



## **ORGANIZATIONAL REDESIGN: INSIGHTS FROM ETHNOGRAPHIC STUDY BEFORE SIMULATION**

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### **1. Introduction**

Simulation is a powerful way to evaluate the performance of a system without having to actually produce a prototype, and simulation can be used at various stages of systems engineering [Walden et al. 2015]. In the case of production and service systems, various types of simulation also exist. In the healthcare sector, Discrete Event Simulation (DES) is very popular [Jun et al. 1999]. However, the implementation of results from simulation studies in healthcare is limited [Brailsford et al. 2009]. One reason could be that social and political issues associated with the implementation of the recommendations drawn from simulation are not taken into account [Merode et al. 2002]. Indeed, although the idea that "all aspects of a system are interconnected" [Clegg 2000] is widely accepted, attempts to have integrated views of sociotechnical systems, without splitting the two dimensions, are not as well-established [Klein 1989]. Multimethodology combining "soft" and "hard" methods has already been used with success in the healthcare sector, e.g. [Holm et al. 2013] who combine Soft Systems Methodology (SSM) and DES. However, even in the frame of methods such as SSM [Checkland 1981] no combination of ethnography and DES for system analysis and design could be identified. In this article, the study of the organizational redesign of an outpatient clinic is presented. In this project, traditional interviews for preparing DES and building conceptual models in SSM are completed by an observation phase which turned into a richer ethnographic study of nurses work and patient experience at an outpatient chemotherapy department. This way, additional dimensions are added to the traditional view focused on operational efficiency. The results provide valuable insights for developing scenarios of new organizations to be simulated with DES. Therefore this study advocates complementing the traditional interviews and "experimental" methods [Juan 1999] with observation methods during redesign efforts.

In section 2, the context of the study and the research protocol are presented. In section 3 the results are analyzed. Section 4 discusses the consequences of these observations for the reorganization project and research. Section 6 concludes on the strengths and limitations of this study and the next steps.

### **2. Materials and methods**

In this section we introduce the context of the study: the organization in which it took place, the project and its objectives, and the different methods used - with a focus on observation.

#### **2.1 Context of the project**

The study is performed in the oncology department of a French university hospital. This department offers both inpatient and outpatient care, as well as consultations. In this study the process of interest is outpatient chemotherapy. The reason why researchers entered the service is that a reorganisation project

is planned in order to increase capacity and reduce patients waiting time, and the head of the service was keen on receiving external opinion.

One of the goals of the project is to come up with a discrete event simulation (DES) model to evaluate reorganisation scenarios. DES is a type of simulation where a system is represented as a set of interconnected tasks, each task being associated to a set of resources and a probability distribution for its duration. Entities flow through these processes, and each time an entity arrives at a task, a randomly generated number is used to select the duration in the probability function associated to the task. The name "discrete event" comes from the fact that time is not divided in equal intervals but in intervals between events, one event being the arrival of an entity at a task or the ending of a task. To build a DES, one needs a conceptual model which can then be transformed into a computer model with a DES software. The conceptual model, built in line with the study's objectives, describes the structure of the process modelled. Therefore at this stage all rules on resource allocation and entity routing must be thought carefully. In our case, two possibilities are to have a pooled set of nurses in which any available nurse takes care of any patient needing it or to have one specific nurse allocated to each specific patient (details are given in Section 3). This needs to be defined at the conceptual modeling stage. However such choices which sometimes seem to be details for managers can have a dramatic impact later on, and in this study we chose to analyze them very carefully to increase the chances of implementing the insights drawn from the simulation project.

DES is a well-established method for organizational improvement. It allows modellers to compare alternative scenarios for an organization and evaluate their respective performance [Robinson 2004]. Therefore, DES is a valuable tool for operations improvement. As such, it has been regularly applied to healthcare organizations [Jun et al. 1999].

