Drafting Meets Doctoring
An Architect's View of Health Design as Resident Physician

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The architect Louis Kahn said that "once challenged, the architect will find completely new shapes and means to produce the hospital, but he cannot know what the doctor knows." (Twombley, 1964, 184) Imagine the lessons learned if the architect could know what the doctor knows. Take an inside look at the hospital environment through the eyes of a dochitect, a hybrid professional in medicine and architecture. See health design from the perspective of an architect pursuing internal medicine residency training at a large New York City teaching hospital. A design journal was kept throughout the dochitect's medical internship to record functional annotations for each subspecialty space and their relation to form the urban hospital. Join the dochitect through core rotations including the medical intensive care unit, emergency department, cardiac care unit, outpatient clinics, infectious diseases, general medicine, and geriatrics. Case studies highlighting the importance of space design are presented. Design anecdotes and functional analysis of hospital departments emphasize the practical importance of design qualities that impact the work environment for staff and the healing environment for patients and families. The dochitect's practical knowledge of environmental design qualities promotes health and well-being within the hospital environment. The clinicians will find the design perspectives useful in providing insight into their daily workspace, empowering them to return to their facilities and promote changes or become involved in renovation or new construction projects; the designers will benefit from the medical perspective and the lessons learned from an architect working within various clinical environments. Personal anecdotes from patient case studies allow for a behind-the-scenes look and a practical understanding of the use of hospital space. The architect can know what the doctor knows.

Keywords: *hospital design, medical training, healing environment*

What the Doctor Knows

"Once challenged, the architect will find completely new shapes and means to produce the hospital, but he cannot know what the doctor knows." – Louis Kahn, architect, excerpt from his 1964 lecture 'Medicine in the Year 2000' (Twombley, 1964, 184). As a self-labeled *dochitect*™ I propose to bridge the gap between architecture and medicine through the field of healthcare design. Throughout

my medical school years and now during my residency training I maintain two notebooks in my white coat pocket; one for the medical facts, a common finding amongst trainees, and the other for design notes and sketches. Through the following commentaries, I provide observations from these notes – the perspective of an architect now working as a resident physician.

Figure 1. Dochitect™ as a hybrid model meant to bridge the gap between medicine and architecture. Photo: Diana Anderson.

The House Officer

When medical students in the United States and Canada graduate from a 4-year Doctor of Medicine program and earn their MD degree (after having completed an initial undergraduate degree), they go on to enter a medical residency for a minimum of three years, depending on their specialty of choice. At this level we are called Residents, our expertise designated by our Post Graduate Year of training (ie: PGY1, PGY2, and so on). The PGY1 year is also known as the infamous intern year, a tumultuous and dramatic time which has been portrayed through multiple medical television dramas. We are also known as the "house staff" or "house officers", based on the original model where residents, initially male only, were forbidden from marrying during this period of training, most moving into the hospital and even having mail forwarded. They lived within the hospital in order to fulfill the duties of being "on-call" up to every second night for immediate availability for patient care. Today work hours have changed dramatically with restrictions on the number of on-call shifts and total hours per week an intern or resident can work. Life outside the hospital is emphasized and encouraged, but residency remains an intense physical and psychological period in the life of a doctor in-training, within both the hospital and ambulatory care settings. House officers remain at the forefront of care delivery and the use of healthcare space.

Internists have the advantage of working in many areas of the hospital campus while also interacting with the other medical specialties. A resident training in internal medicine gains a general understanding of adult medicine, not unlike an architect gaining a general understanding of all the aspects of the building process. Many trained internists choose to later pursue additional specialty training known as Fellowship, in an area of choice such as cardiology, gastroenterology, critical care medicine, etc. Paediatrics, psychiatry, neurology, anesthesiology and the surgical specialties including obstetrics and urology, are all separate residencies. However, as internists we often require expertise from these other fields with many acting as consultants to our patient cases.

