“HOW LONG BEFORE I SEE A DOCTOR?”
AN ANALYSIS OF TRIAGE-TO-DOCTOR WAITING TIMES IN AN EMERGENCY DEPARTMENT IN A JOHANNESBURG PRIVATE HOSPITAL

A research report presented to the

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by

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DECLARATION

I, Christian Piccolo, declare that this research report is my own work. It is being submitted for the degree of Master of Science in Medicine (Emergency Medicine) in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

Sign _____

Date _____

DEDICATION

This work is dedicated to my wife Justine and my daughters Isabella and Olivia.

PUBLICATIONS ARISING FROM THIS STUDY

None

ABSTRACT

Background: Private health care emergency departments (EDs) are vital components of health care systems and have become increasingly popular due to their accessibility, convenience and proficiency. This popularity has led to overcrowding which in turn has led to increased patient waiting times. Lengthy waiting times have been shown to be a common cause of patient dissatisfaction. Patients, however, often overestimate the passage of time which results in unwarranted dissatisfaction.

Study objectives: The purpose of this study was to establish the actual waiting times experienced by patients from the time of triage to first doctor contact at the Dogwood Hospital Emergency Department.

Design: A retrospective cross-sectional descriptive study was undertaken at the Dogwood Hospital Emergency Department from 1st January 2009 to the 30th August 2009. All patients (adults and children) of all priority who sought medical attention at the Dogwood Hospital ED were included in the study.

Main Results: Priority 3 patients waited the longest out of all patients, particularly on weekday mornings. Overall this study revealed that for 70% of patients the triage-to-doctor waiting time was less than 1 hour. Almost 24% of patients waited between one and two hours and about six percent waited more than two hours.

Conclusions: Most patients in this study were seen by a doctor within the target times set by the South African Triage Group (SATG). Numerous studies suggest that patients believe that the acceptable triage-to-doctor waiting time is approximately one hour. In this study 30% of patients waited longer than one hour.

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TABLE OF CONTENTS

NOMENCLATURE

Dogwood Hospital - The name of the hospital the research was conducted in has been substituted with this name to comply with the requirements of the Hospital group's ethics committee.

Abbreviations:

ADSL- Asymmetric Digital Subscriber Line

ACEP- American College of Emergency Physicians

ATS- Australian Triage Scale

CTAS- Canadian Triage and Acuity Scale

CTG- Cape Triage Group

CTS- Cape Triage Score

ED(s) - Emergency Department(s)

EP- Emergency Physician

ENA- Emergency Nurses Association

ESI- Emergency Severity Index

FT- Fast Track

FU- follow-up

LWBS- Left without being seen

MTS- Manchester Triage Scale

NCHS- National Centre for Health Statistics

NHS- National Health Service

NP(s) - Nurse Practitioner(s)

NTS- National Triage Scale

PA(s) - Physician Assistant(s)

P1- Priority 1

P2- Priority 2

P3- Priority 3

PE(s) - Physician Extender(s)

PIT- Physician in triage

SATG- South African Triage Group

SATS- South African Triage Scale

STEMI- ST-segment elevation acute myocardial infarction

Definitions

Triage- the assignment of degrees of urgency to wounds or illnesses to decide the order of treatment of a large number of patients or casualties.[1]

LIST OF FIGURES

LIST OF TABLES

PREFACE

It's the 21st century and our world thrives on speed. Hungry? Go get some fast food. Really hungry? Why not try drive through or even better, "fly through!"

Need information now? Try ADSL or 3G or even 4G. Don't want to wait in a queue? Try the express one. Car needs a service? Try "Formula 1 service". Need some groceries at 02h00? Try the "Quick store". Vomited some blood this morning? Hmmmmm? Try an Emergency Department. That one not quick enough for you? Try another!!

Members of modern society have expectations with regards to how long they are prepared to wait for service. If those expectations are not met, then complaints may arise. Emergency departments are not exempt. Listed below are some examples of complaints received in writing from patients that presented to the Dogwood Hospital ED.

- "We arrived there at about 4:35 pm that day only for a doctor to see the baby at round about 8:30 that evening."
- "After admission we were ushered through and proceeded to sit and wait until 23:00 with no doctor in sight."
- "Today I arrived at the ER at 09:35 am they took my daughters fever and it had come down from the 39.6 to 37.4. At 10:48 I walked out of there and had still not seen a doctor."
- "At 11:20pm my son fell off to sleep, and we had waited for more than 1hr.30min in the trauma unit without any treatment. We finally decided to take my son home as we were getting zero treatment here."
- "Service is horrible & very slow."

- “I'm writing this as I'm waiting for a doctor to attend to my 3 year old. It has been 2 hours since I have arrived and still no one has attended to my son. His temperature was 37.8 when we arrived and it has now increased and must be close to 40. If I had gone to a 'state run' hospital I would have received better care and it would be free! Instead I'm being treated as a 5 year old and would have to pay around R500 for the experience. SHOCKING!!!”
- “ARRIVED AT HOSPITAL X AT 12H20 waited in queue and due to pain went straight to casualties. ASSESSED AND VITALS DONE...12H40.SEEN BY dR X...13H30 (PURPOSELY USED CAPS IN THAT WAY).BACK FROM X RAY...14.35.found my own way back to the emergency ward and assumed I hate to wait, and wait I did...I DECIDED TO LEAVE THE HOSPITAL...15h15.i took my files with as I was on my way to another hospital and did not want to waste time.”

As one of the directors of a private practice managing multiple EDs, I have dealt with many complaints particularly related to the dissatisfaction that has arisen from prolonged triage-to-doctor waiting times. When investigating these complaints, I have found that often the dissatisfaction is unwarranted, as many patients perceive their triage-to-doctor waiting times to be prolonged when in fact the actual triage-to-doctor waiting times are not that long. In the cases where the triage-to-doctor waiting times were actually prolonged, it was found that the ignorance of triage led to the dissatisfaction.

It is for these reasons that I decided to investigate the actual triage-to-doctor waiting times experienced by patients visiting one of our busier EDs.

Chapter 1 INTRODUCTION

1.1Motivation and rational for this research

Emergency departments (EDs) are vital components of health care systems and have become increasingly popular due to their accessibility, convenience and proficiency. People utilise EDs in emergency situations but also for general primary care when general practitioners' practices and clinics are closed. EDs are also utilised by those who do not have general practitioners.[2, 3]

Northington et al[3] performed a study to investigate the reasons why self-referred non-urgent patients utilised the ED. Results from this study showed that patients utilised EDs because they believed they could receive better care at an ED, thought their complaint was urgent, and for the perceived immediacy of treatment. Those that mentioned "better care" did not believe that other sources of health care would have the necessary resources to deal with their complaint (e.g. a fracture requiring X-ray). Those that mentioned "urgency" believed that their conditions warranted prompt medical attention and feared that delaying care would lead to an adverse outcome. "Immediacy" related to the belief that the ED would attend to them quickly and without an appointment. Other reasons for seeking care in an ED were payment flexibility and expediency.

Since the 1940's there has been a steady increase in the use of EDs.[3] In the United States there have been dramatic increases in ED use particularly in the last decade. Annual ED visits between 1992 and 2003 increased from 90 million to 114

million, whereas the total number of EDs declined 8.1% over the period of 1994 to 1999.[4] These increased demands on the ED lead to overcrowding and stretch its abilities to provide efficient, consistent, and cost-effective care. ED overcrowding can affect many aspects of patient's care, in particular, service delivery quality, which is the patient's perspective on the quality of their experience. This is determined by interactions with staff, communication, perceived quality of their medical service, symptom control and waiting times.[4]

Patient satisfaction is a phenomenon that has gained increased attention in emergency medicine literature and is of importance as ED overcrowding continues to escalate.[5-7] Waiting time is an important factor of patient satisfaction.[2, 5, 8-11] Inevitably in a busy ED there is going to be a wait. Many patients cannot understand the concept of having to wait for medical attention especially when attending an ED. They expect to be treated immediately and if their expectations are not met then they complain. A large proportion of complaints in the ED that this study represents, were generated because of perceived long waiting times.

Thompson et al[8] performed a study to assess the accuracy of the waiting time perceptions of patients in the ED. The study found that patients, their parents and caregivers were not very accurate in their perceptions of elapsed waiting time.
Only 22.3% of the respondents were able to estimate accurately the time from triage until examination by an emergency physician. Only 36.6% of respondents were able to estimate accurately the total time spent in the ED. The study could not explain why the respondents were unable to accurately estimate waiting time.

The authors thought that the cause for inaccuracy was multi-factorial which included the misidentification of a nurse as a physician (or vice versa), an altered mental status caused by a medical condition or medication side effect, the absence of objective clues to time passage (e.g. visible clocks) and inexactness of timepieces. They also found in an article by Maister[12] that the psychology surrounding the experience of waiting was more important than any external influence. Maisters' findings were that unoccupied time feels longer than occupied time, patient anxiety makes waiting seem longer, uncertain waits seem longer than known finite waits and solo waits feel longer than group waits.

1.2 Statement of the problem

The Dogwood Hospital ED has had a common occurrence of patient dissatisfaction about prolonged waiting times. When dealing with the complaints arising from this dissatisfaction, it was found that in many cases the perceived waiting time of the patient was far longer with the actual waiting time. There were cases however, where the actual waiting time did correspond with the perceived waiting time.

The entity of actual (measured) waiting time and perceived (subjective) waiting time is well described in the literature.[2, 7, 8] Patients often overestimate the passage of time and therefore the dissatisfaction is unwarranted. If an ED director is aware of waiting time perceptions, it may improve the ability to respond to patient complaints on lengthy waiting times.[8]

The problem, as addressed by this study, is simply that the actual waiting times from triage-to-doctor in the Dogwood Hospital ED are unknown. We do not know if

there is a variation throughout the day or between the periods when there is a single doctor working and when there are two doctors working.

1.3 Aim and objectives

1.3.1 Study aim

The aim of this study was to establish the actual waiting times experienced by patients from the time of triage to first doctor contact at the Dogwood Hospital Emergency Department.

1.3.2 Study objectives

1. To establish the actual triage-to-doctor waiting times of Priority One, Two and Three patients seeking medical attention at the Dogwood Hospital ED
2. To compare the actual triage-to-doctor waiting times when one doctor is on duty versus when two doctors are on duty.
3. To describe the actual triage-to-doctor waiting times at different time periods of the day.
4. To compare the actual triage-to-doctor waiting times on weekdays versus weekends and public holidays.

