Richa Kanwar. Identifying Facilitators and Barriers in the Application of Contextual Inquiry to Understand Provider Burnout. A Master's Paper for the M.S. in I.S degree. May, 2019. 70 pages. Advisor: Dr. Lukasz Mazur

The purpose of this study was to identify the factors and decisions that affect the implementation of Contextual Inquiry, and explain which factors act as facilitators contributing towards the success of the project and which factors act as barriers hindering the success of the project. To determine these factors this study observed the application of Contextual Inquiry in a real-world project where it was applied to understand the reasons behind healthcare provider burnout. Using methods such as interviews, surveys and group discussions with the implementation team of the real-world project, this study was able to identify 18 Facilitators, 9 Barriers, and 3 Critical Decisions that impact the outcome of a Contextual Inquiry implementation in a healthcare setting.

Headings:

Contextual Inquiry

Contextual Inquiry in Healthcare

Facilitators and Barriers in Contextual Inquiry

Success Factors in Contextual Inquiry

Contextual Inquiry Process

Contextual Inquiry for Provider Burnout

IDENTIFYING FACILITATORS AND BARRIERS
IN THE APPLICATION OF CONTEXTUAL INQUIRY
TO UNDERSTAND PROVIDER BURNOUT

by
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Table of Contents

1 Introduction

1.1 Background

Contextual Inquiry (CI) is a user centered design research method based on a qualitative data-gathering and data-analysis methodology. It involves understanding a user's needs by observing and interviewing them in their natural environment or in other words, in the context of the systems they interact with on an everyday basis. The application of CI is based on the following three principles:

1. Data gathering must take place in the context of the user's environment.

2. The data gatherer and the user form a partnership to explore issues together.

3. The inquiry is based on a focus; that is, it is based on a clearly defined set of concerns, rather than on a list of specific questions (such as in a survey).

CI is usually preferred over other tools like interviews because it takes into account the user's context and their physical surroundings. The participants are observed in their environment as opposed to an interview which could be conducted anywhere and whatever the user shares in an interview may be influenced by their views and experience. Thus, the data gathered through observing the user in their environment is more realistic as it does not solely rely on the user's information sharing.

In recent times CI has also been applied to healthcare research. To give an example, with the increasing use of electronic health records systems, CI has been found to be useful in identifying customer needs to design better electronic health records systems. It is now also finding its way into determining healthcare providers needs beyond just their interactions with technology, and instead looking at a holistic picture of healthcare providers needs in their environment including their interactions with technology, their interactions with the population around them, and other subsystems within the hospital, etc.

1.2   Motivation

As noted above, the CI technique is a popular tool in Systems Analysis and gaining popularity in its application to a healthcare setting. One of the reasons for its popularity is the richness of data that it provides. Due to this, the process of implementing CI is understandably complex. A typical CI implementation involves various forces at play, all of which influence the execution and outcome of the effort.

Although the use of CI is widespread, there has been little attention given to the process of applying CI, and to understand the forces on which this process depends.

The primary motivation behind this study was to gain a deeper understanding of the process of implementing Contextual Inquiry from the perspective of identifying these underlying forces. By closely examining the implementation of the CI it may be possible to discover the positive and negative forces which support or oppose the successful implementation of CI.

1.3   Impact

If the positive and negative forces which influence the implementation of CI are known and codified, it will serve as a guide and starting point to anyone who wishes to apply CI. It will help the team implementing the CI methodology to be better prepared in terms of knowing what works and what doesn't. They will be aware of the risks and possible failures and can plan their process better. This will also allow them to optimize the time and resources that they will be investing in such a project.

1.4   Purpose

The purpose of this study was to identify the factors that affect the implementation of CI applied in a healthcare setting, and explain which factors act as facilitators contributing towards the success of the project and which factors act as barriers hindering the success of the project.

The CI project observed in this study focused on understanding systems breakdowns that cause healthcare provider (e.g. physician) burnout. However, the results from the study are generalizable to any healthcare setting.

An additional purpose of this study was to identify the critical decisions made during the execution of a CI implementation project that have a strong impact on the outcomes.

1.5   Setting

This study is based on observations and analysis of a CI implementation project at the University of North Carolina at Chapel Hill. The said CI implementation project was part

of a larger ongoing project that focused on physician wellness and it included a total of 8 Contextual Inquiries performed with 8 Hospitalists from two participating hospitals over a period of 3 months.

The CI Implementation Team (CI Team) is made up of 5 members:

1.   One Project Lead

2.   One Project Manager

3.   Two Provider Subject Matter Experts

4.   One Human Factors Subject Matter Expert

This CI team was observed closely in action as they went through the implementation of CI methodology to identify system breakdowns in a hospital setting.

1.6   Research Questions

This study monitored the implementation of Contextual Inquiry when applied for identifying system breakdowns and opportunities for improvement in participating hospitals. The aim was to identify facilitators and barriers contributing to successful Contextual Inquiry project implementation that can be generalized for broader uses.

Research Question 1: What are the critical factors (facilitators vs. barriers) contributing to a successful Contextual Inquiry implementation process?

Research Question 2: What are the patterns of critical actions and decisions during the Contextual Inquiry implementation process associated with successful implementation?

2 Literature Review

2.1 Contextual Inquiry

Contextual Inquiry (CI) is a user based design research method where participants are asked to perform their work just like they normally do every day, and while they perform their day-to-day tasks in their natural environment, they are observed by one member from the research team to identify the key areas of failures and obstacles. It is performed with one participant at a time. The key difference between Contextual Inquiry and other research methods is that a CI participant needs to take up a more active role in the interaction and the shadowing session. Contextual Inquiry can be applied to any domain. Automobiles industry for example, has also used this methodology to understand the user needs. The first Contextual design project undertaken by General Motors, titled "Journey", used Contextual Inquiry to gain a deeper understanding of how drivers interact with today's information systems in a vehicle so that they could provide for a better experience to their customers (Gellatly et al, 2010).

2.2 Importance of Contextual Inquiry as a Research Tool

What makes CI better than other available methods is that it provides a very high level of detail with the data coming directly from observations and not only relying on a user's narrative. It can reveal subtleties which may not seem important to the participant and they

may fail to mention in an interview or discussion (Nilsen, 2015). CI allows for getting those details which the observer may feel are important from the research perspective, even if the participant does not see it as very important. But because these sessions are led by the participant, it takes into account their perspective, their needs and their issues. It has a comfort level for the participant as it is done their natural environment and does not invite an unnatural behavior from them. This also leads to getting more accurate information.

2.3   Application of Contextual Inquiry in Healthcare domain

There is very little literature on the use of Contextual Inquiry in healthcare settings (Asan et al, 2012). There were two empirical studies that used CI to gather data about end users' needs and their interaction with some technology solutions like an electronic nursing documentation system and their viewpoint on the use of those technologies (Viitanen, 2011). It also brought to attention some specific challenges that a clinical setting posed, like privacy issues and the hectic and chaotic nature of clinical work. So far, the literature indicates that in healthcare settings Contextual Inquiry has been used to understand human interaction with technology, but has not been explored as a tool to understand system breakdowns that arise out of other interactions within a system such as human-to-human interactions, department-to-department interaction, etc.

Lately, there are increasing number of examples of Contextual Inquiry being applied in usability evaluation of healthcare systems (Coble et al, 1997; Miller et al, 2018; Sheehan et al, 2012; Stage et al, 2018). However, there is not much literature available on specific tools or techniques that can be used to evaluate if a Contextual Inquiry itself has been

successful or not. If one can identify what works and what doesn't in successfully deploying Contextual Inquiry as a tool in projects in a healthcare informatics settings, then it can greatly increase the chances of success of such projects and lead to development and adoption of healthcare systems that closely address the needs of their users.

2.4   Outcomes of Successful Implementation of Contextual Inquiry

As a result of a successful implementation of Contextual Inquiry, system breakdowns are identified and if they are fixed it results in increased system efficiency which eventually leads to reduction in time required to perform certain steps or actions, and this allows the user to focus on their key actions and be more productive at their work. For example, a sign-on to the system should be easy and the physician should be able to view radiology reports easily rather than having to struggle looking for the report. Successful CI is able to reveal where exactly in the chain of steps is breakdown. Sometimes, the findings of a Contextual Inquiry can also lead to creation of new tool altogether. For example, a Clinical Information Tool could be created based on the outcome of a Contextual Inquiry (Anna et al, 2001).

Another key outcome is that the participants feel like the project is really focusing on their requirements. According to a study conducted to identify a physician's' true needs, the physicians felt like they are part of the project and believe that the project is really being driven by their needs. This is mostly due to the fact that with CI, the observers spent an extended amount of time with each physician in a one-on-one setting actively inquiring about their needs, wishes, and problems (Coble et al, 1995).

This results in more enthusiastic participation and more involvement on their part. The actual success of the implementation of the CI methodology really depends on how the users feel after changes have been made as a result of the recommendations made based on the findings from the CI.

2.5 Challenges in implementing Contextual Inquiry for projects

There are also some known challenges associated with the implementation of Contextual Inquiry. First, there must be a balance between an interview and an ethnographic observation approach. Participants may not be sure of what Contextual Inquiry is, which may lead to some apprehension form the participant, and this can influence the inputs they share.

Secondly, sometimes participants may either go into an interview state and only answer questions they are asked instead of actively explaining their tasks and activities to the observer, or they may go into an ignorant state while they are in the process of performing their everyday tasks and not really provide sufficient details as they go about it. Thus, it requires balance not only from the researcher, but also the participant. Participants would have to lead these shadowing sessions because they are the ones who are the experts in what they are doing and can explain every little detail of what they are doing and why. This is also important because if the participant is not very actively involved the observer will have to ask a lot of questions which could make them feel like they are pestering the participant. Some participants tend to be more comfortable and more familiar with the traditional "sit back and answer questions" or "perform tasks as told" response.