Design as Treatment

During my first week of intern year I encountered a patient who would solidify for me the importance of design intervention. In my current hospital our critical care unit is racetrack in design, with one side of its patient rooms without windows. This anecdote centres around Ms. T, an 81-year-old woman with dementia. Although we administered fluids and pain medications, her heart rate continued to be elevated for a prolonged period of time. She had been in one of the windowless rooms for several days at which point it was suggested we move her to the other side of the unit, with views overlooking the river. Although there were a few looks of doubt between team members when this was formally mentioned on rounds, she was transferred that afternoon. I recall looking into her room later that day and seeing the distinct light of a summer sunset streaming through her window, noting that her cardiac monitor had stopped its incessant beeping as her heart rate normalized and she appeared calmer. We will never know the exact mechanism for this physiological change given that she was receiving numerous treatments in addition to the room change, but I believe the sunlight and river views had an impact. Although only a medical anecdote, these eventually lead to confirmation studies and change follows. This situation may not apply directly to institutions where private rooms are becoming the industry standard, but many existing facilities maintain shared rooms and may lack windows. This example is encouraging, not only incentivizing the day-lit hospital, but realizing the culture shift of the medical team in accepting the importance of environmental factors as part of the medical plan.

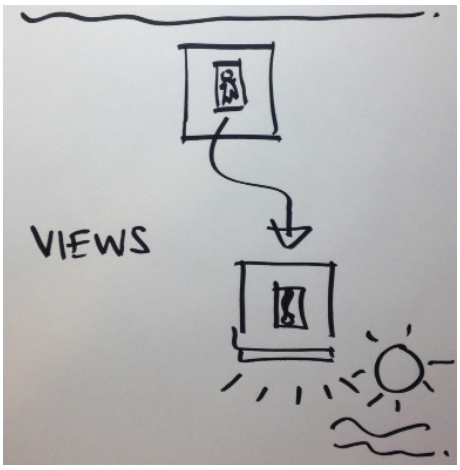

Figure 2. Schematic example of moving a patient to a room with a window and subsequent physiological changes observed. Sketch: Diana Anderson.

The Rotating Curriculum

The process of medical training is a time during which residents work day and night within the hospital, acting at the forefront of patient care and use of the built environment. Join me in my experiences as I rotate through the core medical specialties located within a tertiary academic healthcare campus, including the Coronary Care Unit (CCU), the Medical Intensive Care Unit (MICU), outpatient clinics, the Emergency Department (ED), and inpatient wards. The following commentaries explore the healthcare environment and provide readers with an understanding of working in the hospital with multidisciplinary staff, patients and families. Read case reports of patients who have been affected by design, the impact of design on my learning and practice as an intern, and gain an understanding of the structure of a typical work day (or night) for house staff. New work hour restrictions for training programs across

the US (also being adopted by Canada) will also be explored, and the impact this has on staff workflow, medical practices and patient care.

Portraying stories of medical training and practice to those who are not clinicians, but who are involved in healthcare design and facility operation, promotes an increased understanding of clinical systems within the high-performance team approach to design. With medical experience enhanced by design perspective, perhaps the architect can know and share what the doctor knows.

NIGHT FLOAT

At night, the hospital environment changes. During the day there is a constant flutter of activity, noise levels are high and support staff are everywhere. At night an eerie silence blankets the building with a skeleton crew of staff wandering the halls until morning. No doctor can work constantly, so cross-coverage is essential. Night float is the product of reforms in medical education, limiting the number of hours that doctors in training, notably interns and residents, can work. Teaching hospitals have had to arrange more cross-coverage when the primary resident is off duty. The position of a resident who works the night shift, usually for a few weeks, was created. This allows other residents to sleep, but also promotes frequent patient handoffs, which can result in the transfer of inadequate information.

Limiting trainee work hours gained awareness with the death of a woman named Libby Zion at the emergency room of New York Hospital, after an intern and resident treating her responded slowly when she reacted adversely to a drug they gave her. Medical educators asked whether the young doctors had been more rested, would they have saved her. A special commission in 1987 proposed a number of changes in residency training in New York State. Residents were prohibited from working more than 24 hours at a time or more than 80 hours per week, averaged over four weeks. They got one day off a week. After much debate, 2003 saw similar changes throughout US residency programs (Lerner, 2009).

Demise of the Call Room?