Chapter 2 LITERATURE REVIEW

2.1 How long is long? I was here first. Why is he being seen before me?

With the increasing use of EDs, an efficient system is needed to control the crowding that may occur and to ensure that high acuity patients do not wait excessively. This system is known as triage. Triage is the process of determining the priority of patients' treatments based on the severity of their condition. The term originated from the French verb "trier", meaning to separate, sift or select. Triage was first used in World War 1 by French doctors treating the battlefield wounded. Baron Dominique Jean Larre, a French physician who served as Napoleon's Chief Surgeon, already recognised the need to decrease the time that soldiers spent waiting for surgeons in 1792.[13] During subsequent wars, the military triage system was refined and demonstrated that early triage, assessment, prompt resuscitation and early patient transfer significantly reduced mortality rates.[14]

Hospital service providers developed an interest in the military triage system which created a desire to develop hospital triage systems in order to reduce civilian mortality.[15] Emergency departments began to develop, implement and review their own triage systems in the late 1970s and early 1980s.[15] During these early stages, the triaging of patients was usually performed by a variety of personnel (ambulance, clerical, nursing and/or medical), with varying degrees of experience, education and expertise.[15] In the USA in the early 1970s, emergency nurses had the responsibility of performing the triage role. Britain had implemented a dedicated triage nurse by the 1980s and the Australians implemented the role in the late 1980s. During this time there were no national guidelines for allocating

triage codes and nurses learnt role performance by adopting their department's norms and expectations for role behaviour and function. As a result, triage practice developed with little standardisation.[15]

The Australians responded by developing a national triage tool to standardise the process and in 1994 the Australian National Triage Scale (NTS) was implemented. The NTS however was developed mainly for large EDs and there was a concern regarding its applicability in rural areas and unaccredited emergency units.[15, 16] The Australian Triage Scale (ATS) was introduced in 2000 and has been extensively validated by both research and operational experience. The ATS formed the basis of the CTAS in Canada and the MTS in the United Kingdom.[15, 16]

Table 2-1 The Australian Triage Scale (ATS)[16]

CATEGORY	DESCRIPTION
ATS 1	Immediate
ATS 2	10 minutes
ATS 3	30 minutes
ATS 4	60 minutes
ATS 5	120 minutes

The ATS and the associated performance standards are now the basis of performance reporting throughout Australia and the source of considerable public and political interest.[16]

The Canadians introduced the Canadian Triage and Acuity Scale (CTAS) in 1999. It was derived from the ATS and then upgraded in 2004 and 2008. Like the ATS, the CTAS is a five level categorical scale in which patients are assigned into the levels shown in Table 2-2. When CTAS was established, goals or operating objectives of time-to-physician initial assessment were proposed.[16, 17]

Table 2-2 The Canadian Triage and Acuity Scale (CTAS)[16]

CTAS	TIME TO PHYSICIAN ASSESSMENT
CTAS I Resuscitation	Immediate
CTAS II Emergent	<15 minutes
CTAS III Urgent	<30 minutes
CTAS IV Less Urgent	<60 minutes
CTAS V Non Urgent	<120 minutes

The development of the CTAS made it clear that these times were not established standards of care and perhaps would not make sense for all facilities.

The United Kingdom currently makes use of the Manchester Triage Scale (MTS) which is also based on the on the ATS, but uses an algorithmic approach to improve repeatability:

Table 2-3 The Manchester Scale (MTS)[18]

Numerical Code	Colour Code	Triage Category	Target Time (min)
1	Red	Immediate	0
2	Orange	Very urgent	10
3	Yellow	Urgent	60
4	Green	Standard	120
5	Blue	Non-urgent	240

The scale which forms the basis for the MTS has been mandated for use in the United Kingdom EDs and its use extensively validated including for paediatric patients.[16]

In the USA, most EDs utilise a 3 level scale (emergency, urgent and non-urgent), however 5-level scales are being adopted throughout the country. The most common is the Emergency Severity Index (ESI) which is also a 5-level categorical scale. A joint American College of Emergency Physicians (ACEP)/Emergency Nurses Association (ENA) task force has supported the move to a 5-level scale in the USA.[16]

The National Centre for Health Statistics developed time-based acuity levels based on a five-level severity index recommended by the Emergency Nurses Association. The acuity levels prescribe the recommended amount of time a patient should wait to be seen by a physician.

Table 2-4 The National Centre for Health Statistics (NCHS) timed-based acuity levels[19]

Acuity level	Recommended time frame
Immediate	less than 1 minute
Emergent	1 to 14 minutes
Urgent	15 to 60 minutes
Semi urgent	greater than 1 hour to 2 hours
Non urgent	greater than 2 hours to 24 hours

In 2003 and 2004, the emergent category was defined as any visit with a recommended wait-time of less than 15 minutes. In 2005, the NCHS added an immediate wait-time category. In 2006, national data from NCHS indicated that waiting times in the ED had increased and, in some cases, had exceeded recommended timeframes. For example, the average waiting time to see a physician increased from 46 minutes in 2003 to 56 minutes in 2006.

For emergent patients, the average waiting time to see a physician increased from 23 minutes to 37 minutes, more than twice as long as recommended for their level of acuity. For immediate, emergent, urgent and semi-urgent patients, the NCHS

showed that some patients were not seen within the recommended time frames for their acuity.[16, 19]

In South Africa, the Cape Triage Group (CTG) was convened in Cape Town in 2004 to produce a triage system suitable for local use. The CTG was a multidisciplinary group comprising of doctors, nurses, and paramedics from the state and private sectors, ensuring expertise in all aspects of emergency care from pre-hospital through to admission from the emergency unit.[20, 21]

The CTG found that the ATS, CTAS and MTS required extensive training to implement, making their widespread adoption in South Africa problematic. They also found that the time taken to triage each patient was too long for most emergency units in the South African setting.[20, 21] The CTG found that pre-hospital tools lacked the sensitivity and specificity to make them safe for ED use. They also noted that these pre-hospital tools were validated only for trauma triage while others were too detailed to be of roadside use. Wallis et al[21] noted that in-hospital triage was practised in a minority of units but found this to be inconsistent as no national triage system existed. They found that some private EDs were seeing large volumes of patients per month, including polytrauma and medical emergencies, but did not have formal triage systems in place. The triage in these units was based on the “eyeball” assessment of a nurse. They also noted that the pre-hospital use of triage in South Africa varied from region to region, with patients categorised into one of four priorities (represented by colours and/or numbers). The systems that were taught at South African ambulance training colleges are presented below:

Table 2-5 Triage Systems taught at South African ambulance training colleges.[20]

College	Red (P1)	Yellow (P2)	Green (P3)	Blue (dead)
Cape Technikon,Cape Town	Primary survey compromised	Maintaining own primary survey. Injury/illness requires treatment within 60 minutes	Injury/illness that should not compromise the primary survey within 60 minutes.	The obviously dead
Wits Technikon,Gauteng	Primary survey compromised	Maintaining own primary survey. Injury/illness requires treatment within 60 minutes	Injury/illness that should not compromise the primary survey within 60 minutes.	The obviously dead
Durban Institute of Technology,KZN	Life Threatening emergencies	Non life threatening emergencies requiring hospital treatment.	Minor injury/illness. Walking wounded	The obviously dead
Lebone Ambulance College (Pretoria)	Treatable life-threatening injuries/illness	Serious non-life-threatening injuries	Minor, easily managed injury/illness that may not require ambulance transportation	The obviously dead
Natal Ambulance College,KZN	Life threatening emergencies	Seriously injured patients	Moderate injuries	The obviously dead
Emergency Medical Services College,Cape Town	Primary survey is compromised or there is an injury that will lead to permanent disability	Maintaining own primary survey.Injury/illness requires treatment within 60 minutes	Injury/illness that will not compromise the primary survey within 60 minutes.	The obviously dead

On 1 January 2006, the Cape Triage Group (CTG) launched a triage system for the Western Cape called the Cape Triage Score (CTS). It was intended for utilisation in both the pre-hospital and ED settings. A colour based system was implemented with the colour categories as follows:

1) Red- immediate priority (resuscitation cases);

(2) Orange- very urgent priority (potentially life/limb threatening pathology);

(3) Yellow- urgent priority (significant pathology);

(4) Green-delayed priority (minor injuries/illness); and

(5) Blue-dead.

The CTG subsequently became the South African Triage Group (SATG). The aim of the SATG was to produce a triage scale for use throughout South Africa. The result of SATG's activities is the South African Triage Scale (SATS), a physiology and symptom based scale which prioritises into one of five colours and can be used in hospital EDs as well as in the pre-hospital setting. The SATS has been validated in the public and private health care settings as well as pre-hospital. Similar to the Manchester Triage System (MTS) and the Canadian Emergency Department Triage and Acuity Scale (CTAS), the SATS incorporates target times to treatment. Patients are categorised into one of five acuity levels:

Table 2-6 The South African Triage Scale (SATS)[22]

ACUITY LEVEL	TARGET TIME TO TREATMENT
Red- Emergency	Immediately
Orange- Very Urgent	Less than 10 minutes
Yellow- Urgent	Less than 60 minutes
Green- Routine	Less than 4 Hours
Blue- Dead on arrival	Should be certified within 2 hours

There are three versions of the SATS, depending on whether the patient is an adult, child or infant. The reason for this is that adults, children and infants have different values of heart rate, respiratory rate and blood pressure. The SATG believe that SATS should be implemented as it is easily taught and understood, is

practical and user friendly, is reliable and accurate and has shown to reduce mortality and morbidity.[22]

In both the CTS and the SATS, the orange category was introduced to reduce the number of patients in the potentially large yellow category while limiting the red category to resuscitation or acutely unstable cases. For the sake of simplicity the orange category was excluded from the pre-hospital setting.[21] This is of significance in this particular research. The introduction of the SATS in the Dogwood ED was not easily implemented as the staff (doctors, nurses and pre-hospital personnel) were all familiar with Priority 1, 2, & 3 format of triaging which was similar to that taught in South African ambulance training colleges. Even though the SATS was well established in the Dogwood ED in 2009 (the time period of this study), staff still referred to patients as Priority 1, 2 or 3. It is for this reason that orange and yellow patients were merged to form priority 2. Red patients were classified as priority 1 and green patients as priority 3.