Also, being observed can be awkward for a lot of people. It can cause them to behave unnaturally or out of character and that will essentially defeat the whole purpose of doing a Contextual Inquiry, the purpose of which is to observe the user in their natural setting and in their natural behavior which can reveal their true needs and frustrations. Sometimes people can include other people to try and provide more information and make it more of a group session.

Finally, there is a concern that sessions may not be long enough to allow gathering as much information as would be needed for some meaningful interpretations, and it could also be that one session may not be enough to gather all the information that is required to really make the inquiry a useful activity. It is possible that by coincidence the shadowing happens on a day that is not a typical day for the user. This will not give the actual picture of the user's everyday work and actions. It was noted that sometimes participants don't go into too much details. They may not always understand that every little detail matters. When doing a CI in a domain that is unfamiliar to the observer, the participant may forget that and may use jargon specific to the domain. There is also a possibility that these sessions might turn into ranting sessions where the participant sees this as an opportunity to complain about everything that they feel is wrong at their workplace.

2.6   Effectiveness of Contextual Inquiry in Health Informatics

While there is a lot of literature on Contextual Inquiry as a methodology, it appears that the use of Contextual Inquiry has not examined closely in healthcare. Lately, there are increasing number of examples of Contextual Inquiry being applied in usability evaluation of healthcare systems (Coble et al, 1997; Miller et al, 2018; Sheehan et al, 2012; Stage

et al, 2018). However, there is not much literature available on specific tools or techniques that can be used to evaluate if a Contextual Inquiry itself has been successful or not. By identifying what works and what doesn't in successfully deploying Contextual Inquiry as a tool in projects in a healthcare informatics settings, then the chances of success of such projects can improve greatly, leading to development and adoption of healthcare systems that closely address the needs of their users

3 Methods

3.1 Approach

As outlined in the previous sections, the primary goal of this study was to understand the process of implementation of the Contextual Inquiry methodology (henceforth also referred to as CI methodology) in a healthcare setting, with an aim to arrive at a concrete list of facilitators and barriers that influence the implementation of this methodology. An additional goal was to understand what critical decisions were taken during such implementation which had a significant impact on the outcome of the process.

In view of the above goals, a two-phase approach was adopted in this study. The first phase was exploratory data collection and analysis. The first phase employed direct observation of weekly team meetings of the CI Implementation Team (henceforth also referred to as the CI Team), and semi-structured interviews with each member of the team. This phase helped identify the foundational elements of CI implementation factors, including the critical decisions taken during the process and a bucket list of factors influencing the process. This list of factors was then used to set up the second phase.

The second phase involved a survey developed on the basis of the factors identified in the first phase, and a group discussion among the CI Team members to capture the in-depth reflections of each of the members. This structured data collection and analysis led to the

final results reported in the results section. Across both the phases, it was important to get the perspective of the team members, how each of them looked at the process, and how an individual's role in the process shapes their perspective.

3.2 Data Collection

The data was collected over a period of 3 months through direct observation, semi-structured interviews, and 1 session in which a survey was administered to the CI Team followed by a group discussion on each of the factors in the survey. Some of the documents and artifacts that were created during the implementation of CI were also collected for reference. Each of the data collection methods is discussed in detail below. The methods have been reported in a chronological order to help the reader understand the journey of this study.

3.2.1 Phase I: Direct Observation and Interviews

3.2.1.1 Direct Observation

One of the methods for data collection in the first phase was direct observation. For the direct observation, it was decided that immersion would be the best way to observe a team in action. The CI Team was observed across 10 weekly project meetings which were observed for 2 hours each. The weekly project team meetings allowed observing the team as they went about each step of the CI Implementation and discussed the shadowing process, created models based on the information collected, and planned the next steps. This also provided an opportunity to observe the team dynamics which has an important role to play in the execution of any project.

Notes were taken either on the laptop or a notepad when something noteworthy was observed during the meetings including details such the resources being used (e.g., white board, projector, etc.), layout of the room seating, activities undertaken by each team member in the meeting. Team members were also asked for their inputs when there was more information required.

3.2.1.2 Interviews

Another important method of data collection in this study was one-on-one semi-structured interviews with every member of the CI Team to capture their experience with the CI implementation process. Additionally, two interviews were conducted with the Project Manager to understand timeline of the project and identify critical decisions.

There were 6 interviews conducted in total

- Project Lead – 1 interview

- Project Manager – 3 interviews (1 for process experience, 2 for timeline)

- Provider SME – 1 interview

- Human Factors SME – 1 interview

Semi-structured interviews were chosen as one of the methods for data collection because this was a qualitative study, and the nature of data being collected was more subjective than concrete numbers. It was also clear that the perspectives of each CI Team member would vary based on their role and this was the best way to capture their understanding of the process and their perspective of the factors that affected the implementation of the methodology.

In addition to getting the perspectives and identifying a list of facilitators and barriers, another important insight gathered from the Project Manager's interviews focused on the project timeline was about the critical decisions that were made during the process that influenced the outcome. In these interviews, the Project Manager reflected through every single meeting that took place during the implementation. A hard copy of the meeting calendar was annotated with the key points discussed in each meeting and the key decisions made throughout the process. The Project Manager also explained why these decisions were considered critical and what impact they had on the overall project. This validated the findings from the discussion among the team members observed in the direct observation sessions.

The interviews were semi-structured in nature, with some questions prepared ahead of time to make sure no critical element that needed to be discussed was left out of the interview. The decision to keep the interviews semi-structured comes from the need to let the interviewees share their experience and perspectives in addition to answering specific and pointed questions.

The questions in the interview guide were a mix of specific and open-ended. Due to the semi structured nature, the interviewees were free to add any information they felt was relevant to answer the question completely and satisfactorily. The interview questions are present in the appendix for reference (Appendix A).

The interviews were conducted in the same building in which the CI Team was based and all the team meetings were held. For each interview either the library or a conference room was reserved depending on the availability. The location was chosen with the interviewee's

comfort in consideration. It was believed that the interviewees would be more comfortable in a familiar setting and in the setting that they executed their project. This would allow for them be more receptive and in a more project-oriented state of mind and able to think more deeply and clearly about their experiences.

The duration of the interviews was generally 40-60 minutes except for two interviews with the Project Manager that lasted between 1.5 and 2 hours in which the entire timeline of the project was discussed. During the interviews, the laptop was used to refer to the interview questions. A notepad was also used to capture any thought which might be referred to later or to note down a question that would come to mind as a result of what the interviewees shared. The laptop and notepad were placed on the side to ensure complete attention towards the interviewee and to keep the interviewee interested and motivated to share their perspectives.

The interviews were audio-recorded using the Smart Recorder recording application on the interviewer's personal phone. Prior to the start of each interview, the purpose of the interview and the purpose of the study was explained to the interviewees and they were also asked for their consent on the audio recording. They were informed that the purpose of recording the interview was only so that it could be referred to during the data analysis stage when synthesizing the data and so they could be given complete attention during the interview and not be distracted by note-taking. The interviewees were also told that they were free to take a break when they needed and if at any point they felt uncomfortable or unable to continue with the interview they could ask for the interview to be stopped. It was

also explained that they could ask for the recording to be stopped at any point if they wanted to share something that they did not want on record.

The recordings were only kept on the interviewer's personal phone and were not shared with anyone. They will be purged at the completion of the study.

3.2.1.3 Documents and Artifacts

An additional data collection done during this study was the collection of some documents and artifacts that were created during the implementation process. These were collected to provide a better understanding of the Contextual Inquiry implementation process. The documents and artifacts that were collected are listed below and the images are available for reference in the appendix (Appendix C).

- Affinity Diagrams – During the interpretation sessions after the shadowing of the Hospitalists, the CI Team would collectively analyze the data collected and create affinity diagrams to identify the key themes of the issues that were causing Provider burnout.

- Charts – Another kind of artifact created during the interpretation sessions were charts detailing the step by step activities of the day of a Hospitalist.

- Notes – During the shadowing the researchers took notes using a notepad and pen to record any detail that seemed important. These notes were then used for discussion and to build affinity diagrams.

- Voting sheet – One important step in the CI project was the validation that was carried out with the Hospitalists. At the end of the shadowing process, in a session with the participating hospitalists, the hospitalists were given a sheet which had all the themes of the burnout factors and they were asked to vote on the basis of what they thought were the key issues.

- Images of physical space – Images of the physical space where the team mostly met were also collected to emphasize the importance of resources like a meeting space, whiteboards, projector and screens, etc.

3.2.2 Phase II: Survey and Group Discussion

3.2.2.1 Survey

Upon completion of the interviews, a survey was administered to quantitatively capture the varying perspectives of each of the CI Team members. This survey also served as the primary driver for the results of this study. Its construction was based on the inputs shared by the CI Team members during one-on-one interviews. It captured all possible factors that could have affected the implementation of CI methodology.

Responses to the survey items were made on a five-point scale with the following gradients:

- High Negative Impact

- Low Negative Impact

- No Impact

- Low Positive Impact

- High Positive Impact

For each of the factors, the survey captured both - presence and absence - of the factor. To explain this better, there could be three cases. The presence of a factor could impact the implementation positively, negatively or have not impact at all. Similarly, even the absence of a factor may impact the implementation positively, negatively or have no impact at all. It was important to understand this as some factors would have a strong impact either by their presence or their absence. For example, the presence of internal team support is something that will strongly positively impact any project and the absence of it will strongly negatively impact any project. But the presence of a factor like having a specific skill within the team may be an added asset and may positively impact the project, but its absence may have no impact whatsoever.

The survey was administered on paper at the beginning of a group discussion after all the interviews had been conducted. This served as the basis for the group discussion where every team member shared their perspective of each factor. It was not revealed to the participants that the factors would be discussed in the group discussion. This was done to encourage them to share their genuine thoughts and feelings about each of the factors. A copy of the survey is available in the appendix (Appendix B) for reference.

