Quality improvement plan to reduce patient waiting times in a private emergency department

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Quality improvement plan to reduce patient waiting times in a private emergency department.

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Declaration Form

I declare that this dissertation, which I submit to RCSI for examination in consideration of the award of a higher degree MSc Physician Associate Studies, is my own personal effort. Where any of the content presented is the result of input or data from a related collaborative research programme this is duly acknowledged in the text such that it is possible to ascertain how much of the work is my own. I have not already obtained a degree in RCSI or elsewhere on the basis of this work. Furthermore, I took reasonable care to ensure that the work is original, and, to the best of my knowledge, does not breach copyright law, and has not been taken from other sources except where such work has been cited and acknowledged within the text.

Signed:

Date:

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Abstract

Emergency department overcrowding is a public health problem and results in long waiting times and delays in critical treatment for patients. Moreover it has been associated with a number of negative clinical outcomes such as increased complication rates and mortality. Using the DMAIC (define, measure, analyse, improve and control) model for quality improvement (QI), this dissertation investigated the long patient waiting times experienced in a private emergency department in Dublin West. Applying a variety of QI tools, including a fishbone diagram, stakeholder analysis, process flow maps and data collection the root cause of the long patient wait times was identified. The results highlighted that 14% of patients were waiting over 4 hours from triage to see the consultant and 51% of patients were waiting over four hours from triage to discharge or admission. In May 2017 the Irish government announced in the Sláintecare document that it would be implementing the 4 Hour rule (no patient should be waiting over 4 hours from triage to discharge or admission) in Irish emergency departments over the next ten years. With the new guideline in mind, the QI plan focused on improving wait times for patients waiting over 4 hours from triage to see the consultant. Factors that contributed to delayed patient waiting times in that cohort of patients were analysed; the addition of a Physician Associate or Advanced Nurse Practitioner alongside the implementation of a fast track system to treat minor cases was proposed.

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Chapter 1.0 Introduction

1.1 Introduction

This chapter begins by setting the context within which this piece of research was conducted. It does this by briefly outlining the organisational setting and rationale for the study before setting out the aims and objectives of the thesis. It then outlines the role of student both within the chosen organisation and in conducting the project. The final section provides an outline of the structure of the thesis and a brief overview of each chapter.

1.2 Organisational Context

The Emergency Department (ED) of a private hospital situated in West Dublin was the focus of this piece of research. The hospital is a modern facility consisting of one hundred and twelve beds including eight intensive care beds. It offers a range of services to patients including medical, surgical and advanced radiotherapy, using the latest in medical technology with the most advanced diagnostic equipment available. It has been the recipient of awards from the Joint Commission International (JCI) for the quality and standard of healthcare delivered to its patients.

The ED consists of eight beds, one of which is housed in an isolation room and another in a separate side room to facilitate procedures being carried out. It also contains a small area for patients to be triaged. The staff employed in the emergency department compromise: one emergency medicine consultant, one clinical nurse manager, two nurses, one health care assistant and three administrative staff. The ED operates seven days a weeks and opens Monday to Friday from 8.00 am to 5.00 pm and Saturday, Sunday and Bank Holidays

from 10.00 am to 5.00 pm. A fee of €150 is charged for attending and each additional investigation or treatment will incur a cost. The majority of patients that attend are covered by private health insurance.

Patients must be over sixteen years of age in order to attend the ED and can either self refer or be referred by a General Practitioner (GP). The department also offers a dedicated GP phone service whereby a GP can directly liaise with an ED nurse regarding the care of their patients. The ED can treat a range of aliments from general medicine, cardiology, general surgery, urology, oncology and orthopaedic cases. Of note, the ED does not accept emergency ambulances carrying acutely unwell patient such as those suffering major trauma as a result of an accident or those experiencing symptoms of a stroke or myocardial infraction.

1.3 Rationale for Quality Improvement Project

A significant amount of research suggests that overcrowding and long waiting times in Emergency Departments are associated with negative healthcare outcomes for patients. ED overcrowding can lead to increased complications and mortality rates for patients (Pines et al., 2011) and long waiting times can exacerbate the patients diagnosis and complicate the resultant treatment plan (Singer et al., 2011). Given the constraints on resources in Irish hospitals, it is not surprising that frontline services are under strain and visibly stretched and it is within this context that we need to be proactive in trying to improve our services in the most effective way possible (Health Service Executive, 2016).

Quality improvement is ongoing and dynamic and its success is dependent on the efforts of all those involved. Improving efficiency and effectiveness of healthcare processes and practices will ultimately lead to improved quality of care for patients. According to Health Service Executive (2016)

> "Quality improvement (QI) is the combined and unceasing efforts of everyone - healthcare professionals, patients and their families, researchers, commissioners, providers and educators - to make the changes that will lead to better patient outcomes, better experience of care, continued development and supporting of staff in delivering quality care ".

Quality Improvement Plan (QIP) allows for identification of factors contributing to problems being experienced within healthcare facilities and provides a framework within which to address the identified issues. A QIP guides our planning and delivery of healthcare services. It is fundamentally concerned with quality and safety and in improving the overall healthcare experience for patients.

1.4 Aim and Objectives

Within the following section the aim and objectives of the project is stated. The objectives were formulated based on the SMART (specific, measurable, achievable, realistic and time-bound) goal criteria.

Aim: To reduce wait times for patients attending the emergency department

Objectives:

a) To carry out an audit of the time patients spend in the emergency department, focusing on triage, time the consultant has seen the patient and discharge or admission time by March 2017.
b) Devise a process flow map of a patient's journey by March 2017.
c) Identify and meet key stakeholders by April 2017.
d) Complete a fishbone diagram with potential factors influencing patient delays with key stakeholders by April 2017.
e) Analyse data collected by May 2017
f) Formulate a quality improvement plan based on the outcomes of the above objectives to reduce patient wait times within the emergency department by July 2017.

1.5 Role of the student in the organisation and project

As a Physician Associate (PA) student, I was on placement for a three week period in this Emergency Department (ED) in order to gain experience and develop my skills and knowledge in assessing and treating patients with acute ailments. My role was primarily to shadow the ED consultant, however, the nursing and health care assistant staff also willingly shared their knowledge and practice skills with me.

As a student, I was in a position to observe the operation of the department on different days and over different lengths of time. It was while I was on placement that I noticed patients appeared to be waiting for long periods of time, longer than the hospital's desired six hour target from triage to discharge. Furthermore, during my first week a number of patients made

comments to me such as “will it be much longer to see the doctor?”, “how long will it take for my imaging results to come back?” and “I came here because I thought there wouldn’t be much of a wait”. Furthermore, discussions with the consultant and clinical nurse manger also indicated that they too felt that patient’s were experiencing longer than desired waiting periods.

The role of the Physician Associate (PA) was established in the 1960’s in order to improve and expand on healthcare in the United States. More than fifty years later as one of the first cohort of PA students in Ireland, I am deeply committed to improving the overall healthcare experience for patients in this country. A requirement of the Master of Physician Associate programme is that students are required to complete a Quality Improvement Plan (QIP). Over the course of my placement in the ED I identified processes and practices within the department where improvements could be made. This was an opportunity for me to contribute to the development of a more efficient and effective department that would ultimately benefit patient experience and healthcare and I saw an opportunity to develop a QIP. Moreover, the ED staff welcomed my proposal to evaluate the department and appeared to be invested in the process.

1.6 Summary

This chapter provides an introduction to the dissertation. It sets out the context and rationale for the study, its aims and objectives and it introduces the concept of Quality Improvement and the Quality Improvement Plan. It

concludes by outlining the role of the student in the organisation and the project.

Chapter 2 reviews previous literature on Emergency Departments both within the international and Irish context. It explores the relationship between waiting times and overcrowding in ED's and its impact on the healthcare of patients. The chapter ends by examining international strategies in addressing the above issues.

Chapter 3 provides an overview of the methodology and methods used in carrying out the project.

Chapter 4 sets out the methods for evaluating the QIP.

Chapter 5 provides a discussion of the findings and draws a number of conclusions from the previous analysis and makes recommendations that would facilitate successful project outcomes.

Chapter 2.0 Literature Review

2.1 Introduction

This chapter aims to establish a conceptual framework within which the research data is analysed and interpreted. Section 2.2 outlines the research strategy used to identify the most relevant literature pertinent to the research topic. Section 2.3 sets out a number of themes identified within the international literature reviewed. It reviews a number of strategies utilized by numerous health care systems to address overcrowding and long waiting times. It introduces the concept of the 4 Hour Rule and it's relationship to patient waiting times within the emergency department setting. And finally this section discusses emergency departments within an Irish context. This segment provides a critical analysis of the salient factors relating to patient waiting times within the emergency department. Section 2.4 highlights the implications of the international research for the development of the quality improvement plan to reduce patient waiting times. The chapter concludes by summarising the main theories and writings in relation to emergency departments and in particular their relations to patient waiting times and their influence on patient care.

2.2 Search Strategy

To gather research papers for this topic I began with a broad search of the term 'reducing waiting times in Emergency Departments' through Google Scholar. This yielded a number of papers. The title and abstract of the papers were scanned through and a total of eight appropriate papers were downloaded. I further searched the literature through the RCSI library database. The first database that was searched was Pubmed. I began with a

mesh search of the phrase “emergency service hospital”. This lead to a free text search of the title/abstract of the following phrases; “emergency department” or “accident and emergency” or “A&E” or “emergency room” or “emergency service”. Another free text search was then conducted searching for any title/abstract containing the phrase “wait time*” or “waiting time*”. These two searches were then combined to narrow down the literature to the appropriate papers relating to the quality improvement plan.

To further focus the search I conduced another mesh search of the phrase “physician assistant” followed by a free text search of the following phrases, “physician assistant” or “physician associate” or “nurse practitioner” or “advanced nurse practitioner”. The earlier combined search of emergency department and wait times was then combined with the search for physician associate and nurse practitioner. This yielded a result of 78 papers.
Having read through the title and abstract of these papers further narrowing them down based on whether the information provided was in keeping with the quality improvement plan that was being conducted. Having checked the relevance of these papers there were a total of 20 papers that were imported to endnote.

This search was replicated in Scopus. I carried out the exact same search as above with the addition of one more search term, “fast track”. This resulted in a further 14 papers being imported to endnote.

The two searches from Pubmed and Scopus revealed a total of 31 papers. Again these were further narrowed down based on date and relevance to the quality improvement plan. I choose to include some articles as far back as 2000 as the physician associate position is a relatively new concept in Europe and there were not many articles published regarding them. Some of the data provided are from studies carried out in the United states and Australia. There were a total of 25 articles included in this literature review.

2.3 Review of themes

After reading through the literature there were four main themes that evolved. These included;

- Waiting times within the emergency department
- The optimum waiting time; the 4 Hour Rule
- Strategies used by emergency departments to reduce patient waiting times
- Emergency department, the Irish context

Each of the themes is discussed separately and finally how this will have an impact on the quality improvement plan that is being discussed for this dissertation.

2.3.1 – Emergency department waiting times

For patients attending an emergency department, long waiting times is still a chief complaint for most worldwide (Theunissen et al., 2014). In the United States there has been an enormous increase of 102.8 to 136.1

million patients attending emergencies department nationwide from 1999 – 2009 (Schuur and Venkatesh, 2012). According to Pines et al. (2011) emergency department crowding is a public health problem and results in long waiting times and delays in critical treatment for patients. Moreover, emergency department crowding is linked with a number of negative clinical outcomes such as increased complication rates and mortality (Pines et al., 2011). In addition, long waiting times can exacerbate the patients diagnosis and consequent treatment plan, as well as potentially increasing their length of stay in hospital (Singer et al., 2011). According to Kennedy et al. (2003) long waiting times can result in patients leaving the emergency department before being seen by a doctor which may lead to significant consequences for the patient's health.

Furthermore, research conducted by Guttman et al. (2011) showed that patients who attended the emergency department where their mean length of stay (LOS) was greater than 6 hours had a increased risk of 7-day death amongst those patients when discharged. Similarly, Singer et al. (2011) found that in the United States patient mortality increased by 2.8% when their LOS in the emergency department was up to 2 hours and increased to 4.5% when their LOS was over 12 hours.

This study also found a significant correlation between patient LOS in the emergency department and patient LOS in the hospital. It was found that a patient stay in the emergency department for 2 hours or less, resulted in a total LOS in the hospital of up to 5.6 days. This increased to an average of

8.7 days when a patient stay in the Emergency Department was for 24 hours or more. It was also showed that there was an increase in intensive care unit (ICU) admissions for patients who experienced long LOS in the Emergency Departments whilst waiting on a hospital bed (Singer et al., 2011).

2.3.2 - The optimum waiting period - 4 Hour Rule

In 2000 the English Prime Minister Tony Blair proposed the new National Health Service (NHS) Plan (Hughes, 2010). It was within this document that the new 4 Hour Rule was proposed whereby it was envisaged that no patient will be waiting any more than 4 hours from triage to discharge or admission (Department of Health, 2000). This was in response to increasing numbers of patients attending Emergency Departments and anecdotal reports of patients experiencing long waiting times, of 12 hours or more on trolleys prior to admission (Hughes, 2010). Moreover, it is recognised that long waiting times are associated with increased mortality, longer hospital stays and serve to complicate diagnosis and treatment plans (Singer et al., 2011, Pines et al., 2011, Guttman et al., 2011, Kennedy et al., 2003). The new proposal stated that the 4 hour target rule was to be achieved by 2004.

However the NHS Plan did not give direction in relation to how this was to be achieved and it was left to each hospital trust to implement whatever strategy they deemed suitable to achieve this target. The Department of Health used incentives to encourage trusts to achieve their targets. For

example, trusts that reached 98% of patients being treated and discharged or admitted within the 4 hour target were awarded up to £0.5 million in payments (Hughes, 2010). Many hospitals adapted various strategies to achieve their 4 hour target. These included hiring 600 new Emergency Department nurses, employing Emergency Nurse Practitioners to specifically assess patients with minor injuries, increase the number of consultants by 36%, upgrade hospital facilities, enhance streaming processes to separate minor and major cases and adopt a 'See and Treat' system whereby a highly trained clinician is able to treat patients immediately with minor injuries and discharge (Letham and Gray, 2012).

An evaluation of the 4 Hour Rule introduced by the NHS found that by 2007 97.7% of patients were re-assessed, treated and discharged within the target 4 hour period (Letham and Gray, 2012). Moreover, it was found that the reduced waiting times resulted in improvements in patient and carer experience (NHS England, 2013). Similarly, a study of the effectiveness of the 4 Hour Rule carried out between 2003 and 2006 found that there was an increase from 83.9% to 96.3% of patients being discharged within the target time. However it also showed that the volume of patients that were discharged from the Emergency Department in the last 20 minutes almost doubled, from 4.7% to 8.4% (Mason et al., 2012). Furthermore, a subsequent analysis in 2008 and 2009 showed that 40% of patients in the emergency department were discharged 20 minutes prior to the 4 hour target (Mason et al., 2010), a significant increase on the 2003-2006 figures. Thus suggesting that emergency departments may be

performing to the target but not necessarily improving overall care for patients as hoped (Mason et al., 2012).

The Australian government also made a decision to implement the 4 Hour Rule for Emergency Departments across all of its states in April 2010. Again, this was in an effort to address the continuing pressure on emergency departments as a result of increasing volumes of patients (Sullivan et al., 2015). Financial incentives in the form of additional funding to encourage success were also used. However, the Australian government had set their target at 90% of patients, as opposed to 98% in England, to be triaged and discharged within 4 hours (Sullivan et al., 2015). In addition the rate was gradually increased annually until the desired target of 90% was achieved and resulted in hospitals in each state achieving the target whilst not compromising patient care (Sullivan et al., 2015).