The benefits[22] of SATS according to the SATG are:

- To expedite the delivery of time-critical treatment for patients with life-threatening conditions
- To ensure that all people requiring emergency care are appropriately categorised according to their clinical condition
- To improve patient flow
- To improve patient satisfaction
- To decrease the patient's overall length of stay
- To facilitate streaming of less urgent patients
- To be user-friendly to all levels of health care professionals.

Triage systems are therefore vital for the effective management of EDs. These triage systems are able to provide an estimated or recommended time the patient should wait to see a doctor or receive treatment. They also ensure clinical justice for the patient. Clinical justice refers to the aim of ensuring that the patient receives care appropriate to need and in a timely fashion.[16]

2.2 What are the implications of waiting too long?

Prolonged waiting times may lead to delays in assessment, diagnosis and treatment by emergency physicians. This phenomenon is associated with a large spectrum of negative outcomes which include inadequate pain control, inadequate management of infectious diseases as well as delayed time-sensitive treatment (e.g. thrombolytic administration in acute stroke or STEMI). Prolonged waiting times are a major cause of patient dissatisfaction and also lead to patients leaving the ED without being seen (LWBS).

2.2.1 Inadequate pain control

Acute pain is a common reason for presentation to an ED but it is often undertreated. The Joint Commission on Accreditation of Healthcare Organizations in 2006 stated that patients had the right to have their pain assessed, treated and monitored[23]. The under-treatment of pain or oligoanalgesia can be attributed to many factors, including ED overcrowding. The American Pain Society also emphasised the importance of adequate and timeliness provision of analgesia.[24, 25] Pines and Hollander[26] and Mills et al[27] studied the impact of ED crowding on pain management for patients with severe pain. They found that there was a significant association between ED crowding and the delay and even non-treatment of pain.

2.2.2 Inadequate management of infectious diseases.

A time-sensitive indicator of ED quality was proposed by The Joint Commission and by the Centres for Medicare and Medicaid services, namely antibiotic administration within 4 hours of arrival for admitted patients with community acquired pneumonia.[28] Pines et al[28] found that ED crowding was associated with delayed and non-receipt of antibiotics in a large academic ED for patients with community acquired pneumonia. In this study, when exposed to a full waiting room and a full hospital (as indicated by a long average of length of stay for admitted patients), ED patients presenting with pneumonia had only a 28% chance of receiving early antibiotics compared to a 69% chance when the number of patients in the waiting room was low and the length of stay for admitted patients was low.

2.2.3 Delayed thrombolytic time

The 2007 American College of Cardiology/American Heart Association guidelines recommend that ED patients with possible cardiac ischaemia undergo immediate assessment by an emergency triage nurse and physician and receive an ECG within 10 minutes.[29] The Joint Commission and the Centres for Medicare & Medicaid Services proposed percutaneous intervention within two hours for patients with ST-segment elevation acute myocardial infarction as a time-sensitive indicator of ED quality.[28] Delays in the evaluation of these patients may be detrimental.

More than 1.6 million patients were hospitalised in the USA with a discharge diagnosis of acute coronary syndrome (ACS) in 2005. Of those, 64% were admitted to the hospital through the ED.[30] Pines et al[30] revealed that there was an association between some measures of ED crowding and a higher risk of adverse

cardiovascular outcomes in patients with both ACS-related and non-ACS related chest pain syndrome.

2.2.4 Patient dissatisfaction

Lengthy waiting times have been shown to be a common cause of patient dissatisfaction.[8] Waiting can cause frustration, can negatively affect perception of quality of care, and is a common cause of patient complaints.[8] Patient satisfaction is important as patients who are satisfied with their care are more likely to be compliant with their treatment. Doctors that promote good patient satisfaction experience fewer malpractice suits than their counterparts.[5, 7]

2.2.5 Patients who leave the Emergency Department without being seen (LWBS)

There are many patients who leave the emergency department without being seen by a doctor. These patients are usually labelled “walkouts”, “elopers” or simply “LWBS”.[31] These patients represent a significant problem as they may not get the health care they require, which may lead to life threatening events. They expose an ED to increased liability exposure, they threaten an ED’s public relations and are a potential lost source of income for the ED and hospital.[32, 33] These patients may influence friends, family and neighbours so that they in turn avoid further medical attention at the hospital concerned.[34] There are also patients who intend to visit an ED, but leave before registering in the ED or never even enter due to an overcrowded waiting room or parking lot. These patients are unlikely to be counted in research studies.[35]

2.2.5.1 What is the frequency of LWBS?

The literature displays a large variation in frequency of LWBS. In 2000 a Centres for Disease Control and Prevention report on ED use in the USA reported that at least 1.8 million patients left emergency departments without being seen.[35] Sun et al[36] found that the LWBS rate increased by approximately 67% between 1995 and 2002.

A study in Los Angeles found a LWBS rate of 2.4% for private hospital patients and 7.3% for public hospital patients.[32] Other studies have displayed a large variation of LWBS rates ranging from as low as 0.1%[37] to as high as 15%.[34] Bourgeois et al[33] compared the LWBS rate between paediatric and adult patients. They found the rates to be similar over a six year study period. Overall the LWBS rates were small, with the majority less than 3%.

2.2.5.2 What kind of patients leave?

Many attempts have been made to try to establish the characteristics of patients that LWBS. Weissberg et al[31] performed a study to learn more about patients who leave EDs without being seen. Their findings were interesting as physical illness did not seem to be the LWBS patients' primary problem but rather severe psychosocial distress. The majority of these LWBS patients had illnesses of minor severity. A similar distribution of main complaints was reported by the non-LWBS patients. About 73% of the LWBS patients were suffering from acute psychosocial upsets at the time of their ED visits. These upsets included recent deaths of relatives or close friends, acute bouts of alcoholism, acute financial problems, recent job losses, suicidal thoughts and behaviour, court appearances, recent pregnancies or miscarriages, the arrival of new people in the home, and acute

illnesses in relatives. They also found that 56% of the LWBS patients had no telephone and were extremely difficult to contact, suggesting a disruption in the usual patterns of interaction with family, friends and society at large. Approximately 80% of LWBS patients were single, divorced or separated, compared to 50% of the controls, again suggesting an impaired ability to maintain interpersonal relationships.

In a study of ED visits to 288 hospitals in California in 2007, Hsia et al found that there was a wide range of LWBS rates and that visits to EDs serving a high proportion of poorly insured individuals residing in areas with low income were associated with a higher probability of LWBS.[38] A study in Australia by Lee et al found that the majority of those that did not wait were of a low priority, were male and in their 30s.[10] Fernades et al reported similar findings with the mean age being 27.9 years and with 42.7% being male patients. They also found that their study patients were less likely to leave during the day shift and more likely to leave during the night shift. They postulated that this was because many patients with minor complaints use the ED after hours for its convenience as a source of primary health care.[34]

2.2.5.3 How long do they wait?

The main reason for patients LWBS, is waiting too long. But how long is too long? In a survey conducted by Vieth et al, patients expected an average wait of 2.1 hours although they believed the appropriate waiting time for ED care to be less than one hour. Waits over five hours were expected by 14% of the patients. Actual waiting times reported by patients averaged three-and-a-half hours. Satisfaction

with the perceived waiting times decreased significantly if waiting times exceeded one hour and were very low after four hours.[39]

In the Johnson et al study[35], approximately 24% of patients had a mean waiting time of 70.4 minutes before leaving. Parents of paediatric patients in this study waited for a mean of 93.1 minutes. In a study by Fernandes et al[34], 53% of patients left dissatisfied within one hour and 75% within two hours of registration.

2.2.5.4 Why do patients leave?

Arendt et al[32] performed a study to identify the factors that resulted in patients LWBS and the factors that may have prevented them from leaving. The respondents to the telephonic survey stated many reasons for LWBS including symptom improvement, poor treatment by ED staff, rude ED staff, transportation difficulties, feeling too sick, scared or tired or in too much pain to wait. However the main reasons for LWBS were “waited too long” (46%) and “wait looked like it was going to be too long” (37%). Numerous other studies[10, 31, 35, 39, 40] have shown that prolonged waiting time is the main reason for leaving. Other reasons for leaving were the belief that they could be seen sooner at another facility , responsibilities of work, school or child care,[33] perceived inequity in triage[35], financial reasons, feeling reassured by nurse, or being redirected by a personal physician to seek care elsewhere.[32]

Staff rudeness also appeared to be a prominent cause of patients LWBS. Some 18.6% of responders left because they were “treated poorly by ED workers”. This poor treatment included “nurses were rude enough to be talking and laughing behind the counter while I was in pain”, “doctors/nurses were purposefully ignoring

me". Polite and helpful staff are therefore an important component of patient care. Lack of waiting room comfort measures such as television, coffee or comfortable chairs did not generally cause patients to LWBS. Of the responders, 65% believed that more comfortable chairs, about 60% believed dimmed lights, and about 56% believed available food or coffee would "probably not" or "definitely not" help them wait longer. Arendt et al therefore believed that funding to increase patient satisfaction might be better spent on increasing ED personnel and their education in customer service than spent on waiting room structural improvements.[32]

2.2.5.5 What would make them stay?

Approximately 85% of respondents to the Arendt et al[32] survey stated that more frequent updates on anticipated waiting time as a service would have helped them wait longer. Approximately 70% would have waited longer if there was the availability of immediate temporary treatments (e.g. ice pack, band aid). In a Johnson et al study, 43.8% of LWBS patients stated they may have waited longer if provided with some "comfort measures" such as analgesics, information, or initiation of diagnostic testing.[35] Approximately 32% and 40% of responders in this study believed that "a better play area for children" and "the availability of children's movies" would have helped them wait longer.