It is interesting to consider this change in hours on our work culture and use of space. Recently in my hospital we developed a plan to renovate our resident lounge and provide a separate space for our white coats and personal belongings. A representative group from our administration came to assess the space and our proposed plans. They liked it, they said, but recommended we turn one of our neighboring overnight on-call rooms into our coat room – "with the new work hour restrictions, residents shouldn't need sleeping quarters anymore," one of the administrators remarked. If one has ever worked two weeks of night float in a row with shifts starting at 9 pm and ending approximately 12 hours later, they will endorse that a place to rest is still required. Ask any resident and they will tell you that working a 12-hour night shift is not the same as a 12-hour day shift. Especially with our constant switch back and forth between the day and night schedules which can cause extreme fatigue and

destroy our circadian rhythms. Research into the new work hour system is underway with preliminary results suggesting interns and residents are no more rested and may even be more fatigued with this model, although it is still too early to know. With this conversion to the shift work model, I wonder whether on-call rooms will remain part of department programs or will we need to develop innovative spaces for short naps and additional forms of rest and rejuvenation?

Figure 3. Example of an overnight on-call room for resident physicians to rest if the opportunity arises. Photo: Diana Anderson.

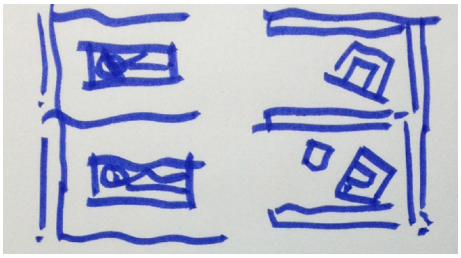

Figure 4. Schematic idea of the traditional physician on-call room with a bed (left); the design possibility for new, smaller spaces for shorter periods of rest using recliners or chairs (right). Sketch: Diana Anderson.

Night float raises a question about work limits for interns: Is it better to be cared for by a tired resident who knows the patient or a rested resident who does not? Many hospitals continue to rely on interns signing out verbally to each other, often at busy and noisy nurse stations, potentially inviting error.

The Bed Check

On night float we typically wake patients throughout our shift to perform necessary "bed checks" as signed out for us to do by the primary team. I carry paper lists of patients in the back pocket of my scrubs with varying instructions; "Lung check for Mr. R once overnight" my sheet will say. So, I enter the room at a point when I have a moment, usually in the deep hours of the night and turn on a light, waking Mr. R and placing my stethoscope on his lung fields to listen for any abnormal sounds. In my hospital many rooms are shared and as I reach for a light switch in the pitch black I often illuminate the whole room, waking my patient and their neighbour.

My sign-out sheet will often have written the dreaded "NTD" or "nothing to do", which is almost never true. On my last intern night float shift I went to see an elderly patient. He did not wake easily for me and could not tell me the year or his name. This was apparently not his baseline function, which I would know as the primary team but I was just the covering doctor. I proceeded to work him up for "altered mental status" taking time to rule out serious events – ordering a chest X-ray and blood work to rule out infection, assessing oxygen status and cardiac function to rule out a heart attack or stroke. Everything returned normal. The next day I learned that he had exhibited the same behavior two nights prior which I was not told. The diagnosis of exclusion was "sundowning", a psychological phenomenon associated with increased confusion and restlessness in patients with some form of dementia, occurring in the evening or while the sun is setting. The next morning the patient was sitting up in bed answer-

ing questions appropriately, unaware of overnight events. This case serves to illustrate the environmental night-time effect on patients and the perspective clinicians have at the time, the priority to rule out urgent and emergent issues while working with minimal information.

Arrest, STAT!

In addition to our admission and cross coverage duties, the night internal medicine residents form the "code team", the first responders to any cardiac or respiratory arrest called on the overhead loudspeakers. This yields a heightened sensitivity to sounds, almost like symptoms seen in post-traumatic stress disorder, as our hearts quicken and we begin to sweat at any overhead noise, always prepared to stop and run with the call of "Arrest, STAT!" Sometimes we run up or down numerous flights of stairs, or across the connector bridge to neighboring buildings on campus. When considering the hospital layout, wayfinding should be a forefront strategy in the overall design. Periodic views to the exterior, especially at the ends of long corridors, are important features in promoting orientation for both visitors and patients, and serve as a moment of respite for staff or as cues that we are running in the correct direction if going to an arrest. Interestingly, less than ten percent of wayfinding is associated with signage, while the remainder is attributed to architectural layout and building design. In addition to wayfinding, the hospital corridor has additional design potential as many clinical activities and social interactions occur here. At night these corridors can be our running track and wayfinding becomes even more important without the cue of daylight.