There were 33 factors captured in total. At the time the survey was administered, the factors were arranged in no particular order. This was done on purpose to get the participants to think about each of the factors in isolation and not get biased due to a carryover effect from one factor to the next. Apart from the random arrangement of the factors for the purpose

of administering it, the factors were divided into six broad categories. These categories were based on the themes that the factors had in common. The themes represented the kind of influence that its comprising factors had on the project. The categories and the factors under each of the categories are listed below:

Table 1 *List of Factors*

External Support Factors
The factors falling under this category are the ones that affect the overall project throughout its duration.   - Physical resources support (like meeting space, flipcharts, post its, etc.)   - Leadership Support and buy-in   - Flexibility available to the CI Team in driving and executing the project   - Faith and trust in the methodology by the entire ecosystem of the project (leadership, executing team, supporting teams, etc.)   - Having the support of other teams/groups (like ISD, EEP, etc.)   - Individual team members and the team being acknowledged and appreciated for their work and contributions
CI Team Composition
The factors falling under this category are some characteristics of the CI Team members and the team, which influences their role and contribution in the project.   - Specialized skills of each of the team members in the CI Team   - A relatively small project team comprising of 5 members   - The CI Team having the same level of experience with respect to the CI methodology
CI Team Readiness
The factors falling under this category are the ones that affect the CI Team's readiness for such a project.   - Prior experience of the Contextual Inquiry methodology or a similar methodology/approach   - Having prior knowledge of some of the issues that exist   - A sense of urgency on the project   - Having clarity on the vision and expectation
Project Management
The factors falling under this category are the ones that affect the Project Management aspect of the Contextual Inquiry Implementation Project.   - Deciding on the scope of the issues at the beginning of the project   - Deciding on the scope of the issues after the observations have been completed   - The set of CI participants being decided by the Hospitalists leadership rather than the CI Team recruiting participants based on a carefully defined criterion   - Regular team meetings (CI Team)   - Scheduling issues (within the CI team)   - Scheduling issues (outside of the team, with Hospitalists and other Teams)   - Role Flexibility (Each team member playing multiple roles. For example, a team member focusing on the Human Factors aspect, but also conducting the Contextual Inquiry)   - Weather emergencies

CI Setup & Execution:
The factors falling under this category are the ones that affect the setup and execution of the Contextual Inquiry process.   - Individual Researcher doing an observation (as opposed to more than one researcher doing an observation together)   - Two or more researchers together doing an observation (as opposed to a single researcher doing an observation)   - Striking a rapport with the CI participants (Hospitalists)   - Flexibility in using the CI methodology (not adhering strictly to the textbook definition or method and tweaking the method where required)   - One researcher dedicated to doing ALL of the observations in one standard way   - Multiple researchers doing the observations and in slightly different ways   - Project Lead and Project Manager demonstrating the process by doing the first round of observations and interpretations   - Building models together during the interpretation session (as opposed to holding discussions on the findings and taking notes and arriving at conclusions)   - Cooperation of the systems connected to the system being observed. (For example, hospitalists are being observed and their burden is the subject of study, but other connected systems such as Radiology, Pharmacy, Specialists, and other such systems/entities are also involved when the issues need to be fixed for Hospitalists)   - Multiple sites where observations need to be done
Participant Characteristics
The factors falling under this category are participant attitude and characteristics that influence the inputs shared by the participants.   - CI Participants' bias towards the issues that are important to them   - Less diverse set of CI Participants in terms of Age, Gender, Race, etc.

3.2.2.2   Group Discussion

Another important data collection source was a group discussion with the CI Team after the interviews and the survey. As mentioned earlier, the survey provided the basis for this group discussion. The purpose of this discussion was to have the team first record their answers on the survey and then to have to team discuss each factor in detail to understand where and why are there differences in opinions and perspectives, and also for the team to learn about the other perspectives and learn from each other. This also served as a collective reflection session on the project that the team had worked on together but while in the process of executing the project did not have an outside and post-implementation view on what worked for the project and what didn't work. These learnings would help in planning

the next phase of the project. The group discussion was held in a conference room. Each member was first handed out a survey on paper and was asked to fill it out. The duration of the group discussion was three hours.

At the end of the group discussion on all of the factors, each participant was asked to identify the top three facilitators and the top three barriers from their perspective. These top facilitators and barriers were also discussed for the purpose of reflection and understanding the individual's perspective in their particular role, but no changes to these were made by any of the participants as a result of the discussion.

The group discussion was also audio recorded on phone, only for reference and to avoid lack of attention during the discussion as a result of taking notes.

3.3   Data Analysis

3.3.1   Phase I: Direct Observation and Interviews

The purpose of direct observations, using immersion, was to gain familiarity with the project and understand the landscape of the CI Implementation process, including the individual actors, their roles in the project, their interactions with each other and with the various elements such as artifacts, documents methods, etc.

The notes captured during each meeting were organized by chronology and from each meeting a broad understanding of challenges and achievements from the team's perspective was developed. The observations also led to an appreciation of the complexity of the

process and the dynamics associated with the implementation. This analysis from observations, in conjunction with further analysis of interviews from Phase I, helped lay the foundation for Phase II.

The purpose of the interviews was to gain insight into the perspectives of the CI Team members experience and to arrive at a list of factors that were potential facilitators or barriers that influenced the implementation process. Further, two additional interviews with the Project Manager were conducted to identify the critical decisions that were made throughout the implementation which contributed to the success of the project.

The first set of interviews to capture the experience of the each of the four team members resulted in approximately 3 hours of recordings. These recordings were revisited and analyzed for broad themes related to identifying potential facilitators and barriers. In addition to gathering responses on specific questions about facilitators and barriers, inferences were also drawn from the responses to open ended questions. These questions were answered by the interviewees in terms of their experiences with the project and it required human judgement to infer the possible factors that may or may not have been explicitly stated.

A final list of factors was prepared and logically organized into broad categories corresponding to External Factors, CI Team Composition, CI Team Readiness, Project Management, CI Setup & Execution, and Participant Influence. These categories were based on the themes that the factors had in common. The themes represented the kind of influence that its comprising factors had on the project. These have already been covered in a preceding section. (**Table 1**)

The second set of interviews was with the Project Manager on timeline of the entire project and resulted in approximately three hours of recordings. The discussion on the timeline was performed specifically to elicit the Project Manager's recollection of key events and thereby trigger a discussion of important decisions. Based on the analysis of these interviews, these important decisions were further contextualized to arrive at a list of critical decisions. To identify critical decisions from a longer list of important decisions the following guidelines were followed:

- Did this decision have a major qualitative impact on the outcome of the project? For example, improvement in process, smoother experience for participants and the team, etc.

- Did this decision have a major quantitative impact on the outcome of the project? For example, savings in terms of time and resources, etc.

- Was this criticality of this decision supported by the evidence collected through other data collection methods in Phase I such as interviews and direct observations?

The final list of critical decisions is presented in the Results section.

3.3.2 Phase II: Survey and Group Discussion

The foundational work performed in Phase I helped in understanding the project, listing potential factors and identifying critical decisions. This helped set up the Phase II of the research which was aimed at the primary research question, identifying facilitators and barriers from this bucket list of potential factors that influenced the implementation of the CI methodology. Thus, Phase II was the primary investigation of this study.

As outlined in the Data Collection section above, the data collected during this phase of study was in the form of a survey administered to the CI Team, capturing their rating on the influence of the factors. The rating from the survey helped quantify the perspectives of team members. The respondents were asked to rate each factor's impact on a five-point scale, representing polarity as well as intensity of impact i.e. High Negative Impact, Low Negative Impact, No Impact, Low Positive Impact, and High Positive Impact. For each factor the respondents gave two ratings – one for the presence of the factor and one for the absence of the factor. This survey was immediately followed by a group discussion among the CI Team members during which different team members provided context to their answers.

Data analysis was performed on the survey responses. The understanding and information collected through interviews and group discussion served as the foundation for building the survey, and it also supported the interpretation of the survey responses. For example, if in the interview one of the team members shared their perspective of the weather emergencies that impacted the project, then their survey response about the weather emergencies can be understood and interpreted better because their perspective and thought process behind it is known.

The survey and all the responses from all participants were transferred to a digital spreadsheet. The raw data collected from the survey digital spreadsheet had four different versions of the results:

- Five-point scale responses: This recorded the responses as indicated by all the participants on the five-point scale survey.

- Five-point scale agreement: This recorded the agreement that the participants had on all the factors in terms of the five-point scale. Agreement on a factor (both presence and absence) here indicates that each participant responded on the exact same point on the scale for that factor. Even if one of the participants varied on the scale by even one point that was not considered an agreement.

- Three-point scale responses: This recorded the polarity (positive impact, negative impact, or no impact) of the responses regardless of the intensity (High, Low). This conversion from five-point to three-point was done manually by looking at the polarity of all responses by all participants.

- Three-point scale agreement: This recorded the agreement that the participants had on the polarity of all the factors regardless of the intensity. Agreement on a factor (both presence and absence) here indicates that each participant responded with the same polarity for that factor not considering the intensity within the polarity. Even if one of the participants varied on the polarity, that was not considered an agreement.

The purpose of having the two scales was to capture the factors where there was disagreement on whether the presence or absence of a factor had a positive, negative or no impact and then to see within the same polarity how different participants varied on the intensity. It is also important to note that the disagreement on the three-point scale represents true disagreement since the disagreement is on positive vs negative, whereas disagreement on the five-point scale could reflect a disagreement on the intensity, such as high positive impact vs low positive impact. The group discussion provided the basis for interpreting

these differences and hence contributed to the understanding of, not just what factors affect the implementation of the CI methodology, but also how different roles viewed different factors.