2.2.5.6 How serious are LWBS patients?

Are LWBS patients more ill or less ill than the patients who remain? The general perception is that patients who leave without being seen are more likely to have non-urgent illnesses. However, studies of these patients have shown that 30% to 35% have serious, acute conditions.[41, 42] These are the patients that represent

potential medico-legal risks for the institution.[34] A study at an urban ED in Los Angeles found that of the patients who left without being seen, 46% needed immediate medical attention, 29% needed care within 24 to 48 hours and 8.2% were hospitalised within 1 week.[32] Another study found that about 72% of LWBS patients sought medical care elsewhere and 31% had deterioration in their condition.[33]

2.3 How to shorten the wait

2.3.1 Fast Track (FT)

Reducing waiting times in the ED has become a worldwide focus and EDs have sought innovative ways of achieve this goal. Fast track has evolved as one of the methods and has been shown to decrease overcrowding and facilitate patient flow. It can be defined as a separate process within an emergency department whereby patients with low acuity or minimal injuries and illnesses would be seen and treated in a dedicated area by a health care provider.[43, 44]

The aim of a Fast Track is to attend to those patients timeously who previously had to wait to be treated for minor illnesses or injuries, such as sprains, fractures, lacerations, sore throats, rashes, and insect bites. In ED fast track systems, patients with non-urgent complaints are triaged to treatment in a dedicated area aimed at decreasing waiting times and ED length of stay, reducing ED overcrowding, and increasing patient and staff satisfaction. [43]

2.3.1.1 Staffing of Fast Track

The staffing of ED fast track areas varies and may include emergency physicians (EP), registered nurses, nurse practitioners (NPs) and/or physician assistants (PAs). A survey of 250 hospital EDs in the USA revealed that approximately 22% used PAs and/or NPs. PAs and NPs are collectively referred to as Physician Extenders (PEs).[43, 45]

Ellis et al[45] performed a study to examine the use of PEs and FTs in a random sample of hospitals. The study showed that the use of PEs increased with increasing hospital size, ED census, and urban environment. About 21.6% of the EDs surveyed were utilising PEs and 23.5% of those EDs not using PEs at the time of the survey, stated that they intended to do so within the next two years. In those facilities that employed PEs, 75.9% used only PAs, 16.7% used only NPs, and 7.4% used both PAs and NPs. In 25% of the facilities that utilised PEs, the PE was required to discuss the case with the EP before ordering tests, and in 27.7% of facilities the PE was required to discuss the case with the EP before ordering any medications. In 39.6% of the facilities, the EP was required to physically see the patient before discharge.

The use of NPs and PAs in FT is well documented and these providers have been shown to provide competent and cost effective health care. They have been shown to decrease patient waiting times, length of stay, LWBS frequency and to improve overall quality in both adult and adult/paediatric EDs without sacrificing patient satisfaction.[43, 46-50]

Sanchez et al[51] questioned the validity of this increased effectiveness. They were concerned that the improvement occurred at the cost of a decrease in the quality of provided care. They were also concerned as many FT areas are physically separated from the main ED with patient care provided by PEs with varying EP supervision. Their study, however, demonstrated that the opening of a FT area was associated with the improvement in well-known effectiveness markers, without detrimental effect on the quality of provided care when measured by means of LWBS, revisits and mortality.

Counselman et al[52] performed a study to determine patient satisfaction with PAs in an emergency department FT and to determine if patients would be willing to wait longer to be seen by an emergency physician rather than a PA. The fast track being studied was staffed at all times by one PA. Before final disposition, the PA discussed all patients with the attending EP. The EP may or may not examine the patient, depending on nature of the patient complaint and the confidence of the PA or EP in the final diagnosis and treatment plan. All ECGs and X-rays are reviewed by the EP concurrent with the patient's evaluation in the FT. The outcome of the study was that the majority of patients were very satisfied with the care received in an ED FT by a PA. This appeared to be the consensus of all patients regardless of age, sex or insurance status. It also showed that 88% of patients indicated that they would not be willing to wait longer in the ED to be seen primarily by an EP, rather than a PA. About 12% indicated that they would be willing to wait longer with times ranging from 30 additional minutes to two additional hours to be seen by an EP.

Moser et al found that most tertiary care ED patients with minor problems indicated a willingness to be treated by a NP, often even if this meant discharge without direct emergency physician assessment.[53]

There have been concerns that assessments by NPs may not be as accurate as those by a doctor.[54] Sakr et al[55] assessed the care and outcome of patients with minor injuries who were managed by a NP or a junior doctor in an ED. They looked at adequacy of care, which included history taking, examination, X-ray interpretation, treatment decision, advice, and follow-up. Their results showed that well trained, experienced NPs, who work within stipulated guidelines, can provide care for patients with minor injuries that is equal to or, in some ways, better than that provided by junior doctors. The NPs were more accurate in their history taking but less so in their examination. There was no difference in patient satisfaction among these two types of providers. Buchanan et al showed that patients are generally satisfied with the care they receive from NPs and that patient outcomes were equivalent for NP and physician providers.[56]

Nash et al[46] looked at the effectiveness and efficiency of a newly developed NP-staffed FT unit at a level 1 trauma unit. They specifically looked at unscheduled return visits, LWBS rate, and patient satisfaction for the newly developed FT unit. Of the patients seen in their FT area, 2.3% returned to the ED within three days, but none required hospital admission. The overall return rate for their main ED during the same time period was higher at 4.2%. The LWBS rate for the study period for their FT area was lower than that of the main ED (3.9% vs. 6.7%). A full 100% of the patients seen in the FT area during the study period reported that the

quality of care given by the NP was good or excellent. The turnaround times in this study did not improve dramatically as expected. The authors attributed this to inexperience of newly appointed NPs as well as the study corresponding with one of the busiest times the ED has seen. Even though the FT times were not as expected, the patients appeared to be satisfied with the wait times and the care they received.

Wright et al[50] performed a one year evaluation of FT in the ED. During the study period, 12% of the total patients who presented to the ED were seen in the FT area. The FT area treated an average of 1.6 patients per hour when open. Most patients who were triaged to FT were young (average age 21.5 years) and healthy and required only acute episodic care. Most of the visits were for wound care or minor medical problems such as otitis media or pharyngitis. Only 21.5% of patients had X-rays and 12.1% had laboratory tests performed. The average waiting time from triage to being brought into the FT area was 41.6 minutes. Patients stayed in the FT area for an average of 52.9 minutes before discharge. The average total time from triage to discharge was 94.4 minutes. Patients that required investigations or specialist consultation stayed longer in the FT area. The majority of patients in this study were satisfied with the waiting times and the care given to the by NPs.

Meislin et al[48] studied the feasibility of a FT area within a teaching hospital setting. The average turnaround time for all patients in the ED was 161 minutes. The average total time of patients being put through FT was 94.5 minutes. Triage time averaged 23 minutes and diagnostic time averaged 71.5 minutes. They compared

visits for similar discharge diagnoses and found that the average turnaround time for FT patients was considerably less than for patients seen in the main ED before institution of FT. In some cases times were reduced more than 50%. Nearly 70% of FT patients were seen without the use of the laboratory or X-rays. For those patients the average turnaround time was 79 minutes. The 31% who did have laboratory tests or X-rays had an average turnaround time of 121.4 minutes. Laboratory tests and X-rays thus added an average of 42 minutes to the length of stay to FT patients. They also found that FT allowed physicians and nurses to dedicate their entire efforts either to the most sick or to the urgent care population, resulting in a more efficient effort for both groups.

Similarly, Simon et al[57], who studied a FT area in a paediatric ED, found that increased volumes of patients could be seen while allowing the paediatric ED physician to attend to more acute care cases. They also found that the FT system helped to maintain a steady overall turnaround time for all patients in spite of an increasing patient census. They also showed that lower acuity patients seen in the FT were seen quicker and therefore more efficiently than those patients with similar acuities seen in the main ED when fast track was not in operation.

2.3.1.2 Effectiveness of fast track

Combs et al[44, 58] performed a study to evaluate the effectiveness of introducing Fast Track into an ED, and to evaluate the impact of Fast Track on a week by week basis. The ED in which this study was performed was in a crisis in 2003/2004. Many patients were experiencing long delays before receiving treatment, leaving before receiving treatment and subject to lengthy journey times

while being treated. The main reason for these problems was an increase in ED presentations and a decrease in access to vacant inpatient beds resulting in overcrowding. The main driver for implementing this Fast Track pilot study was the unacceptable number of patients who LWBS after being triaged. This pilot study commenced in May 2004 at which time the LWBS rate was 10%. As soon as the Fast Track commenced on two days per week, there was an immediate decrease in percentage of LWBS patients. Two months after the implementation of Fast Track on two days a week, the LWBS rate decreased from 10% to 8%. The improvement project finished in May 2005 by which time the LWBS rate had further decreased from 8% to 5.4%. [44] It was clear from this study that Fast Track was a significant contributor in reducing the LWBS rate.

2.4 Other methods to shorten the wait.

Other strategies have been employed to try deal with the issue of ED overcrowding.

2.4.1 Ambulance Diversion

Reducing intake by ambulance diversion or the practice of triaging away has been reported with varying degrees of success.[59] Reducing intake may however have deleterious consequences. Schull et al[60] studied the diversion of ambulances to other locations during periods of ED overcrowding and sought to determine the resulting pre-hospital delays for cardiac patients. They found that a period of greater ED overcrowding was associated with significant delays in the ambulance transport of patients with chest pain. The importance of this is that for example, a 30 minute delay in the initiation of thrombolysis, in patients with acute myocardial infarction, can shorten their survival by one year. Ambulance diversion can cause important delays for critically ill patients.

2.4.2 Triaging away

In July 1988 Derlot and Nishio[61] adopted a policy of refusing to treat patients in their ED if they failed to have what was considered an emergency condition. They developed new triage guidelines for their ED. Patients who presented to the triage area, had a screening examination performed by a specially trained triage nurse. This screening included vital signs, a brief history of the main complaint and an examination focusing on the area of main complaint. Those with vital signs within a certain range and those who had one of 50 minor complaints were categorised as “non-emergencies”. Included in the list of minor complaints were anxiety, backache (non-traumatic), coughing, dental pain, headache, joint pain, pharyngitis, sinusitis, sleep disorders. Those that were determined to be non-emergencies were instructed that they would not be seen in the ED and were referred to an assistance desk with a copy of their triage record. The receptionist at the

assistance desk then informed these patients of their options for further medical evaluation which included private community clinics, primary care centres, university faculty clinics or their personal physician.