To increase the potential for implementation, DES is used in the more general frame of action-research methodology Soft Systems Methodology (SSM) [Checkland 1981]. SSM is a methodology for addressing problematical situations in organizations using systemic principles. Figure 1 describes the steps of SSM. SSM starts with an exploration of an unstructured initial problem situation (steps 1 and 2). In these steps Checkland and Scholes [1990] makes extensive use of interviews and workshops but do not mention direct field observation. Then SSM goes to the "systems world" where models of ideal systems are built (steps 3 and 4). These ideal models are compared to the real situation (step 5), which leads to the definition of feasible, desirable changes (step 6) that can then be implemented (step 7).

In our project, DES is embedded in SSM and used to simulate the conceptual models in step 4 and compare the model with the real world in step 5. However, in this paper we only describe steps 1 and 2. We show that observation brings additional aspects that are important and not easy to find through interviews. These additional insights then inform the simulation process.

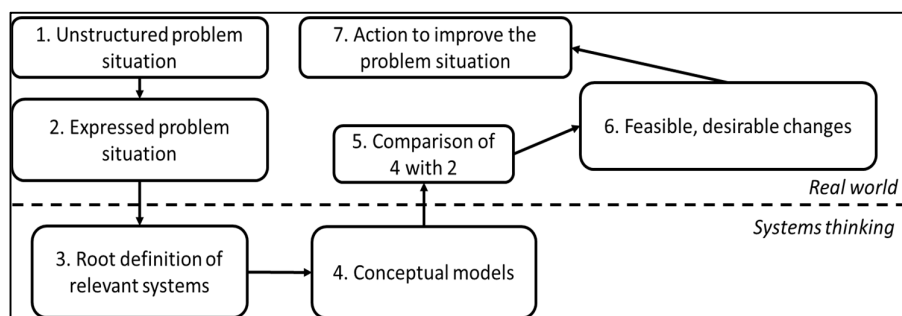


Figure 1. Steps of SSM [Checkland 1981]

## 2.2 Observation as a first method

The first step of the project was to understand the care process in outpatient chemotherapy and to gather data for the DES model. This is equivalent to steps 1 and 2 of SSM, thus preparing DES performed in steps 3 and 4. For DES, data is needed on the duration of each task in the process. As this data is not recorded in the hospital, only two options were available: use experts' opinion to evaluate the duration

of tasks, or perform time studies. It was decided to perform time studies which could then be confronted with expert opinion. Therefore, the first author performed the following observations:

- 2 sessions in the waiting room, where patients wait before they see the doctor
- 2 sessions in the consultation room, where doctors evaluate whether the patient is fit for treatment, answer questions and try to minimize side-effects
- 7 sessions in the injection room, where nurses manage the injection of chemotherapy drugs

However, the rhythm of events is not very quick in these settings, which let the researcher a lot of time to study the activities rather than only writing down times of events. In fact, once the activities of the nurses was understood, everything "out of the process" could be observed. A famous quote says that "there is no such thing as a worthless conversation, provided you know what to listen for" (James Nathan Miller, quoted in [Zhang and Wildemuth 2009]). The same is true with observation: no time is lost on the field. Here the "time-study observation" turned into an ethnographic observation punctuated by some notes on the times of events. Informal conversational interviews [Blessing and Chakrabarti 2009] permitted to elicit some aspects.

Sociologists classify observation and interviews in the "comprehensive" methods category as opposed to "explicative" approaches [Juan 1999]. Interviewing is a form of experimentation, since the material is created by stimuli from the researcher, whereas in observation "the researcher did not produce the material: she studies "natural" situations or objects created by others" [Juan 1999, p.13]. The method used here mixes these two data acquisition techniques and is called "ethnographic research" by Myers [2009], who underlines that it is well-suited for understanding activities in their context.