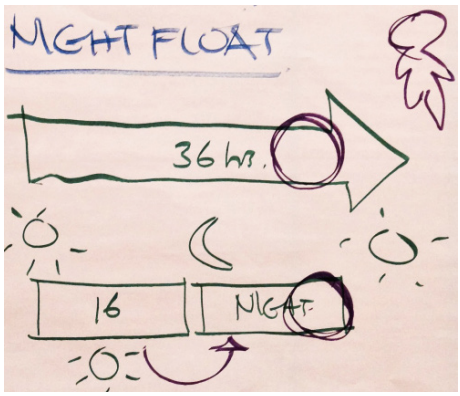

Figure 5. Is it better to be cared for by a tired resident who knows the patient or a rested resident who does not? Sketch: Diana Anderson.

The practice of medicine is changing with the new work hour restrictions. A doctor in training benefits from seeing a patient's illness through its course, in order to understand the dynamics of disease. However, frequent handoffs are now a reality and medical teams and institutions are still figuring out the best system to avoid errors and maximize learning. The way we use the hospital space will likely change with this new model, and may require novel planned spaces designated for handoffs to take place, areas for short rest breaks and ways of bed-checking patients without excessive noise and light during the night float hours.

Figure 6. At night the hospital atmosphere changes and night float residents arrive to take over from the day shift. Photo: Diana Anderson.

Figure 7. Frequent handoffs between clinical staff are now becoming the standard of care, and spaces designed for the accurate exchange of medical information are necessary. Sketch: Diana Anderson.

INTO THE TRENCHES

As incoming residents we are often told by seasoned clinicians that the training period of residency is akin to going to battle. We put on our uniform (in this case our scrubs) and go "into the trenches" (ie: the medical inpatient floors), told not to look back and focus on one task: surviving the training. It is a brutal period complete with sleep deprivation, physical demand, emotional stress and the need to confront human suffering and death on a daily basis. Many ask how we can work such long hours without breaks, but in truth with so much work and little access to natural light our sense of time becomes lost. Major activities on the floors are being on-call and performing bedside procedures.

The On-Call Shift

As an internal medicine intern, the bulk of our year is spent on the medicine inpatient floors. When we say we are "on-call" many outside of medicine consider this to mean we are home awaiting a call from the hospital. This is not the case, except for "home call" which occurs later in the course of training, and in fact the call shifts are the most intense times. We are "in-house" or in the hospital for these shifts, occurring every third to fourth day of a monthly rotation. They involve a 16 hour shift for interns, but up to 24 hours for higher years in some settings with few, if any, breaks. During these shifts we take care of our list of patients already admitted but we also admit new patients to our service and often cross-cover patients from other teams if they have the day or night off. New admissions generally require leaving our existing patients upstairs on the floors and taking the often long trip to the Emergency Department (ED) to meet our new patients. We must interview and examine new patients, prepare for their admission by researching their case, place orders in the computer, run tests and determine a diagnosis to initiate treatment. This takes time and we have multiple new cases per shift. All the while our pager goes off for ongoing issues for patients upstairs and on-call becomes an exercise in multitasking while learning to triage given minimal information through a text page.

Because we admit several patients over the course of a shift and beds are not always available immediately, we care for patients who may be in the ED for some time. We make the trip back and forth between the ED and the floors numerous times per shift in order to eyeball our new patients and ensure they are not "looking more sick", as the clinical gestalt of recognizing a decline is what we are trying to master as junior doctors.

Call days are some of the more challenging times and require residents to travel to many parts of the hospital, including the ED, the laboratory, the blood bank and the imaging suites. Healthcare architects would no doubt benefit from shadowing clinicians or residents during a call shift in order to maximize these departmental adjacencies and the need to shorten certain walking distances.