The survey data was analyzed by first organizing the factors into 6 broad categories as outlined earlier in the data collection. For each factor, the respondents' ratings were collapsed from a 5-point scale to a 3-point scale to reflect just the polarity of impact and not the degree. The ratings from each respondent were compared to gauge if the respondent's agreed on the polarity. Thereafter, for the presence and absence of each factor, the ratings from each respondent were compared to gauge the respondent's agreement on the polarity. For a given factor, agreement was gauged separately for presence and absence. Based on this, two labels were assigned to each factor – one for its presence and one for its absence, the label indicating the agreement across respondents. A label indicating agreement was assigned if all respondents agreed on the same polarity on a 3-point scale. Even if one respondent differed, a label of disagreement was assigned. Therefore, each factor was assigned one of the following four labels for both presence and absence:

- Agreement – Positive

- Agreement – Negative

- Agreement – No Impact

- Disagreement

Assignment of labels as above introduces the concept of evidence in this analysis. The ultimate goal of this analysis was to be able to ascertain whether a factor has an influence on the CI implementation project and if there is evidence from the survey to support this

claim, and also if the evidence from the survey (label assigned in the manner above) is conclusive enough to support this claim. It can be postulated that wherever the label assigned to a factor is different for its presence and absence, this evidence supports the claim that the factor has some influence on the project. Conversely, if the factor is assigned the same label for its presence as well as absence, then this evidence is inconclusive whether it has an influence on the implementation project or not.

To illustrate, let's say for a given factor, the presence has a label Agreement-Positive and absence has a label Agreement-Negative, then this evidence suggests that the presence of this factor has a positive impact and its absence has a negative impact on the project. Therefore, this factor has an influence on the outcome of the project. On the other hand, if the label for presence as well as absence was Agreement-Positive, this evidence is inconclusive because the evidence is contradictory in nature and thereby inconclusive. Same is the case when, for example, there is disagreement for both presence and absence This evidence too is inconclusive in nature to determine the influence of the factor on the project.

Once this analysis was performed, the results were prepared for reporting. For the reporting, each category of factors had a table listing the factors, and the agreement and disagreement on the presence or absence of each factor was recorded in the table.

The results of this analysis are discussed in detail in the next section of this paper.

4 Results

In the previous sections the two-phase approach adopted for this study was outlined. In Phase I the initial data collection was performed using direct observations of the CI Implementation Team meetings and interviews with the CI Implementation Team members. The analysis of this data helped in understanding the landscape of the CI Implementation process, identify critical decisions and was informative of the various factors that influenced the CI implementation acting as facilitators or barriers either by their presence or by their absence.

The results from this analysis were used to set up the Phase II of this study, which involved a survey of the CI Team members followed by a Group Discussion among the CI Team members to understand their perspectives on the factors that influenced the project.

In this section, the results from Phase I are presented first, followed by the results from Phase II.

4.1 Phase I: Direct Observation and Interviews

Phase I helped in broadly understanding the CI Implementation project through direct observation of the team meetings. There were two key results from the Phase I. The direct observation of the CI Team discussions during the project team meetings and the interviews with the Project Manager led to the identification of the critical decisions taken during the

project that strongly impacted the outcome of the CI implementation project. Another key result from the Phase I was the building of a list of factors that influenced the project which would be used to create the survey and set up the group discussion for the Phase II. Both these results are discussed in detail below.

4.1.1 List of Factors

Through the interviews with the CI Team and direct observations of team meetings, this phase also led to building a list of all the factors that possibly affected the project as facilitators or barriers. The classification of whether any of these factors was a facilitator or a barrier was done through the survey and groups discussion in Phase II. The list of 33 factors identified as a result of Phase I has been shared in the Methodology section. (**Table 1**)

4.1.2 Critical Decisions

Based on the direct observations and interviews with the Project Manager, there were three critical decisions identified that were made during the course of the project and these decisions played an important role in the final outcomes.

1. **Engaging a dedicated Project Manager**

   Having a dedicated Project Manager turned out to be an important decision for this project. The project team comprised of students, professors, and staff engaged in other activities as well, which meant that the time and attention of all

team members was divided between all their engagements. The Project Manager was dedicated to this project and this made a huge difference in how the project was managed and executed.

2.   **Shifting focus from EPIC (the Electronic Health Records system)**

This project started with some prior awareness of the issues that the hospitalists were facing. One of these issues was the challenges they faced in using EPIC, the EHR system that they use on a day-to-day basis. As the project unfolded, it was discovered that while there were some genuine concerns regarding EPIC, this was not the core of the issues causing physician burnout. Upon gaining this understanding, even though the scope of the project remained unchanged, through the shadowing process and the data analysis done using Affinity Diagrams the CI Team discovered larger issues such as issues of culture, roles and relationships which were in fact causing the physician burnout. This learning was critical and was also used to define the scope for the next phase of the project.

3.   **Engaging a Subject Matter Expert**

Another critical decision made during the course of the project was to engage a subject matter expert (SME) on EPIC – the Electronic Health Records system used by the Hospitalists in their day-to-day work. The SME is the Lead Informatics Physician within the specialty of Hospitalists. He is an expert EPIC user in addition to being highly knowledgeable about the work processes and workflows. This SME turned out to be instrumental in translating workflows and

work processes of delivering care effectively in the informatics aspect of the workflow. He understood and helped educate the CI Team when they saw breakdowns in workflows and work process. He was able to help understand which of those issues could be modified or changed in EPIC to improve the situation and which of those were outside the EPIC domain because some issues seem to EPIC issues but are not. The recommendation is that such subject matter experts should always be integrated in similar projects in future.

4.2   Phase II: Survey and Group Discussion

The Phase II of this study was the most critical. All the data collected and analyzed in Phase I was used to set up Phase II, including creating the survey from the list of factors. The survey was administered to the CI Implementation Team members, which was followed by a group discussion among the team members on each of the factors. The survey facilitated the quantification of the team members' perspectives on each of the factors and the discussion led to the understanding of the thought process and perspective behind the responses.

The survey responses were analyzed for deriving the agreement and disagreement on the effect of a factor by its presence or absence. These results of this analysis are reported below for each category of factors.

4.2.1 External Support Factors

The following table (**Table 2**) represents the perception of the CI project team on the factors relating to the more general categories that affect the entire project throughout its duration. There is a total of 6 factors in this category. The entire team agreed that Leadership Support and buy-in, Physical Resources Support, Flexibility available to the CI Implementation team in driving and executing the project, and Faith and Trust in the methodology by the entire ecosystem of the project were all necessary for a successful implementation. The absence of these factors would have had a negative impact on the entire project and its outcome.

Table 2 Impact of External Support Factors by Presence

Factor	Presence	Absence
Leadership Support and buy-in	Agreement - Positive	Agreement - Negative
Physical resources support (like meeting space, flip-charts, post its, etc.)	Agreement - Positive	Agreement - Negative
Flexibility available to the CI Implementation team in driving and executing the project	Agreement - Positive	Agreement - Negative
Faith and trust in the methodology by the entire ecosystem of the project (leadership, executing team, supporting teams, etc.)	Agreement - Positive	Agreement - Negative
Having the support of other teams/groups (like ISD, EEP, etc.)	Agreement - Positive	Agreement - Negative
Individual team members and the team being acknowledged and appreciated for their work and contributions	Agreement - Positive	Agreement - Negative

4.2.2 CI Team Composition

The following table (**Table 3**) represents the perception of the CI project team on the factors relating to characteristics of the team members of the research team that affect the project. There is a total of 3 factors in this category. On two of three factors, the factors

about the skills and size of the project team members the team agreed on the polarity of the impact, but were inconclusive on whether the team members having the same level of experience with respect to CI methodology had a positive or negative impact on the project as a result of their presence and absence.

Table 3 Impact of CI Team Composition Factors by Presence

Factor	Presence	Absence
Specialized skills of each of the team members in the CI Implementation team	Agreement - Positive	Agreement - Negative
A relatively small project team comprising of 5 members	Agreement - Positive	Agreement - Negative
The CI Implementation team members having the same level of experience with respect to the CI methodology	Disagreement	Disagreement

4.2.3   CI Team Readiness

The following table (**Table 4**) represents the perception of the CI project team on the factors that affect the readiness of the research team members and the team as a whole. There is a total of 4 factors in this category. The entire team agreed that a sense of urgency on the project and having clarity on the vision and expectations was important and the absence of both these factors would negatively impact the project.

However, while everyone agreed that having prior knowledge of some of issues that exist for the population under study is important and has a positive impact, they disagreed on whether not having that that knowledge has a negative impact on the project. On the other hand, they agreed that not having a prior experience of the CI methodology can have a negative impact on the methodology, they disagreed that having prior experience of CI has any positive impact on the project.

Table 4 Impact of CI Team Readiness Factors by Presence

Factor	Presence	Absence
A sense of urgency on the project	Agreement - Positive	Agreement - Negative
Having clarity on the vision and expectations	Agreement - Positive	Agreement - Negative
Having prior knowledge of some of the issues that exist	Agreement - Positive	Disagreement
Prior experience of the Contextual Inquiry methodology or a similar methodology / approach	Disagreement	Agreement - Negative

4.2.4 Project Management

The following table (**Table 5**) represents the perception of the CI project team on the factors relating to project management of the CI project. There is a total of 8 factors in this category. While team agreed completely that deciding on the scope of issues after the observations were completed would have a positive impact on the project, and that the absence of scheduling issues and weather emergencies would also have a positive impact on the project, they disagreed on the impact of deciding the scope of issues at the beginning of the project. For two of the factors there was agreement on the presence of the factor but disagreement on the absence of the factor. These factors were the Regular team meeting of the CI Team, and the decision of the CI participants being made by the CI Team or the Hospitalists Leadership.

