MP3 recorder and transferred to an external storage device for transcription. Interviews will occur in staff work areas such as the staff lounge or office space. Interviews will not occur in rooms while patients are being examined or treated by clinical staff. Healthcare administrator interviews will not collect any information regarding patient treatment or medical information.

Participants for the interviews will consist of 2 healthcare administrators for each site.

Healthcare Administrator Interview Worksheet Instructions

- Read the participant the consent form for the interviews
- Inform the participant that for ease of conversation during the interview that an audio-recorder can be used. If participant declines to have the interview recorded then prepare to take hand notes.
- Identify the date, clinic name, staff role, start and end time of the interview
- For each participant interview the researcher will have a copy of the questions and two blank floor plans of the clinic
- Provide the participant with a pen and blank floor plan of the clinic.
- Instruct the participant that they can draw and make any necessary comments related to the design on the floor plan during the interview
- Read the participant the first question and make necessary notes as needed.

- On closed-ended questions that use a 4 point-Likert scale circle the participant’s response.

Interview Questions

1. What is your role in (insert clinical name)?

2. Do you have any prior experience working in primary care? What were the name of the facilities that you work at?

3. Do you have specific rooms assigned to the clinical teams for patient care? (If so mark the boundaries on floor plan assigned to the teams)

4. Where does the staff go to perform work that requires focus and concertation?

5. Where in the clinic do staff go to collaborate with fellow staff members for preparation for patient care? How does that space support collaborative team work?

   a. Where does the staff go for team huddles?

6. How do you feel about the ability for staff to visual connect with fellow staff members in the clinic?

7. How do you feel about the location of the team rooms in the clinic?

8. Which rooms need to be directly available in your team area to support team-based care? Which rooms should be shared among teams in the clinic?

9. How do you feel about staff travel distances in the clinic for patient care activities?

10. How do you feel about staff sharing corridors with patients to deliver patient care?

11. On a scale of 1-4, 1 being very dissatisfied and 4 being very satisfied, how satisfied are you with the overall clinic design in supporting a team-based approach for patient care?

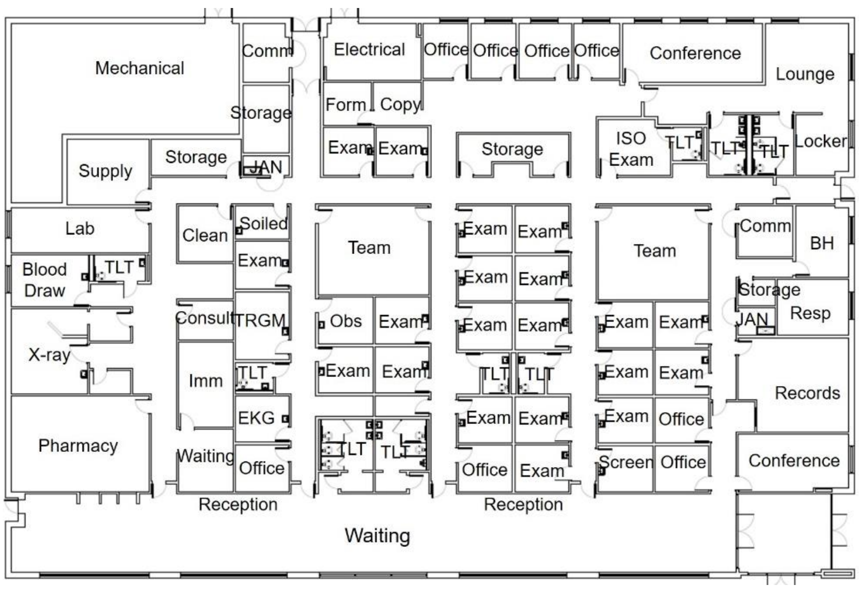
1	2	3	4
Very Dissatisfied	Dissatisfied	Satisfied	Very Satisfied

12. What space works best in the clinic for supporting the delivery of team-based care?

13. If you could change one space to better support the delivery of team-based care in the clinic what would it be?

(Insert Floor Plan for PCMH Clinic)—Example

Bowe Soldier Centered Medical Home



Team Room Observation Protocol

Role of the Physical Environment on Team-Based Primary Care in the Military Health System

Description of the Study

The purpose of the direct observations is to gather staff locations and activities in understanding how the team room are used to support team-based care. The location and activities of staff in the team room will be documented on pre-printed observation worksheet. The observations in the team room will occur from a location that will not interfere the staff's ability to deliver patient care. Each clinical module team room will be directly observed 5 times per day in 5 minute sessions over 2 days.