2.3.3 – Strategies employed to reduce emergency department wait times

Pines et al. (2011) has shown that long waiting times in emergency departments is not a universal issue. Denmark, Sweden and Holland have reported no emergency department overcrowding or long waiting times. One of the main reasons for their success is their robust primary care/prehospital care systems. In Holland they have a 24 hour 7 day a week general practitioner (GP) service available. Denmark, Sweden and Finland have urgent care centers where GP's treat the patients and refer

to an emergency department when necessary, and in Denmark their ambulances are staffed with physicians or nurse anesthetists who can treat and discharge a patient at the scene (Pines et al., 2011). In addition GP's in Scandinavia can arrange a direct admission to a specific inpatient department in the hospital, bypassing the emergency department altogether (Pines et al., 2011). These strategies have resulted in little to no overcrowding and reasonable turn around times in the Netherlands and Scandinavian emergency departments.

In contrast a number of European countries such as Ireland, UK, Poland, Italy as well the United States and Australia are grappling with emergency department overcrowding and long waiting times. In these countries it has increasingly become a high priority politically, socially and economically. As a consequence, a number of different strategies directly targeting emergency departments are currently being employed by health care systems to address overcrowding and long waiting times. These strategies include employing additional staff, redefining staff roles and responsibilities and introducing new systems of patient evaluation.

2.3.2.3 – The Medical Team Evaluation system

In a university hospital in Switzerland, Lauks et al. (2016) implemented a medical team evaluation (MTE) in an effort to reduce patient waiting times in the emergency department. This involved redesigning their patient flow process through the emergency department. With the MTE in place, patients presented directly to triage rooms located beside the doors of the

Emergency Department. The patients were then triaged immediately by an emergency room triage nurse or a physician. Within the triage rooms the nurse or doctor was able to use the new quick registration system to record the patients basic details (e.g. name, date of birth and gender). From this point, where you went next was based on the triage category you were given. In this study they used the emergency severity index (ESI), placing patients in a category from 1-5. Level 1 and 2 indicated a life saving/high risk category. Level 3 indicated an urgent category, level 4 patients were less urgent and level 5 patients were consider non urgent. Patients with a level 1 and 2 were sent directly to a resuscitation or emergency treatment area. For the remaining categories, it was the role of the nurse and physician to initiate investigations, treatment and discharge the non-urgent patients. Patients were sent directly to radiology or to the fast track area to see other clinicians.

In evaluating the study, data recorded pre implementation of the MTE and post implementation of the MTE was analysed. Results showed that overcrowding and waiting times for patients were reduced post implementation of the MTE. Post implementation of the MTE, 90% of patients were seen by a physician within 30 minutes of their arrival to the emergency department as opposed to 30% pre implementation of the MTE (Lauks et al., 2016). The new system seemed to have the biggest impact on patients who were triaged as a category ESI 4, less urgent patient. Their length of stay in the emergency department decreased significantly by 73%. The data found no significant difference for categories 1 and 2 as

they are life threatening cases and were seen immediately pre implementation of the MTE.

2.3.2.1 - The use of a Physician Associate or Advanced Nurse Practitioner in the emergency department.

Emergency departments worldwide have employed Advanced Practice Providers (APP's) such as Physician Associates/Assistants (PA's) and Advanced Nurse Practitioners (ANP's) to help combat the ever-growing number of patients attending the emergency departments (Myers et al., 2014, Jennings et al., 2008, Doan et al., 2012). PA's are highly trained clinicians that work under the supervision of a consultant/physician (Counselman et al., 2000b) while ANP's are also highly trained clinicians but work independently (Doetzel et al., 2016). PA's have been established clinicians in the USA for the past 50 years, in the UK for the past 11 years while the first cohort of PA's are set to graduate in Ireland in 2018. While APP's have been shown to help reduce patient waiting times and length of stay in the Emergency Department and provide a cost-effective way to increase the number of clinicians on their Emergency Department teams. Moreover, the NHS published a report in October 2017 regarding securing the workforce in Emergency Departments in England and has stated that they will invest in recruiting PA's for employment in emergency medicine (Health Education England et al., 2017).

Jennings et al. (2008) conducted a study in a major urban emergency department in Melbourne Australia, employing an emergency nurse practitioner to 'see and treat' patients to evaluate if it made any difference to patient waiting times and length of stay when compared to the traditional method of being seen by a physician. The results showed that patients seen by the emergency nurse practitioner waited only 12 minutes when compared to 31 minutes by the traditional method of a physician. The study also found that the length of stay in the emergency department lessened by 76 minutes when patients were seen by the emergency nurse practitioner (Jennings et al., 2008).

In another study Myers et al. (2014) suggest that not only is it beneficial to have APP's employed in the emergency department but that it is important to ensure that they are scheduled on at peak times. The study was conducted with existing APP's already employed in the emergency department focusing on staff scheduling instead. The results were able to identify two scheduling options that resulted in a 78% reduction in patient wait times. This study is particularly important as it clearly demonstrates the need to synchronise the timing of APP's work schedule to the department's peak patient time, to ensure a reduction in patient waiting times.

2.3.2.2 – A fast track system within the emergency department.

In an effort to reduce patient wait times in the emergency department many hospitals have opted to introduced a fast track system. This is a

system whereby minor complaints or low to moderate urgency cases are separated from major complaints and/or emergency cases, with the simple goal of improving patient flow and reducing patient waiting times in the emergency department (Theunissen et al., 2014). 68% of university-affiliated emergency departments in the United States use APP's to staff their fast track system (Counselman et al., 2000b).

A study by Theunissen et al. (2014) in a Dutch emergency department set out to see if there was a reduction in patient waiting times for those who attended the fast track system, which was lead by a PA. Their results not only showed a decrease of 68 minutes for low to moderate urgency patients but it also showed a reduction of 32 minutes in the urgent patient group. This finding was very significant as it highlighted the benefit of separating the two patient flows while also allowing for more efficient use of staff to treat patients with more urgent conditions.

Another study by Counselman et al. (2000a) explored patient satisfaction with attending a fast track system and being seen by a PA rather than a physician. Out of 111 patients, 88% were satisfied to be seen by the PA and not have to wait longer in the emergency department. The study also showed that there was an average length of stay of 72 minutes in the fast track system when compared to patients in the main treatment area of the emergency department.

2.3.4 Emergency Departments, the Irish context.

The Irish healthcare system consists of a two-tier system; public and private sectors. The public service is managed by the Health Service Executives (HSE) and provides free health care. The private sector is privately owned and patients attending such services are either self-payers or can use private health insurance. There are currently 29 public emergency departments on 28 hospital sites across Ireland (The Irish Association for Emergency Medicine). With regard to the public emergency department waiting times, Ireland has ranked as the worst country in Europe for emergency department waiting times according to the Euro Health Consumer index in 2015. See fig.1 below.

Figure 1 - Wait times for Emergency Departments in Europe 2016

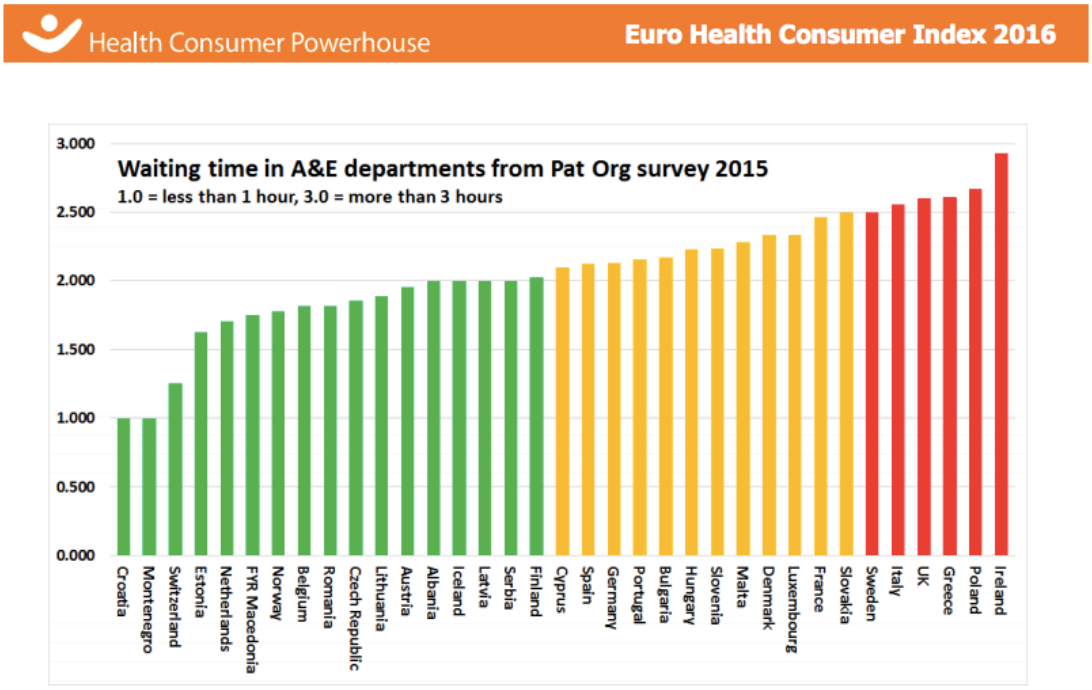


Figure 7.10.2.6 Survey responses on A&E department waiting times

Sources of data: Survey commissioned by HCP 2013. National healthcare agencies. Non-CUTS data.

In the private sector there are a total of 19 private hospitals. 5 of these hospitals have an Emergency Department and 4 have implemented

Medical Assessment Units (Private Hospital Associations, 2017). Unlike the public Emergency Departments which open twenty four hours a day, the private Emergency Departments only opens from 8 am and closing times vary from 17.00 to 18.00 pm, Monday to Sunday. Patients can be referred by their GP or attend as a self-referral. Public ambulances do not attend any private Emergency Departments. They do not accept any major trauma, strokes, acute mental illness or any obstetrics patients. Unfortunately I was unable to find any data regarding their waiting times in the Emergency Department. Their medical assessment units are similar to the private Emergency Departments except they only accept a patient who has been referred by their GP. As more and more patients turn to private health care as a means of being seen to more quickly, private health insurance in Ireland has soared from 2014 with 46% of the population purchasing private health insurance (Gleeson, 2016).

In The National Emergency Medicine Programme it has a target of six hours for patients to be seen and either discharged or admitted to the hospital (Health Service Executive, 2012). Long waiting times can hugely impact on patient safety. In the recent Sláintecare report published by the Houses of the Oireachtas (2017), they propose to reform the emergency department wait time to a new target of four hours, from triage to discharge or hospital admission . This new target is due to commence in Spring 2018 and gradually be implemented by 2023.

2.4 Implications for the project

A review of the literature indicates that long waiting times are still experienced in Emergency Departments worldwide. The literature emphasizes the adverse effects long waiting times in the Emergency Department can have on the patient's health. From increased mortality and higher complications rates to prolonged hospital admissions. Ireland ranked as the worst country in Europe for patient waiting times in the Emergency Department, further highlighting the need for change. The new guidelines published in the Sláintecare document of May 2017 states that Ireland will be implementing the 4 hour target from triage to discharge/admission gradually over the next ten years. With this new total Emergency Department target time in mind, ED's in both the private and the public will have to look at applying various strategies within their Emergency Departments to achieve this new target time.

Some of the strategies discussed have shown to reduce patient waiting times and could be adapted for this quality improvement plan. Jennings et al. (2008) showed that by utilizing advanced practice providers such as physician associates or advance nurse practitioners not only can you achieve a reduction in patient wait times but that it is also a very cost-effective way of achieving that goal. This is an aspect that could work extremely well in this quality improvement plan given the fact that there is an advanced nurse practitioner currently working in the emergency department of the rural private hospital. As seen from Lauks et al. (2016) in the Switzerland University hospital, redirecting existing staff to a new process can have a positive impact on patient waiting times. From the data

collected during the early stages of the quality improvement plan outlining the amount of minor complaints attending the emergency department, a fast track system would be an excellent way of further streamlining patient flow and reducing patient wait times.

2.5 Summary

Most countries have experienced an increase in the number of patients attending emergency departments and consequently long patient waiting times have ensued. In the United States alone there was been an enormous increase of 102.8 to 136.1 million patients attending emergencies department nationwide from 1999 – 2009. This has evidently become a huge public health problem resulting in increases in mortality, exacerbation of conditions leading to more complex treatments, increased length of stays in hospital and overall poor clinical outcomes. Scandinavia and the Netherland have not reported any issues with overcrowding or prolonged waiting times in their emergency departments. This seems to be a direct result of their efficient primary care system. GP's offer a twenty four hour service, nurse or physician lead help lines and urgent care centers where patients can attend for assessment. GP's can then refer to emergency departments or directly to a specific department within the hospital if specialist care is needed.

The UK and Australia have adopted a 4 Hour target from triage to discharge/admission for patients attending the Emergency Department in response to large numbers of patients experiencing long waiting times

within the department. This has seen some positive results with Australia achieving the 4 hour target for 90% of their patients by 2014 and 96.3% of patients in the UK by 2006. However in recent years it has been reported that 40% of patients in the UK have been discharged from the emergency department within the last twenty minutes of the 4 Hour target, suggesting that the target is being achieved, but on the other hand raises the question: has the quality of patient care been compromised?

Some countries throughout Europe, Australia and the United States have implemented various strategies to achieve a reduction in patient waiting times within the emergency department. For example, employing additional staff such as a Physician Associate or Advance Nurse Practitioner, implanting fast track systems to segregate minor injury cases from major case and redefining the roles of staff within the department. All of these strategies have shown promising results with emergency departments reporting reductions in patient waiting times.

Chapter 3.0 Methodology

3.1 Introduction

The following chapter will provide an overview of a selection of approaches to quality improvement and discuss the rationale for the use of the DMAIC (Define, Measure, Analyse, Improve and Control) model in sections 3.2 and 3.3 respectively. Section 3.4 provides details on how the area for quality improvement was identified and the tools used to highlight this using the DMAIC model based on data collected, making a compelling case for improvement. From the data collected, a quality improvement project plan is proposed which can ultimately reduce patient waiting times in the emergency department. This chapter will conclude with a summary of the pertinent findings.

3.2 Approaches to Quality Improvement

Quality improvement (QI) is a methodical approach to the examination of practice performance and efforts to enhance performance. QI within healthcare is the unity of healthcare professionals, patients and their families, payers, researchers and educators, with the combined goal of achieving better patient outcomes, improving system performances and enhancing professional development through implementing changes (Health Service Executive, 2016). The concept of QI derived in the manufacturing industries and has since been applied to many other settings, including healthcare. There are a variety of different approaches to QI, depending on what system or structure requires improvement. Some methods focus on improving flow while another may focus on variation

within a process - some methods combine both. Within this section different types of QI approaches will be examined.

3.2.1 – Lewin's Change Management Model

Lewin's model originates from the 1940's and is also referred to as the 'unfreeze, change, refreeze model' (Hussain et al., 2017). Lewin developed an analogy to the changing of the shape of a block of ice. In order to change the shape of the block of ice, it first needs to melt and be molded into its new shape and allowed to refreeze. See fig.2 for diagram. According to Lewin, this is exactly how the process of QI needs to occur in order for it to be successful.

Figure 2 - Lewin's Change Management Model

This is a three-step process (Manktelow et al., 2017). The first step involves motivating staff to acknowledge and accept the need for an improvement. Sales data, performance indictors and patient satisfaction surveys are important visual tools in the formulation of a compelling case for a QI project. Motivation and investment from staff is key for success. The second step in this process is the implementation of change. Within this section of the process, clear and open communication is essential. Change can bring uncertainty and a resistance to a new way of doing

things. By engaging people within the process, it empowers positive action. Time is another crucial segment of this stage, as change does not occur overnight. The third and final step of Lewin's change management module is the re-freeze process. This is where the changes are anchored within the company. To ensure that the new change is sustained, feedback to staff regarding progression and success is vital (Manktelow et al., 2017).