Excluded from the triage category of nonemergency were all patients younger than 15 years old, non-ambulatory patients, patients in severe pain, and all patients that arrived by ambulance. All other patients who were determined to have emergencies were seen in the ED. In this study, Derlot and Nishio concluded that selective triage can be used to send large numbers of patients away from EDs. They also found that 99% of these patients cooperated with this system, and they appeared not to be harmed by this system. They felt that by using such a system, ED resources can be focused on patients who actually require immediate care. Derlet and Nishio's policy was severely criticised by some for numerous reasons including medical, moral, legal, ethical and financial concerns.[50]

Wright et al[50] found that with similar triage guidelines, some patients felt to have only minor complaints were triaged to FT and were found to have more significant problems. Their feelings were that even though the incidence of serious illness in patients with seemingly minor complaints is very low, they do occur and a disservice is done to those patients if they are not seen and evaluated. They also felt that refusal of care or transfer to an off-site facility may pose a significant medico legal risk in the event of a poor outcome.

2.4.3 Increasing Capacity

Khare et al[62] evaluated a computer simulation model designed to assess the effect on ED length of stay of varying the number of ED beds or altering the interval of admitted patient departure from the ED. They concluded that improving the rate at which admitted patients depart the ED produced an improvement in overall length of stay, whereas increasing the number of ED beds did not. Gantt[63] and others have created satellite units/ holding units to hold admitted patients, pending the availability of inpatient beds and they have created specialty units for large subgroups of patients such as those admitted for substance abuse, psychiatric issues and cardiac observation.[59]

Welch et al[64] performed a study to look at ED intake processes and identify new strategies for improving patient intake. Thirty five departments/organisations submitted abstracts for consideration involving intake innovations. These abstracts were organized into three categories: Physical Plant Changes, Technological Changes, and Process/Flow Changes.

2.4.4 Physical plant changes

Physician Cubicles: The staff at Arrowhead Regional Medical Centre in California trialed a physician-in-triage model by bringing in furniture modules that created small cubicles in which physicians could see patients. This new model reduced the LWBS from 20% to 1%, and the time to see a physician was reduced from four hours to 31 minutes

Triage Pod: The staff at Methodist Hospital in Sacramento created a six-bed “triage pod” area using simple room dividers, for team assessment of patients and

rapid intake. This change in physical space was associated with a process change. The team was made up of one physician, two PAs, and four nurses and worked the triage pod with an intention of moving each patient to an appropriate area (the waiting room, the main ED, or a monitored higher acuity ED bed) in less than 15 minutes. This resulted in only the sicker patients occupying ED beds. This system resulted in a drop of the LWBS rate from 5% to 1%.

Internal Waiting room: Massachusetts General Hospital implemented an internal waiting room called the “post screening area” which allowed less acute patients to remain vertical, instead of occupying bed space, while awaiting test results. This, together with some other changes, resulted in an 8% decrease in length of stay and a drop in LWBS rate from 4.1% to 2.4%.

2.4.5 Technological Changes

Self-populating Triage Tool: Staff at the ED at the University of California San Diego developed an informatics tool that immediately populated the fields of the electronic health record in the triage note. This shortened intake time by 20 minutes and led to improved provider satisfaction.

Palmar Screening: At Carolinas Medical Centre, the ED utilises an intake process of palmar scanning to create biomedical identification. In this process, a palm print is used to generate an immediate identifier for a patient which is linked to an identification number. Since the implementation of this process, the door to physician time has drastically reduced.

Radio/Communication Devices: Staff at St. Rose Dominican Siena Campus used radios to call a physician to the triage area to asses each patient and begin the work-up. With this small process change, the LWBS rate fell from 12% to 1.5%.

2.4.6 Process/Flow Changes

Physician in triage (PIT): At memorial Hospital in York, the intake process is begun by a podium nurse performing a quick look before the PIT team asses the patient. The PIT physician makes an initial rapid medical assessment of each patient which takes less than three minutes. High acuity patients are immediately bedded and low acuity patients are assigned to a PA in FT. This system decreased the LWBS rate from 6% to 0.4%, and door-to-physician times were reduced from 65 minutes to 32 minutes.

Patient Streaming/Segmentation: Banner Health System in Arizona instituted a new intake model in which they performed a “quick look” of patients followed by patient segmentation. In this model, less sick patients were not undressed or bedded, and were treated as though they were in a clinic setting. The sickest patients were seen in an expedient manner and treatment initiated. Banner implemented this process across eight different EDs and saw reductions in the LWBS rates of 30 to 60% across the board.

2.4.7 Team Assignment System

Patel and Vinson[65] in an attempt to decrease waiting times in their ED, designed and implemented a team assignment system in which patients were assigned to a team consisting of one physician, two nurses, and usually one ED technician after a nurse completes the medical screening examination. Their primary goal was to decrease the time from medical screening examination completion to physician

evaluation as measured by, the wait time to be seen by the ED physician, the percentage of patients waiting more than one hour, and the percentage of patients waiting more than three hours to be seen by the ED physician. Their secondary goals were to decrease the percentage of LWBS and to improve patient satisfaction. They monitored the team assignment system throughout a two year period to take into account seasonal variations. This study found that a team assignment system was associated with reduced waiting times, reduced LWBS rates, and improved satisfaction. These improvements occurred in the face of an increase of their ED census by 1.5%.

Debehnke and Decker[66] found that ED patient care using a nurse-physician patient care team improved patients' overall waiting time and length of stay satisfaction and improved the patients' satisfaction with staff and their likelihood of recommending the ED to others.

Lau and Leung[67] similarly introduced a small team consultation system in a busy ED of a Hong Kong hospital. This system produced a significant improvement in average patient waiting time without compromising the quality of service.

Chapter 3 MATERIALS AND METHODS

3.1 Ethics

This research was approved by the Human Research Ethics Committee of the Faculty of Health Sciences of the University of the Witwatersrand (Clearance certificate number M10448 - see Appendix 2) as well as the Dogwood Hospital group research committee (Approval number: MED-2012-0001- see Appendix 7)

3.2 Study Design

Retrospective cross-sectional descriptive study.

3.3 Study Period

January 1st 2009 until August 30th 2009.

3.4 Study Setting and Population

All patients who sought medical attention at the Dogwood Hospital ED during the study period.

Inclusion criteria:

1. All patients (adults and children) of all priority that, sought medical attention, who were triaged by a qualified nursing staff member and who were attended to by the ED doctor.

Exclusion criteria:

1. Patients that were triaged but left the ED before being attended to by the ED doctor. The actual time that these patients waited could not be

determined accurately as they absconded and did not notify staff of their departure.

2. Incomplete data

3.5 Study Protocol

3.5.1 Data collection

This data is routinely collected by the nursing staff at the Dogwood Hospital ED. A document is opened for each and every patient. All time keeping is recorded on this document. The arrival time is noted on the document. Each patient is triaged by a qualified nurse at a triage area and, based on the triage status, is then placed in a queuing system for consultation by the ED doctor. The time that the triage begins is documented. Depending on the triage status, a patient is either asked to return to the hospital reception area to open a file or placed in an examination cubicle where a reception staff member will come and collect necessary information to open a file. The starting time of consultation with the doctor is documented by the nursing staff member that is assigned to the particular patient. On a daily basis, all data is captured from each patient's document and entered onto an electronic spreadsheet. This is performed by the nursing staff member who has been assigned shift leader status for the particular shift.

3.5.2 Sample Population Size

After cleaning to remove incomplete records, 16 714 records remained in the data set (96.8% of the original data set).

3.5.3 Data Analysis

The data was obtained from an electronic database from the Dogwood Hospital ED. This electronic database was password protected and only the staff of the ED had access to it. The data did not identify patients by name but rather by a file number. Each patient that presented to the Dogwood Hospital ED was assigned a file number. These unique file numbers were to prevent duplication. The extracted data was stored on electronic spreadsheets (Microsoft Excel, Microsoft Office 2007, Microsoft Corporation) (Appendix 1) which was password protected and contained no identifying information. The data was analysed as follows: statistics of continuous variables (time variables) were reported as means and standard deviations for normally distributed data and with medians and interquartile ranges for skewed data. Categorical and discrete variables (such as time categories) were described by use of percentage frequency distributions.

To test for differences in continuous variables, the student's t-test (or the Wilcoxon signed rank) was used. Pearson's chi-square test was used to assess for association between two categorical variables. Scatter plots and bar charts were used to present the data graphically.

Statistical significance at the 5% level (i.e. p-value less than 0.05) as well as clinical significance was investigated.

Specific subgroup analyses were performed as follows:

1. Triage to Doctor Waiting times at different times of the day i.e. 07h00-11h59, 12h00-13h59, 14h00-18h59, and 19h00-06h59. One doctor was available at times 07h00-11h59 and 19h00-06h59. Two doctors were available from 12h00-18h59. The category 12h00-13h59 was included as there may have been a large proportion of patients that arrived before 12h00, still waiting to see a doctor when the second doctor arrived at 12h00.This factor may have influenced the waiting times for "two doctors present." The 14h00-18h59 time period was a better indication of the true waiting times measured when two doctors were working in the ED.
2. Triage to Doctor Waiting times for Priority one, Priority two and Priority three patients.
3. The number of patients presenting to the Dogwood ED at different times of the day i.e. 07h00-11h59, 12h00-13h59, 14h00-18h59 and 19h00-06h59.
4. Triage to Doctor waiting times on weekdays versus weekends and public holidays.

For each of these subgroup analyses, waiting times were reflected as continuous data as well as waiting-time categories (<30minutes, 30 to 60 minutes, 61 to 120 minutes and >120 minutes).

3.5.4 Significance level

A 5% significance level was used for all statistical tests, unless specified otherwise.

3.6 Software

All data was entered and stored in a Microsoft Excel® (Microsoft Office 2007, Microsoft Corporation) spreadsheet. Data analysis was carried out in SAS (SAS Institute Inc., SAS software, version 9.1.3 for Windows, Cary, NC, USA: SAS Institute Inc. (2002-2003)

3.7 Methodological limitations of this study

Potential inaccurate data collection was the main methodological limitation of this retrospective study. This study was based on time-keeping which may have been difficult to capture accurately due to inaccurate time pieces and human error. Patients may also have been inaccurately triaged and therefore assigned to an incorrect priority group which may have affected the triage-to-doctor waiting time.

