Patient and Staff Satisfaction Model Using Queuing Theory

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Abstract:
There Abstract—This project investigates the connection between patient satisfaction, waiting time, staff satisfaction, and service time. It uses a variety of models to enable improvement against experiential and operational health service goals. Patient satisfaction levels are estimated using a model based on waiting (waiting times). Staff satisfaction levels are estimated using a model based on the time patients spent with the doctors (service time). An integrated model of patient and staff satisfaction, the effective satisfaction level model, is then proposed (using queuing theory). This gives relation between satisfaction of patients, their waiting time, satisfaction of staff, and their service time, on the basis of two important concepts, namely, experience and efficiency in care delivery and leading to a more holistic approach in designing and managing health services. The proposed model will enable healthcare systems analysts to objectively and directly relate elements of service quality to capacity planning. Moreover, as an instrument used jointly by healthcare commissioners and providers, it affords the prospect of better resource allocation

Keywords: Queuing theory, Satisfaction levels of Patient and Staff, Patients' waiting time and Staff service time

I. INTRODUCTION

Patients' satisfaction is generally accepted as a key indicator of the quality of care. Patients' waiting time is also considered as one measure of access to healthcare. From the perspective of queuing theory, and by the consideration of Little's Law, the authors identified three key variables of the problem that are very closely linked - Waiting time, Service time (or service rate) and Number in system. If these are so closely linked, then it may be expected that setting targets for waiting time - the patient side of care, may have indirect consequences for service rate – on the staff side of care - if nothing is done about the number in system. A recent study has shown that in some situations much needed care is left undone due to staff not having enough time for tasks. This model puts forward three main challenges to those in service provision, namely to optimize patient satisfaction, staff satisfaction and service efficiency. The need to understand the interaction between patients' needs, staff needs and service efficiency (or service quality) has been recognized for many decades. The challenge of understanding this interaction between patients' needs, staff needs and service efficiency is the motivation for this project. To address this challenge, the project reports on an approach that adds new methods to established ways of modelling healthcare processes. This project contributes both in the integrated solution (Effective Satisfaction Level (ESL) model) proposed and the staff satisfaction model developed. This project attempts to introduce the concept of Queuing Theory into the challenge presented above. This gives priority to the problem on patients' satisfaction with waiting time and staff satisfaction with service time. Therefore the proposed Effective Satisfaction Level (ESL) model, believed to be the best trade-off between patients and staff needs, is presented before finally finishing with some discussion and conclusions.

II. LITERATURE SURVEY
Improving Communication between Healthcare Professionals and Their Patients through a Prescription Tracking System

(Dhiya Al-Jumeily1, Abir Hussain1, Áine MacDermott1, Hissam Tawfik2, and Jennifer Murphy1) The aim of the project is to improve the communication by supplying information more efficiently via the development of a PTS. The PTS will be used to provide real time information about the status of a prescription. Currently there is no direct system for patients to access therefore, the requirements of the system were developed from feedback of patient's needs. Improving communication platforms with the means of technology can improve efficiency and accuracy of the prescription lifecycle. This paper proposes the development of a new system based on using an information/database management system. The Proposed system will be user friendly targeting all audiences. Usability and accessibility will be of a high importance, due to targeting users of a wide background of health conditions and IT Experience.

REDUCING THE OUTPATIENT WAITING TIME BASED ON CBR ALGORITHM USING SMARTPHONE
(YUH-TZONG LW\ YI-HAN CHEN2, NEI-PHON WANG3, CHUN-JUNG LIN4', YUN-AN CHEN5 978-1-4799-4215-2/14/$31.00 ©2014 IEEE)
Many people who live in Taiwan may have the experience of medical treatment so called "three longer, two shorter "situations. The "Three longer" phenomenon means we must keep in line waiting for registration, waiting to see a doctor in the clinic room and waiting for prescriptions. The "Two shorter" phenomenon means a doctor has many patients on his hands so the visit and the in-query time of out-patient diagnostic will be relatively short. With the development of medical information system and the application of the internet, registration and prescription have made a rapid progress. Because the complexity of the disease and the doctor's regular practice of diagnosis, medical institutions usually can't reduce the waiting time for outpatient efficiently. This study will introduce the smart phone apps as the carrier, using Case-Based Reasoning (CBR) algorithm to construct an Expert System, so as to inform patients the right time needed to go to

the clinic. For the patients using this apps, we not only can reduce the waiting time but also improve the satisfaction of patients'. Besides, we believe the quality of care will also be improved.

OPTIMIZING STAFFING SCHEDULE IN LIGHT OF PATIENT SATISFACTION FOR THE WHOLE OUTPATIENT HOSPITAL WARD

(Further research of the 2008 Winter Simulation Conference S. J. Mason, R. R. Hill, L. Mönch, O. Rose, T. Jefferson, J. W. Fowler eds. 978-1-4244-2708-6/08/$25.00 ©2008 IEEE) The waiting time for patients in outpatient departments of hospitals is a problem throughout the world. In this context, a discrete-event-simulation model was developed to examine congestions and doctor schedules in all departments of an outpatient hospital ward of the Nagoya University hospital. The details of all the outpatients are collected and is described in this research as part of a simulation performance, especially by using electronic medical records. This study identified some of the best doctor schedule mixes by integrating the simulation model into an optimization program in order to reduce patient waiting time as well as doctor idle-time without adding a single additional resource.