Team room observations will occur during:

Morning Huddle	0900	1100	1400	1600

Team Room Observation Location Mapping Protocol

- Identify the date, clinic name, team name, start and end time of the observation period
- Identify the location of primary care providers with a circle, PCP, and numerical number in the circle for different individuals
- Identify the location of registered nurses with a circle, RN, and numerical number in the circle for different individuals
- Identify the location of licensed practical nurses with a circle, LPN, and numerical number in the circle for different individuals
- Identify the location of specialty providers with an circle, SP, and numerical number in the circle for different individuals

Team Room Observation Activities Protocol

- The first column will identify staff members with the following codes:
    - Primary Care Providers (PCP) and corresponding numerical number
    - Registered Nurses (RN) and corresponding numerical number
    - Licensed Practical Nurses (LPN) and corresponding numerical number
    - Specialty Providers (SP) and corresponding numerical number
- The second column will identify staff members activities based on the following codes:
    - Review medical charts and notes
    - Telephone consult
    - Primary Care Provider consult
    - Team huddle
    - Other: any activity that may not be categorized in the above mentioned activities
- The third column will identify needs assessment for that activity

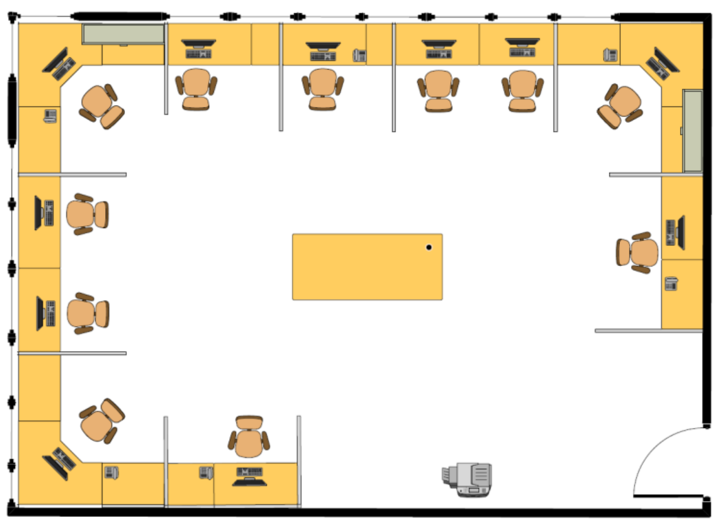
Team Room Observation Protocol

Role of the Physical Environment on Team-Based Primary Care in the Military Health System

- The fourth column will identify physical environment problems for performing those activities

Team Room Observation Worksheet

Researcher Name:____________________	Date:____________________
Clinic:____________________	Team:____________________
Start Time:____________________	End Time:____________________



Staff Member	Activity Performed	Needs Assessment	Physical Environment Problems
Primary Care Provider (PCP) 01	Review medical charts and patient notes	Computer, medical notes, dragon-speak recorder	
Registered Nurse (RN) 02	Telephone Consult	Telephone, wireless headset	
Licensed Practical Nurse (LPN) 03	Consult PCP	Chairs, desk	
Specialty Provider 01	Consult PCP	Chairs, desk	

Appendix D

Sources for List of Figures

Figure 2.1 Pioneer Health Center

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Image 2: http://ivanovversteegarchitecture.com/projects/public/peckham-pioneer

Image 3: https://www.gettyimages.com/detail/video/members-arriving-and-enjoying-the-facilities-at-stock-video-footage/mr_00057851