3.2.2 – Lean

The concept of the Lean process within QI focuses on value for the customer. While examining the process and outcomes for the customer, non-added value or waste is measured. The aim of the Lean process is to eliminate waste and increase value for the customer. In order for Lean to be successful it requires the active participation of all staff across all levels of employment, from top to bottom of a given hierarchy. Lean encourages every employee to be attentive in identifying waste and poor quality. In a healthcare setting Lean has been successful in improving patient flow through services, eliminating non-added value to the patients journey.

3.2.3 – Six Sigma

Six Sigma is a fact-based, data driven process that examines variation within a system, attempting to reduce errors to six standard deviations within a normal distribution (Kuwaiti and Subbarayalu, 2017). In healthcare for example, Six Sigma has been employed in the elimination of errors in medication distribution and improvement of hand hygiene. Lean and Six

Sigma are frequently used in combination, as more often than not the flow of a process can result in variations in a specific task.

3.2.4 – DMAIC

DMAIC is a model of QI that combines both Lean and Six Sigma tools. It provides a structured framework to examine both process flow and variation within a specific area (Kuwaiti and Subbarayalu, 2017). There are five steps to the DMAIC model, see fig.3 below for steps. Each step provides the foundation for the next step.

Figure 3 - DMAIC Steps

The process begins with defining the area for QI. There are various tools that can be applied to visualise the current process and identify the area for improvement. For example, using a stakeholder analysis to highlight key personnel whose input will be vital for the success of the project, process flow maps allow all involved to visualize the reality of the patient's journey verses personnel's perception of the process. Within this first step, the problem is defined and the aims are established. Measure is the next step in the DMAIC model. This section allows the team and project coordinator to gather data around the selected area. This step is pivotal in the QI process as it identifies the area for improvement.

The analysis step permits the team to identify the cause of the problem. Using tools such as the 5 whys, fishbone diagrams and waste identification can aid the team in the establishment of the root cause. Once the root cause is established the team can begin the process of brainstorming on the improvement and initiate the implementation of the QI. After the improvement/solution has been identified and implemented, the control step is critical to sustaining the new change. It is important to measure the progression of the new process and ensure that the changes that have been implemented are impacting positively. The new plan needs to be communicated with all staff and success needs to be celebrated.

3.3 Rationale for the Model Selected

DMAIC was the model selected for this quality improvement project. The reason for the selection of this particular model was for its facilitation of a structured framework to identify specific areas that required improvement. The DMAIC model allowed the writer to identify all of the factors that contributed to long wait times for patients attending the emergency department, highlighting one particular area to focus on. The DMAIC model then provided the writer with the tools to measure and analyze the problem and develop a new plan to improve patient wait times. Within the DMAIC model, Lean and Six Sigma improvement methods were also incorporated in solving some of the issues that arose.

3.4 DMAIC Model Overview

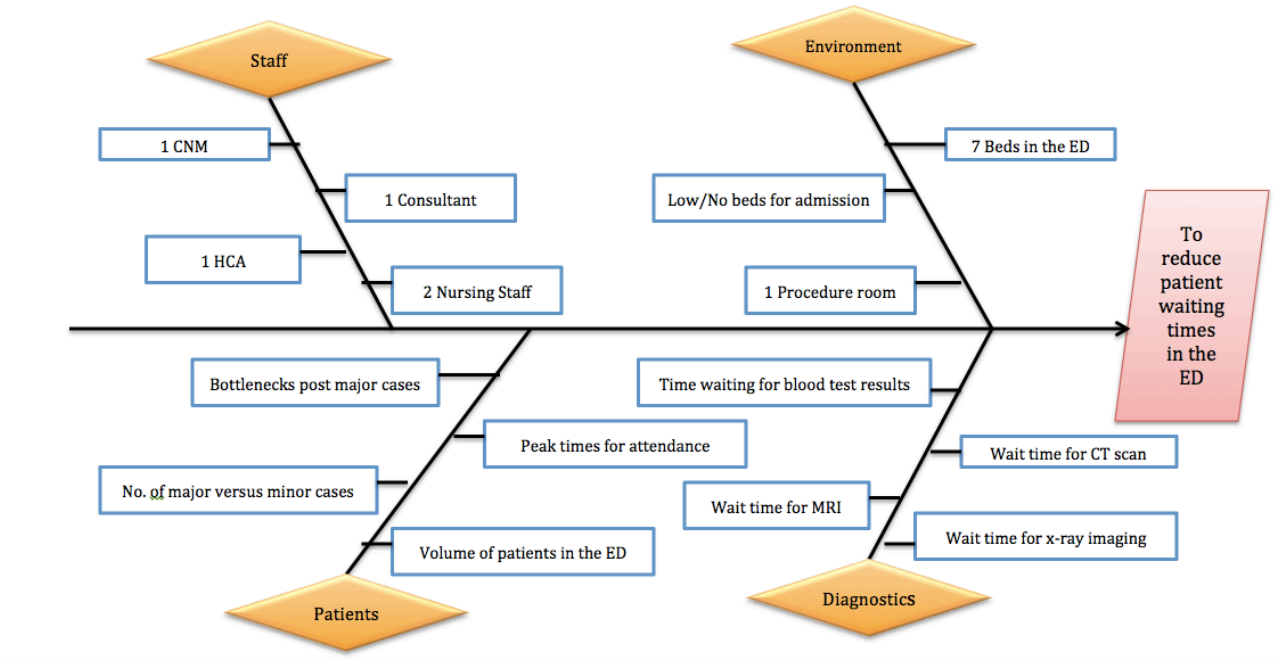
3.4.1 Define:

The quality project plan was carried out during a three-week placement period in the emergency department of a private hospital. Within a short period of time it became evident that delays in waiting times to see the consultant was an issue for both patients and staff alike. Both the consultant and nursing staff expressed concerns regarding this issue. It was noticed that there was only one consultant employed in the emergency department, alongside one clinical nurse manger, two nursing staff and one health care assistant. Patients attending the emergency department were triaged by the nursing staff using the Manchester Triage System. Patients were grouped into Emergency/Resuscitation cases, Major cases and Minor cases. The expectations of the emergency department are that patients arriving would be triaged within 15 minutes. This step in the patient's journey appeared to be operating effectively.

3.4.1.2 Fishbone tool

In order to define the area where the quality improvement plan is needed, all the factors that were influencing the long patient wait times need to be explored. The writer, consultant, nursing staff, health care assistants and administration staff devised a list of factors that they considered to affect patient waiting times. This was displayed on a fishbone diagram, so everybody could visualise the problem areas. See fig.4 below for the results.

Figure 4 - Fishbone Diagram



Key: CNM = Clinical nurse manager, HCA = Health care assistant, ED = emergency department, No. = number

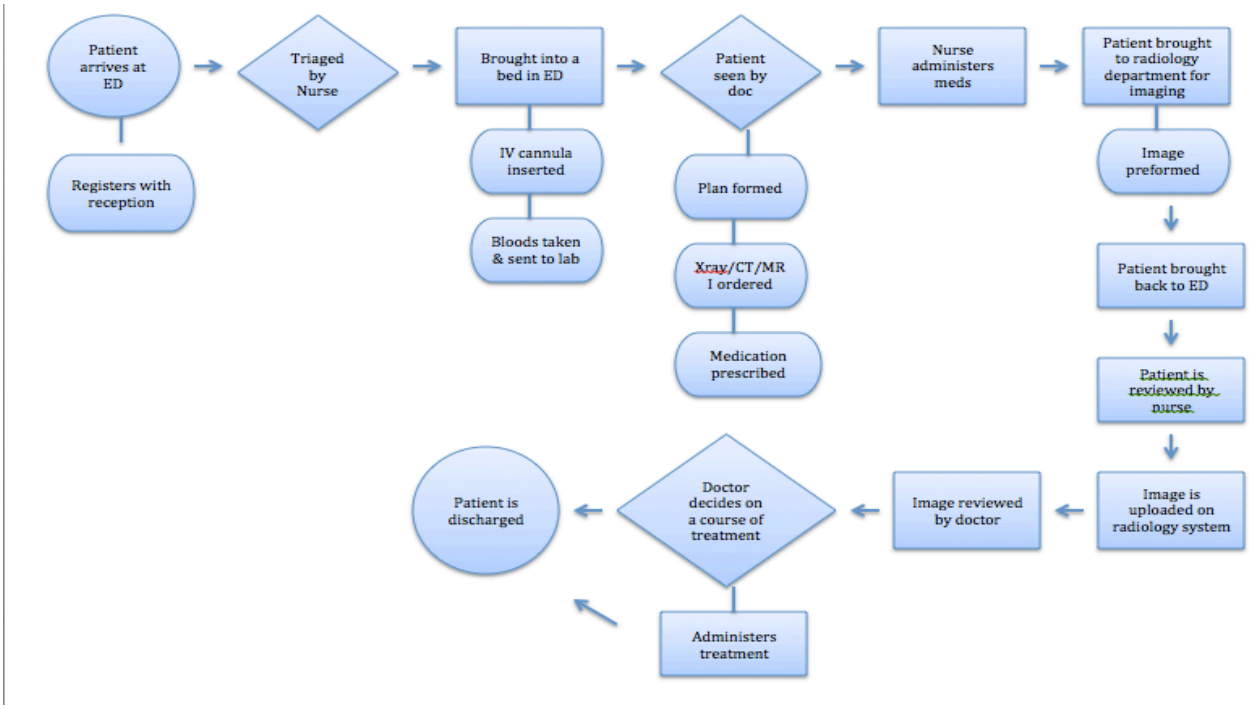
There are a variety of factors within the environment that were not possible to change. For example, there was no option to create more rooms within the emergency department. In order to establish the biggest impact on patient waiting times and what would be achievable for this quality improvement plan, we needed to further explore the areas identified in fig.4.

3.4.1.3 Process flow map

The next quality improvement tool used to visualize factors influencing long patient wait times was to compile a process map of the patient's journey through the emergency department. This allowed the writer to view the

patient's journey from the patient's perspective. A patient was randomly selected as they entered the emergency department and their journey documented. See fig.5 for the process flow map.

Figure 5 - Process Flow Map



Key:

Represents the start & end of the patients journey

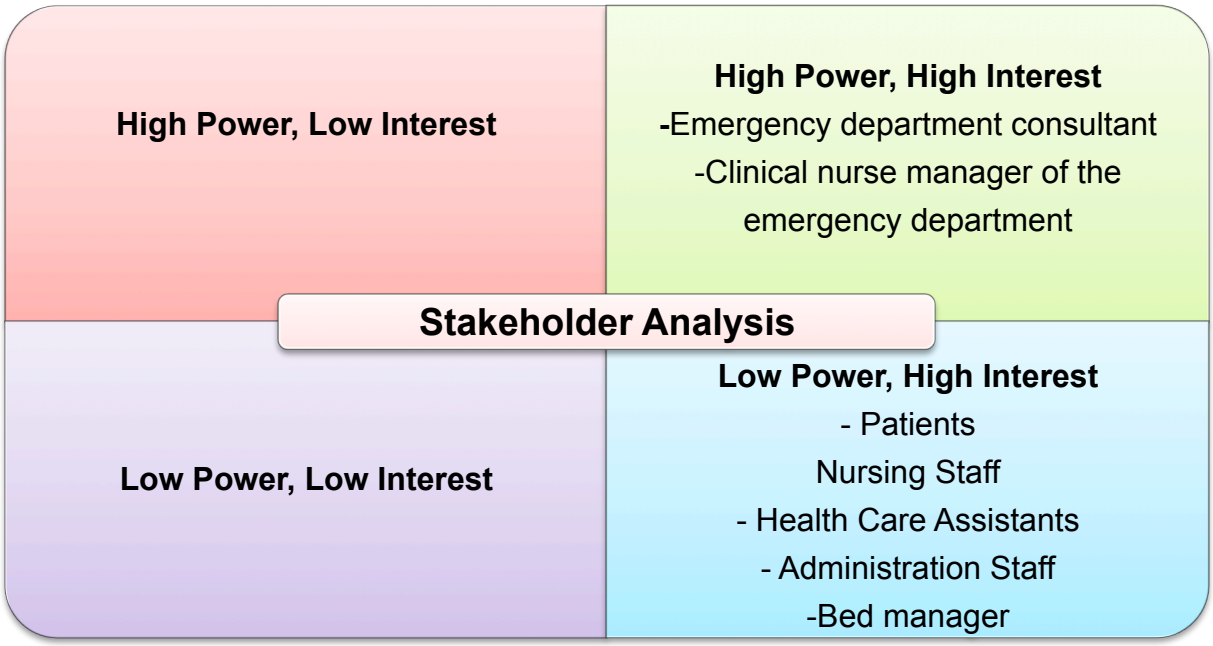
Represents a clinical decisions

Represents a process

3.4.1.4 Stakeholder analysis

Finally, identifying key stakeholders is another important tool that was used in this project. It is vital to the success of the project plan that all essential staff are identified. The completed stakeholder analysis can be seen below in fig.6 below.

Figure 6 - Stakeholder Analysis



The patients attending the ED are the key stakeholders and are the focus of the QIP. Although they have a high interest in improving the wait times in the ED they are very limited in what they can do to achieve this. It is for this reason that they are in the low power, high interest category.

The two driving forces behind this quality improvement plan were the emergency department consultant and also the clinical nurse manger. They were the two stakeholders who initially had highlighted their concerns over patient delays and were eager to engage with the quality improvement plan to improve the patients waiting times and also their level of satisfaction. They have the ability to implement change, which is why they have been identified as key stakeholders.

The nursing staff, health care assistants and administration staff also expressed their concerns and the need for change. These are frontline staff members who are in constant contact with the patients throughout their journey. They are some of the first people that patients complain to regarding the long waiting times, whether it is to see the consultant, waiting for tests to happen or awaiting test results. They are keen to help try and move things along but unfortunately they are limited in what they can do. It is for this reason that they were grouped as low power, high interest stakeholders.

The bed manager is somebody that I identified as someone of low power, high interest. Every morning the ED is contacted by the bed manger to inform them of the amount of beds they have available to admit patients to the hospital. The availability of beds directly effects the waiting times for patients in the emergency department. The ED consultant has to allocate the available bed to the sickest patient and ensure the other patients are safe to discharge or make the decision to transfer the patient to another hospital with beds available. This can mean that the patients will spend the day in the ED to monitor their condition and make a decision as how best to proceed with their care.

3.4.2 Measure

Data Collection:

In order to confirm long patient wait times were occurring, data was collected over a five-day (mid-week) period. There were a total of 111 patients included.

The hospital electronically documented the time the patient registered with reception, the time they were triaged, what category of the Manchester triage system they were put into and the time they were discharged from the emergency department (meaning they were either admitted to hospital, referred to another hospital or completely discharged from care). The times the patient saw the consultant were not documented electronically. This is the information was gathered manually by the writer. This allowed the calculation of the time difference at various aspects of the patient's journey and allowed the writer to see where the biggest wait times were. See table 1 below for an example of one day of data collection. See appendix 1 for the complete set of data collected. Table 2 displays the average time results for major cases in three categories; average time from triage to time seen by the doctor, average time from the time seen by the doctor until discharge and the average time from triage to discharge. Table 3 displays the average time results for the minor cases within the same categories.

Anomalies with the data:

While collecting the data, there was a system update in the hospital on the first day. Some of the check in times and three discharge times were not recorded. On some of the data it can be noted that the patients triage time happened before they even check in with reception. This occurred as some of the patients were unwell and were triaged first and registered with reception later, or at the same time by a family member. The data was only collected while the writer was on placement during the week (Wednesday, Thursday,

Friday, Monday and Tuesday). No weekend data will be included in this research.