Table 5 Impact of Project Management Factors by Presence

Factor	Presence	Absence
Deciding on the scope of the issues after the observations have been completed	Agreement - Positive	Agreement - Negative
Regular team meetings (CI Team)	Agreement - Positive	Disagreement
Scheduling issues (within the CI Team)	Agreement - Negative	Agreement - Positive
Scheduling issues (outside of the team, with Hospitalists and other Teams)	Agreement - Negative	Agreement - Positive
Weather emergencies	Agreement - Negative	Agreement - Positive

The set of CI participants being decided by the Hospitalists leadership rather than the CI Team recruiting participants based on a carefully defined criterion	Agreement - Negative	Disagreement
Deciding on the scope of the issues at the beginning of the project	Disagreement	Disagreement
Role Flexibility (Each team member playing multiple roles. For example, a team member focusing on the Human Factors aspect, but also conducting the Contextual Inquiry)	Disagreement	Disagreement

4.2.5   Contextual Inquiry Setup and Execution

The following table (**Table 6**) represents the perception of the CI project team on the factors relating to the setup and implementation of the Contextual Inquiry methodology. There was a total of 10 factors identified in this category. The 5 factors that the team was completely in disagreement on were Cooperation of the systems connected to the system being observed. (For example, hospitalists are being observed and their burden is the subject of study, but other connected systems such as Radiology, Pharmacy, Specialists, and other such systems/entities are also involved when the issues need to be fixed for Hospitalists), Multiple researchers doing the observations and in slightly different ways, Multiple sites where observations need to be done, and One researcher dedicated to doing ALL of the observations in one standard way, and Two or more researchers together doing an observation (as opposed to a single researcher doing an observation).The 4 factors that the team was completely in agreement on were Striking a rapport with the CI participants (Hospitalists), Flexibility in using the CI methodology (not adhering strictly to the textbook definition or method and tweaking the method where required) and Building models together during the interpretation session (as opposed to holding discussions on the findings and taking notes and arriving at conclusions). There was one factor where the team agreed on

the presence but disagreed on the absence. This was Project Lead and Project Manager demonstrating the process by doing the first round of observations and interpretations.

The one inconclusive factor in this was Individual Researcher doing an observation (as opposed to more than one researcher doing an observation together). This was inconclusive because the team agreed that both presence and absence of this factor have a positive impact.

Table 6 Impact of Contextual Inquiry Setup and Execution Factors by Presence

Factor	Presence	Absence
Individual Researcher doing an observation (as opposed to more than one researcher doing an observation together)	Agreement - Positive	Agreement - Positive
Striking a rapport with the CI participants (Hospitalists)	Agreement - Positive	Agreement - Negative
Flexibility in using the CI methodology (not adhering strictly to the textbook definition or method and tweaking the method where required)	Agreement - Positive	Agreement - Negative
Project lead and Project Manager demonstrating the process by doing the first round of observations and interpretations	Agreement - Positive	Disagreement
Building models together during the interpretation session (as opposed to holding discussions on the findings and taking notes and arriving at conclusions)	Agreement - Positive	Agreement - Negative
Cooperation of the systems connected to the system being observed. (For example, hospitalists are being observed and their burden is the subject of study, but other connected systems such as Radiology, Pharmacy, Specialists, and other such systems/entities are also involved when the issues need to be fixed for Hospitalists)	Disagreement	Disagreement
Multiple researchers doing the observations and in slightly different ways	Disagreement	Disagreement
Multiple sites where observations need to be done	Disagreement	Disagreement
One researcher dedicated to doing ALL of the observations in one standard way	Disagreement	Disagreement
Two or more researchers together doing an observation (as opposed to a single researcher doing an observation)	Disagreement	Disagreement

4.2.6 Participants Characteristics

The following table (**Table 7**) represents the perception of the CI project team on the factors relating to the attitudes or characteristics of the CI participants that affect the inputs that the participants share. There is a total of 2 factors in this category. While the team agreed that having a less diverse set of CI participants has negative impact on the project and they also agreed that the CI participants' bias towards issue that are important to them has no impact on the project, they disagreed on impact that the absence of the CI participants' bias has.

Table 7 Impact of Participant Characteristics Factors by Presence

Factor	Presence	Absence
Less diverse set of CI Participants in terms of Age, Gender, Race, etc.	Agreement - Negative	Agreement - Positive
CI Participants' bias towards the issues that are important to them	Agreement - No Impact	Disagreement

4.3 Top 3 Facilitators and Barriers

At the end of the survey process each team member was also asked to highlight their top three factors that they felt acted as facilitators contributing to the project and the top three factors that according to them acted as barriers during the project. Each of the members reported the top three facilitators and barriers, which are tabulated in **Table 8**.

Table 8 Top 3 Facilitators and Top 3 Barriers, as identified by Project Personnel in different Project Roles

Role	Top 3 Facilitators	Top 3 Barriers
Project Lead	Voting by Hospitalists	Scheduling issues (outside of the team, with Hospitalists and other Teams)
	A sense of urgency on the project	Scheduling issues (within the CI Team)

	Flexibility in using the CI methodology (not adhering strictly to the textbook definition or method and tweaking the method where required)	The set of CI participants being decided by the Hospitalists leadership rather than the CI Team recruiting participants based on a carefully defined criterion
Project Manager	Leadership Support and buy-in	Scheduling issues (outside of the team, with Hospitalists and other Teams)
	Striking a rapport with the CI participants (Hospitalists)	Scheduling issues (within the CI Team)
	A sense of urgency on the project	Building the well-being support team without defined roles
Provider SME	Leadership Support and buy-in	Scheduling issues (outside of the team, with Hospitalists and other Teams)
	Prior experience of the Contextual Inquiry methodology or a similar methodology/approach	Scheduling issues (within the CI Team)
	Faith and trust in the methodology by the entire ecosystem of the project (leadership, executing team, supporting teams, etc.)	Weather emergencies
Human Factors SME	Leadership Support and buy-in	Scheduling issues (outside of the team, with Hospitalists and other Teams)
	Regular team meetings (CI Team)	Scheduling issues (within the CI Team)
	Having the support of other teams/groups (like ISD, EEP, etc.)	Striking a rapport with the CI participants (Hospitalists)

The factors shared by the team members which they felt acted as facilitators or barriers shows that there was strong agreement that Scheduling was a major issue in this project and Leadership support and buy-in was an important factor contributing positively to the implementation process.

All results are discussed in detail in the next section.

5 Discussion

5.1 Interpretation of Results

In this section the interpretation of the results is discussed in detail. This interpretation will lead to the final findings for this study.

5.1.1 Identifying Facilitators and Barriers

One of the primary goals of this study was to identify the Facilitators and Barriers contributing towards the success and hindering the success of the CI Implementation Project. The Results section reported, for each factor's presence and absence, the agreement or disagreement of the CI Team on whether a factor had a certain (positive, negative or none) effect. Based on the results it is possible to identify which factors were perceived as facilitators and which factors were perceived as barriers in the CI implementation.

- Identifying Facilitators: Any factor having a positive impact by its presence, OR a negative impact by its absence

- Identifying Barriers: Any factor having a negative impact by its presence, OR a positive impact by its absence

For all other scenarios, as outlined before, the evidence is inconclusive to make a determination.

Each factor from the results tables was revisited using the above-mentioned understanding to arrive at the Facilitators and Barriers for each category. These Facilitators and Barriers are discussed in detail below:

5.1.1.1   External Support Factors

Table 9 Facilitators and Barriers with respect to CI Team Composition

Facilitators
Leadership support and buy-in
Physical resources support (like meeting space, flipcharts, post its, etc.)
Flexibility available to the CI Implementation team in driving and executing the project
Faith and trust in the methodology by the entire ecosystem of the project (leadership, executing team, supporting teams, etc.)
Having the support of other teams/groups (like ISD, EEP, etc.)
Individual team members and the team being acknowledged and appreciated for their work and contributions
Barriers
None
Inconclusive
None

From **Table 9**, it can be seen that based on the results, 6 facilitators were identified for the External Support Factors. It is interesting to note that there are no Barriers and no inconclusive factors in this category. External support factors support a project throughout its lifecycle, and it is understandable that such support would be important for any project. This importance is also evident by the fact everyone was in agreement over the positive impact that these factors have on the project. The factors of leadership support and faith and trust in the methodology were perceived to be highly important. In the words of one of the CI Team members on the importance of faith and trust in the methodology – "Sometimes when things weren't good, that faith and trust helped carry us through". This also

relates to the flexibility given to the implementation team, which is considered to be just as important. The absence of this flexibility would result in a lot of added challenges which will probably eat into the time, energy and resources that could be put to better use in achieving the end goals of the project. As the project is in progress, acknowledgement and appreciation of the team members may not be an important thing in terms of its impact in getting the work done as everyone is going fulfil the responsibilities of their role in any case, but it does make the experience positive and adds to the morale of the team and keeps them motivated. It can even be said that these big-picture factors form the foundation for the success of the project.

5.1.1.2   CI Team Composition

Table 10 Facilitators and Barriers with respect to External Support Factors

Facilitators
Specialized skills of each of the team members in the CI Implementation team
A relatively small project team comprising of 5 members
Barriers
None
Inconclusive
The CI Implementation team members having the same level of experience with respect to the CI methodology

From **Table 10**, it can be seen that for this category, there were identified 2 facilitators and one factor that could not conclusively be classified as a facilitator or a barrier. There was no barrier identified. This category captures the factors related to the CI Implementation team. Two facilitators in this category that contribute to the success of the CI implementation project are about the size of the team and the skills of the team members. The team for this project was comprised of 5 members. For this project this worked well, as a larger

team would have led to more management issues like scheduling, which was already something that this team had struggled with in this project. While there is no way of ascertaining the exact number of people, a large team involves managing that many people. But this is something that can really differ from project to project, and the needs of the project need to be evaluated and only then can it really be said if the team needs to small or large.

Within the team members, having specialized skills is always an asset. In this CI implementation project, there were team members with specialized skills and had been assigned roles accordingly. There was a human factors expert in the team, and this turned out to be a great asset to the project, especially for understanding the hospitalists' interactions with the electronic systems. Similarly, there was a project manager with a background in psychology and had the right skills that were required to manage such a project. It required coordinating with the hospitalists for scheduling, interacting with the hospitalists during the shadowing sessions and building a partnership with them, and the project manager possessed all of those skills. All of this goes to show how these factors positively contribute towards the success of a CI implementation project.