Figure 2.2: Finsbury Health Center

Image 1: Wikiarquitectura, 2018: https://es.wikiarquitectura.com/finsbury_health_centre_first_floor_plan/

Image 2: Municipal Dreams in Healthcare 2018: https://municipaldreams.wordpress.com/2013/04/09/finsbury-health-centre-nothing-is-too-good-for-ordinary-people/

Image 3: Municipal Dreams in Healthcare 2018: https://municipaldreams.files.wordpress.com/2012/09/finsbury-health-centre-architects-plan-ii.jpg

Figure 2.3: Pholela Health Center

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Figure 2.7: Clinical Core Team and Clinical Support Team

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Image 2: Army One Source (2018) https://www.myarmyonesource.com/cmsresources/Army%20OneSource/Media/images/Family%20Programs%20and%20Services/Family%20Programs/army_family_425x362.jpg

Image 3: Bon Secours (2017) http://www.bs757.com/wp-content/uploads/2011/12/medical-team.jpg

Image 4: Halos Daily (2018) http://halosdaily.com/wp-content/uploads/2016/03/your-medical-team.jpg

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Figure 2.9: Silvis (2016) Having it All: New Trends in Clinic Design. Retrieved from https://www.healthcaredesignmagazine.com/trends/architecture/having-it-all-new-trends-clinic-design/

Figure 2.10: Boulder Associates. (2011). Design considerations for collaborative care: The physical environment of a patient-centered medical home. Boulder Associates.

Figure 2.11: Norouzzadeh, S., Riebling, N., Carter, L., Conigliaro, J., & Doerfler, M. E. (2015, December). Simulation modeling to optimize healthcare delivery in an outpatient clinic. In Winter Simulation Conference (WSC), 2015 (pp. 1355-1366). IEEE.

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Figure 3.1 MHS Quadruple Aim

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Figure 3.2 MHS Primary Care Clinic Typologies

Image1 : Martin Army Community Hospital (2017) http://www.martin.amedd.army.mil/aboutUs/Careers.aspx

Image 2: Wakefield Beasley (2017) https://www.google.com/search?q=Fort+Stewart+North+TMC&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjdk4_51YraAhWoVN8KHRkiANAQ_AUIDSgE&biw=1538&bih=735#imgrc=IEABfRIaFEImZM

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Figure 3.3: MHS Design Guidance Tools

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Figure 3.5: Military Health System Space Planning Criteria (2015) Primary Care/Family Medicine

Figure 3.6: Military Health System Space Planning Criteria (2015) Primary Care/Family Medicine

Figure 4.5: Clinical Core Team and Clinical Support Team

Image 1: CDN Skim (2018) http://cdn.skim.gs/image/upload/v1456337837/msi/military-family-before-deployment_gc0yo4.jpg

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Image 3: Bon Secours (2017) http://www.bs757.com/wp-content/uploads/2011/12/medical-team.jpg

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Figure 4.6: Team-Based Care Staff Roles

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Figure 5.3:

Image1 : Martin Army Community Hospital (2017) http://www.martin.amedd.army.mil/aboutUs/Careers.aspx

Image 2: Wakefield Beasley (2017) https://www.google.com/search?q=Fort+Stewart+North+TMC&source=lnms&tbm=isch&sa=X&ved=0ahUKEwjdk4_51YraAhWoVN8KHRkiANAQ_AUIDSgE&biw=1538&bih=735#imgrc=IEABfRIaFEImZM

Image 3: Evans Army Community Hospital (2017) https://evans.amedd.army.mil/Services/50/Mountain-Post-Medical-Home

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Figure 5.6: Ewing Cole (2018) http://www.ewingcole.com/us-army-opens-ewingcole-designed-brian-d-allgood-ambulatory-clinic/

Figure 6.1: Army.mil, 2018 https://www.army.mil/article/165368/army_corps_makes_soldier_health_priority

Figure 6.7

Image 1: Bon Secours (2017) http://www.bs757.com/wp-content/uploads/2011/12/medical-team.jpg

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Figure 7.6

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Image 2: Halos Daily (2018) http://halosdaily.com/wp-content/uploads/2016/03/your-medical-team.jpg