Data details:

Table 1 - Data collected in the ED on 01/03/17

	Date	Check In Time	Triage Time	Time Doc Seen	Time dif (Triage - Doc)	Discharge Time	Time Dif (Doc- DC)	Time Dif (Triage - DC)	Category of Injury
1	01/03/17	08.12 am	8.25 am	9.30 am	1hr 5 mins (65 mins)	18.44 pm	9 hrs 14 mins (554 mins)	10hrs 19 min (619 mins)	Major - Shoulder pain
2	01/03/17	09.20 am	09.30 am	10.45 am	1.15 mins (75mins)	13.53 pm	3 hrs 8 mins (188 mins)	4 hrs 23 mins (263 mins)	Major - Feeling unwell
3	01/03/17		11.47 am	15.02 pm	3.15 mins (195 mins)	16.04 pm	1 hr 2 mins (62 mins)	3 hrs 17 mins (197 mins)	Major - Uro sepsis
4	01/03/17		9.50 am	11.50 am	1 hour (60 mins)	12.17 pm	27 mins	2 hrs 17 mins (137 mins)	Minor - Swollen Knee
5	01/03/17	10.13 am	10.20 am	10.34 am	14 mins	14.28 pm	3 hrs 52 mins (234 mins)	4 hrs 8 mins (248 mins)	Minor - Right foot injury
6	01/03/17	10.36 am	10.40 am	13.30 pm	2.50 mins (170 mins)	14.11 pm	41 mins	3 hrs 31 mins (211 min)	Minor - Back pain
7	01/03/17	10.42 am	10.55 am	14.10 pm	3.05 mins (185 mins)	14.33 pm	23 mins	3 hrs 38 mins (218 mins)	Minor - Shoulder Abscess
8	01/03/17	10.56 am	11.05 am	15.30 pm	4.25 mins (305 mins)	17.15 pm	1 hr 45 mins (105 mins)	6 hrs 10 mins (370 mins)	Minor - Back Pain
9	01/03/17	11.06 am	11.10 am	14.50 pm	3.40 mins (220 mins)	Admitted	ADMITTED	ADMITTED	Major - Pneumonia
10	01/03/17		12.00 noon	12.30 pm	30 mins	13.00 pm	30 mins	60 mins	Minor - Hand Laceration
11	01/03/17	12.32 pm	12.40 pm	16.50 pm	4.10 mins (250 mins)	17.13 pm	23 mins	4 hrs 33 mins (273 mins)	Minor - Back and Arm pain
12	01/03/17	12.39 am	12.50 pm	17.05 pm	4.15 mins (255 mins)	17.31 pm	26 mins	4 hrs 41 mins (281 mins)	Major - Abdo pain
13	01/03/17	12.45 pm	13.00 pm	15.51 pm	2.51 mins (271 mins)	19.13 pm	3 hrs 22 mins (202 mins)	6 hrs 13 mins (373 mins)	Major
14	01/03/17	13.10 pm	13.20 pm	16.04 pm	2.44 mins (164 mins)	Admitted	ADMITTED	ADMITTED	Major - Appendix
15	01/03/17	13.05 pm	14.10 pm	18.30 pm	4.20 mins (260 mins)	19.36 pm	1 hr 6 mins (66 mins)	5 hrs 26 mins (326 mins)	Minor - Abdo pain
16	01/03/17	14.48 pm	15.00 pm	DNW	DNW	18.55 pm	DNW	3.55 mins (235 mins)	Minor - Leg pain
17	01/03/17		15.20 pm	19.15 pm	3.55 mins (235 mins)	19.54 pm	39 mins	4 hrs 34 mins (274 mins)	Minor - Pre syncope
18	01/03/17	15.24 pm	14.40 pm	16.14 pm	1.34 mins (94 mins)	18.48 pm	2 hrs 34 mins (154 mins)	5 hrs 8 mins (308 mins)	Minor - Headache
19	01/03/17		16.00 pm	19.10 pm	3.10 mins (250 mins)				Minor - Ankle injury
20	01/03/17		16.20 pm	20.00 pm	3.40 mins (220 mins)	Admitted	ADMITTED	ADMITTED	Minor Dizziness
21	01/03/17	16.20 pm	16.30 pm	16.50 pm	20 mins	18.21 pm	1 hr 31mins (91mins)	1 hr 51 mins (111 mins)	Minor - Swollen finger
22	01/03/17		16.40 pm	20.32 pm	3.52 mins (332 mins)				Minor - Head Laceration
23	01/03/17		17.00 pm	17.43 pm	43 mins				Major - Numbness to groin

Data Key: dif = difference, DC = discharged, DNW = Did not wait, Hrs = hours, Mins = minutes

Table 2 - Average results for major cases

Day	Average wait time from triage to see the doctor	Average wait time from time seen by doctor to discharge	Average wait time from triage to discharge
01/03/17	Major case: 161 mins/ 2 hrs 41 mins	Major case: 206 mins/ 3 hrs 26 mins	Major case: 347 mins/ 5 hrs 47 mins
02/03/17	Major case: 116 mins/ 1 hr 56 mins	Major case: 154 mins/ 2 hrs 34 mins	Major case: 286 mins/ 4 hrs 46 mins
03/03/17	Major case: 104 mins/ 1 hr 44 mins	Major case: 280 mins/ 4 hrs 40 mins	Major case: 366 mins/ 6 hrs 6 mins
06/03/17	Major case: 124 mins/ 2 hrs 4 mins	Major case: 180 mins/ 3 hrs	Major case: 301 mins/ 5 hrs 1 min

07/03/17	Major case: 177 mins/ 2 hrs 57 mins	Major case: 158 mins/ 2 hrs 38 mins	Major case: 339 mins/ 5 hrs 39 mins

Table 3 - Average results for minor cases

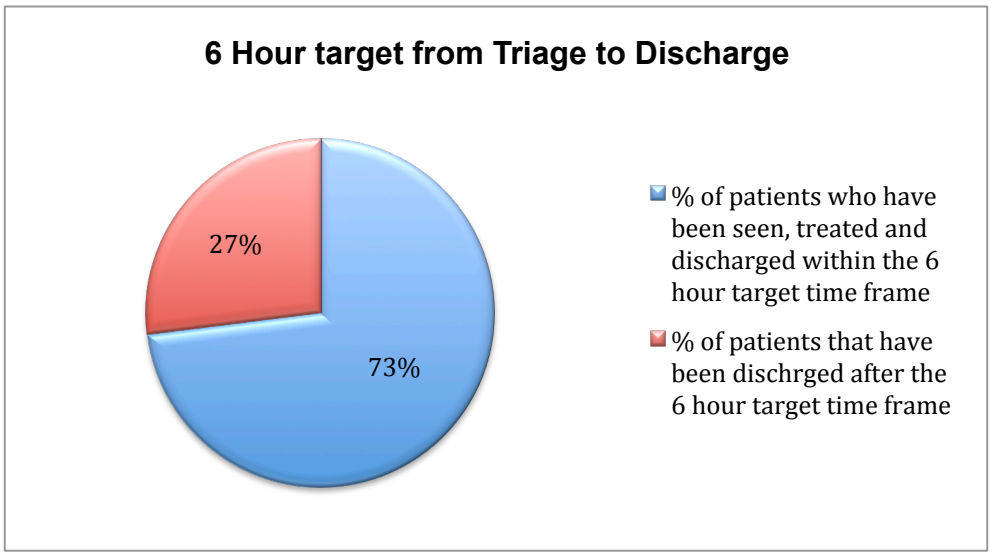
Day	Average wait time from triage to see the doctor	Average wait time from time seen by doctor to discharge	Average wait time from triage to discharge
01/03/17	Minor case: 173 mins/ 1hr 56 mins	Minor case: 76 mins/ 1 hr 16 mins	Minor case: 231 mins/ 3 hrs 51 mins
02/03/17	Minor case: 138 mins/ 2 hrs 18 mins	Minor case: 106 mins/ 1 hr 46 mins	Minor case: 245 mins/ 4 hrs 5 mins
03/03/17	Minor case: 83 mins/ 1 hr 23 mins	Minor case: 146 mins/ 2 hrs 26 mins	Minor case: 221 mins/ 3 hrs 41 mins
06/03/17	Minor case: 129 mins/ 2 hrs 9 mins	Minor case: 219 mins/ 3 hrs 39 mins	Minors case: 370 mins/ 6 hrs 10 mins
07/03/17	Minor case: 229 mins/ 3 hrs 49 mins	Minor case: 141 mins/ 2 hrs 21 mins	Minor case: 367 mins/ 6 hrs 7 mins

3.4.3 Analyze

Firstly, the 6 Hour Rule (a total of six hours from triage to discharge for patients attending the emergency department) was applied to the data and the average time spent in the emergency department for both major and minor cases was calculated. From this information, it was discovered that the average total time spent in the emergency department was above the target time for three out of the five days. Secondly, the total number of patients waiting over six hours from triage to discharge was checked. It showed that over 27% of patients were waiting longer than six hours. These results are

displayed on a pie chart, see fig.7. Finally, the information was further broken down into major/minor categories to see which groups were waiting longer. There were a total of 20 major cases and 10 minor cases over the five days waiting over six hours.

Figure 7 - Results from triage to discharge, a 6 Hour target



In May 2017, the Houses of the Oireachtas released a new guideline in the Sláintecare (Houses of the Oireachtas, 2017) document stating patients should be seen and admitted or discharged from the emergency department within 4 hours. The new guideline was applied to the data in order to investigate if there was any significant impact on the results. It showed that a total of 51% of patients who attended the emergency department were waiting over four hours from triage time to discharge. This was analysed into 31 major cases and 26 minor cases over the five day period. See results in fig.8. Upon closer look at the data it was discovered that 14% of patients were actually waiting over four hours to see the consultant. See results in fig.8. The

categories of these patients were examined and it showed that 8 of the patients were major cases and 8 patients were minor cases.

Figure 8 - Results from triage to discharge, a 4 Hour target

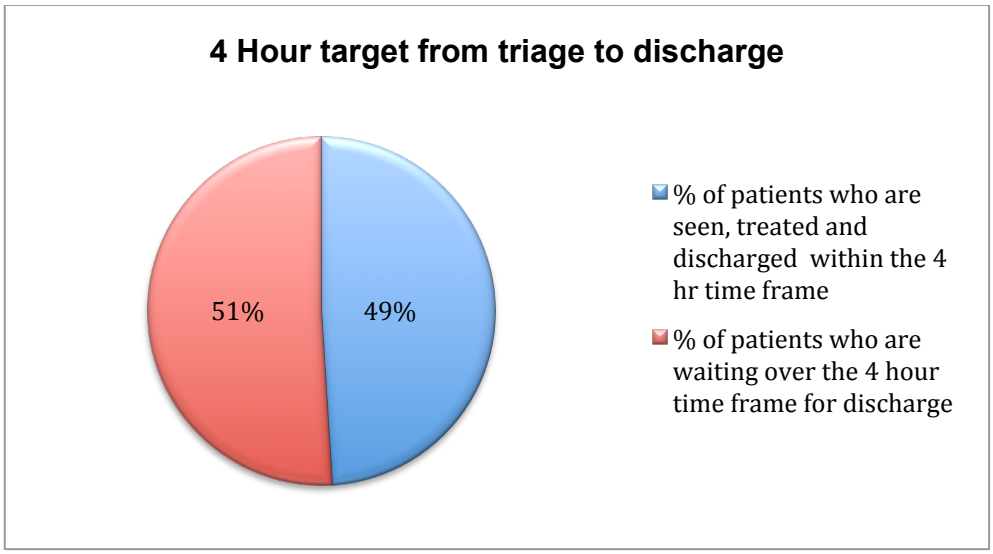
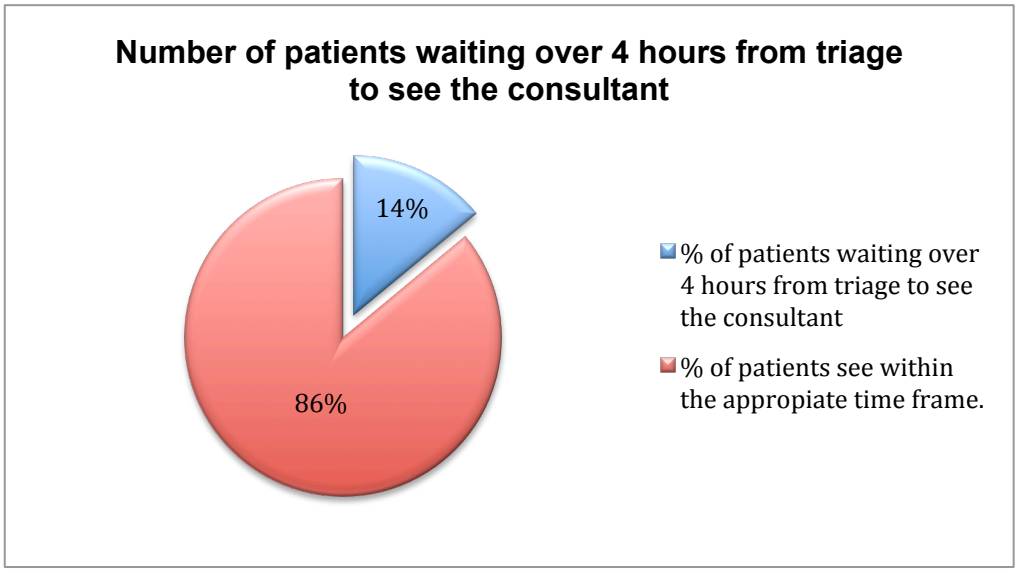


Figure 9 - Results for the number of patients waiting over 4 Hours from Triage to see the Consultant



At this point the writer referred back to the earlier fishbone diagram to check what factors the staff considered to be contributing to patient delays, see fig.4. It was decided to investigate whether imaging delays were impacting on patient waiting times. The writer retrospectively examined the radiology imaging system to record what type of image was requested, what time it was taken and what time the report was made available. This was done for two randomly selected days out of the five days. See table 4 below for data collected. There was an average wait of 1 hour 12 minutes from the time an x-ray image was ordered to the time the image was taken. And an average time of 23 minutes from the time the x-ray image was taken to the time the official report was uploaded onto the radiology system. For CT imaging, there was an average of 2 hours 20 minutes wait from the time the image was ordered to the time the image was taken. There was an average of 53 minutes then for the report to be uploaded onto the radiology system after the image was taken. The radiology department had the availability for one MRI image a day from the Emergency Department. Most patients were actually discharged from care once it was deemed safe to do so and brought back at a later date for their scheduled MRI image. The average time for the official MRI report to be made available on the radiology system is approximately 4 hours 47 minutes. The consultant then contacts the patient with the results by phone and any necessary follow up care or referrals were also arranged.

The writer also retrospectively looked at whether blood test results were having an impact on patient waiting times. One day was selected at random and the times the laboratory started to process the blood sample were taken

and the times in which the results were uploaded onto the system were also recorded. The bloods included full blood counts, CRP, d-dimers, troponin's, urea and electrolytes, thyroid function tests and an amylase. The average time from the time the laboratory began processing the sample to the time the result was uploaded onto the system was 25 minutes. There was also a system in place where the laboratory called the emergency department with any worrying results, e.g. elevated troponin level or elevated d-dimer.

The writer does not believe that waiting for imaging or laboratory test results are having a significant impact on patient waiting time in the emergency department.