Bedside Procedures

Working in the trenches often means the need to perform bedside procedures. In the realm of internal medicine, these generally involve removing fluid from a particular body cavity in order to provide symptomatic relief for the patient in addition to serving as a diagnostic tool by sending fluid to the laboratory for analysis. With our understanding of infection control, procedures are now taught using sterile techniques, but we frequently lack a surface to gown, glove and set up in the necessary fashion and then easily access our tray of supplies. We frequently reach for the patient's bedside table, the only mobile and flexible surface we have, also used for patient belongings and food. Because of this lack of space, we generally tell the patient that we will use them as a surface once we have draped their body with a sterile cover. I have never found this to be ideal as patients can move suddenly thus tipping over supply trays and risking needle stick injuries for staff. The ideal room would provide a ledge, portable surface or even convertible nightstand that might provide some additional space. Proper overhead lighting within the room is essential, especially during the night when you cannot reply on daylight for added visibility. Patient rooms already provide a wall-mounted sharps container, although procedures are generally done from either side of the patient, yielding the need to walk around the room to dispose of dirty equipment, where an additional container would be helpful.

Figure 8. The Columbia University Medical Center campus in New York City illustrates the distance that can occur between inpatient units and the emergency department. Photo: Diana Anderson.

Places of Respite

Perhaps some of the more challenging aspects about being in the trenches are the lack of areas of respite for staff and the shortage of nature and daylight. In design workshops, the patient space is often considered the highest priority, while staff lounges and workrooms are frequently the last areas to be given natural light or situated along the building perimeter. I have often found this to be paradoxical when considering that patient length of stays are decreasing to only a few days, whereas staff will work in the same environment for years.

Critical care units are intense environments for staff and are generally designed in such a way to allow for direct visibility into each patient room from the central work station. Some critical care units allow for an enclosed area with comfortable seating, ambient lighting and music for staff to take a few moments and recharge during long shifts. Having worked in critical care units without this type of space, I found myself retreating to the clean supply room as a place where I could disappear out of sight between ceiling-high supply shelving units and take a few moments to compose myself during overwhelming clinical moments. Awareness of the need for areas of respite for staff, especially within intensive care, should be included in the planning process and their importance cannot be minimized.

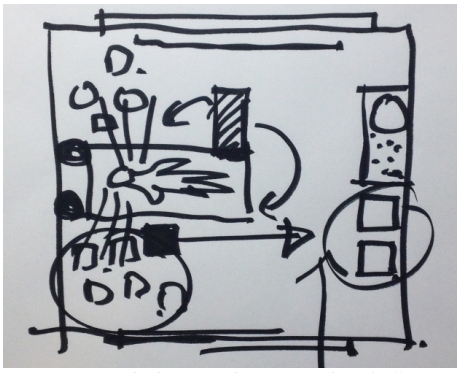

Figure 9. Bedside procedures can be challenging given medical equipment in the room and the lack of mobile surfaces for sterile supplies. Sketch: Diana Anderson.

Figure 10. Clean utility supply rooms are often the only locations for staff to be able to gain some privacy for moments of reflection and composure during long shifts. Photo: Diana Anderson.

Design as Influencer of Change

Are there ways in which the design of the environment can soften the metaphor of the hospital as a battleground for trainees? Room layout to promote bedside procedure efficiency can reduce the potential for contamination and needle stick injury. Can better design encourage medical staff to take short breaks and be an influence in the model for behavioral change? Barriers to these moments of respite include individual and community beliefs about work, the operational demands of healthcare work itself, and the quality of the built environment in which that work is being performed. There is a large window at the end of a corridor on the top floor of my hospital and I will take time to go there, especially after an overnight shift, just to see the sunrise over the city and reflect, leaving behind emotional and physical burdens of the shift. By providing light to staff areas, views to the exterior along wayfinding paths and areas of respite, the training experience can likely be made easier and more humanistic.

The Problem List

When my patients come to see me in the clinic, our structured template that populates within the electronic medical record begins with a "Problem List" for each patient. This is a summary of their medical history and can often provide me with a snapshot into that person's health status prior to seeing them that day. From this list, I can often tell how to prepare my room and if they will enter with assistive walking devices, be accompanied by their children or a home health aide requiring an extra chair, or require the services of an interpreter to help with language. Outpatient or ambulatory medicine requires a particular approach which differs from that of inpatient medicine. Time is often limited and clinics are high-traffic areas, so one must decide on a focus for the brief time period that is allotted. Our role is also to emphasize the importance of preventative m edicine to our patients and record a patient's compliance and maintenance with their screening tests such as flu shots, colonoscopies and cholesterol checks.