Figure 7.7: Red Alfa Neuorciencias (2017): http://redalfaneurociencias.org/wp-content/uploads/2015/06/Echipa-medicala.jpg?w=640

Figure 8.1: Ewing Cole (2018) http://www.ewingcole.com/us-army-opens-ewingcole-designed-brian-d-allgood-ambulatory-clinic/

Figure 8.6

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Figure 8.7: Red Alfa Neuorciencias (2017): http://redalfaneurociencias.org/wp-content/uploads/2015/06/Echipa-medicala.jpg?w=640

Appendix E

Team-Based Care Clinic Design Strategy Checklist

Goals/Objective #1: Efficient Clinic Workflow

- Proximity Between Support Room & Staff Work Areas
    - ☐ Cluster frequently used support rooms in-between team-based clinical modules such as:
        - Point-of-care lab
        - Specialty providers offices
        - Clinic soiled linen room
        - Clinic clean linen/supply room
        - Treatment room
        - Triage section
        - Immunization.
    - ☐ Cluster less frequently used support rooms on the perimeter of the clinic such as:
        - Pharmacy
        - Radiology
        - Audiology
        - Physical therapy
    - ☐ Cluster building support rooms and administrative areas in the back of the clinic away from the public.
- Provide Fluid Circulation Pathways In The Clinic
    - ☐ Create semi-private corridors in the back of the clinic for staff to have direct access to areas that include:
        - Clinical support rooms (clean and soiled linen rooms, treatment room, isolation exam room)
        - Ancillary services (point-of-care lab, immunization, specialty provider offices, pharmacy, radiology, triage section)
        - Team-based clinical modules
    - ☐ Establish shared staff and patient corridors to access patient care areas
    - ☐ Restrict public circulation to the front of the clinic.

Goal/Objective #2: Optimize Clinical Module Functionality

- Functional Team-Based Clinical Module Should Include Four Room Types.
    - ☐ Team room (1)
    - ☐ Patient toilet (1)
    - ☐ Supply room (1)
    - ☐ Exam rooms (4 to 8)
- Minimize Staff Travel Distances In The Team-Based Clinical Module

- ☐ Team room door-way should be 70 Ft. or less from the waiting room
- ☐ Exam rooms should be 60 Ft. or less from the entry-way of the team room

- Create Standardize Team-Based Clinical Modules
  - ☐ Use the patient workload to determine the number of team-based clinical module and size per clinic
  - ☐ Ensure exam rooms are allocated to the clinical teams and not individual primary care providers
  - ☐ Patient and staff areas should be separated by locating the team room in the back of the team-based clinical module
  - ☐ Use support rooms in the team-based clinical module to provide a spatial barrier between exam rooms and the team room

<u>Goal/Objective #3:</u> Facilitate Collaboration and Focused Work in the Team Room:

- Provide a Team Room that is Conducive for both collaborative and focused work
  - ☐ Team room should range from 48 Sq. Ft. to 60 Sq. Ft. per staff member
  - ☐ Consider environmental factors for daylight and views to outside for the location of the team room
- Accommodate Space for Focused Work
  - ☐ Private workstations should be located on the perimeter of the team room
  - ☐ Use glass or other clear materials for partition walls to reduce noise and enhance visibility of staff workstations
- Arrange Space for Collaborative Work
  - ☐ Collaborative space for team huddles and informal meetings should be located in the center of the team room.
  - ☐ Use glass windows on the perimeter of the team room to enhance staff visibility outside to corridors
  - ☐ Avoid team rooms that are shaped as a rectangle or L
  - ☐ Provide flexible and ergonomic workstations for staff

<u>Goal/Objective #4:</u> Promote Universal Exam Rooms

- Establish Exam Room Sizes that Accommodate Team-Based Care Approach
  - ☐ Exam room sized to afford space for the clinical team, patients, and family members while all in the room
- Create Flexible Exam Rooms That Consolidate Patient Care Activities
  - ☐ Exam rooms should include furniture and equipment that supports:
    - Patient screening
    - Patient exam
    - Consults
    - Patient Education
    - Telemedicine