During analysis of the data it was noted that:

- There were 70 records with either missing priorities or with two priorities assigned. It was not possible to validate these, so they were deleted from the data set
- One hundred and seventy five (175) records which were duplicates with respect to patient number, date, triage time, file time doctor time and priority were deleted
- Three hundred and thirty one (331) records were duplicates with respect to patient number. Of these, 30 pairs of records were genuine repeat visits and were retained. One hundred and nine (109) pairs of records appeared to be duplicate entries: same date but one or more times differed slightly and/or the priority category was different. It was decided that these were

most likely duplicate entries resulting from human error during data capture. After careful analysis of these entries, some were retained.

- One hundred and ninety two (192) pairs of records appeared to be duplicate entries: different date but some with everything else identical, some with slightly different times or different priority categories. It was decided that these were most likely duplicate entries resulting from human error during data capture. The earlier of the two records was retained, since it was highly likely to correspond to the true date of the visit of the patient to the ED.
- There were 10 cases with missing triage-to-doctor times giving rise to erroneous triage-to-doctor times. These records were deleted.
- There was no data for seven out of 75 weekend/public holiday days in the time period of the study. There were no weekdays in the study period with completely missing data.
- Frequency analysis of the triage and doctor times indicated that these times were often recorded to the nearest five minutes (with peaks on the hour and half-hour). As a result, the triage-to-doctor times frequency distribution also had peaks at periods of five minutes. This granularity of data could have affected the category of waiting time (e.g. <30min *vs* >30min) into which the patient was allocated.

Chapter 4 RESULTS

4.1 Primary Analysis

The data set covered 242 days, of which 68 (28%) were weekends and/or public holidays.

The breakdown of patients according to priority groups is shown in the graph below:

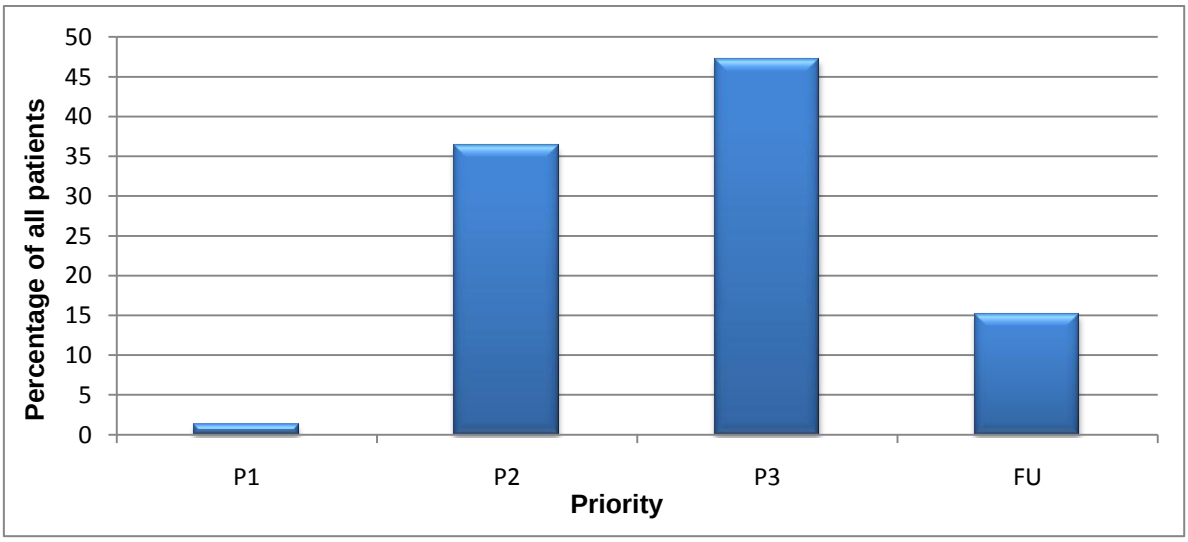

Figure 4-1 Breakdown of patients according to priority groups

Priority 3 (P3) patients comprised nearly half (47%) of all patients visiting the Dogwood Hospital ED followed by priority 2 (P2) patients (36%). Priority 1 (P1) patients comprised only 1.3% of all patients visiting the ED, while follow-up (FU) patients made up the remaining 15%.

The breakdown of the average number of patients arriving at different times of the day (as measured by the triage time) is shown below:

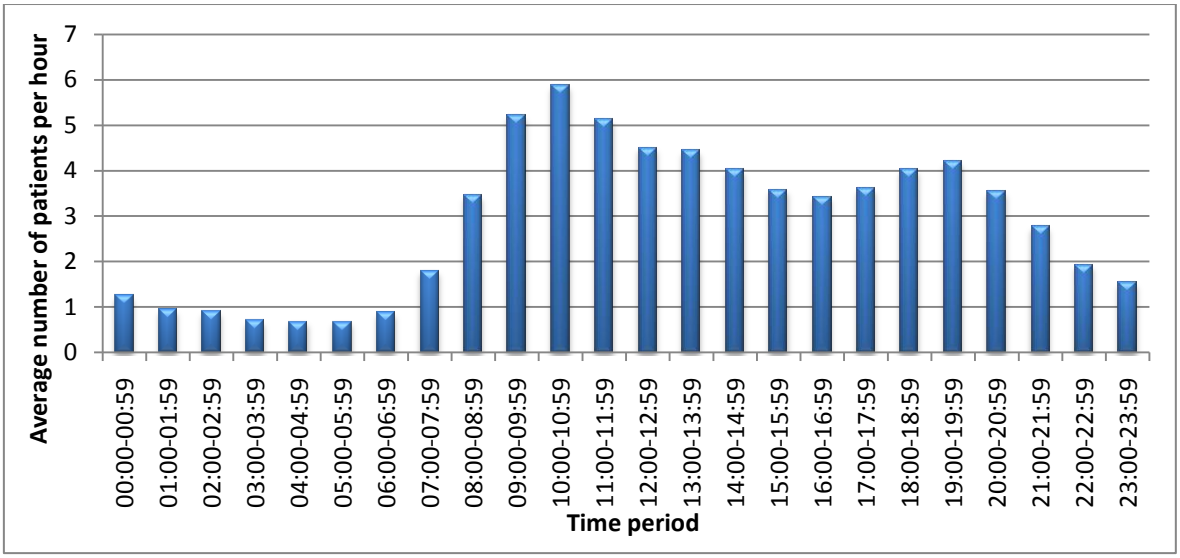

Figure 4-2 Average number of patients arriving at different times of the day

The same data are presented in time periods where the number of doctors on duty varies:

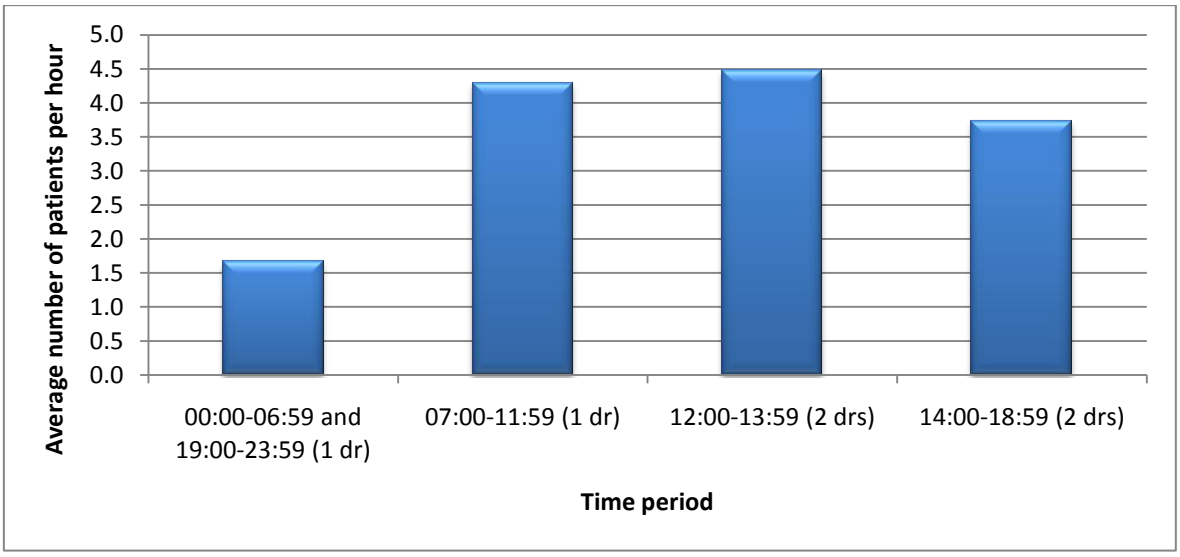

Figure 4-3 Average number of patients arriving at different times of the day with indication of how many doctors on duty

Note that the number of patients was standardised by dividing by the number of hours in the specified time period, since the time periods were not of equal length.

The average number of patients arriving at the ED on weekdays vs. weekends and public holidays is shown below:

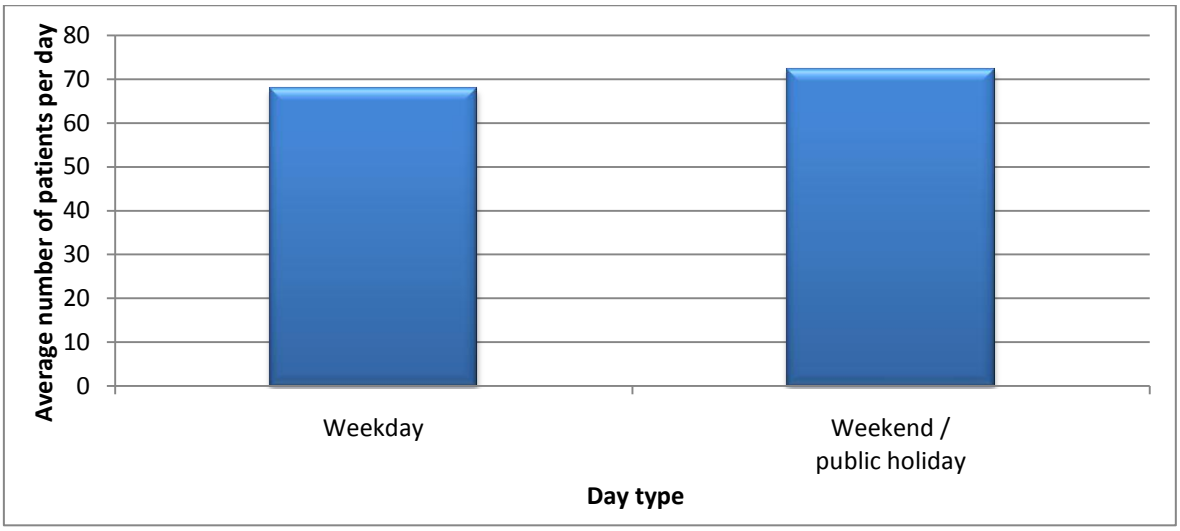

Figure 4-4 Average number of patients arriving at the ED on weekdays vs weekends and public holidays

There was a slight increase of approximately 4 patients per day (6%) on weekends/public holidays compared to weekdays.

