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Improving Wait Time of Chemotherapy Patients in Infusion Center at Dubai Hospital, Dubai Health Authority

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Abstract

Cancer is one of the causes of increasing mortality rate in the world. One of the leading governmental hospitals in Dubai dealing with Oncology and Haematology patients is Dubai Hospital; Chemotherapy is given in Day Case Infusion Center of Dubai Hospital. Long wait time for chemotherapy lead to increased dissatisfaction and compromise the safety of the client beyond the working hours. Reducing wait time and treatment burden affects the satisfaction status of the patient and wellbeing. A clinical practice improvement program the Plan do check act (PDCA) project to reduce wait time for elective chemotherapy and identify factors which causes the delay. Data were collected from 2013 to 2017, Continuous monitoring and timely intervention of the project, we notice a tremendous reduction in wait time from 6 hours for single agent chemotherapy to 3 hours and also there was reduction in the mean prescription time less than 1 hour from the baseline and also the drug arrival reduced from 2 hour to 1 hour. Outpatient cancer treatment is considered as a complex system in which a good coordination from administrative staffs, medical professionals & nursing professionals, who work effectively for the overall goals of providing care by reducing the patient wait time and improve efficiency.

Keywords

Operation Hours, Day Case, Cancer, Patient Waiting Time, Chemotherapy

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1. Introduction

The occurrence of cancer rate is rising annually. The cancer patients treatment modality include chemotherapy, surgery & radiation therapy. Depends upon the diagnosis and classification the treatment options are planned. Cost of the stay can be increased as the clients may require more hydration to increase the kidney perfusion or may require blood and blood products as the chemotherapy affects the bone marrow and bring down the blood components. Cancer patient needs desired outcome such as hopefulness, a patient centered nursing intervention, sense of wellbeing and trust were most likely for patients who received and needs positive impact while delivering the care. The treatment of cancer is often complicated and required multidisciplinary specialist team and this marked a significant pressure on patient and family. Early screening & treatment can cure the disease. Cancer is a leading cause of morbidity and mortality worldwide (WHO). Multiple safeguards persist in Chemotherapy day case unit in Dubai hospital to ensure prescriptions and administration safety, including scrutiny by personnel from various departments such as physicians, nurses, pharmacist, case management, inexorability resulting in long wait times.

Long wait time in CDU (Chemotherapy Day Case Unit) resulted in frustration not only to patient and family but also to health care providers. The effect of long waiting time can compromise patient safety as the unit closed by 18 pm and

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the number of staffing also less. Chemotherapy treatment controls the growth of abnormal cell so it is a main stay of oncology, and provides implausible opportunities for cure, but it also possess potentially life threatening risks to patients. Extending the ability to oblige the demands for complex anticancer treatment regimens, a health care system faces many exterior pressures on time. A quality improvement project with the aim of improving waiting times of patients for chemotherapy in day case unit as well as of preserving the essential inherent safety processes.

2. Background

Dubai Hospital under DHA is one of the leading specialized centers in rendering comprehensive care for all sorts of cancer patients in the oncology unit, which is located in level 7th floor. This hospital is one of the governmental organizations with the vision of providing a healthier and happier community. The main values of Dubai hospital are providing the care delivery through a coordinated set of services and involving the family in the decision making process, delivering quality care by pursuing the efficiency and utilization of resources, motivating the employees, to encourage the innovative ideas to serve the community better. The infusion center deals with oncology patients with different types of solid tumors. Most of the oncology cases which takes treatment in infusion center are breast cancer, coloncancer, pancreatic carcinoma, rectal carcinoma, germ cell carcinoma, lung cancer and head & neck cancer and hematology cases include Leukemia's, blood disorders, and lymphoma cases. The infusion center (Level 7 center) is day case units with the bed capacity of 27. The National Comprehensive Cancer Network protocols are followed up in the infusion center and Tumor board meetings and support in the decision of treatment regimen. Due to the increase rate of cancer, the chemotherapy preparation in the infusion center number also increased. A minimum number of 15-20 patients per day we receive in the infusion center. We were concern about the increasing demand which were mirrored by a steady increase in the number of complaints from clients due to the increased waiting time in CDU (chemo day case unit).