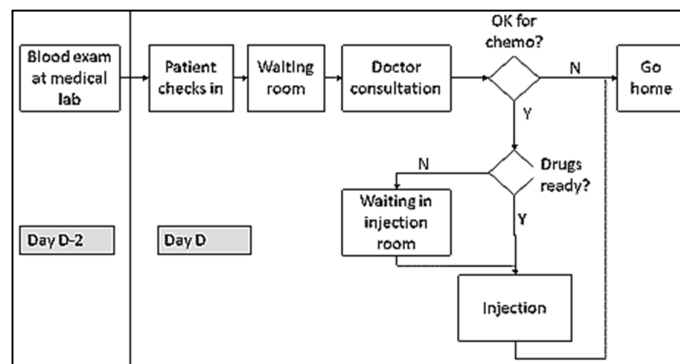
The results of this process therefore included the expected process map, task descriptions and distributions of delays for the different tasks, all of them necessary to build a simulation model. But this research also provided elements on patient experience in the treatment room and nursing work.

### 3. Results

In this section, the results of the observation phase are presented along three dimensions: the process for outpatient chemotherapy, to understand all steps patients go through; the way patients interact in the treatment room; and finally the way nursing is organized.

#### 3.1 Outpatient chemotherapy process

The process for outpatient chemotherapy is very regular in this hospital. It is represented in Figure 2. First, patients have to go to a medical laboratory 2 days before their chemotherapy appointment for a blood exam. The lab sends the results directly to the hospital.



**Figure 2. Outpatient chemotherapy process from the patient's perspective**

On the day of chemotherapy, patients check in at the hospital, wait to see a doctor and have a 20 minutes consultation. This is mainly to check on side effects and the physical state of the patient. The doctor then decides whether the patient can get is chemotherapy. If the patient is fit, she moves to the injection room. There, patients wait for their drugs to arrive and get their injection. The time for injection varies a lot, from 15 minutes to more than 3 hours if multiple drugs are injected. After the injection, patients check out and go home (sometimes after having waited for the ambulance).

### 3.2 Patients in the treatment room

Chemotherapy treatments are long. Some patients wait more than three hours before their drugs are ready, and spend another few hours for the injection. In this situation, three attitudes can be observed:

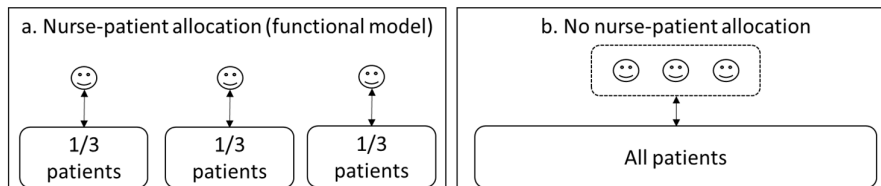
- Indifference: these patients will try to sleep, leave the injection room for walks in the corridors, read, do crosswords
- Annoyance: before they get their treatment, these patients will regularly ask about their drugs, and underline the fact that even if they were on time, treatment is late. During the injection, they will monitor the perfusion and ask the nurse about the remaining time
- Socializing: these patients will start a discussion with their neighbours or other patients
- The two first categories were expected. However, we did not expect the third one, which we will now discuss in more details.

In this hospital, most patients come on the same day of the week, e.g. Tuesdays every other week or Wednesdays every three weeks. This allows that patients always see the same doctor before their injection, which facilitates follow-up. On one given day, two doctors give the consultations. Doctors have specialties (for instance, digestive cancers) for which the set of treatments is similar. Therefore, on a given day, part of the patients will meet at a given frequency. For example, Mr A and Mrs B, who started a type T chemotherapy at the same period, will have their treatment every other Thursday.

Patients have the opportunity to discuss their disease. Discussions are very neutral, "factual": patients will compare their experiences, talk about surgery and treatments. They will also discuss more common issues like work or family. In both cases, no asymmetry towards the disease comes in the way of conversation: both persons are sick and can discuss with someone whose empathy is as deep as possible. Social interactions in the treatment room can also be a more concrete form of support. The researcher witnessed great solidarity between patients. When a patient had suffered from an injury (unrelated to cancer), three other patients' maintained conversation with her to change her mind and help her cope with the situation.