Table 4 - Radiological data collected in the ED

Date	Image type	Time image was ordered at	Time image was taken at	Time dif order-image	Time image reporte	Time dif between image and report
03.03.17	Xray elblow	9:45:00	10:40:00	0:55:00	12:23:00	1:43:00
03.03.17	CXR	ICU portable	18:04:00		19:15:00	1:11:00
03.03.17	MRI taken on 6th	3 days	9:00:00		21:24:00	12:24:00
03.03.17	CTPA	11:10:00	13:18:00	2:08:00	13:28:00	0:10:00
03.03.17	CT TAP	11:40:00	14:50:00	3:10:00	16:08:00	1:18:00
03.03.17	CXR	12:30:00	13:06:00	0:36:00	13:13:00	0:07:00
03.03.17	Abdo Xray	15:55:00	16:37:00	0:42:00	16:43:00	0:06:00
03.03.17	Pelvic Xray	13:10:00	14:49:00	1:39:00	15:10:00	0:21:00
03.03.17	CXR	14:50:00	19:18:00	4:28:00	19:23:00	0:05:00
03.03.17	CT TAP	15:55:00	18:17:00	2:22:00	18:29:00	0:12:00
03.03.17	CXR	16:20:00	16:48:00	0:28:00	16:56:00	0:08:00
03.03.17	CXR	17:10:00	18:39:00	1:29:00	18:41:00	0:02:00
07.03.17	CXR	10:00:00	10:46:00	0:46:00	10:56:00	0:10:00
07.03.17	MRI Lumbar spine	11:00:00	9:58:00		11:48:00	1:50:00
07.03.17	CXR	11:25:00	11:58:00	0:33:00	12:03:00	0:05:00
07.03.17	CT Aortic arch	11:15:00	12:30:00	1:15:00	13:05:00	0:35:00
07.03.17	CT Brain	13:00:00	14:28:00	1:28:00	15:35:00	1:07:00
07.03.17	CT TAP on 8th	1 day previous	13:50:00		15:40:00	1:50:00
07.03.17	CT Abdo + Pelvis	17:45:00	19:05:00	1:20:00	19:37:00	0:32:00
07.03.17	CT TAP on 8th	1 day previous	9:24:00		10:23:00	0:59:00
07.03.17	CT Abdo + Pelvis on 9th	2 days previous	11:26:00		12:09:00	0:43:00
07.03.17	MRI Foot on 15th	8 days previous	14:10:00		19:30:00	5:20:00
07.03.17	MRI Lumbar spine	12:20:00	13:45:00	1:25:00	14:54:00	1:09:00
07.03.17	CT Abdo + Pelvis on 8th	1 day previous	13:27:00		13:46:00	0:19:00
07.03.17	CT Abdo + Pelvis on 8th	1 day previous	13:40:00		15:46:00	2:06:00
07.03.17	CXR	14:35:00	16:15:00	1:40:00	16:31:00	0:16:00
07.03.17	MRI Brain on 10th	3 days previous	16:06:00		19:17:00	3:11:00

Again, the fishbone diagram was consulted to check factors such as the times patients attend the Emergency Department, bottlenecks, and the amount of major cases versus minor cases in order to show if any of these could be

identified as a component of long patient delays. The main focus was on the 14% of patients who were waiting over the 4 Hour timeline from triage to see the consultant. It was noted that all of these waiting times occurred between the hours of 11.00 am and 14.20 pm. See table 5 below for an example of data collected on the 07/03/17. This would indicate that there is an issue around mid morning/lunch time for patients delays due to the fact that there is only one consultant employed here.

The categories of the cases were also looked at. On the 01/03/17 the cases preceding the first 4 Hour delay were mixed of both major (3 cases) and minors (4 cases). On the 06/03/17 the cases were both mixed between majors (4 cases) and minors (5 cases). On the 07/03/17 the majority of cases were majors (7 cases) with one minor case. There was also an emergency case preceding the first patient waiting over 4 hours from triage to see the consultant. However the consultant saw this case, which was a suspected stroke, within 20 minutes and the patient was transferred to the public emergency department with a stroke unit. At 12.20 pm another emergency case attended the emergency department. This patient had an emergency spinal cord condition called a cauda equina. This case caused significant delays for lower acuity patients already awaiting consultant review.

Table 5 – Patient numbers waiting more than 4 Hours to see the Consultant after triage.

1	07/03/17	8.12 am	8.15 am	10.00 am	1.45 mins (105 mins)	Admitted	ADMITTED	ADMITTED	Major - Chest Pain
2	07/03/17	9.12 am	9.10 am	11.00 am	1.50 mins (110 mins)	17.18 am	6 hrs 18 mins (378 mins)	8 hrs 8 mins (488 mins)	Minor - Back pain
3	07/03/17	9.56 am	10.00 am	11.25 am	1.25 mins (85 mins)	12.22 pm	57 mins	2 hrs 22 mins (142 mins)	Major - Dizziness and SOB
4	07/03/17	10.01 am	10.00 am	10.15 am	15 mins	10.54 am	39 mins	54 mins	Major - Dysuria
5	07/03/17	10.07 am	10.05 am	11.15am	1.10 mins (70 mins)	19.54 pm	8 hrs 39 mins (519 mins)	9 hrs 49 mins (589 mins)	Major - Head injury
6	07/03/17	10.14 am	10.30 am	13.00 pm	2.30 mins (150 mins)	19.23 pm	6 hrs 23 mins (383 mins)	8 hrs 53 mins (533 mins)	Major - Back/Neck pain
7	07/03/17	10.25 am	10.20 am	10.30 am	10 mins	12.23 pm	1 hr 53 mins (113 mins)	2 hrs 3 mins (123 mins)	Major - STAFF - splash of bloo
8	07/03/17	10.31am	10.30 am	10.50 am	20 mins	11.00 am	10 mins	30 mins	Emergency Stroke - Ambo to
9	07/03/17	10.35 am	10.40 am	14.00 pm	3.20 mins (200 mins)	17.50 pm - admitted	ADMITTED	ADMITTED	Major - Nausea + Vomiting
10	07/03/17	10.41 am	10.45 am	17.45 pm	7.00 hrs (420 mins)	20.22 pm	2 hrs 27 mins (147 mins)	9 hrs 37 mins (577 mins)	Major - Abdominal pain
11	07/03/17	11.03 am	11.15 am	18.15 pm	7.00 hrs (420 mins)	19.13 pm	58 mins	7 hrs 58 mins (478 mins)	Major - Headache
12	07/03/17	11.10 am	11.10 am	15.30 pm	4.20 mins (260 mins)	18.15 pm	2 hrs 45 mins (165 mins)	7 hrs 5 mins (425 mins)	Minor - Ankle fracture?
13	07/03/17	11.26 am	11.30 am	19.15 pm	7.45 mins (465 mins)	19.50 pm	35 mins	8 hrs 20 mins (500 mins	Major - Rectal pain (R 8th for
14	07/03/17	11.38 am	11.50 am	12.30 pm	40 mins	18.00 pm	5 hrs 30 mins (330 min)	7 hrs 10 mins (430 mins)	Major - Urinary retention post
15	07/03/17	12.01 pm	12.00 pm	16.15 pm	4.15 mins (255 mins)	16.34 pm	19 mins	4hrs 34 mins (274 mins)	Minor - Foot injury
16	07/03/17	12.09 pm	12.10 pm	DNW	5.50 mins (DNW)	18.00 pm	DNW to see DOC	5 hrs 50 mins (350 mins)	Minor - injury to both wrists
17	07/03/17	12.18 pm	12.30 pm	18.35 pm	6.05 mins (365 mins)	19.18 pm	43 mins	6 hrs 48 mins (408 mins)	Major - Abdominal pain
18	07/03/17	12.18 pm	12.20 pm	12.20 pm	(seen immediately)	Admitted	ADMITTED	ADMITTED	Emergency - Cauda Equina
19	07/03/17	12.23 pm	12.45 pm	18.15 pm	5.30 mins (330 mins)	19.43 pm	1 hr 28 mins (88 mins)	6 hrs 58 mins (418 mins)	Minor - Right hand pain
20	07/03/17	13.30 pm	13.35 pm	Sent straight to eye and ear. Doc seen in triage			Sent straight to eye and ear. Doc seen in triage		Minor - Piece of food stuck in
21	07/03/17	14.22 pm	14.30 pm	15.00 pm	30 mins	18.19 pm	3 hrs 19 mins (199 mins)	3 hrs 49 mins (229 mins)	Major - Headache
22	07/03/17	14.29 pm	14.35 pm	19.30 pm	4.55 mins (295 mins)	20.30 pm	60 mins	5 hrs 55 mins (355 mins)	Major - Pleuritic pain in Chest
23	07/03/17	15.24 pm	15.30 pm	15.45 pm	15 mins	18.09 pm	2 hrs 24 mins (144 mins)	2 hrs 39 mins (159 mins)	Major - Confused/ Infection?
24	07/03/17	15.31 pm	16.00 pm	Sent to public ED from Triage			Sent to public ED from Triage		Major - Dizziness
25	07/03/17	15.48 pm	15.50 pm	19.00 pm	3.10 mins (190 mins)	19.54 pm	54 mins	4 hrs 4 mins (244 mins)	Minor - Pain in Left lower leg
26	07/03/17	16.14 pm	16.30 pm	18.00 pm	1.30 mins (90 mins)	19.24 pm	1 hr 24 mins (84 mins)	2 hrs 54mins (174 mins)	Major - Balance issue

Note: The orange rows highlight the number of patients waiting over 4 hours to see the doctor. The first grey column represents the time difference from triage to time seen by the doctor.

3.4.4 – Improve

Based on the above results it was chosen to try and improve the patient waiting times for the 14% of patients who are waiting over 4 hours to see a consultant from triage time. This is a vital step in trying to achieve the new target time of a total of 4 hours from triage to discharge as outlined by the Houses of the Oireachtas in the May 2017 Sláintecare report. Discussions were held with the stakeholders regarding changes that need to occur to achieve this goal. From the data collected and from staff's observation it has shown that there needs to be another clinical decision maker employed in the emergency department. Mid morning/lunchtime has been identified as the peak time for increasing patient wait times. There needs to be another clinical

decision maker to cover these times in particular, to keep the patient flow moving and preventing delays.

While its important to achieve a reduction in patient wait times from triage to seeing the consultant, it is also important to look at the other data collected. There are 51% of patients waiting over 4 hours from triage to discharge. And this also needs to be improved to provide a more time efficient service while delivering quality patient care. Finally the data shows that there does not seem to be a pattern of when major cases may attend the emergency department versus when minor cases may attend. They occur randomly throughout the day. It can be noted, especially on the 07/03/17 that the higher ratio of major cases to minor cases played a significant part in causing patient delays. These patients may require longer times with the consultant and may need some form of imaging or a procedure carried out. With only one consultant working per day and a large number of major patients attending early in the morning, there is a knock on effect on patient waiting times throughout the day.

3.4.4.1 – The Plan

The improvement plan proposed to achieve a reduction in patient waiting times requires two implementations, one is the addition of a Physician Associate (PA) or an Advanced Nurse Practitioner (ANP) and secondly the implementation of a fast track system. The PA and ANP are highly trained clinicians who can diagnose, treat and discharge patients. I think the addition of one of these staff members could have a positive impact on reducing

patient waiting times as an increase in resources is created. Previous studies have shown they are frequently implemented in Emergency Departments worldwide to increase staff numbers, reduce waiting times and to deliver quality care to patients.

In addition, implementing a fast track system can further streamline the patient flow and reduce waiting times within the ED. A fast track system is where two separate routes are created within the ED. The initial stages of the patient's journey would remain the same as what is currently in practice. The patient would arrive and register their details with administrative staff, moving onto the triage area where a nurse will determine the severity of their complaint and group them into the appropriate category; emergency, major or minor case. It is at this point where the fast track system will be implemented. All emergency and major cases will go straight to the main ED treating area and be assessed and treated by the consultant. All minor cases will enter the fast track system whereby a PA or ANP would see, diagnose, treat and discharge all of those patients. The majority of assessments and treatments for the minor cases would take place in the side procedure room within the ED. It is noted that on occasion a minor case may need to use a bed for monitoring depending on the nature of the ailment, however it is hoped that this QIP will increase the number of beds available for more serious cases. In separating the patient routes within the ED it will allow the consultant more time to attend to the patients with more severe presentations and expediently treat and discharge the minor case. Moreover, it will keep patient flow moving,

as there would be two clinical decision makers working simultaneously within the ED.

Structurally, nothing would need to change in the Emergency Department. The QIP has utilised the available space within the ED providing a more streamlined process.

3.5 Summary

QI within healthcare is the unity of healthcare professionals, patients and their families, payers, researchers and educators, with the combined goal of achieving better patient outcomes, improving system performances and enhancing professional development through implementing changes (Batalden and Davidoff, 2007). After studying the various models for QI, the DMAIC (define, measure, analyse, improve and control) model was chosen for this QI plan, as it provided structure and numerous tools to identify the root cause of the long patient delays and allowed the development of the improvement plan to address the issue.

Whilst on placement in the emergency department, it was observed that patients seemed to be waiting for long periods of time. This observation was discussed with some staff member within the emergency department and they voiced their concerns. To begin the process of the DMAIC QI model, the writer created a fishbone diagram with consultation from the emergency department staff in regards to factors they considered to be possibly contributing to long patient delays. From this, a process flow map was created

to highlight the patient's journey through the emergency department and all of the processes the patient experienced. A stakeholder analysis was then carried out and all key stakeholder were identified.

In section 3.4.2, data regarding the different aspects of the patient's journey was collected while the writer was on placement over a five day (midweek) period. This included the time the patient was triaged, the time they were seen by the consultant and the time they were either admitted to the hospital or discharged from the emergency department.

Section 3.4.3 analysed the data collected. The difference between each step was calculated to identify the biggest delay in the journey. At the time the data was collected the 6 hour target from triage – discharge was in place. In May 2017 the HSE declared that a new target time of 4 hours from triage – discharge was to be implemented. Both of these target time were applied to the data. The data showed that 27% of patients were waiting over 6 hours in the emergency department. When the 4 Hour target was applied, it indicated that 51% of patients were waiting over the target time. Upon closer inspection of the data it highlighted that 14% of the patients were waiting over 4 hours from triage to see the consultant. The timing of those 14% of patient's were examined and it illustrated that they all occurred between the hours of 11.00 am and 2.30 pm, indicating that mid morning/lunchtime was having a significant impact on patient's length of time in the emergency department. After referring back to the earlier fishbone diagram, other potential factors for causing patient delays were investigated. For example, time waiting for

radiological investigations and hematological results. The results did not have a major impact on causing patients delays within the emergency department.

After highlighting that 14% of patients were waiting over 4 hours from triage to even see the consultant, this is the area that QI plan needs to focus on. In section 3.4.4 the implementation of an advanced practice provider such as a Physician Associate or an Advanced Nurse Practitioner was discussed with the stakeholders along with initiating a fast track system to treat minor cases. Having another member of staff who can treat and discharge a patient would be hugely beneficial to this department, as it would allow for two clinicians to work simultaneously and keep patient flow moving. The following chapter will discuss how the QI plan can be evaluated and sustained.

Chapter 4.0 Evaluation

4.1 Introduction

This chapter will evaluate the proposed QI plan. It will provide an overview of the plan and the expected outcomes. Specific QI tools will be discussed in section 4.3 to demonstrate how to evaluate and sustain the changes that will be implemented in the emergency department. Section 4.4 will outline how the plan will be disseminated to the emergency department staff. Section 4.5 will summarise the tools used to evaluate the QI plan.