3. Objectives

a) To investigate the problem related to delay in receiving treatment

b) Identifying waste in process and eliminating non value adding steps

c) Reducing variation and leveling workload to improve the quality and flow

d) To continuously measure the impact of quality improvement introduced to the oncology service.

e) Develop action plan to improve any gaps in the care delivered to the oncology patients

4. Theoretical Framework Modeling Patient Flows Through the Healthcare System

The study of health care delay is an application of the discipline of queuing theory [1]. Health care is similar to other forms of queuing in these respects:

a) Translating the need of the patient into demand of service – system must ensure in proper identification of patients and referring to appropriate service

b) Health services require a multidisciplinary team comprising of, physicians, nurses medications, and diagnostic equipment.

c) In health care system network of services are rendered services with the attendant issues of "grid lock" and "bottlenecks."

d) Through careful forecasting, scheduling, process improvement and information management delays can be reduced.

In these respects, reducing health care delays is similar to the efficient coordination of work.

a) Delivery of services commence when the patient is physically present (unlike a piece of work that can be dropped off and picked up later), which makes rapid service particularly important.

b) Meeting the demands of service by ensuring the timely and equitable delivery of service

c) The outcome of the service - including survival, recovery time, and suffering — is adversely affected by waits.

d) The flow of work will be disturbed in the infusion center due to the arrival of critical patients, who can both require an exceptional amount of attention, and be exceptionally urgent.

e) A patient's condition may independently change while waiting and require more or different care.

4.1. Queuing Theory

Mathematical modelling of waiting lines, whether of people, signals, or things. It aims to estimate if the available resources will suffice in meeting the anticipated demand over a given period. Queuing systems means patients arrive at the

facility, wait for services they need, then they are served and they depart [1] The structure of the waiting line model comprises of patients arriving to the facility, followed by the patient getting into a line and waits to be served. A patient is chosen from the queue then the required service is then delivered and the patient leaves the queuing system [2]. The accommodation of clients in the department depends on the bed capacity and how the choice of the next patient in line is made from the queue system of a health facility. For most facilities the choice of the next patient in the line is according to the urgency of their health needs or on a first come first served basis by using the patient arrival times [3] After patients receive the services they sought in outpatient clinics, they leave the clinic via a number of ways which includes; admission to a CDU, getting the service and discharge to home or referred to other facilities. [3] The waiting line model theory will be of help in this study at CDU by providing an understanding on how patient arrival time, staff availability and service needs of the clients affect the mean waiting time in a health facility.

4.2. Arrival Process

a) how customers arrive e.g. singly or in groups (batch or bulk arrivals)

b) how the arrivals are distributed in time (e.g. what is the probability distribution of time between successive arrivals (the interarrival time distribution))

c) identification of a finite population of clients or (effectively) an infinite number

The arrival process is categorized into regular arrivals (i.e. the same constant time interval between successive arrivals).and a Poisson stream of arrivals which corresponds to arrivals at random. In a Poisson distribution rate of occurrence of arrival of clients at successive intervals are exponentially distributed The Poisson stream is important as it is a convenient mathematical model of many real life queuing systems and is described by a single parameter - the average arrival rate.

4.3. Service Mechanism

a) a description of the resources needed for service to begin

b) how long the service will take (the service time distribution)

c) the number of servers available

d) whether the servers are in series (each server has a separate queue) or in parallel (one queue for all servers)

e) whether preemption is allowed (a server can stop processing a customer to deal with another "emergency" customer)

Each client was scheduled a particular time for the arrival to CDU, to prevent the workload of the unit and for the fast delivery of service. A common assumption about service time is that they are equally distributed

4.4. Queue Characteristics

1) how, from the set of customers waiting for service, do we choose the one to be served next (e.g. FIFO (first-in first-out) - also known as FCFS (first-come first served); LIFO (last-in first-out); randomly) (this is often called the queue discipline)

2) do we have:

   a) balking (customers deciding not to join the queue if it is too long)

   b) reneging (customers leave the queue if they have waited too long for service)

   c) jockeying (customers switch between queues if they think they will get served faster by so doing)

   d) a queue of finite capacity or (effectively) of infinite capacity

3) The congestion can be reduced by changing the queue discipline, this is possible by choosing the customer with the lowest service time required