The frequency distribution of triage-to-doctor waiting times is shown below:

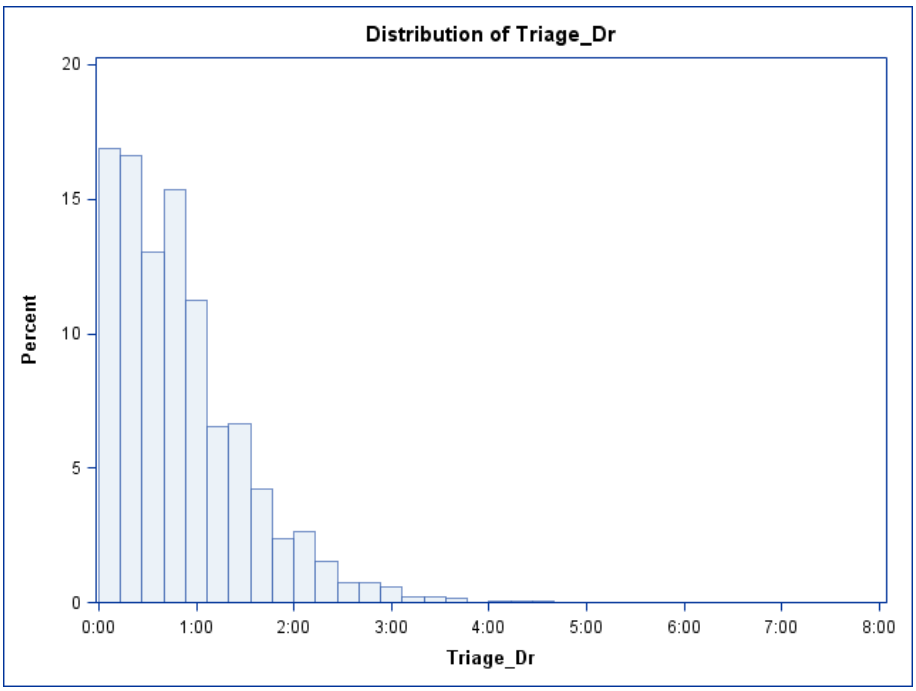

Figure 4-5 Frequency distribution of triage-to-doctor waiting times

As expected, the distribution of waiting times was positively skewed: most waiting times were short, while few were very long.

The cumulative distribution of the waiting times is shown below:

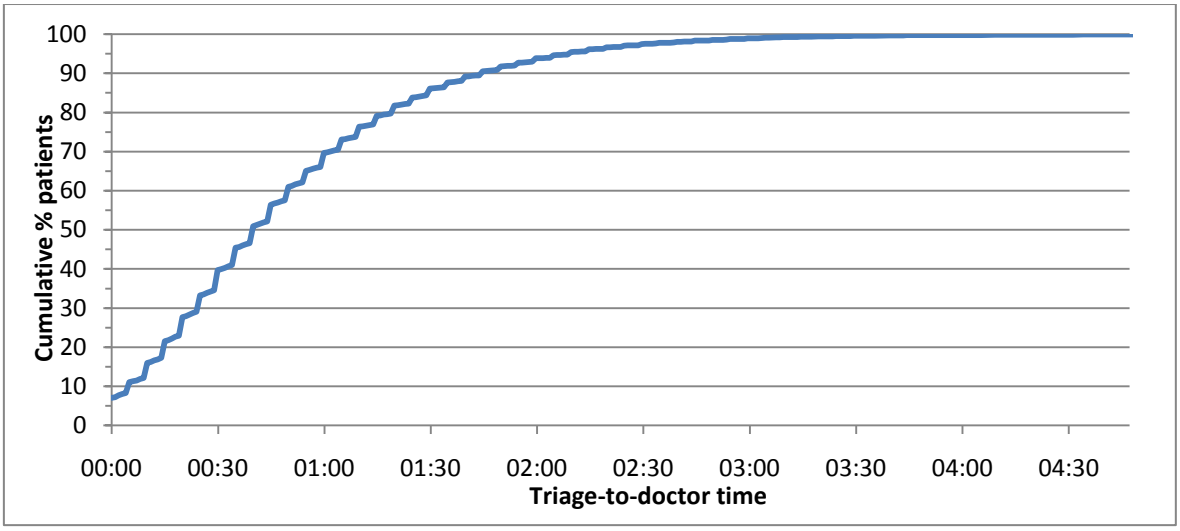

Figure 4-6 Cumulative distribution of waiting times

Table 4-1 Cumulative distribution of waiting times

Cumulative % of patients	Waiting time
10%	00:05
20%	00:15
30%	00:25
40%	00:32
50%	00:40
60%	00:50
70%	01:02
80%	01:20
90%	01:45
95%	02:10
99%	03:05

As also shown in the table above, 50% of patients saw a doctor within 40 minutes of triage, 95% of patients within 2 hours 10 minutes.

Alternatively, the percentage of all patients who saw the doctor within the specified time periods is shown below:

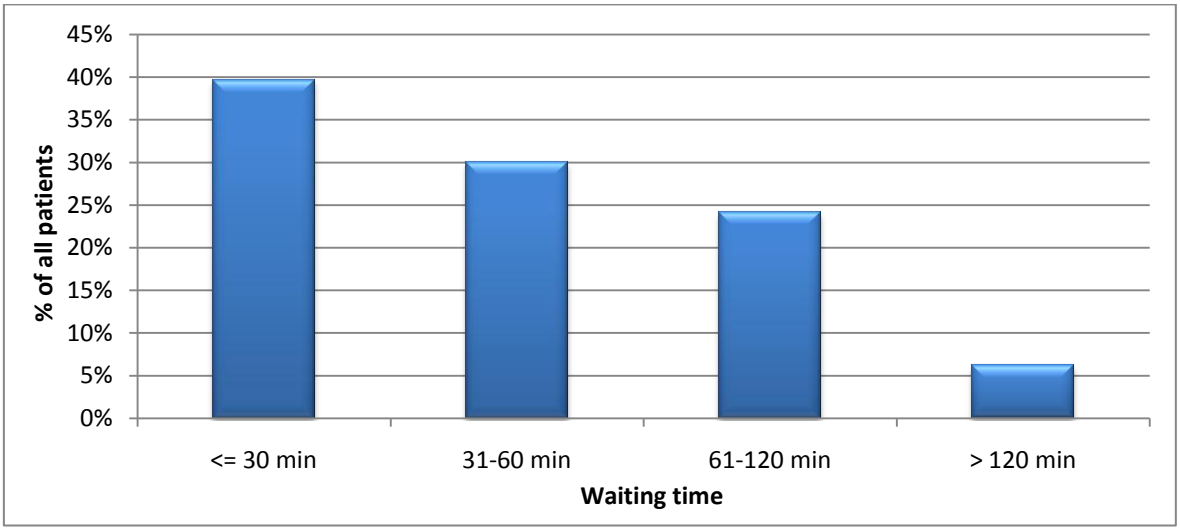

Figure 4-7 Percentage of patients who saw the doctor within specified time periods

Table 4-2 Percentage of patients who saw the doctor within specified time periods

Waiting time	% of patients
<= 30 min	39.7%
31-60 min	30.0%
61-120 min	24.1%
> 120 min	6.2%

4.2 Analysis of the number of patients arriving per hour

In order to analyse the actual triage to doctor waiting times, it was vital to look at the number of patients arriving in the four time periods specified in chapter 3.4.3 (subgroup analyses). Since the time periods encompass different numbers of hours, the number of patients was standardised to the number of patients per hour (NPH) in order to make comparisons across the time periods meaningful.

A factor which could affect the number of patients arriving per hour was the day type (weekday vs. weekend / public holiday). The time of day and / or the day type could be linked to the priority types of patients arriving in the ED, so the data was examined overall, but also by each priority group separately.

The data were analysed by using an Analysis of Variance (ANOVA) with the number of patients per hour as the dependent variable and day type and time period, as well as the interaction between them, as the independent variables.

ANOVA assumes that the observations are normally and independently distributed. The observations (the number of patients per hour for each time period for each day) were independent since the arrival times of the patients were independent. To check whether the observations were normally distributed, the frequency distribution of the observations were examined.

4.2.1 All patients

The frequency distribution of the numbers of patients arriving per hour (per time period, for each day) was slightly positively skewed. The diagnostics of the ANOVA indicated that the variability of the data increased as the number of patients per hour increased. Log, inverse and square root transformations of the data were considered, of which the square root transformation was the most successful at stabilising the variance. (The conclusions were, in fact, the same as those obtained using the un-transformed data).

There was a significant interaction between day type and time period [$F(3, 905) = 6.68$, $p < 0.001$]. The main effect of time period was also significant [$F(3, 905) =$

239, $p < 0.001$]. Post hoc comparisons using the Unequal N HSD test (used since there were unbalanced groups) showed the following:

- For both day types **(**weekday and weekend/public holiday), the numbers of patients arriving per hour at night (00:00-06:59 and 19:00-23:59) was significantly lower than during any of the three time periods during the day. The effect sizes were large (Cohen's d's all greater than 2.0*) (the numbers of patients arriving per hour at night was not significantly different between weekdays and weekends/public holidays).
- On weekdays, the numbers of patients arriving per hour during the 07:00-11:59 and 12:00-13:59 periods was not significantly different, and both these periods had a higher numbers of patients arriving per hour than the 14:00-18:59 period. The effect sizes were moderate (Cohen's d = 0.62 and 0.64) respectively.
- By contrast, on weekends/public holidays, the numbers of patients arriving per hour during the 07:00-11:59 period was significantly lower than during the week (moderate effect size: Cohen's d=0.59). The numbers of patients arriving per hour during the other two daytime periods were not significantly different to those during the week. Thus, the numbers of patients arriving per hour during the 12:00-13:59 period was significantly higher than in both the 07:00-11:59 and 14:00-18:59 periods (moderate effect size: Cohen's d = 0.79 and 0.61 respectively).