The one factor that could not be conclusively classified as a facilitator or a barrier was that the members of the CI implementation team have the same level with respect to the CI methodology. This could mean that either none of the team members have any experience with CI methodology, or maybe all of them have an experience of 2-3 CI projects, etc. While most of the team members felt that this would have a positive impact on the project as it could contribute towards building camaraderie by way of learning together, one team member felt that it does not really have any impact. It is something that would be good to

have but if it isn't there it really doesn't have any impact. So, while inconclusive, this factor appears to have some positive influence on the project.

5.1.1.3 CI Team Readiness

Table 11 Facilitators and Barriers with respect to CI Team Readiness

Facilitators
A sense of urgency on the project
Having clarity on the vision and expectations
Having prior knowledge of some of the issues that exist
Prior experience of the Contextual Inquiry methodology or a similar methodology / approach
Barriers
None
Inconclusive
None

From **Table 11**, it can be seen that for this category, there were 4 facilitators identified, no barriers, and 2 factors that could not be conclusively classified as a facilitator or a barrier.

The readiness of the team that is going to execute the CI Implementation project needs to be well prepared to handle such a project. As can be seen in the table, one of the facilitators was sense of urgency on the project. This acted as a facilitator because a high sense of urgency gets people to respond to scheduling requests. But as important as it is, this is the kind of thing that doesn't directly impact the entire team and it is something that the Project Lead and Project Manager can handle. Knowing things beforehand is always good as it contributes to preparedness. This is why having clarity on the vision and expectations, having prior knowledge of some of the issues that exist, and if possible, prior experience of the CI methodology, all act as facilitators.

Having prior knowledge of issues is also debatable in that there may be cases where knowing issues beforehand may bias the observers and they may overlook some issues due to focusing on the already known issues.

5.1.1.4   Project Management

Table 12 Facilitators and Barriers with respect to Project Management

Facilitators
Deciding on the scope of the issues after the observations have been completed
Regular team meetings (CI Team)
Barriers
Scheduling issues (within the CI Team)
Scheduling issues (outside of the team, with Hospitalists and other Teams)
Weather emergencies
The set of CI participants being decided by the Hospitalists leadership rather than the CI Team recruiting participants based on a carefully defined criterion
Inconclusive
Deciding on the scope of the issues at the beginning of the project
Role Flexibility (Each team member playing multiple roles. For example, a team member focusing on the Human Factors aspect, but also conducting the Contextual Inquiry)

From **Table 12** it can be seen that in this category there were 2 facilitators identified, 4 barriers identified and there were two factors that could not be conclusively be classified as a facilitator or a barrier.

Deciding on the scope of issues to be focused on after the observations have been completed may be a good way to eliminate any bias if it exists on the observers' end, and to remain open to discover any new issues that are not known as part of the scope.

A major barrier during this project was scheduling issues, both within the team and outside (with the CI participants, other teams, etc.). This also had the most impact on the Project

Manager, who had to manage the scheduling. Along similar lines were the weather emergencies that took place in the duration of this project. Weather emergencies eventually affect scheduling and that disturbs the plan of the whole project.

One of the factors that acted as a barrier was that the CI participants were selected by the Hospitalist leadership instead of being recruited by the CI Team based on a certain criterion. This has two aspects to it. From a logistical perspective this facilitates the project because it is one less thing for the CI Team to do. They don't have to do the recruitment process. However, from a research perspective there is some disadvantage in this. Not getting a set of participants that is diverse or suitable enough can affect the quality of data gathered through shadowing.

One of the factors that could not be classified as a facilitator or a barrier was deciding the scope of issues at the beginning of the project. This ambiguity exists because there is one thought that this could bias the observers when they go for the shadowing. One of the team members, however, mentioned that while they are aware of the scope it is not limiting. There is an idea but no boundary around the scope, so it doesn't bind in any way and hence it is not really a barrier. In fact, it is good to know the general boundary so the expectations of the CI participants can be managed accordingly.

5.1.1.5   Contextual Inquiry Setup and Execution

Table 13 Facilitators and Barriers with respect to Contextual Inquiry Setup and Execution

Facilitators
Striking a rapport with the CI participants (Hospitalists)
Flexibility in using the CI methodology (not adhering strictly to the textbook definition or method and tweaking the method where required)

Building models together during the interpretation session (as opposed to holding discussions on the findings and taking notes and arriving at conclusions)
Project lead and Project Manager demonstrating the process by doing the first round of observations and interpretations
Barriers
None
Inconclusive
Cooperation of the systems connected to the system being observed. (For example, hospitalists are being observed and their burden is the subject of study, but other connected systems such as Radiology, Pharmacy, Specialists, and other such systems/entities are also involved when the issues need to be fixed for Hospitalists)
Multiple researchers doing the observations and in slightly different ways
Multiple sites where observations need to be done
One researcher dedicated to doing ALL of the observations in one standard way
Two or more researchers together doing an observation (as opposed to a single researcher doing an observation)
Individual Researcher doing an observation (as opposed to more than one researcher doing an observation together)

From **Table 13** it can be seen that in this category there were 4 facilitators identified, no barriers, and 6 factors that could not be conclusively classified as a facilitator or a barrier.

The two most important facilitators in this category are about striking a rapport with the CI participants and the flexibility in using the CI methodology. Striking a rapport with CI participants is important because they need to feel comfortable in sharing their issues and information. The other important facilitator for this category is that the flexibility in using the CI methodology. This works in favor of the project because this allows to handle the unexpected situations that crop up during the project. Some of the important steps taken in this project were not part of the textbook process but were critical in the success of this project. For example, the voting by CI participants is not a standard activity but it was a critical activity for this project.

5.1.1.6 Participants Characteristics

Table 14 Facilitators and Barriers with respect to Participant Characteristics

Facilitators
None
Barriers
Less diverse set of CI Participants in terms of Age, Gender, Race, etc.
Inconclusive
CI Participants' bias towards the issues that are important to them

From **Table 14**, it can be seen that in this category, there was one barrier identified and one factor that could not be conclusively classified as a facilitator or a barrier. The barrier in this case is the lack of diversity in the set of CI participants. Although there was diversity on many dimensions (e.g., shift-type, sex, age, length of tenure), there was the one dimension, racial diversity, that the set of CI participants lacked on. Having diversity on that one dimension as well would have allowed for more perspectives and an even richer information gained through the shadowing process.

The CI participants may also sometimes have some issues that they would like resolved that are important to them. It is possible that sometimes they may be focused on those issues, but the thing to remember here is that the observers must trust the process and trust the data. If there is a bias on the participants end, the pattern in the data will show if it is really an issue. Thus, it can be said that this factor does not really have an impact on the project.

5.1.2 Influence of Project Role in Perceptions of Facilitators and Barriers

One of the revelations this study made was that facilitators and barriers vary for each role. Even though it is an implementation by a team that is being observed, every team member

will view the factors differently from a perspective of their role and what impacts their role and responsibilities. To give an example, one factor looked at in this study was the scheduling issues. This particular factor had the most impact for the Project Manager who had to deal with scheduling issues on a day-to-day basis. The rest of the team was aware of this, but it did not impact their role directly. This difference in perceptions is also supported by the top 3 facilitators and barriers shared by each member of the CI Implementation team (**Table 8**).

The top facilitator shared by the Project Lead was Voting by Hospitalists. This voting validated the findings of the CI Team and thus it was critical. From a Project Lead's perspective, as someone spearheading such a project, the support, buy-in and validation from the population under study was extremely important for evaluating the success of the project. However, the top facilitator shared by all other team members was different from this one. Similarly, the Human Factors Subject Matter Expert felt that Striking a Rapport with the CI Participants was one of the top 3 barriers for their role. This was because as the Human Factor Subject Matter Expert, the interaction with the CI participants included getting them to wear eye tracking headsets, which some participants are not very comfortable with. So, it becomes especially challenging for the Human Factors SME to engage and strike a partnership with the CI participants. The other team members did not feel this was a barrier from their perspectives. All of these examples support the fact that the team members perceive the factors and whether a certain factor is a facilitator, or a barrier based on their role.

5.1.3 Critical Decisions

1. **Engaging a dedicated Project Manager:** The CI Implementation project team was mix of students, professors, and other staff that was also working on other projects besides this one. Due to this reason, for this project it made it critical to have one person on the team who could be completely dedicated to this project and ensure that the ball doesn't get dropped at any stage. There is likely to be similar implementation projects where the entire team is dedicatedly working on the CI implementation project, but even in that scenario, there are a lot of activities that need to managed like schedules, communicating and coordinating with the CI participants, preparing documentation, keeping the leadership updated on the status of the project. Another reason that makes this decision a critical one is that the entire team on this project was new to a CI Implementation project, and because there was one dedicated resource taking care of all the activities as mentioned above, everyone else could focus on learning the process. This greatly impacted to the quality of everyone's contributions and eventually led to a successful implementation. Bearing all of this in mind, the recommendation is that there should always be a dedicated Project Manager who can handle the complexity of such projects and manage the unexpected surprises that come along.

2. **Shifting focus from EPIC (the Electronic Health Records system):** This project started with some prior awareness of the issues that the hospitalists were

facing. The perception was that the most important issues are about the interactions with EPIC – The Electronic Health Records system that the hospitalists use every day. While this did not bind the scope of issues and the team went in for shadowing sessions with an open mind to look out for whatever issues might exist, it did still remain an important issue for a while until a Subject Matter Expert was brought in who was able to help the CI Team understand which issues were really arising out of EPIC and could be fixed at an electronic system level, and which issues were not really related to EPIC. This led the team to eventually discover that a lot of the concerns were in fact stemming from other deeper issues like culture, roles and relationships. This decision was critical as it led to the core issues and also served as a basis for re-aligning the scope for the next phase of the project.