4.2 Overview of the QI plan

In chapter three, the data collected highlighted that 51% of patients were waiting over four hours from triage to discharge. Furthermore, on closer examination of the data it showed that 14% of patients were waiting over four hours from triage to see the consultant. This is the main area of focus for the QI plan, to improve the timing for patients from triage to seeing a consultant with a long-term goal of reducing the total time spent in the emergency department. After examining other factors including staffing and timing of delays, it was proposed that implementing a fast track system for minor cases lead by a Physician Associate or Advanced Nurse Practitioner would have the biggest influence on reducing waiting times in this circumstance. The following sections will focus on how to evaluate if the QI implementation has been successful in reducing patient waiting times.

4.3 Evaluation

4.3.1 Aim of Control phase of DMAIC model

The purpose of this section is to outline the methods of monitoring and sustaining the proposed project plan.

4.3.2 Monitoring and review

Gathering data identified the root causes of the delays. In the evaluation of whether implementing a fast track system lead by a PA or ANP has reduced patient waiting times, continuously recording data and analyzing the results will provide the team with ongoing statistical information and identify how performance is going. Upon initiating the fast track system and providing the extra staff member there needs to be an adjustment period to allow staff to familiarise themselves with the new system. After the adjustment period, recording data post implementation of the fast track alongside an additional staff member is a good starting point. It will provide the emergency department team with a new baseline of patient waiting times. The effect of these two changes needs to be noted firstly before any further fine tuning of the system occurs.

Ideally, recollecting data should correspond to the same date, one year later in order to compare and contrast. This will help to rule out seasonal variation in the data.

Success is not going to happen overnight but it is important to keep goals realistic in order to be successful in the long run. The key to successfully

implementing the 4 Hour rule in Australia was directly related to the gradual targets the government set (Sullivan et al., 2015). The government set incremental targets over a period of four years to finally achieve their target of 90% of patients attending the emergency department being admitted or discharged within four hours. The idea of incremental targets is an effective way to achieve the targets along the way. The gradual addition of targets can then be set accordingly.

In order for the QI plan to thrive, it is vital to have the participation of the entire team in the updates of patient waiting times. Currently this emergency department does not hold any team meetings. I think the formation of a weekly team meeting on a Monday morning for example could provide a platform to discuss the previous weeks total time spent in the emergency department for patients, discuss any issues that may be arising with the new system and also to set their own goals/ targets for the coming week. Visual management tools, such a bar charts or simply displaying the percentage of patients waiting over four hours can be displayed weekly or fortnightly in the consultants rooms outlining the previous weeks data regarding patient waiting times. The use of visual displays is a powerful tool in encouraging progression and sustaining a change. A run chart could be displayed on a monthly basis to illustrate peaks or trends that may occur.

The Lean model for QI focuses on reducing waste or non-added value for the customer. In this environment, the patient is the customer and waste or

non-added value in this circumstance is prolonged time spent in the Emergency Department. Repeating a process flow map will allow the Emergency Department staff to compare the patient's journey with the new fast track system in place to the previous patients journey. It would be beneficial to repeat the process flow map for one minor case and one for a major case to highlight any unforeseen steps to the patient's journey.

4.3.3 Expected results

Based on previous studies carried out worldwide, the implementation of a fast track system and the addition of a PA or ANP has shown to have significant reductions inpatient waiting times. In a study in the USA Theunissen et al. (2014) found a decrease of 68 minutes in their low to moderate patients after implementing a fast track system in just three months. It also had an indirect effect on urgent patients who attended the main emergency department area, reducing their wait time by 32 minutes. We are expecting the implementation of the fast track system coupled with an additional staff member to have similar results in wait times.

4.4 Dissemination Plan

In order to initiate the plan, it needs to be formally introduced to the key stakeholders and staff within the emergency department. A meeting will be arranged with the sponsor to present the findings and discuss when they want to initiate the implementation of the fast track system and the addition of the new PA or ANP. Although the emergency department staff was involved in discussions regarding the PA/ANP and the fast track system, I

think arranging a meeting with a presentation of the findings and a discussion regarding the evaluation process would be essential.

4.5 Summary

After the improvement area has been identified and the solution implemented, the control step is critical to sustaining the new change. For this QI plan, the implementation of a fast track system to treat minor cases lead by a PA or ANP was the improvement that needs to be evaluated. It is important to measure the progression of the new process and ensure that the changes that have been implemented are impacting positively, by reducing patient waiting times. The main focus of this QI plan was to reduce patient wait times from patient triage to seeing the consultant.

A variety of QI tools were suggested to monitor and evaluate the process. As we are implementing a new pathway within the emergency department alongside the addition of a new staff member, an adjustment period needs to occur at first, to allow all staff to familarise themselves with the new process. After this time period has passed, recording data focusing on the different time points throughout the patient's journey will provide a new baseline for how the system is functioning. Subsequently, the evaluation needs to center on the times from triage to seeing the consultant with a long term goal of achieving a reduction from triage to discharge, keeping with the new guidelines issued in Sláintecare document (Houses of the Oireachtas, 2017).

Visual management tools such as, bar charts, run charts and displaying percentages of weekly progress, coupled with a weekly staff meeting to discuss targets for the week and address any issues that may arise is an excellent way of informing staff of the progression of the new system. Key stakeholders would need to be included in the weekly meetings. Repeating a process flow map of the patient's journey will allow for comparison of the new system to the old system.

Chapter 5.0 Discussion and Conclusion

5.1 Introduction

This chapter outlines the potential impact the QI project will have on the Emergency Department, its stakeholders and practices in the context of the literature reviewed. The chapter discusses the strengths of the project and also acknowledges the limitations of the study. It will also suggest other areas of research that would contribute to the further reductions in patient waiting times. The pertinent learning points for the writer regarding the quality improvement process will be discussed. This chapter concludes by summarising and concluding the salient points.

5.2 Project Impact

Within this section the potential impact of the proposed QIP can only be discussed, as it has not yet been executed. However, it will endeavor to form a critical discussion based on the literature reviewed in chapter 2.0.

The proposed project improvement plan is a fast track system that is lead by a PA or ANP. The QIP commences following the triage stage of the patient journey through the ED. The plan proposes a duel system of patient assessment whereby major and minor cases take separate patient routes. The consultant will assess major cases while the PA or ANP will assess minor cases. This is a diversion from current practice within the ED whereby all patients are seen by the consultant regardless of triage category. The following sections will critically analyse the potential impact of the QIP on stakeholders and practices within the ED.

5.2.1 Impact on Stakeholders

5.2.1.1 Patients

Clearly the patients attending the ED are the principle stakeholders in relation to the QIP and have been the key focus of this study. Increasing numbers and longer waiting times in Emergency Departments have lead to delays in delivering critical treatment, exacerbation of conditions, increasing the patient's length of stay in hospitals and an increase in patient mortality (Kennedy et al., 2003, Pines et al., 2011, Singer et al., 2011). The findings of Theunissen et al. (2014) indicate that the implementation of a fast track system results in a reduction of 68 minutes for wait times in minor cases. Applying this reduction to the average wait time of 4 hours 47 minutes in this study results in a new average wait time of 3 hours 39 for minor cases, well within the 4 hour ideal wait time. An effect of the reduced wait times for minor cases was also a reduced wait times for major cases.

Within the new QIP plan, following triage, only major/emergency patients will be seen by the consultant. Thus, allowing the consultant more time to focus on the patients that are most ill.

Not withstanding the above reduction in wait times, minor cases will not be seen by the consultant in the proposed QIP which may result in patient dissatisfaction, especially within the private healthcare system.

5.2.1.2 Emergency Department Staff

In terms of the Emergency Department staff, the new proposed QIP is likely to have the most impact on the consultant. At present, the consultant sees both major and minor patients attending the ED, whereas within the new QIP only major cases will be seen by the consultant. This will result in a reduction in work load and more time available to spend with individual patients.

The new proposed QIP will have little impact on administrative and nursing staff because their roles and responsibilities will remain largely unchanged by the QIP.

The QIP plan requires the addition of a PA or ANP to the ED. This will add to resources within the emergency department however it will have a financial cost to the hospital. The new role created within the ED will require them to work with minor cases only. Minor cases will be redirected from the consultant and will be dealt with expediently. In a recent document published by the NHS on securing their workforce in ED's in the UK, they have stated they want to double the amount of ANP's to 84 by next year. In regards to implementing PA's within the Emergency Departments they have stated that it will provide additional clinical resources (Health Education England et al., 2017).

5.2.2 Impact within the practice

It is hoped that the proposed QIP will provide a clear structure to the patient flow within ED. Once triaged, the patients will be separated based on their triage category. By implementing a fast track system it is anticipated that the process will become more streamlined. As the fast track system will mainly be operating out of the side procedure room, it will inevitably reduce the amount of minor cases taking up beds in the main ED treatment area. This will allow for more efficient use of resources within the ED.

In order for the QIP to be effective it relies on patients being accurately triaged into the correct categories. If a minor case was triaged as a major case and vice versa it would result in the patient waiting for treatment in the incorrect branch of the system potentially incurring an even longer wait time within the ED and an inefficient use of resources. However, as the aim of the fast track system is to expediently treat and discharge patients, it is expected that if a major case was incorrectly triaged into the fast track system it would be identified quickly by the PA or ANP and redirected to the main treatment area to receive medical care from the consultant.

A positive impact that the proposed QIP will hopefully have on the Emergency Department is that it will be able to achieve the new standards outlined in the Sláintecare document in May 2017. Within the Sláintecare document the HSE has announced that Ireland will be implementing the 4 Hour Rule (no patient should be waiting any longer than 4 hours from

triage to discharge or admission), over the next ten years, in an effort to reduce the long waiting times experienced by patients in Emergency Departments throughout the country (Houses of the Oireachtas, 2017). Additionally, the proposed QIP will provide structure and focus for staff, more efficient use of resources and provide a more proficient patient experience. Moreover, this should contribute to the high standard expected from the hospital to achieve future JCI awards.

5.3 Strengths of the project

From the beginning of this project all staff working within the multidisciplinary team were very supportive of working together to improve waiting times for patients. It was the open communication between myself and staff that allowed for extensive discussions throughout the various steps in the QI process. As they are the frontline staff, facing the issues everyday coupled with the practicalities of working within the environment proved to be a major strength for the project.

In addition to this, the extent of the data collected throughout this study highlighted the need for improvement within the ED in order to provide a better service to the patients. Given the fact that this environment is a private emergency department and patient's attending are paying customers, the expectation is that the service provided would be more time efficient than attending a public emergency department.

5.4 Limitations of the project

The research quality improvement plan is limited in that it is based on a small sample of five midweek days of data and therefore the findings and conclusions drawn cannot be reliably extrapolated to represent patient waiting times within the emergency department. Further data over a longer period of time, including weekends, would need to be examined to accurately investigate trends in patient waiting times. However, given the high percentage of patients waiting over four hours from triage to discharge in just five days of data, it is hoped that that the findings of this study will contribute to, supplement and corroborate any additional data gathered by the emergency department regarding patient waiting times.

Furthermore, the data collected throughout this QI plan was specific to one private Emergency Department. The resulting QI plan may not be transferable to another private Emergency Department or a public one for that matter, as they would have a different environment, increased staffing and a different cohort of patients attending their Emergency Departments.

Additionally, a limitation of the study is the fact that the writer is a Physician Associate student and recognises that bias may be introduced within the proposed introduction of a PA in the Quality Improvement Plan.

5.5 Recommendations

In the process of identifying factors that were influencing long patient delays, one particular factor has huge effects on patient wait times and I

think warrants a separate QI plan. This is the availability of beds allocated to the emergency department for potential admission on a daily basis. This can fluctuate from two to three beds available one day to no beds available the next. This is a common problem experienced not only within this specific emergency department but also worldwide. The availability of beds is a multifactorial issue and unfortunately was too big to undertake in the time constraints of this dissertation. However, it is an extremely important factor and I think further research in this area could impact positively on the emergency department.

Another recommendation that would make monitoring and evaluation of the various time points throughout the patients journey in the emergency department more efficient, would be to electronically document the time the patient has seen the consultant. At present this information has to be documented manually whilst all other data throughout the patients journey is available through the hospital's computer system. As the main focus of the QI plan is to reduce the waiting time from triage to seeing the consultant, having electronic access to that data would allow for continuous and accessible monitoring of progression.

5.6 Learning about quality improvement

This dissertation was my first introduction into a structured quality improvement plan. Although most of us are unaware, we are actually practicing quality improvement within our personal, professional and social aspects of our lives. Embarking on this process has given me huge insight

on the importance of structure and following a process in order to achieve the desired outcome. When the project began, while the problem was evident it also appeared that the solution seemed obvious. However, in the very early stages of the defining step of the DMAIC model it became very clear to me that what I had originally hypothesized based purely on observation was incorrect. Throughout the steps of the process and using the various QI tools such as the fishbone diagram and the process flow map, it highlighted that this was a multifactorial issue and not one single factor that was contributing to patient delays. I learnt that engaging the key stakeholders very early on in the process was vital. Providing open communication and involving them within the process, proved to be an extremely important step. Without their knowledge and input it would prove quite difficult to complete this task.

During this dissertation I developed skills in data collection and analytics. The data collected combined with addressing potential factors from the fishbone diagram lead us to discovering the root cause of the patient delays. The tools used were so powerful that it highlighted a specific point in the patient's journey were the QI plan needed to focus on.

From reading documents and frameworks regarding quality improvement it has highlighted to me the importance of quality improvement, particularly within healthcare. According to Batalden and Davidoff (2007)

> *"Everyone in healthcare has two jobs when they come to work everyday: to do their work and to improve it"* (p.3).

5.7 Summary and Conclusion

Long waiting times are experienced in Emergency Departments worldwide resulting in several adverse effects such as increased mortality, exacerbation of conditions and longer hospital stays. Efforts to reduce patient wait times in Emergency Departments have become a high priority politically, socially and economically for multiple countries. In a survey conducted by the Euro Health Consumer Index in 2015 it ranked Ireland as the worst country in Europe for long patient delays in their Emergency Departments. The data collected in this dissertation highlights that long wait times are still an issue for patients, even those attending a private Emergency Department.

The current process involves the patient being triaged by a nurse who classifies the patients as either emergency, major or minor. Waiting times from arrival to triage are good however, due to the fact that there is only one consultant treating all three categories, the result is longer wait times for patients. The focus of this dissertation was to identify the area for improvement (patient waiting times) and propose a QIP to address these issues. The proposed project improvement plan is a fast track system that is lead by a PA or ANP. The QIP commences following the triage stage of the patient journey through the ED. The plan proposes a duel system of patient assessment whereby major and minor cases take separate patient routes. The consultant will assess major cases while the PA or ANP will assess minor cases. After critiquing the proposed QIP against the

literature reviewed in chapter 2.0 it has shown to possess a number of positive potential impacts and also some negative potential impacts.

The patients attending the ED were identified as the key stakeholders from the beginning of this QIP. As discussed in section 5.2.1.1, the greatest potential impact for the success of the QIP is to significantly reduce patient wait times from triage to seeing a Consultant or PA/ANP. It will also allow the consultant to focus on patients presenting to the ED with more serious conditions. The main negative impact of the QIP on patients was that the minor cases would no longer be assessed or treated by the consultant, which may lead to patient dissatisfaction in some cases. Furthermore, the QIP will reduce the consultants work load.

It is hoped the QIP will provide a more structured, streamlined process and more efficient use of resources within the Emergency Department. Furthermore, it is anticipated that the implementation of the new QIP will allow the Emergency Department to achieve the new guidelines outlined in the Sláintecare document and also to continue to meet the hospitals high standards for future awards from the JCI.

Upon embarking on the QIP journey for reducing patient wait times, it seemed that both the problem and the solution were obvious, however, following the clear steps in the DMAIC model highlighted that my original hypothesis was incorrect. The process allowed me to gather the

appropriate evidence to examine the root causes and ultimately find a better solution to reduce wait times.