### 3.3 Organizing nursing

For the vast majority of patients, the nursing involved for chemotherapy sessions can easily be performed by a single nurse. It consists in putting the patient on the drip, monitoring the drip rate, and finally removing the drip. Lunch is served by nurse auxiliaries.



**Figure 3. Nurse-patient allocation: Functional model (3.a) and witnessed model (3.b)**

In this hospital, all patients are gathered in one room (except those who need with risks of infections or those who need to lie down). Three nurses are present. At least two options to organize such a system exist, they are presented in Figure 3 and differ on the existence of nurse-patient allocation.

One way to proceed could be to divide patients between nurses: one third of the patients for each nurse (Figure 3.a). This is what Liang and Turkcan [2015] call the "functional care delivery model", where "nurses are assigned to a group of patients depending on patient mix in a given day". What happens in reality is that the whole group of patients is monitored by all three nurses (Figure 3.b). This can obviously lead to double-checking: one nurse makes a round and checks all drips, leaves the injection room, a second nurse enters and starts the same checking round. The researcher has witnessed such thing regularly and nursing management also mentioned it as a possible source of inefficiency in the current organization. Nurse managers have tried to change this organization and to move towards the functional model (Figure 3.a). However, nurses have refused, arguing that security was increased by this double-checking. Nonetheless, the discussion is still open and the functional model remains one of the options for the reorganisation of the department.

## 4. Analysis

Results from the observation are now put in context with the literature to offer tentative explanations and understand their impact.

### 4.1 Communication between patients in the treatment room

These observations can be related to some of the characteristics of peer-support groups [Ussher et al. 2006]. The setting is of course quite different: there is no group-leader, and these discussions are not organized separately from treatment. Although we do not say that what is happening in the treatment room is similar to a peer-support group, dimensions such as "community" and "non-judgemental acceptance" [Ussher et al. 2006] are important.

The main uncertainty is on the real impact of the social interactions witnessed in the treatment room. Do patients discuss their issues to pass time, or is there really a benefit? If the impact of these interactions is longer than simply the day of treatment, then this factor could be taken into account for the reorganization. Patients with similar interests, or patients who wish to discuss cancer issues during these treatment sessions, could be planned so as to meet on the same days. If patients can benefit from these interactions, it would also be good not to break them with an inappropriate treatment room layout (for instance by separating patients completely). In a questionnaire study in German hospitals by Kleeberg et al. [2008], 26% of patients declared that communication with other patients was an area of potential improvement.

### 4.2 On nurse teamwork

By using a safety argument to refuse the functional nurse-patient allocation model, nurses admit that operations may be performed twice. In doing so nurses acknowledge the apparent inefficiency of the system and open the way to criticism. The probability of something serious happening when a patient is with a drip is actually very low. Therefore the safety argument is rather weak. Still, nurses defend this apparently less efficient way of working with an ultimate argument in healthcare, patient safety. This attitude raises questions: why defend this system, even at the expense of weak arguments?

During the day, nurses spend a lot of effort discussing what they do and passing on information. The nurses spend a lot of time coordinating so that everyone knows what is the status of Mr A's drugs, that Mrs B's second drug has arrived, that Mr C's drip has been checked. The need for coordination in the treatment room is in fact artificially created: if one nurse was allocated to one patient, she would know all of this already. However, a lot of activities rely on nurses: coordination with the pharmacy for drugs preparation and delivery, getting missing equipments, sometimes even going to the pharmacy to get the drugs... By organizing the way they do, nurses allow for coordination. They can cover for each other when one of them is busy communicating with the pharmacy or meeting patients' relatives.