5. Review of Literature

Most of the articles reviewed related with long waiting times covers the large hospitals and outpatient clinics. Majority of articles published related to this title is from developed countries. Several factors have been established from the findings of these studies that they affect patient waiting time. Some of these factors are few health personnel, high patient load and inadequate infrastructure and medical equipment [4]

The objectives are to reduce the patient waiting times and maximizing output. Simulation study [5] to test different scheduling rules based on bin-packing algorithms and determine the time allocated for pre-treatment process, preparation and nursing. Woodall et al. [6] use simulation based optimization to determine the optimal nurse schedules with the objective of minimizing expected waiting times. Scheduling the patient flow in oncology clinics to the infusion center affects the start time as the clinic appointment takes time to get an appointment with oncologist. The oncologist and infusion appointments simultaneously should be considered important for better coordination for appointment schedules, improved patient flow and more balanced resource utilization in oncology clinics. Matta and Patterson (2007) use simulation to evaluate the impact of different patient arrival rates, resource [6]: states that patient

flow is improved due to scheduling the client in Oncologic clinics through queuing policies, [7] Peter K. H. Lau, MBBS, Melanie J. Watson, MSc (Stat) and Arman Hasani, MBBS, - states that separating the oncology day case unit will provide more efficiency. Excessive patient wait time for chemotherapy was a primary source of ambulatory care setting which result in patient dissatisfaction [8]

Patient waiting time - the time a client spends in the facility that is from admission process till discharge. Waiting time is due to the multiple factors in developing countries like the shortage of staff (medical, nursing, pharmacist, clerks, messenger etc). Admission process of different specialty together in one area can delay the scheduled patient time to the CDU. Patient waiting time management has been a challenge to many health facilities mainly due to lack of buffer and coupling outpatient systems. However, several studies that have been done to measure waiting time and to track patient flow [3]. The mean waiting time of a patient in a facility is one measure used to determine the efficiency of health care delivery in health facilities [10] In a Malaysian public hospital for example, it was established that patients waited for more than two hours since registration time till collection of drugs [11]. The recommendation by the institute of medicine is that patients should be seen within 30 minutes of their arrival time [3] This has however not been realized in many countries. For instance, a study done at a tertiary hospital in Nigeria, shows that majority of patients waited 90-180 min in the clinic [12]

Arrival time of the client - Arrival time to the health facility is the time the patient presents themselves to the first service point which is the registration office [13]. The time the patient check in to the facility and the complete process till the service rendered are considered. Considering the service in CDU the arrival time is considered as the scheduled appointment time to the facility to take the treatment. Arriving late to the facility or delay due to the lab work up not done on time all result in the overall efficiency of the facility The way patients are booked determines how many arrive on the queue at any given time

and this can influence the waiting time [14] The mean wait time for patients who arrive early is shorter than those who arrive late to receive specialized services [13]

Shortage of staff in the day case unit also lead to long waiting time stated by [12] Less health care providers can also increase the waiting time in a health care facility [15]

6. Methodology

We took this as a key performance indicator of our unit based quality improvement project a baseline measurement was taken into consideration.

Study population – it includes all the patients got treatment in the day case unit of Dubai Hospital during the course of study Sampling procedure –daily a record was maintained to monitor the time of admission till the physician writes the order and also monitoring the time till the administration of medication. Simple random sampling was done on a monthly basis considering the 2 parameters mentioned above.

Study variables – the dependent variable in the study was the waiting times while the independent variable were staffing pattern, type of service, protocol of chemotherapy administration

Data processing and analysis – Data's were collected everyday by the staffs in the infusion center and these were represented in table. The descriptive data include health card number of the patient, diagnosis, patient arrival, physician medication order, drug arrival from chemo pharmacy and administration of medication. These data were entered on a regular daily basis and monthly random sampling was done to access the waiting time

6.1. Baseline Measurement

For this project, the following measurements were included to find out the maximum hours of stay in CDU. A tool was developed and monitored throughout the years and paved a lot of improvement from 2013 to 2017

2012-2013	Day case and inpatient units were mixed up, with bed capacity of 12
2014-2015	Day case separated from inpatient and the bed capacity increased to 18
2016 April	Hematology, Oncology and Immunology day case patients came under one umbrella named Infusion Center & under different administration and bed capacity increased to 27