In conclusion, the value of embracing quality improvement and striving to continuously improve a system is fundamentally important for the progression of our healthcare system and providing the best possible service we can to our patient's.

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Chapter 7.0 Appendices

Appendix 1: Complete set of data collected in the private Emergency Department of five days

	Date	Check In Time	Triage Time	Time Doc Seen	Time dif (Triage - Doc)	Discharge Time	Time Dif (Doc- DC)	Time Dif (Triage - DC)	Category of Injury	Majors x 8
1	01/03/17	08.12 am	8.25 am	9.30 am	1hr 5 mins (65 mins)	18.44 pm	9 hrs 14 mins (554 mins)	10hrs 19 min (619 mins)	Major - Shoulder pain	Minor x 14
2	01/03/17	09.20 am	09.30 am	10.45 am	1.15 mins (75mins)	13.53 pm	3 hrs 8 mins (188 mins)	4 hrs 23 mins (263 mins)	Major - Feeling unwell	DNW X 1
3	01/03/17		11.47 am	15.02 pm	3.15 mins (195 mins)	16.04 pm	1 hr 2 mins (62 mins)	3 hrs 17 mins (197 mins)	Major - Uro sepsis	Total: 23 pts
4	01/03/17		9.50 am	11.50 am	1 hour (60 mins)	12.17 pm	27 mins	2 hrs 17 mins (137 mins)	Minor - Swollen Knee	
5	01/03/17	10.13 am	10.20 am	10.34 am	14 mins	14.28 pm	3 hrs 52 mins (234 mins)	4 hrs 8 mins (248 mins)	Minor - Right foot injury	Average wait time (WT) from Triage to see the Doctor
6	01/03/17	10.36 am	10.40 am	13.30 pm	2.50 mins (170 mins)	14.11 pm	41 mins	3 hrs 31 mins (211 min)	Minor - Back pain	Major Average WT: 161 mins/ 2 hrs 41 mins
7	01/03/17	10.42 am	10.55 am	14.10 pm	3.05 mins (185 mins)	14.33 pm	23 mins	3 hrs 38 mins (218 mins)	Minor - Shoulder Abscess	Minor Average WT: 173 mins/2hr 53 mins
8	01/03/17	10.56 am	11.05 am	15.30 pm	4.25 mins (305 mins)	17.15 pm	1 hr 45 mins (105 mins)	6 hrs 10 mins (370 mins)	Minor - Back Pain	
9	01/03/17	11.06 am	11.10 am	14.50 pm	3.40 mins (220 mins)	**Admitted**	**ADMITTED**	**ADMITTED**	Major - Pneumonia	
10	01/03/17		12.00 noon	12.30 pm	30 mins	13.00 pm	30 mins	60 mins	Minor - Hand Laceration	**Average WT from the time seen by doc to discharge (DC)**
11	01/03/17	12.32 pm	12.40 pm	16.50 pm	4.10 mins (250 mins)	17.13 pm	23 mins	4 hrs 33 mins (273 mins)	Minor - Back and Arm pain	Major Average WT: 206 mins/ 3 hrs 26 mins
12	01/03/17	12.39 am	12.50 pm	17.05 pm	4.15 mins (255 mins)	17.31 pm	26 mins	4 hrs 41 mins (281 mins)	Major - Abdo pain	Minor Average WT: 76 mins/ 1 hour 16 mins
13	01/03/17	12.45 pm	13.00 pm	15.51 pm	2.51 mins (271 mins)	19.13 pm	3 hrs 22 mins (202 mins)	6 hrs 13 mins (373 mins)	Major	
14	01/03/17	13.10 pm	13.20 pm	16.04 pm	2.44 mins (164 mins)	**Admitted**	**ADMITTED**	**ADMITTED**	Major - Appendix	
15	01/03/17	13.05 pm	14.10 pm	18.30 pm	4.20 mins (260 mins)	19.36 pm	1 hr 6 mins (66 mins)	5 hrs 26 mins (326 mins)	Minor - Abdo pain	**Average WT from Triage to Discharge**
16	01/03/17	14.48 pm	15.00 pm	**DNW**	**DNW**	18.55 pm	**DNW**	3.55 mins (235 mins)	Minor - Leg pain	Major Average WT: 347 mins / 5 hrs 47 mins
17	01/03/17		15.20 pm	19.15 pm	3.55 mins (235 mins)	19.54 pm	39 mins	4 hrs 34 mins (274 mins)	Minor - Pre syncope	Minor Average WT: 231 mins / 3 hrs 51 mins
18	01/03/17	15.24 pm	14.40 pm	16.14 pm	1.34 mins (94 mins)	18.48 pm	2 hrs 34 mins (154 mins)	5 hrs 8 mins (308 mins)	Minor - Headache	
19	01/03/17		16.00 pm	19.10 pm	3.10 mins (250 mins)				Minor - Ankle injury	
20	01/03/17		16.20 pm	20.00 pm	3.40 mins (220 mins)	**Admitted**	**ADMITTED**	**ADMITTED**	Minor Dizziness	
21	01/03/17	16.20 pm	16.30 pm	16.50 pm	20 mins	18.21 pm	1 hr 31mins (91mins)	1 hr 51 mins (111 mins)	Minor - Swollen finger	
22	01/03/17		16.40 pm	20.32 pm	3.52 mins (332 mins)				Minor - Head Laceration	
23	01/03/17		17.00 pm	17.43 pm	43 mins				Major - Numbness to groin	

1	02/03/17	8.28 am	8.22 am	12.10 pm	3.48 mins (228 mins)	17.55 pm	5 hrs 45 mins (345 mins)	9 hrs 33 mins (573 mins)	Major - Back pain	Major x 8	
2	02/03/17	8.32 am	8.32 am	10.15 am	1.43 mins (103 mins)	12.03 pm	1 hr 48 mins (108 mins)	3 hrs 31 mins (211 mins)	Minor - Tibia Lac	Minors x 6	
3	02/03/17	10.15 am	10.16 am	11.10 am	54 mins	11.55 am	45 mins	1 hr 39 mins (99 mins)	Major - Anxiety	1 x Referred elsewhere	
4	02/03/17	10.18 am	10.22 am	12.30 pm	2.08 mins (128 mins)	**Admitted**	**ADMITTED**	**ADMITTED**	Major - Migrane (CVA)	Total: 15 pts	
5	02/03/17	10.45 am	10.48 am	13..30 pm	2.42mins (162mins)	17.35pm	4hrs 5 mins (245 mins)	6 hrs 47 mins (407 mins)	Minor - Lower back pain		
6	02/03/17	11.02 am	11.02 am	11.30 am	28 mins	**Admitted**	**ADMITTED**	**ADMITTED**	Major - Unwell	**Average wait time (WT) from Triage to see the Doctor**	
7	02/03/17	12.00 pm	12.05 pm	14.00 pm	1.55 mins (115 mins)	**Admitted HDU**	**ADMITTED HDU**	**ADMITTED HDU**	Major - Headache	Major Average WT: 116 mins/1 hr 56 mins	
8	02/03/17	12.20 pm	12.20 pm	15.00 pm	2.40 mins (160 mins)	17.56 pm	2 hrs 56 mins (176 mins)	5 hrs 36 mins (336 mins)	Minor - RTI	Minor Average WT: 138 mins/ 2 hr 18 mins	
9	02/03/17	13.20 pm	13.25 pm	15.50 pm	2.25 mins (145 mins)	16.47 pm	57 mins	3 hrs 22 mins (202 mins)	Major - DVT		
10	02/03/17	13.30 pm	13.30 pm	15.20 pm	1.50 mins (110 mins)	18.36 pm	3 hrs 16 mins (196 mins)	5 hrs 6 mins (306 mins)	Major - Rectal pain	**Average WT from the time seen by doc to discharge (DC)**	
11	02/03/17	13.45pm	13.35 pm	16.45 pm	3.10 mins (190 mins)	17.10 pm	25 mins	3 hrs 35 mins (215 mins)	Minor - Head Lac	Major Average WT: 154 mins/ 2 hrs 34 mins	
12	02/03/17	14.00 pm	14.00 pm	***Not seen by doc, sent straight to eye and ear hosiptal***						Minor Average WT: 106 mins/ 1 hr 46 mins	
13	02/03/17	14.55 pm	15.05 pm	17.10 pm	2.05 mins (125 mins)	19.16 pm	2 hrs 6 mins (126 mins)	4 hrs 11 mins (251 mins)	Major - Cellulitis		
14	02/03/17	15.30 pm	15.30 pm	18.00 pm	2.30 mins (150 mins)	18.16 pm	16 mins	2 hrs 46 mins (166 mins)	Minor - Back pain	**Average WT from Triage to Discharge**	
15	02/03/17	15.50 pm	16.00 pm	17.05 pm	1.05 mins (65 mins)	18.12 pm	1 hr 7 mins (67 mins)	2 hrs 12 mins (132 mins)	Minor - Wrist injury	Major Average WT: 286 mins / 4 hrs 46 mins	
										Minors Average WT: 245 mins / 4 hrs 5 mins	

1	03/03/17		8.00 am	9.45 am	1.45 am (105 mins)	12.17 pm	2 hrs 32 mins (152 mins)	4hrs 17 mins (257 mins)	Minor - elbow injury		
2	03/03/17	8.14 am	8.15 am	8.40 am	25 mins	**Admitted Cath lab &**	**ADMITTED**	**ADMITTED**	**Emergency - MI**	Resus x 1	
3	03/03/17	8.30 am	8.30 am	10.00 am	1.30 mins (90 mins)	10.52 am	52 mins	2 hrs 22 mins (142 mins)	Minor - Review and drainage	Major x 14	
4	03/03/17	9.03 am	9.00 am	10.20 am	1.20 mins (80 mins)	10.51 am	31 mins	1 hr 51 mins (111 mins)	Minor - shoulder injury	Minor x 6	
5	03/03/17	9.21 am	9.30 am	10.45 am	1.15 mins (75 mins)	18.58 am	8 hrs 13 mins (493 mins)	9 hrs 28 mins (568 mins)	Minor - shoulder injury	DNW x2	
6	03/03/17	9.47 am	10.00 am	11.10 am	1.10 mins (70 mins)	18.45 am	7 hrs 35 mins (455 mins)	8 hrs 45 mins (525 mins)	Major - Back and chest pain	Referred to Gp x1	
7	03/03/17	10.18 am	10.30 am	11.30 am	60 mins	18.44 am	7 hrs 14 mins (434 mins)	8 hrs 14 mins (494 mins)	Major - Thromboses hemorrh	Total 24 pts	
8	03/03/17	10.28 am	10.30 am	11.40 am	1.10 mins (70 mins)	**Admitted**	**ADMITTED**	**ADMITTED**	Major - RTI		
9	03/03/17	10.47 am	11.00 am	12.30 pm	1.30 mins (90 mins)	19.02 pm	6 hrs 32 mins (392 mins)	8 hrs 2 mins (482 mins)	Major - Unwell	**Average wait time (WT) from Triage to see the Doctor**	
10	03/03/17	11.11 am	11.20 am	13.10 am	1.50 mins (110 mins)	20.01 pm	6hrs 51 mins (411mins)	8 hrs 41 mins (521 mins)	Major - chest pain	Major Average WT: 104 mins/ 1 hr 44 mins	
11	03/03/17	11.33 am	11.40 am	13.20 pm	1.40 mins (100 mins)	Admitted	**ADMITTED**	**ADMITTED**	Major - bowel impaction	Minor Average WT: 83 mins/ 1 hr 23 mins	
12	03/03/17	11.36 am	11.50 am	***Referred back to GP - Needs apt for colonoscopy***						Emergency WT: 25 mins	
13	03/03/17		12.20 pm	13.40 pm	1.20 mins (80 mins)	13.54 pm	14 mins	1 hr 34 mins (94 mins)	Minor - Bursitis		
14	03/03/17	12.31 pm	12.35 pm	14.40 pm	2.05 mins (125 mins)	19.38 pm	4 hrs 58 mins (298 mins)	7 hrs 3 mins (423 mins)	Major - Arrhythmia	**Average WT from the time seen by doc to discharge (DC)**	
15	03/03/17	12.45 pm	12.50 pm	**DNW - Public ED**	DNW	15.38 pm	**DNW**	2.48 mins (168 mins)	Minor - Cyst on leg	Major Average WT: 280 mins/ 4 hrs 40 mins	
16	03/03/17	12.46 pm	13.10 pm	15.35 pm	2.25 mins (145 mins)	20.14 pm	4 hrs 39 mins (279 mins)	7 hrs 4 mins (424 mins)	Major - Right hip pain	Minor Average WT: 146 mins/ 2 hrs 26 mins	
17	03/03/17	12.49 pm	12.55 pm	14.50 pm	1.55 mins (115 mins)	19.22 pm	4 hrs 32 mins (272 mins)	6 hrs 27 mins (387 mins)	Major - Generally unwell		
18	03/03/17	13.22 pm	13.35 pm	15.55 pm	2.20 mins (140 mins)	19.45 pm	3 hrs 50 mins (230 mins)	6 hrs 10 mins (370 mins)	Major - Diverticulitis		
19	03/03/17	13.45 pm	14.00 pm	**DNW - Public ED**		15.50 pm	**DNW**	1.50 mins (110 mins)	Major - Appendicitis	**Average WT from Triage to Discharge**	
20	03/03/17	14.14 pm	14.20 pm	16.20 pm	2.00 mins (120 mins)	19.06 pm	2 hrs 46 mins (166 mins)	4 hrs 46 mins (286 mins)	Major - chest pain	Major Average WT: 366 mins / 6 hrs 6 mins	
21	03/03/17	14.40 pm	14.50 pm	16.40 pm	1.50 mins (110 mins)	19.48 pm	3 hrs 8 mins (188 mins)	4 hrs 58 mins (298 mins)	Major - Chronic cough	Minor Average WT: 221 mins / 3 hrs 41 mins	
22	03/03/17	15.21 pm	15.30 pm	17.10 pm	1.40 mins (100 mins)	19.41 pm	2 hrs 31 mins (151 mins)	4 hrs 11 mins (251 mins)	Major - Unwell		
23	03/03/17	16.31 pm	16.35 pm	18.20 pm	1.45 mins (105 mins)	19.39 pm	1 hr 19 mins (79 mins)	3 hrs 4 mins (184 mins)	Major - Peritonitis		
24	03/03/17	16.45 pm	16.40 pm	17.50 pm	1.10 mins (70 mins)	20.06 pm	2 hrs 16 mins (136 mins)	3 hrs 26 mins (206 mins)	Minor - Dizziness		