Another hypothesis is that this way of working also allows teamwork. Teamwork has regularly been associated with higher job satisfaction on part of nurses [Kalisch et al. 2010]. In turn, job satisfaction is a predictor of nurse turnover [Hayes et al. 2006], a major issue in modern healthcare management [O'Brien-Pallas et al. 2006]. To analyse the connection between teamwork and other aspects of care, references on the topic are summarized in a Reference Model as proposed by Blessing and Chakrabarti [2009, p.25]. This reference model model is presented in Figure 4.

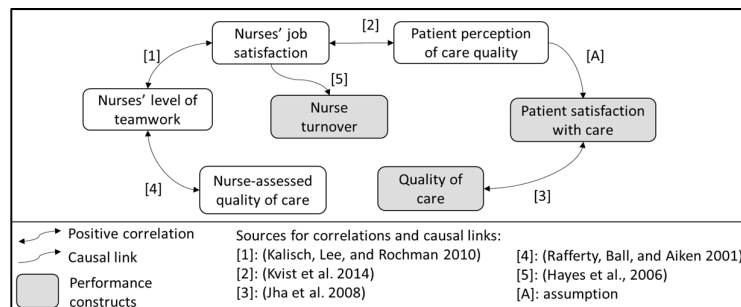


Figure 4. Reference model for nurses' job satisfaction and teamwork

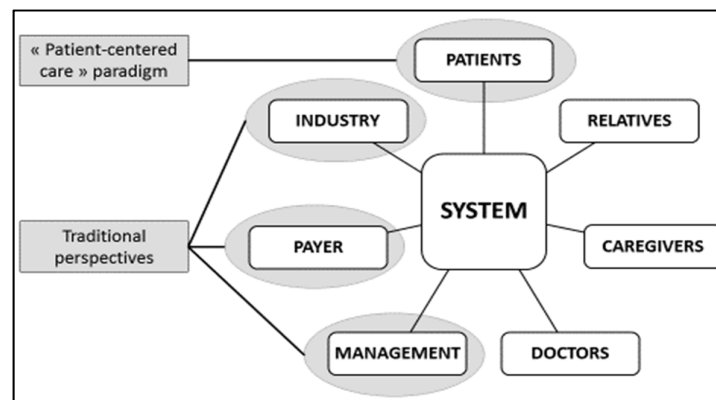
This reference model shows how teamwork, job satisfaction, patient perception of care quality, patient satisfaction with care and quality of care relate to each other [Rafferty et al. 2001], [Hayes et al. 2006], [Jha et al. 2008], [Kalisch et al. 2010], [Kvist et al. 2014]. Ultimately, nurses' level of teamwork is related to three important performance constructs, nurse turnover, patient satisfaction and quality of care. This relation happens through positive correlations and causal links which are documented by academic studies in medical journals. Only one assumption had to be made to build this model: that patient perception of care quality is a cause for patient satisfaction with care. This assumption should be verified to assess the strength of the relation. Nonetheless stating that the relation exists is a reasonable assumption. Some additional connections may also exist (e.g. a direct correlation between nurses' job satisfaction and quality of care) but they have not been identified in the literature (further limitations of this model will be discussed in section 5.2.). Nonetheless in its current state this model provides insights. This reference model shows that reorganization scenarios must be built with great caution. Here, teamwork appears to be linked to patient satisfaction, a key element in today's paradigm of patient-centred care [Kupfer and Bond 2012]. Teamwork is a somehow "hidden" parameter: nobody mentioned it when discussing reorganization. Teamwork is also positively correlated with nurse turnover, a major concern in healthcare management [O'Brien-Pallas et al. 2006]. Given this new perspective, reorganization scenarios which involve a different nurse-patient allocation will have to be discussed more deeply. The objective is not anymore only to prove that they are operationally efficient in terms of patient waiting time. Long term workforce dynamics must be accounted for as well.