Figure 11. Outdoor views should be made accessible to clinical staff for moments of respite and reflection. Photo: Diana Anderson.

Design for the Clinical Encounter

As a doctor in-training, I have yet to develop comfort with my own style of interviewing patients in the clinic setting. Some physicians will begin an interview while seated and then ask additional questions during the physical exam, while others prefer to interview entirely during the exam and later chart their notes. I recently shadowed a senior physician in the chronic pain clinic. The room in this instance was set up with a central desk and computer for the provider which faced the door. On one side of the desk there were two chairs for the patient and a family member, set up to face the exam table across the room but not the desk, requiring patients to turn their heads ninety degrees to make eye contact with the physician. The large format computer screen appeared as a barrier to communication as the physician asked questions and typed as the patient answered, frequently looking at the screen or his keyboard. I, too, am guilty of this practice. I began my residency by taking hand-written notes, focusing on my patient, transcribing them at the end of the day, but then my patient list became longer and the time for charting shorter.

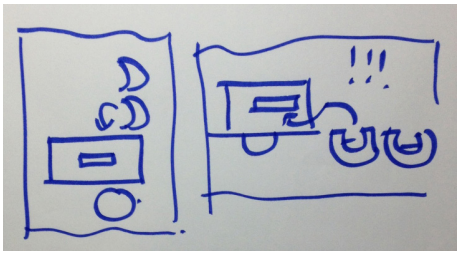

Figure 12. Schematic floor plan layouts of clinic rooms where patients may have difficulty making eye contact with the provider (left), or have visual access to the computer screen (right).
Sketch: Diana Anderson.

Figure 13. Example of a clinic room where access to the right-hand side of the patient is difficult given the placement of the examination table.
Photo: Diana Anderson.

Another example from time spent in a dermatology clinic had patient chairs in line with the physician's seat to try and eliminate the computer screen as a barrier. However, this yielded challenges with patients also watching the monitor and noting medical terminology charted by the physician and feeling displeased with the choice of words, thus creating a new barrier to our tool of communication. Can the design of the clinic room encourage flexibility, efficiency, and patient experience? Successful exam rooms make work processes efficient, help alleviate anxiety for patients, and break down barriers through layout, encouraging patients to take greater ownership of their healthcare.

Multidisciplinary Spaces to Promote Collaboration

The physical design of the environment affects individual and organizational performance, including communication and interaction. Locating subspecialty clinics adjacent to one another to promote interdisciplinary collaboration through shared spaces is an area with potential for exploration.

It has been documented that 80% of scientific breakthroughs occur outside the laboratory environment in social settings (Jen, 2006). The Salk Institute for Biological Studies in La Jolla, California, designed in the 1960s by Louis Kahn, incorporates social spaces into a laboratory setting with the goal of fostering scientific creativity. The Institute was established by Dr. Jonas Salk, developer of the first polio vaccine. His goal was to establish an institute that would make it possible for scientists to work together in a collaborative environment. In planning the design, Kahn recognized the importance of informal and social spaces by separating them from the laboratory spaces. Salk's vision of collaboration can be applied to the hospital environment where design can foster crossing points, supporting the multidisciplinary model of patient care. This is especially relevant in the outpatient primary care setting which often requires input from specialists in addition to social workers, nurses, nutritionists and diabetes educators to provide comprehensive patient care.

In my current hospital we have public elevators, in addition to separate service elevators also used for patient transport. Because of wait times and the inability to discuss cases when inside the elevators, medical teams tend to use the egress stairs. As we walk up and down between floors we often have chance encounters with consultants. Clinicians will frequently stop and review perplexing cases and questions, engaging in real-time discussion rather than communicating through electronic chart notes. Most urban hospitals are vertically stacked with multiple elevator banks. The horizontal or "medical mall" design, although potentially increasing walking distances, also allows for impromptu meetings between multidisciplinary professionals and promotes beneficial face-to-face interactions. Egress stairs are required to be enclosed and usually stripped of any appealing design.