3. **Engaging a Subject Matter Expert:** As discussed in the previous point, the CI team's understanding that the core of the issues lies elsewhere and not in the EPIC led to discovering the concerns that were actually causing physician burnout. The Subject Matter Expert (SME) on EPIC and the wok process and workflows for the Hospitalists was instrumental in translating some of the EPIC related concerns and educating the team about the work processes. Thus, bringing in this SME turned out to be a critical decision and contributed greatly to the success of the project. The recommendation is that such partnerships should be integrated within CI implementation projects in future.

5.2 Limitations and Future Work

For this study, only one phase of the project was observed, and rest was performed retrospectively. None of the shadowing sessions were observed for this study. It is possible that a direct observation of the actual shadowing process would have revealed more factors that have not been captured in this study.

The categories of factors were based on human judgement. For future studies, it would be better if the categories can be created on the basis of some criteria instead of human judgement on what the categories should be and which factor should fall into which category.

In the survey administered to the CI Implementation team members, for every factor, the survey required responses on the presence as well as on the absence of the factor. Some of the respondents found it challenging to respond on the 'absence' of a factor. For example, one of the factors was Individual Researcher doing an observation (as opposed to more than one researcher doing an observation together). The presence of this factor is clear and easy to interpret, but the absence of it would mean not individual, which could mean two, three, or any number. For this study, the respondents were asked to not answer any of the items on the survey if it was not easy to interpret. Thus, when designing such surveys, it would be very helpful to the survey owner if they factored this in when creating the survey.

Comprehensive literature could not be conducted for this study. The study involved a lot of activities which were time consuming and the available time for the study was not enough to explore in more detail specific literature on prior work done on similar subjects.

Future work for this study would definitely involve a deeper dive into the literature on factors that affect the application of Contextual Inquiry in a healthcare setting.

5.3   Conclusion

The purpose of this study was to identify the factors that affect the implementation of Contextual Inquiry in a healthcare setting to identify the systems breakdowns that cause physician burnout, and explain which factors act as facilitators contributing towards the success of the project and which factors act as barriers hindering the success of the project. A total of 32 themes were identified as factors that impacted the CI Implementation project, comprising 18 Facilitators, 5 Barriers and 9 such factors that could not be conclusively classified as a facilitator or a barrier.

Results suggest that 'Leadership support and buy-in', 'Physical resources support (like meeting space, flipcharts, post its, etc.) ', 'Flexibility available to the CI Implementation team in driving and executing the project', 'Faith and trust in the methodology by the entire ecosystem of the project (leadership, executing team, supporting teams, etc.) ', 'Having the support of other teams/groups (like ISD, EEP, etc.) ', 'Individual team members and the team being acknowledged and appreciated for their work and contributions', 'Specialized skills of each of the team members in the CI Implementation team', 'A relatively small project team comprising of 5 members', 'A sense of urgency on the project', 'Having clarity on the vision and expectations', 'Having prior knowledge of some of the issues that exist', 'Prior experience of the Contextual Inquiry methodology or a similar methodology / approach', 'Deciding on the scope of the issues after the observations have been completed', 'Regular team meetings (CI Team), Striking a rapport with the CI participants

(Hospitalists) ', 'Flexibility in using the CI methodology (not adhering strictly to the text-book definition or method and tweaking the method where required) ', 'Building models together during the interpretation session (as opposed to holding discussions on the findings and taking notes and arriving at conclusions)' and 'Project lead and Project Manager demonstrating the process by doing the first round of observations and interpretations' are the Facilitators that contributed to the success of the CI implementation project.

On the other hand, 'Scheduling issues (within the CI Team)', 'Scheduling issues (outside of the team, with Hospitalists and other Teams)', 'Weather emergencies', 'The set of CI participants being decided by the Hospitalists leadership rather than the CI Team recruiting participants based on a carefully defined criterion', are the Barriers that hindered the success of the project.

It was also discovered that the following factors could not be conclusively classified as facilitators or barriers – 'The CI Implementation team members having the same level of experience with respect to the CI methodology', 'Deciding on the scope of the issues at the beginning of the project', 'Role Flexibility (Each team member playing multiple roles. For example, a team member focusing on the Human Factors aspect, but also conducting the Contextual Inquiry) ', 'Cooperation of the systems connected to the system being observed. (For example, hospitalists are being observed and their burden is the subject of study, but other connected systems such as Radiology, Pharmacy, Specialists, and other such systems/entities are also involved when the issues need to be fixed for Hospitalists) ', 'Multiple researchers doing the observations and in slightly different ways', 'Multiple sites where observations need to be done', 'One researcher dedicated to doing ALL of the observations

in one standard way', 'Two or more researchers together doing an observation (as opposed to a single researcher doing an observation)' and 'Individual Researcher doing an observation (as opposed to more than one researcher doing an observation together)'.

This study will be able to serve as a guide and starting point to anyone who wishes to apply better understand how to effectively and efficiently apply Contextual Inquiry in a healthcare system to identify system breakdowns. Results from this study provide practical suggestions on what works and what doesn't during implementation efforts, summarizes risks and possible failures during project executions, and provides suggestions on what and how to optimize the time and resources for optimal use.

Personally, for me, this was a great learning experience. Having studied this methodology as part of my graduate program, it was very enriching to see it being applied in a real-world project. I feel this has equipped me with more skills that what I started with and I am certain this learning will benefit me in my career.

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Appendices

Appendix A: Interview Questions

On Role
    • How did you view your role as in this project?
    • How do you perceive the roles of the other teams or individuals in this project?

Direct Questions
    • What do you think were the facilitators contributing to the success of this project?
    • What do you think were the barriers hindering the success of this project?

Urgency   • Describe the sense of urgency you felt about this project and how was the urgency for this project communicated to you? (prior to start of this project / during this project/ end of the project)

Readiness / Preparedness
    • Do you feel there was enough leadership support on this project?
    • Do you feel there was enough operational support on this project?

Expectations and Rewards
    • Do you feel that the expectations were clear on this project?
    • Do you feel you were rewarded or recognized for your contributions to this project? If so, can you describe how you felt rewarded?

Autonomy   • Did you feel you were given enough autonomy and flexibility while working on this project?

Training & Time Availability
    • Did you feel prepared to work on this project?
    • Did you feel you had adequate time to work on this project?

Individual Readiness
    • Do you feel the approach used on this project was appropriate?
    • Do you feel you were able to positively contribute to this project?
    • Do you understand how working on this project will benefit you?

Learning by Doing   • What and how much do you feel you learned while working on this project?

Individual Transformation
    • Moving forward, would you be willing to participate in this type of project?
    • Do you see yourself sharing your experience working on this project with others, and would you recommend this process to be used for other type of providers?

Appendix B: Survey Questions

Participant Code …………………………………

Contributing Factors Survey for Contextual Inquiry Research

The purpose of this survey is to capture the DHE Team's perspectives on the various factors which contributed towards and against the success of the Contextual Inquiries done as part of the Well-Being project.

Instructions

For each of the factors, please indicate using a tick mark (✓) the level of impact that in your opinion it had on the project.

If there are any factors that you feel had different levels of impact at different stages in the project, please indicate so by a tick mark on multiple points on the scale and also mention the corresponding stage of the project in the Factor text box.

When thinking of these factors, please consider all possibilities even if the choice of impact level seems very obvious. There could be two perspectives to each of these factors. Purely as an example, for "Team meetings", one obvious perspective is that it helped the team to get together and remain in sync, which no doubt has a positive impact, but on the other hand it also took time away from the actual activities of the project, which sometimes may have a negative impact.

		High Negative Impact	Low Negative Impact	No Impact	Low Positive Impact	High Positive Impact
1. Prior experience of the Contextual Inquiry methodology or a similar methodology/approach	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
2. Individual Researcher doing an observation (as opposed to more than one researcher doing an observation together)	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
3. Two or more researchers together doing an observation (as opposed to a single researcher doing an observation)	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
4. Leadership Support and buy-in	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
5. Striking a rapport with the CI participants (Hospitalists)	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
6. Having prior knowledge of some of the issues that exist	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
7. Deciding on the scope of the issues at the beginning of the project	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
8. Deciding on the scope of the issues after the observations have been completed	Presence	O	O	O	O	O
	Absence	O	O	O	O	O

Participant Code …………………………………

		High Negative Impact	Low Negative Impact	No Impact	Low Positive Impact	High Positive Impact
9. CI Participants' bias towards the issues that are important to them	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
10. Scheduling issues (within the DHE team)	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
11. Scheduling issues (outside of the team, with Hospitalists and other Teams)	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
12. Less diverse set of CI Participants in terms of Age, Gender, Race, etc.	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
13. A sense of urgency on the project	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
14. Role Flexibility (Each team member playing multiple roles. For example, a team member focusing on the Human Factors aspect, but also conducting the Contextual Inquiry)	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
15. Regular team meetings (DHE Team)	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
16. Having clarity on the vision and expectations	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
17. Flexibility in using the CI methodology (not adhering strictly to the textbook definition or method and tweaking the method where required)	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
18. Physical resources support (like meeting space, flipcharts, post its, etc)	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
19. Multiple sites where observations need to be done	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
20. The set of CI participants being decided by the Hospitalists leadership rather than the DHE team recruiting participants based on a carefully defined criterion	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
21. Specialized skills of each of the team members in the DHE team	Presence	O	O	O	O	O
	Absence	O	O	O	O	O

Participant Code …………………………………

		High Negative Impact	Low Negative Impact	No Impact	Low Positive Impact	High Positive Impact
22. A relatively small project team comprising of 5 members	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
23. Flexibility available to the DHE team in driving and executing the project	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
24. Faith and trust in the methodology by the entire ecosystem of the project (leadership, executing team, supporting teams, etc)	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
25. Having the support of other teams/groups (like ISD, EEP, etc)	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
26. Weather emergencies	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
27. Individual team members and the team being acknowledged and appreciated for their work and contributions	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
28. The DHE team having the same level of experience w.r.t to the CI methodology	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
29. One researcher dedicated to doing ALL of the observations in one standard way	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
30. Multiple researchers doing the observations and in slightly different ways	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
31. Project lead and Project Manager demonstrating the process by doing the first round of observations and interpretations	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
32. Building models together during the interpretation session (as opposed to holding discussions on the findings and taking notes and arriving at conclusions)	Presence	O	O	O	O	O
	Absence	O	O	O	O	O
33. Cooperation of the systems connected to the system being observed. (For example, hospitalists are being observed and their burden is the subject of study, but other connected systems such as Radiology, Pharmacy, Specialists, and other such systems/entities are also involved when the issues need to be fixed for Hospitalists)	Presence	O	O	O	O	O
	Absence	O	O	O	O	O

## Appendix C: Documents and Artifacts

During this study, some documents and artifacts were collected to provide a better under-standing of the Contextual Inquiry process. The documents and artifacts collected are listed below along with their images.