Admission time of the patient

a) Physical assessment of the Dr. and the drug order time

b) Time of arrival of chemotherapy drugs

c) Time of commencement of chemotherapy

d) Time of completion of drugs administered to time of discharge

The process of tracking down the causes of long wait times for elective chemotherapy were summarized and the causes were classified into 4 categories (appendix A)

1) Patient factors

a) Location of treatment as mixed up with in patient and outpatient

b) Inadequate pre work – as the client not done the blood

test, radiological interventions, interventional procedures like bone marrow, pleural, ascetic tapping etc.

c) Late of appointment

2) Physician factors

a) Physicians choosing patients files/ not in order

b) Physician forgetting to enter the treatment online

3) Resource

a) Production and delivery of chemotherapy from pharmacy (ground floor –7thfloor)

b) Lack of staff

c) Ward attendees

d) Resources used for non-chemo procedures

6.2. Design

A focus group was conducted among the physicians, nurses, pharmacist, IT, case management to determine the underlying issues, and several brain storming sessions were conducted. Based on the gaps identified, the team changed the old practices.

1) Fax removed from the process, pharmacy depends on online order only from 2014.
2) Chemotherapy orders in the Doctors Order sheet removed
3) As a backup of online system, Drug chart introduced
4) SAM booking online started in 2015.
5) Instead of scheduling the appointments in the books online booking started
6) Patient will receive SMS that has booked online for chemotherapy with date and time.
7) Able to control the booking and reduce over booking.
8) Patient admitted on time slots-4 patient every hour, this improve the flow, give time for proper nursing assessment and oncologist assessment.
9) Filing room prepare the files and send to the unit, Ward clerk check the files availability, one day before
10) Transfer Cytotoxic preparation room to L7 East from ground floor came into effect by 2016
11) Separation of unit – all day cases will be admitted to infusion center
12) Optimize the nurses schedule into 3 shifts to minimize the wasting of time and to cover the unit till chemotherapy finish
13) A standardized discharge plan with specific instruction for prior workups or investigation was also implemented to ease the workflow.

7. Results

The effects of a changed workflow and standardized discharge plan were monitored and the following results were seen. There was reduction in the average length of stay by 10%and this improved patient satisfaction level as they can resume their duties after chemotherapy and also can be with their family

Monitoring time of prescription till the time of drug start. (Table 1) Monitoring time of prescription till the time of drug start REASON FOR THE DELAY OF TREATMENT. (Figure 1)

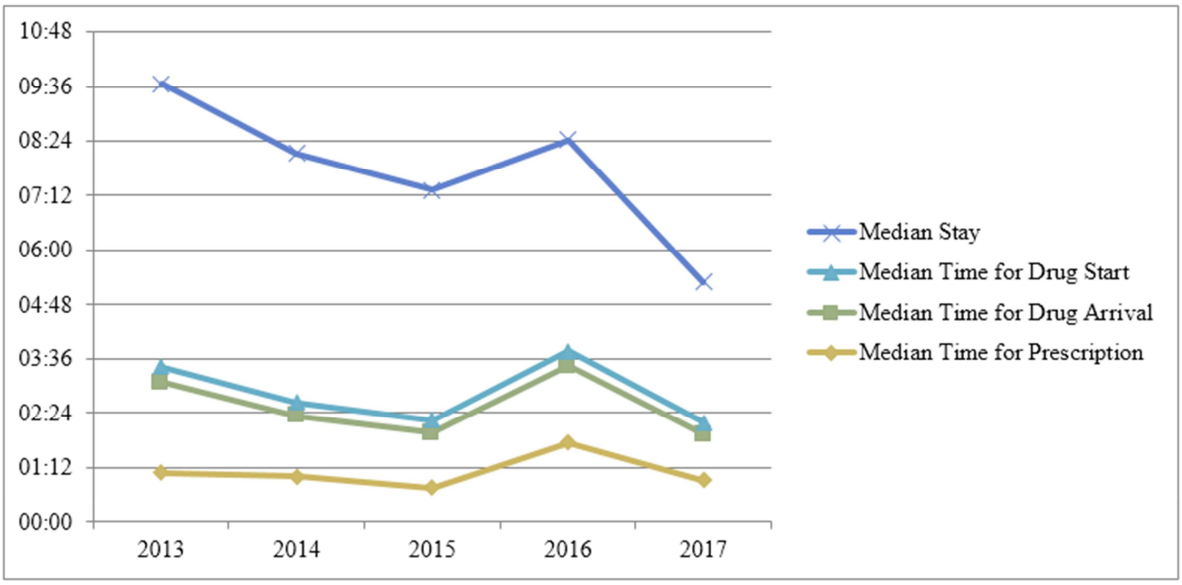

Figure 1. Reduction in the average length of stay.