Figure 14. The Salk Institute's outdoor spaces provide chalkboards for scientists to leave their individual laboratories and write notes to be discussed with colleagues, thereby promoting discovery.
Photo: Diana Anderson.

I have often considered a hospital design proposal consisting of a grand open central stair, connecting at least the first few levels of commonly accessed spaces such as the cafeteria, phlebotomy lab and radiology centre. This design feature would promote physical activity and chance encounters between subspecialists, who could then retreat to planned alcoves for further discussion.

Breaking Care Barriers through Design

Patients and healthcare providers are beginning to think differently about how they use spaces and about how they want to receive care. The clinic should encourage communication and facilitate the physical examination of the patient at the level of the exam room layout. The ambulatory setting should promote communication between multidisciplinary team members through planned adjacencies, open stairs and strategic social spaces. With increasing emphasis on preventative medicine and minimally invasive surgical techniques, we will likely see a growth in ambulatory care facilities moving forward, helping us to address each patient's problem list and hopefully making it shorter.

CONCLUSIONS

Future trends in healthcare design will likely include the need for areas of respite for staff, supporting the need for short periods of rest given the changing practice of medicine to a shift-work model. In addition, increased time required for computer documentation and decreased time at the bedside with patients will likely have design implications; additional staff work areas and specific documentation zones will need to be planned, allowing for flexibility and acoustic privacy. Finally, with the increasing complexity of chronic illness and an aging population, inter-disciplinary teams are now necessary in caring for patients. This will require a shift from the traditional "M.D." or doctor's lounge to the need for multidisciplinary (MD) spaces where teams can meet and discuss complex patient care plans.

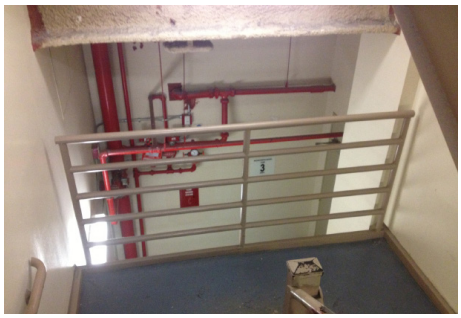

Figure 15. An egress stair used by clinical teams on daily rounds to go between floors; staff frequently pause to discuss patient care plans with consultants who may be passing by. Photo: Diana Anderson.

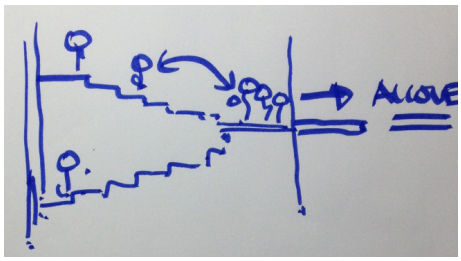

Figure 16. Schematic section of an open staircase design with landings large enough for teams to pause while on rounds and alcoves where providers may retreat and discuss patient care plans.
Sketch: Diana Anderson.

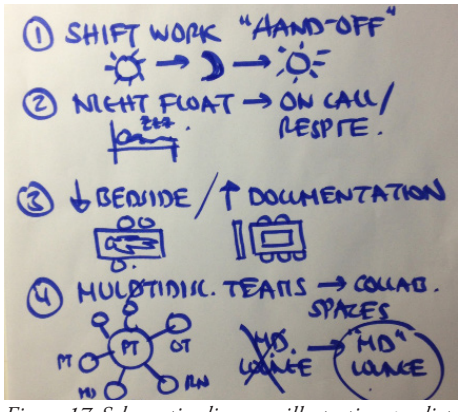

Figure 17. Schematic diagram illustrating predicted design trends for future clinical environments.
Sketch: Diana Anderson.

REFERENCES

Jen, L. (2006). Genetic complement. *Canadian Architect,* 51: 28-33.

Lerner, B. H. (March 3, 2009). *A Life-Changing Case for Doctors in Training*. The New York Times.

Twombley, R. (ed.) (1964). Medicine in the Year 2000. *Louis Kahn: Essential Texts. New York*, NY: WW Northon & Co.