1	06/03/17	8.15 am	8.15 am	9.00 am	45 mins	16.16 pm	7 hrs 16 mins (436 mins)	8 hrs 1 mins (481 mins)	Minor - Swollen knee	Majors x 10	
2	06/03/17	8.20 am	8.10 am	9.15 am	1.05 (65 mins)	16.10 pm	6 hrs 55 mins (415 mins)	8 hrs (480 mins)	Minor - Ankle fracture?	Minors x 12	
3	06/03/17	8.26 am	8.30 am	9.45 am	1.15 (75 mins)	**Admitted**	**ADMITTED**	**ADMITTED**	Major - Abdo and back pain	Direct Adm x1	
4	06/03/17	8.34 am	8.45 am	10.20 am	1.35 mins (95 mins)	17.59 pm	7 hrs 39 mins (459 mins)	9 hrs 14 mins (554 mins)	Minor - Injured thumb	Total: 23 pts	
5	06/03/17	10.07 am	**Review**	12.15 pm	2.8 mins (128 mins)	17.31 pm	5 hrs 16 mins (316 mins)	7 hrs 24 mins (444 mins)	Minor - Review of Abscess		
6	06/03/17	10.25 am	10.30 am	11.25 am	55 mins	15.20 pm	3 hrs 55 mins (235 mins)	4 hrs 50 mins (290 mins)	Major - Diveticulitis?	**Average wait time (WT) from Triage to see the Doctor**	
7	06/03/17	10.30 am	10.40 am	11.50 am	1.10 mins (70 mins)	**Admitted**	**ADMITTED**	**ADMITTED**	Major LUQ pain	Major Average WT: 124 mins/ 2hrs 4 mins	
8	06/03/17	10.35 am	11.00 am	13.10 pm	2.10 mins (130 mins)	16.17 pm	3 hrs 7 mins (187 mins)	5 hrs 17 mins (317 mins)	Minor - Leg injury	Minor Average WT: 129 mins/ 2hr 9 mins	
9	06/03/17	11.02 am	11.05 am	13.30 pm	2.25 mins (145mins)	16.00 pm	2 hrs 30 mins (150 mins)	4 hrs 55 mins (415 mins)	Minor - Broken thumb		
10	06/03/17	11.06 am	11.20 am	13.00 pm	1.40 mins (100 mins)	18.19 pm	5 hrs 19 mins (319 mins)	6 hrs 59 mins (419 mins)	Major - Abdo pain	**Average WT from the time seen by doc to discharge (DC)**	
11	06/03/17	11.10 am	11.30 am	15.40 pm	4.10 mins (250 mins)	**Admitted**	**ADMITTED**	**ADMITTED**	Major - Hematuria	Major average WT: 180 mins/ 3 hrs	
12	06/03/17	11.43 am	11.45 am	13.50 pm	2.05 mins (125 mins)	17.33 pm	3 hrs 43 mins (223 mins)	5 hrs 48 mins (348 mins)	Minor - Sprained ankle	Minor Average WT: 219 mins / 3 hrs 39 mins	
13	06/03/17	11.57 am	12.oo pm	15.50 pm	3.50 mins (230 mins)	16.32 pm	42 mins	4 hrs 32 mins (272 mins)	Major - Chest pain		
14	06/03/17	12.20 pm	12.30 pm	13.40 pm	1.10 mins (70 mins)	15.20 pm	1 hrs 40 mins (100 mins)	2 hrs 50 mins (170 mins)	Minor - Wrist and hand injury	**Average WT from Triage to Discharge**	
15	06/03/17	12.35 pm	12.40 pm	17.00 pm	4.20 mins (260 mins)	20.31 pm	3 hrs 31 mins (211 mins)	7 hrs 51 mins (471 mins)	Major - Pleuritic chest pain	Major Average WT: 301 mins / 5 hrs 1 min	
16	06/03/17	13.08 pm	13.15 pm	**Direct admission to Dr Leong**			**ADMITTED**	**ADMITTED**	Major - Chest pain	Minor Average WT: 370 mins / 6 hrs 10 mins	
17	06/03/17	13.42 pm	13.50 pm	18.55 pm	5.05 mins (305 mins)	19.20 pm	25 mins	5 hrs 30 mins (330 mins)	Minor - Left groin pain		
18	06/03/17	14.21 pm	14.30 pm	18.20 pm	3.50 mins (230 mins)	**Admitted**	**ADMITTED**	**ADMITTED**	Minor - Very swollen Knee		
19	06/03/17	14.50 pm	15.00 pm	16.50 pm	1.50 mins (110 mins)	19.22 pm	2 hrs 32 mins (152 mins)	4 hrs 22 mins (262 mins)	Minor		
20	06/03/17	15.32 pm	15.40 pm	16.30 pm	50 mins	18.00 pm	1 hr 30 mins (90 mins)	2 hrs 20 mins (140 mins)	Major - Chest pain & Abdo pain		
21	06/03/17	16.05 pm	16.15 pm	18.00 pm	1.45 mins (105 mins)	20.39 pm	2 hrs 39 mins (159 mins)	4 hrs 24 mins (264 mins)	Minor - Shoulder injury		
22	06/03/17	16.27 pm	16.40 pm	17.40 pm	60 mins	**Admitted**	**ADMITTED**	**ADMITTED**	Major - Unwell		
23	06/03/17	16.56 pm	17.00 pm	17.30 pm	30 mins	20.34 pm	3 hrs 4 mins (184 mins)	3 hrs 34 mins (214 mins)	Major - Chest pain		

1	07/03/17	8.12 am	8.15 am	10.00 am	1.45 mins (105 mins)	**Admitted**	**ADMITTED**	**ADMITTED**	Major - Chest Pain	Emergency x 2	
2	07/03/17	9.12 am	9.10 am	11.00 am	1.50 mins (110 mins)	17.18 am	6 hrs 18 mins (378 mins)	8 hrs 8 mins (488 mins)	Minor - Back pain	Major x 16	
3	07/03/17	9.56 am	10.00 am	11.25 am	1.25 mins (85 mins)	12.22 pm	57 mins	2 hrs 22 mins (142 mins)	Major - Dizziness and SOB	Minor x 5	
4	07/03/17	10.01 am	10.00 am	10.15 am	15 mins	10.54 am	39 mins	54 mins	Major - Dysuria	DNW x 1	
5	07/03/17	10.07 am	10.05 am	11.15am	1.10 mins (70 mins)	19.54 pm	8 hrs 39 mins (519 mins)	9 hrs 49 mins (589 mins)	Major - Head injury	Referred to public ED x2	
6	07/03/17	10.14 am	10.30 am	13.00 pm	2.30 mins (150 mins)	19.23 pm	6 hrs 23 mins (383 mins)	8 hrs 53 mins (533 mins)	Major - Back/Neck pain	Total: 26 pts	
7	07/03/17	10.25 am	10.20 am	10.30 am	10 mins	12.23 pm	1 hr 53 mins (113 mins)	2 hrs 3 mins (123 mins)	Major - STAFF - splash of blood in eye while in theatre		
8	07/03/17	10.31am	10.30 am	10.50 am	20 mins	11.00 am	10 mins	30 mins	Emergency Stroke - Ambo to	3 pts sent public ED	
9	07/03/17	10.35 am	10.40 am	14.00 pm	3.20 mins (200 mins)	17.50 pm - **admitted**	**ADMITTED**	**ADMITTED**	Major - Nausea + Vomiting		
10	07/03/17	10.41 am	10.45 am	17.45 pm	7.00 hrs (420 mins)	20.22 pm	2 hrs 27 mins (147 mins)	9 hrs 37 mins (577 mins)	Major - Abdominal pain	**Average wait time (WT) from Triage to see the Doctor**	
11	07/03/17	11.03 am	11.15 am	18.15 pm	7.00 hrs (420 mins)	19.13 pm	58 mins	7 hrs 58 mins (478 mins)	Major - Headache	Major Average WT: 177 mins/ 2 hrs 57 mins	
12	07/03/17	11.10 am	11.10 am	15.30 pm	4.20 mins (260 mins)	18.15 pm	2 hrs 45 mins (165 mins)	7 hrs 5 mins (425 mins)	Minor - Ankle fracture?	Minor Average WT: 229 mins/ 3 hrs 49 mins	
13	07/03/17	11.26 am	11.30 am	19.15 pm	7.45 mins (465 mins)	19.50 pm	35 mins	8 hrs 20 mins (500 mins	Major - Rectal pain (R 8th for	Emergency Average WT: 10 mins	
14	07/03/17	11.38 am	11.50 am	12.30 pm	40 mins	18.00 pm	5 hrs 30 mins (330 min)	7 hrs 10 mins (430 mins)	Major - Urinary retention post cystoscopy		
15	07/03/17	12.01 pm	12.00 pm	16.15 pm	4.15 mins (255 mins)	16.34 pm	19 mins	4hrs 34 mins (274 mins)	Minor - Foot injury	**Average wait time (WT) from time seen by doc to discharge**	
16	07/03/17	12.09 pm	12.10 pm	**DNW**	5.50 mins **(DNW)**	18.00 pm	**DNW to see DOC**	**5 hrs 50 mins (350 mins)**	Minor - injury to both wrists	Major average WT: 158 mins / 2 hrs 38 mins	
17	07/03/17	12.18 pm	12.30 pm	18.35 pm	6.05 mins (365 mins)	19.18 pm	43 mins	6 hrs 48 mins (408 mins)	Major - Abdominal pain	Minor average WT: 141 mins / 2 hrs 21 mins	
18	07/03/17	12.18 pm	12.20 pm	12.20 pm	**(seen immediately)**	Admitted	**ADMITTED**	**ADMITTED**	**Emergency - Cauda Equina**		
19	07/03/17	12.23 pm	12.45 pm	18.15 pm	5.30 mins (330 mins)	19.43 pm	1 hr 28 mins (88 mins)	6 hrs 58 mins (418 mins)	Minor - Right hand pain	**Average WT from Triage to Discharge**	
20	07/03/17	13.30 pm	13.35 pm	**Sent straight to eye and ear. Doc seen in triage**			**Sent straight to eye and ear. Doc seen in triage**		Minor - Piece of food stuck in	Major Average WT: 339 mins / 5 hrs 39 mins	
21	07/03/17	14.22 pm	14.30 pm	15.00 pm	30 mins	18.19 pm	3 hrs 19 mins (199 mins)	3 hrs 49 mins (229 mins)	Major - Headache	Minor Average WT: 367 mins / 6 hrs 7 mins	
22	07/03/17	14.29 pm	14.35 pm	19.30 pm	4.55 mins (295 mins)	20.30 pm	60 mins	5 hrs 55 mins (355 mins)	Major - Pleuritic pain in Chest		
23	07/03/17	15.24 pm	15.30 pm	15.45 pm	15 mins	18.09 pm	2 hrs 24 mins (144 mins)	2 hrs 39 mins (159 mins)	Major - Confused/ Infection?		
24	07/03/17	15.31 pm	16.00 pm	**Sent to public ED from Triage**			**Sent to public ED from Triage**		Major - Dizziness		
25	07/03/17	15.48 pm	15.50 pm	19.00 pm	3.10 mins (190 mins)	19.54 pm	54 mins	4 hrs 4 mins (244 mins)	Minor - Pain in Left lower leg		
26	07/03/17	16.14 pm	16.30 pm	18.00 pm	1.30 mins (90 mins)	19.24 pm	1 hr 24 mins (84 mins)	2 hrs 54mins (174 mins)	Major - Balance issue		

Average wait time (WT) from Triage to see the Doctor
Major Average WT: 138 mins/ 2 hrs 18 mins
Minor Average WT: 150 mins/ 2hr 30 mins

Average WT from time seen by doc to discharge time (DC)
Major Average WT: 196 mins / 3 hrs 16 mins
Minor Average WT: 138 mins / 2 hrs 18 mins

Average WT from Triage to Discharge
Major Average WT: 328 mins / 5 hrs 28 mins
Minor Average WT: 287 mins / 4 hrs 47 mins

Note: The above averages are the averages of minor and major cases over the five days for each calculated category.

Appendix 2: Complete set of data collected for diagnostic imaging over two days

Date	Image type	Time image was ordered at	Time image was taken at	Time dif order-image	Time image reported at	Time dif between image and report
03.03.17	Xray elblow	9:45:00	10:40:00	0:55:00	12:23:00	1:43:00
03.03.17	CXR	ICU portable	18:04:00		19:15:00	1:11:00
03.03.17	MRI taken on 6th	3 days	9:00:00		21:24:00	12:24:00
03.03.17	CTPA	11:10:00	13:18:00	2:08:00	13:28:00	0:10:00
03.03.17	CT TAP	11:40:00	14:50:00	3:10:00	16:08:00	1:18:00
03.03.17	CXR	12:30:00	13:06:00	0:36:00	13:13:00	0:07:00
03.03.17	Abdo Xray	15:55:00	16:37:00	0:42:00	16:43:00	0:06:00
03.03.17	Pelvic Xray	13:10:00	14:49:00	1:39:00	15:10:00	0:21:00
03.03.17	CXR	14:50:00	19:18:00	4:28:00	19:23:00	0:05:00
03.03.17	CT TAP	15:55:00	18:17:00	2:22:00	18:29:00	0:12:00
03.03.17	CXR	16:20:00	16:48:00	0:28:00	16:56:00	0:08:00
03.03.17	CXR	17:10:00	18:39:00	1:29:00	18:41:00	0:02:00
07.03.17	CXR	10:00:00	10:46:00	0:46:00	10:56:00	0:10:00
07.03.17	MRI Lumbar spine	11:00:00	9:58:00		11:48:00	1:50:00
07.03.17	CXR	11:25:00	11:58:00	0:33:00	12:03:00	0:05:00

07.03.17	CT Aortic arch	11:15:00	12:30:00	1:15:00	13:05:00	0:35:00
07.03.17	CT Brain	13:00:00	14:28:00	1:28:00	15:35:00	1:07:00
07.03.17	CT TAP on 8th	1 day previous	13:50:00		15:40:00	1:50:00
Date	Image type	Time image was ordered at	Time image was taken at	Time dif order-image	Time image reported at	Time dif between image and report
07.03.17	CT Abdo + Pelvis	17:45:00	19:05:00	1:20:00	19:37:00	0:32:00
07.03.17	CT TAP on 8th	1 day previous	9:24:00		10:23:00	0:59:00
07.03.17	CT Abdo + Pelvis on 9th	2 days previous	11:26:00		12:09:00	0:43:00
07.03.17	MRI Foot on 15th	8 days previous	14:10:00		19:30:00	5:20:00
07.03.17	MRI Lumbar spine	12:20:00	13:45:00	1:25:00	14:54:00	1:09:00
07.03.17	CT Abdo + Pelvis on 8th	1 day previous	13:27:00		13:46:00	0:19:00
07.03.17	CT Abdo + Pelvis on 8th	1 day previous	13:40:00		15:46:00	2:06:00
07.03.17	CXR	14:35:00	16:15:00	1:40:00	16:31:00	0:16:00
07.03.17	MRI Brain on 10th	3 days previous	16:06:00		19:17:00	3:11:00

CT Average	9:51:00	(590 /11 = 53 minutes)
CXR Average	4:14:00	(254/ 11 = 23 minutes)
MRI average	23:54:00	(1434/5 = 287 minutes 4hrs 47 mins

Appendix 3: Data collected blood samples received by the laboratory for one day

Date	Time received by lab	Results on system	Time dif between	
06.03.17	9:00:00	9:16:00	0:16:00	
06.03.17	11:00:00	11:23:00	0:23:00	Average wait time for bloods: 04:54:00 (294/12 = 25 minutes
06.03.17	11:45:00	12:03:00	0:18:00	
06.03.17	12:00:00	12:20:00	0:20:00	
06.03.17	12:16:00	12:34:00	0:18:00	
06.03.17	12:51:00	13:36:00	0:45:00	
06.03.17	8:35:00	8:57:00	0:22:00	
06.03.17	19:05:00	19:12:00	0:07:00	
06.03.17	15:40:00	15:55:00	0:15:00	
06.03.17	10:17:00	10:30:00	0:13:00	
06.03.17	10:28:00	11:42:00	1:14:00	
06.03.17	17:00:00	17:23:00	0:23:00	

Appendix 4: Gantt Chart

Project Plan		Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17
Item	Responsible								
Define									
Arrange meeting with sponsor									
Submit signed sponsorship form									
Collect data from ED									
Start data analysis									
Carry out Stakeholder Analysis									
Project aim & objectives									
Meeting with key stakeholders									
Meeting with QI professionals to discuss my progress									
Fishbone diagram, Process flow chart,									
Revist Hermitage to gather more data									
Identify area for improvement									
Form the OI plan									
Search literature for paper & documents									
Start lit review									
Write methods									
Results									
Write Intro									
Write Abstract									
Submit draft of disseration									
Amend any corrections									
Submit Dissertation									
Submit signed sponsorship form									
Key:	Completed								
	Planned								
	Delayed								