III. SYSTEM ARCHITECTURE

System architecture is a formal description and representation of system that supports reasoning about the structures and behavior. The following architectural diagram shows the complete process of the patient and staff satisfaction model. As the first block shows, initially the patient request for the appointment and fill the required details in the form. Every patient and doctor will have their own login credentials through which they can login, after that patients can check their service status and doctors will also have a complete knowledge of how many patients are there in waiting in queue for service and all other information.
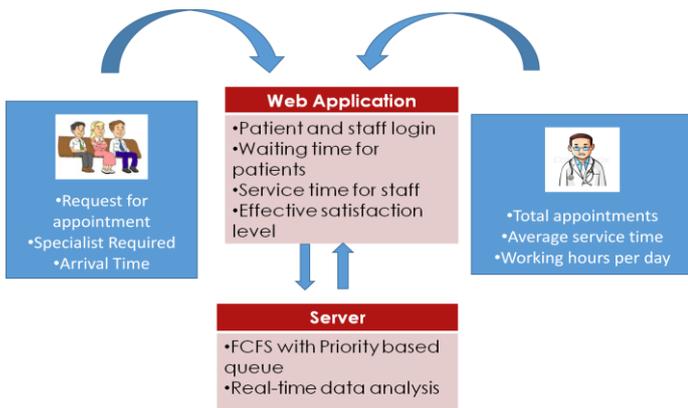
IV. PROPOSED SYSTEM

Finally, the Queuing Theory relationship between waiting time and service time, patient satisfaction with waiting time and staff satisfaction with service time are integrated to develop the concept of the Effective Satisfaction Level (ESL). Figure 2 shows the various aspects put together. The ESL is the maximum level of satisfaction on the optimum Total Satisfaction Curve (TSC) at a given value of ideal service time expressed in terms of Δp, the waiting time ratio. The TSC is simply the plot of the weighted sum of the satisfaction of patients and staff at a given value of ideal service time and expected waiting time. In this paper, however, equal weight

age is given to the satisfaction of both patients and staff as we only focus on the development of the ESL concept at this stage. It may be necessary at times to maximize patient satisfaction in this way but this may require a shared understanding in a staff team to be effective. It is suggested that the ESL must be the goal of most healthcare systems. Even when capacity constraints make it difficult for a system to operate at the ESL, it may still be desirable to know how far the system is from its ESL. This concept uniquely provides a meaningful method for assessing the capability of a healthcare system to examine the validity of any arbitrary target.
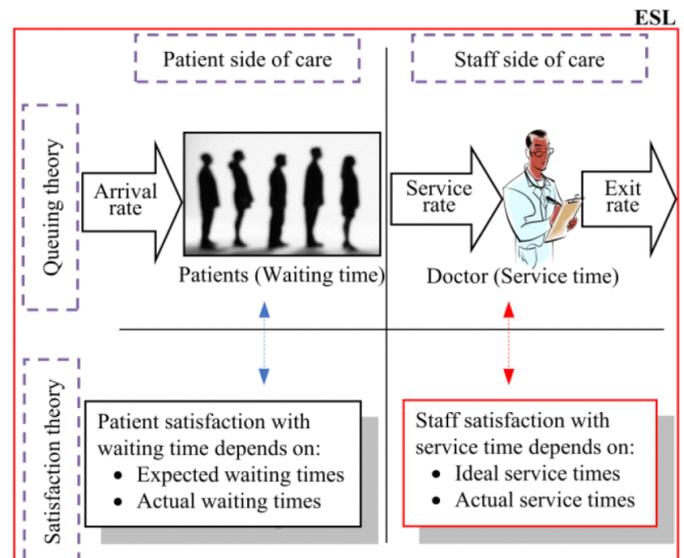

Figure.1. Effective Satisfaction Level (ESL) model

Queuing Theory Relationship between Waiting Time and Service Time:
Queuing theory is a well-established field of research that has been applied to many systems including healthcare. Several queuing models exist, from single stations to complex networks of queues implementing several queuing disciplines. In this paper we employ one of the most basic queuing models – *M/G/1* in order to demonstrate how patient satisfaction with waiting time may be connected to staff satisfaction with service time

V. CONCLUSION

Through the concept of the Effective Satisfaction Level (ESL) we present an argument that a synergy between patient satisfaction and staff satisfaction is the key to sustainable improvement in healthcare quality. The study of the relationships of various factors with staff service times may facilitate the inclusion of multiple factors and eventually the development of a more unifying satisfaction model. The results have shown that the ESL occurs when the ideal service time is close to or equal to the actual service time with the corresponding actual waiting time also close to or equal to the expected waiting time. This means that there is the potential to be able to accurately predict what may be expected from doctors and nurses for a desired level of patient experience. It enables us to more easily control the parameters that influence the phenomenon or the interaction between staff and patients.

VI. REFERENCES

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