• Affinity Diagrams – During the interpretation sessions after the shadowing of the Hospi-talists, the research team would collectively analyze the data collected and create affinity diagrams to identify the key themes of the issues that were causing Provider burnout.
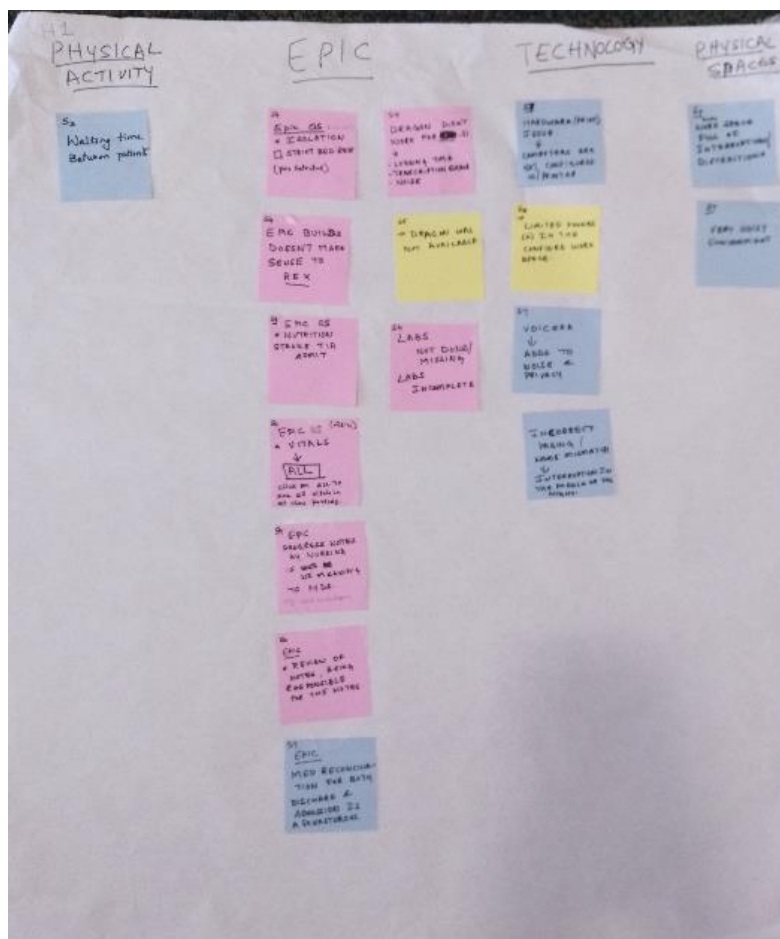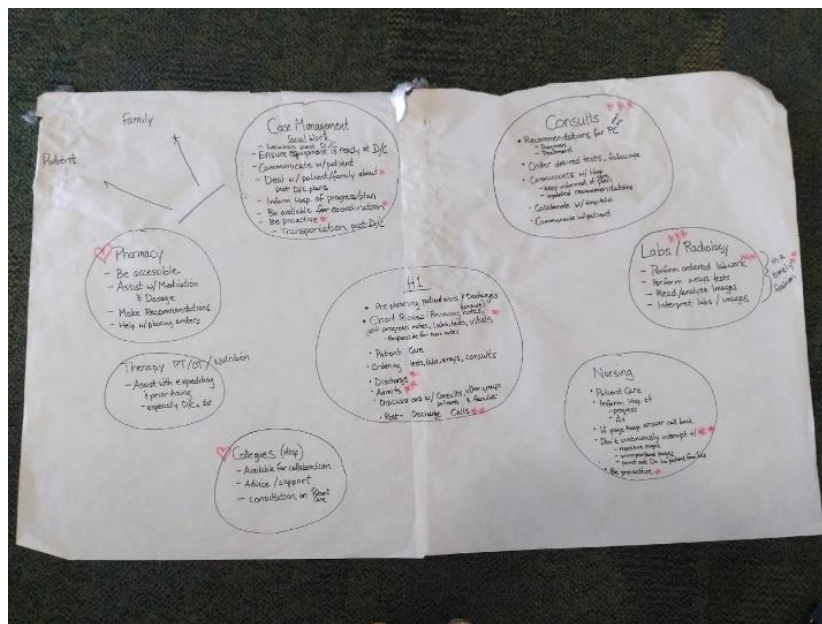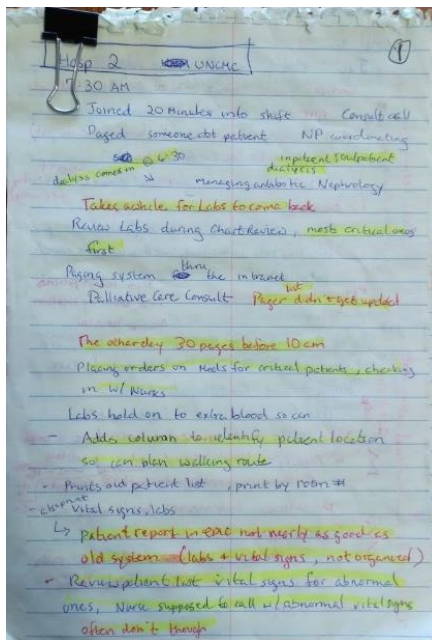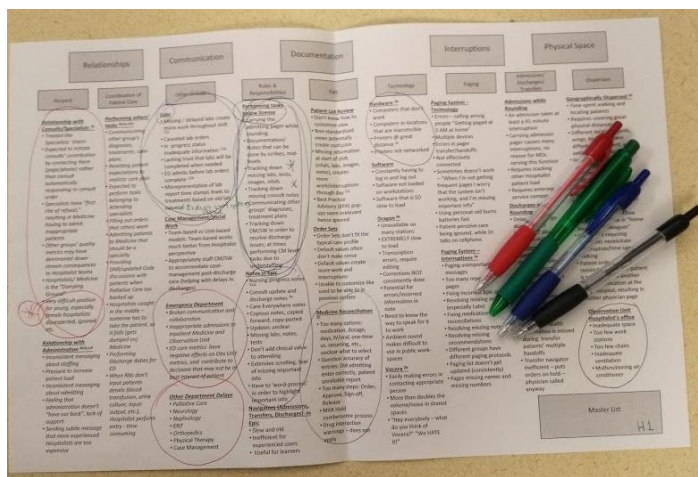
• Charts – Another kind of artifact created during the interpretation sessions were charts

detailing the step by step proceedings of the day of a Hospitalist.
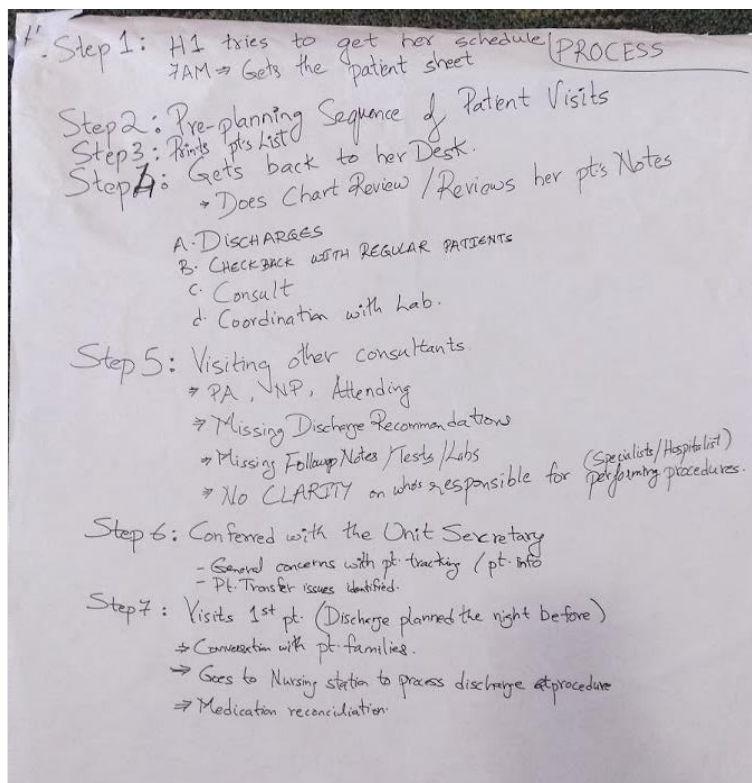
- Notes – During the shadowing the researchers took notes using a notepad and pen to record any detail that seemed important.

- Voting sheet – One important step in the CI project was the validation that was carried out with the Hospitalists. The hospitalists were given a sheet which had all the themes of the burnout factors and they were asked to vote on what they thought were the key issues.

- Images of physical space – Images of the physical space where the team mostly met were also collected to emphasize the importance of resources like a meeting space, white-boards, projector and screens, etc.