## 5. Discussion

### 5.1 Stakeholders and value: Hospital as workplace

#### *Stakeholders*

Following Gray [2011], Young and McClean [2008] identify five value perspectives to consider: the payer's, the patient's, the clinician's, the manager's and industry's. The clinicians group can be further divided into doctors and caregivers i.e. nurses and nursing auxiliaries [Minvielle et al. 2008]. Family and relatives can be added, which creates the stakeholder set represented in Figure 5.



**Figure 5. Stakeholders in hospital care and the two main associated perspectives on hospitals**

As shown in Figure 5, nowadays most often, patients are included as patient-centered care is the new paradigm for healthcare. The perspectives of management, industry and the payer are also included. It could be argued that the doctor perspective is at least partly included as clinical quality is a prerequisite for any healthcare activity. However, the "hospital as a workplace" view is rare, in particular caregivers are included as "processors" rather than as individual workers. When it comes to modelling, models such as DES do not intrinsically make a difference between a nurse and an artificial item performing the same task with given efficiency and failure rate.

Moreover, the perspectives considered are mostly economic, with clinical quality as an imperative, and often do not take account for softer, psycho-social or emotional dimensions that may impact efficiency.

One exception is patient satisfaction. However, most OR models link it to waiting times, when many other elements impact patient satisfaction [Lis et al. 2009].

### *Investigating different "fields"*

French systemic theorists Mèlèse [1979] and Le Moigne [1977] define different "fields" in which a system is immersed. The notion of fields is based on a physical metaphor. Fields are "a direction, a capacity to influence, a permanent ensemble of forces of variable intensity" [Le Moigne 1977 - our translation]. In Business Process Reengineering and operations management, when organizations are analysed, financial and economic fields are systematically investigated. Some other fields are often set aside, as the objective is to work on the efficiency and the effectiveness of the system. Specifically, emotional and psychosocial aspects are often not mentioned, as well as labor and work. The lack of consideration for human factors has already been identified as a strong assumption in systems engineering [Pennock and Wade 2015]. An hospital can be seen as a productive organization or as a clinical structure, but also as a workplace or a meeting space. All these perspectives are interdependent. Yet these dimensions can have an impact on efficiency and effectiveness as shown earlier in this paper. Reversely changes made to increase efficiency and effectiveness without taking into account the professional expertise of field workers can have serious impact on psycho-social dimensions [Detchessahar and Grevin 2009].

## **5.2 Reorganization project**

In order not to break any positive dynamic in the system, two additional considerations need to be added to the reorganization project. First, teamwork and its impact on job satisfaction. One of the options to increase efficiency was to adopt the "functional model" (Figure 3.a), which was already discussed by nursing management. With the additional knowledge brought by this study, operational efficiency cannot be the only viewpoint to evaluate this option, and the expertise of nurses on their own work must be taken into consideration. The present results would rather favor self-organization of the nurse team. Secondly, treatment room design and patient-chair allocation. A consultation process should be organized to clearly understand what patients expect from a reorganization. A detailed knowledge of patients expectations and desires is crucial to any project concerned with patient satisfaction [Tzelepis et al. 2015] including reorganization projects.

## **5.3 DES process**

A parallel task in the process is the building of the DES model. DES is used to study the performance of a system under different conditions, as a "what-if tool" [Jun et al. 1999]. In our case, a model of the present system can be built and parameters can be changed to assess the resulting performance. If changes are important, e.g. if the process is to be changed by the re-organization project, then a new model can be built for the future system. In all cases, these decisions and the scenarios to be tested will be informed by the results of the observation study. Room for teamwork may be necessary, which impacts nurse availability. For instance, because it is quite mechanistic DES will not show that some nurse allocation rules may have a detrimental effect on the overall performance due to higher nurse turnover, but we now know that these effects are possible. Therefore even if the DES simulation shows that scenarios with functional nurse-patient allocation perform better on KPIs such as waiting times or resource efficiency, the decision will be made with a fuller picture taking into account psycho-social factors identified during observation.