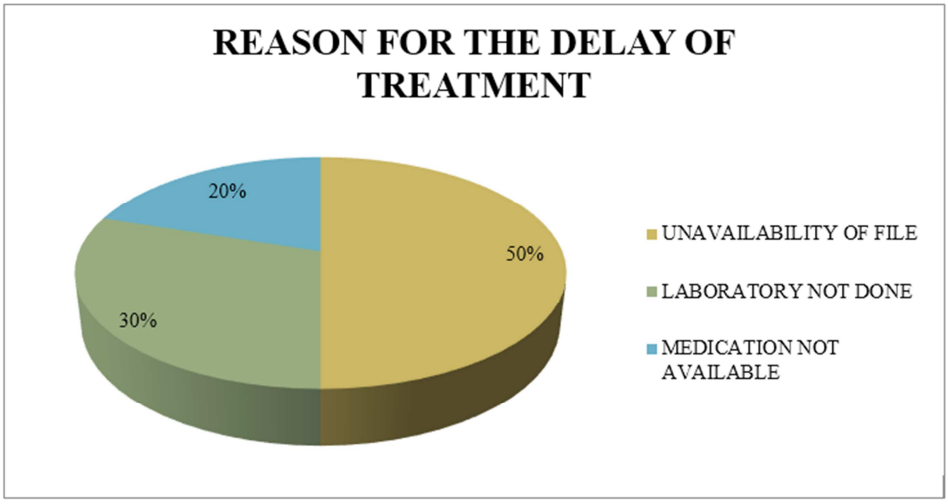

Figure 2. Reason for the delay of treatment.

Table 1. Monitoring time of prescription till the time of drug start.

Year	Median Time for Prescription	Median Time for Drug Arrival	Median Time for Drug Start	Median Stay
2013	1:05	2:00	0:20	6:15
2014	1:00	1:20	0:18	5:30
2015	0:45	1:13	0:16	5:05
2016	1:45	1:41	0:20	4:40
2017	0:55	1:01	0:15	3:07

8. Evaluation

The effects of changes in the workflow have brought about several positive outcomes. As we are booking online with treatment modalities and cycle, awareness about the disease condition, treatment plans ahead. The pharmacy can make sure about the availability of medication from the central store which helps to prevent the delay of medicine to the patient. The nurses become more efficient in their work and chemotherapy administration.

There was also few challenges faced in the infusion center so decided to

Monitor and reduce factors causing delay of treatment in Dubai Hospital Infusion Center under the following criteria

1) Monitoring time of admission until time of physicians order.

2) Monitoring time of order until delivery of medication/ treatment

OBJECTIVE

1) The physician will see 80% of patients within the first hour of admission

2) 80% of patients will receive their treatment within one hour from doctors order time.

Patients delay is going to be further classified into the following risk factors gathered from 2016 data:

1. Monitoring time of admission until time of physicians order.
   i) Admission procedure/ financial clearance process.
   ii) Files not available
   iii) Physicians choosing patients files/ not in order.
   iv) Patients' blood work not done.
   v) Medication not available in pharmacy
   vi) Blood products are not available in blood bank.
   vii) Physician forgetting to enter the treatment online
2. Monitoring time of order until delivery of medication/ treatment
   i) Wrong dosage of medication entered online
   ii) Unavailability of medication in the pharmacy
   iii) Difficult cannulation
   iv) Delay by cytoprep room/ no messenger.

Delay from pharmacy (includes misplacement of medication to the unit either by the messenger or through pneumatic)

9. Conclusion

Teamwork, communication and involvement of all stakeholders play an important role for this project to be

successful and sustainable in long run. Project initiative resulted in improved quality of care and improved understanding of complex system constraints within CDU. From August onwards implement an electronic system known as the Epic software which helps to improve a fast delivery of service in future by removing the medical records and able to identify the areas of delay to enable to get timely service.

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Conflict of Interest

The Author Declare there is no conflict of interest.

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