## **6. Conclusion**

### **6.1 Contribution**

This study enlarges the perspective on value in hospital process redesign by including a dimension on nurse labor and questioning idle patient times in the process of outpatient chemotherapy. Organizational dynamics may be fragile and reorganization projects involving re-layout, process re-engineering and

challenging efficiency objectives such as this one should be planned carefully. It can then be used to build a "transitional system" [Klein 1989], in this case a simulation model.

This study needs to be analyzed in a context where most studies using DES in healthcare do not mention implementation. One way forward is to combine DES and a Problem Structuring Method such as Soft Systems Methodology. However, when Checkland and Scholes [1990] describe their projects using Soft Systems Methodology, they mainly mention interviews and verbal interactions (workshops, discussions) when building their understanding of a problem situation. However, interviews are "explicative" approaches [Juan 1999] and can hide important aspects that people won't mention. Although observation is more time-intensive, it provides different information and insights that would not necessarily be mentioned in interviews. Observations can then be related to existing literature which would not necessarily have been explored: observations point to the relevant dimensions for which confidence can be gained based on the literature. We hope that this study contributes to showing that observation and ethnographic approaches provide valuable and complementary insights to interviews for building scenarios prior to reorganizations.

## 6.2 Limits and future work

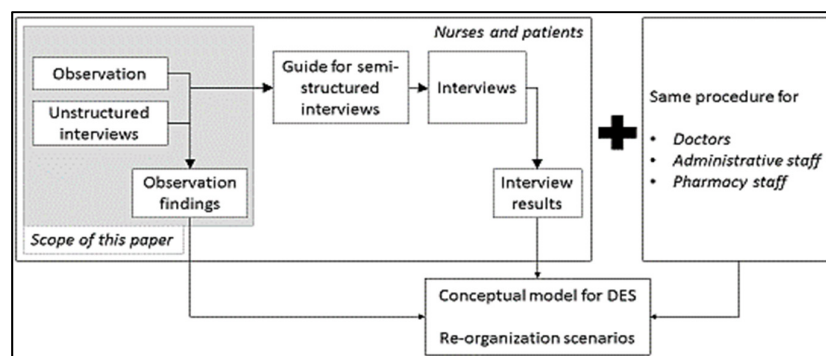
On peer support groups, mixed results can be found in the literature. If [Ussher et al. 2006] show that peer support groups can have a positive impact, other studies find no impact [Jacobs et al. 1983], [Helgeson and Cohen 1996].

Some limitations must also be underlined in our Reference model (Figure 4):

- First, the literature review for this model is not exhaustive. For example, the link between patient satisfaction and quality of care is controversial, e.g. [Chang et al. 2006].
- Secondly, some references are not specific for cancer. Therefore, generalizations are made which should be investigated (e.g. Jha and colleagues [2008] measure quality of care using Hospital Quality Alliance data, which relies on the measurement of 24 evidence-based medicine practices for "three conditions — acute myocardial infarction, congestive heart failure, and pneumonia — and with respect to the prevention of complications from surgery", and we assume that the correlation is also valid for outpatient cancer treatment).
- Thirdly, none of the studies in the model is French. Yet cultural aspects could be important for such causal networks.

### Next steps

To increase confidence in the findings of this observation study, and to draw some more general conclusions, some next steps are planned. As Figure 6 shows, the findings of this paper are the first part of a wider study.



**Figure 6. Position of the present results in the research framework**

The results presented here will be used to develop a complete understanding of the respective visions nurses and patients have on the outpatient chemotherapy service. First, the observations of this study are used to create two interview guides: one for patients and one for nurses. This second phase will provide a deeper understanding of values. Secondly, other stakeholders need to be investigated, in particular



doctors (oncologists), pharmacy staff and the administration. The same procedure will be used. This work will then be used to create scenarios to be tested for operational performance in a Discrete Event Simulation model. The objective is to gain operational efficiency, without breaking any valuable dynamics in the department.

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