* Cohen's d: between 0.20 and 0.50: small effect size
between 0.50 and 0.80: moderate effect size
greater than 0.80: large effect size.

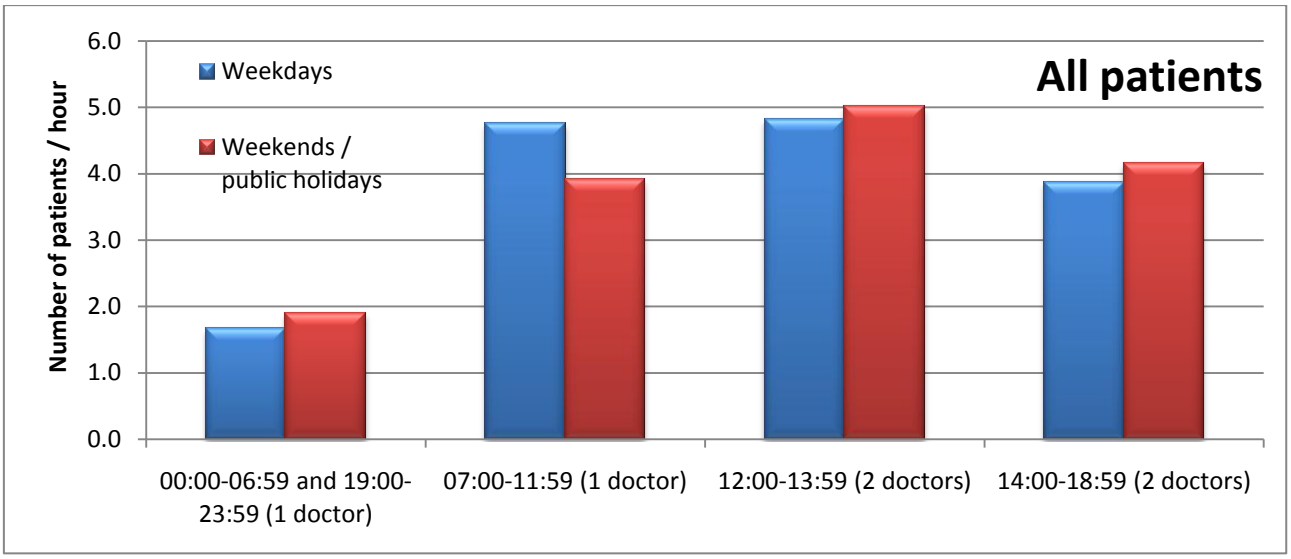

Figure 4-8 Number of patients arriving per hour-All Patients

Table 4-3 Number of patients arriving per hour- All Patients

Grouping variables		N	Number of patients per hour			
			mean	standard deviation	95% LCL	95% UCL
overall		913	3.75	1.80	3.64	3.87
weekend / public holiday		268	3.74	1.65	3.54	3.94
weekday		645	3.76	1.86	3.62	3.90
00:00-06:59 and 19:00-23:59 (1 doctor)		233	1.73	0.61	1.65	1.81
07:00-11:59 (1 doctor)		230	4.51	1.46	4.32	4.70
12:00-13:59 (2 doctors)		222	4.88	1.75	4.64	5.11
14:00-18:59 (2 doctors)		228	3.96	1.21	3.80	4.12
weekend / public holiday	00:00-06:59 and 19:00-23:59 (1 doctor)	68	1.90	0.67	1.74	2.06
	07:00-11:59 (1 doctor)	67	3.93	1.10	3.66	4.19
	12:00-13:59 (2 doctors)	66	5.02	1.63	4.61	5.42
	14:00-18:59 (2 doctors)	67	4.16	1.17	3.87	4.44
weekday	00:00-06:59 and 19:00-23:59 (1 doctor)	165	1.66	0.57	1.58	1.75
	07:00-11:59 (1 doctor)	163	4.76	1.52	4.52	4.99
	12:00-13:59 (2 doctors)	156	4.82	1.80	4.53	5.10
	14:00-18:59 (2 doctors)	161	3.88	1.21	3.69	4.07

4.2.2 P1 patients

The frequency distribution of the numbers of patients arriving per hour for P1 patients was positively skewed, as might be expected. There were many time periods in which the number of P1 patients arriving per hour was zero.

The ANOVA indicated that there was no significant effect of day type, time period or the interaction between day type and time period on the number of P1 patients arriving at the ED. A square root transformation of the dependent variable yielded

the same outcome. (Log and inverse transformations were not used due to the presence of 0s in the data.)

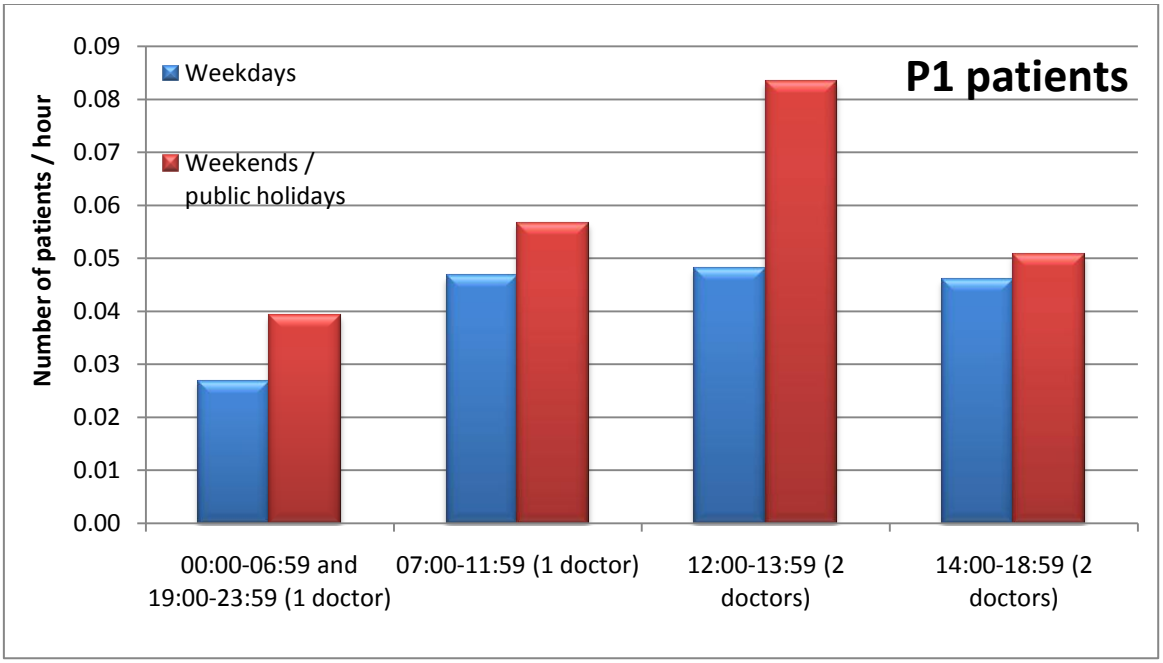

Figure 4-9 Number of patients arriving per hour-P1 patients

Table 4-4 Number of patients arriving per hour-P1 patients

Grouping variables		N	Number of patients per hour			
			mean	standard deviation	95% LCL	95% UCL
Overall		913	0.05	0.13	0.04	0.05
weekend / public holiday		268	0.06	0.14	0.04	0.07
weekday		645	0.04	0.12	0.03	0.05
00:00-06:59 and 19:00-23:59 (1 doctor)		233	0.03	0.06	0.02	0.04
07:00-11:59 (1 doctor)		230	0.05	0.12	0.03	0.07
12:00-13:59 (2 doctors)		222	0.06	0.19	0.03	0.08
14:00-18:59 (2 doctors)		228	0.05	0.10	0.03	0.06
weekend /	00:00-06:59 and 19:00-23:59 (1 doctor)	68	0.04	0.05	0.03	0.05
public holiday	07:00-11:59 (1 doctor)	67	0.06	0.12	0.03	0.09
	12:00-13:59 (2 doctors)	66	0.08	0.23	0.03	0.14
	14:00-18:59 (2 doctors)	67	0.05	0.09	0.03	0.07
weekday	00:00-06:59 and 19:00-23:59 (1 doctor)	165	0.03	0.06	0.02	0.04
	07:00-11:59 (1 doctor)	163	0.05	0.12	0.03	0.07
	12:00-13:59 (2 doctors)	156	0.05	0.18	0.02	0.08
	14:00-18:59 (2 doctors)	161	0.05	0.11	0.03	0.06

4.2.3 P2 patients

The frequency distribution of numbers of patients arriving per hour for P2 patients was fairly normally distributed. The diagnostics of the ANOVA indicated that the variability of the data increased as the number of patients per hour increased. Log, inverse and square root transformations of the data were considered, of which the log transformation was the most successful in stabilising the variance.

(The conclusions were, in fact, the same as those obtained using the un-transformed data).

The main effect of day type was significant [$F(1, 876) = 22.4$, $p < 0.001$]. The numbers of patients arriving per hour on weekends/public holidays was higher across all time periods than the numbers of patients arriving per hour during weekdays. The effect size was small (Cohen's d=0.37).

The main effect of time period was significant [$F(3, 876) = 29.1$, $p < 0.001$]. Post hoc comparisons using the Unequal N HSD test showed the following:

- The numbers of patients arriving per hour at night was significantly lower than during any of the three time periods during the day. The effect sizes were moderate to large (Cohen's d = 0.55, 0.64 and 0.93 for night vs. 07:00-11:59, 12:00-13:59 and 14:00-18:59 respectively).
- The numbers of patients arriving per hour during the 07:00-11:59 period was significantly lower than the numbers of patients arriving per hour in the 14:00-18:59 period. The effect size was small (Cohen's d = 0.29).
- There was no significant difference between the numbers of patients arriving per hour in the (07:00-11:59 and 12:00-13:59) and (12:00-13:59 and 14:00-18:59) time periods.

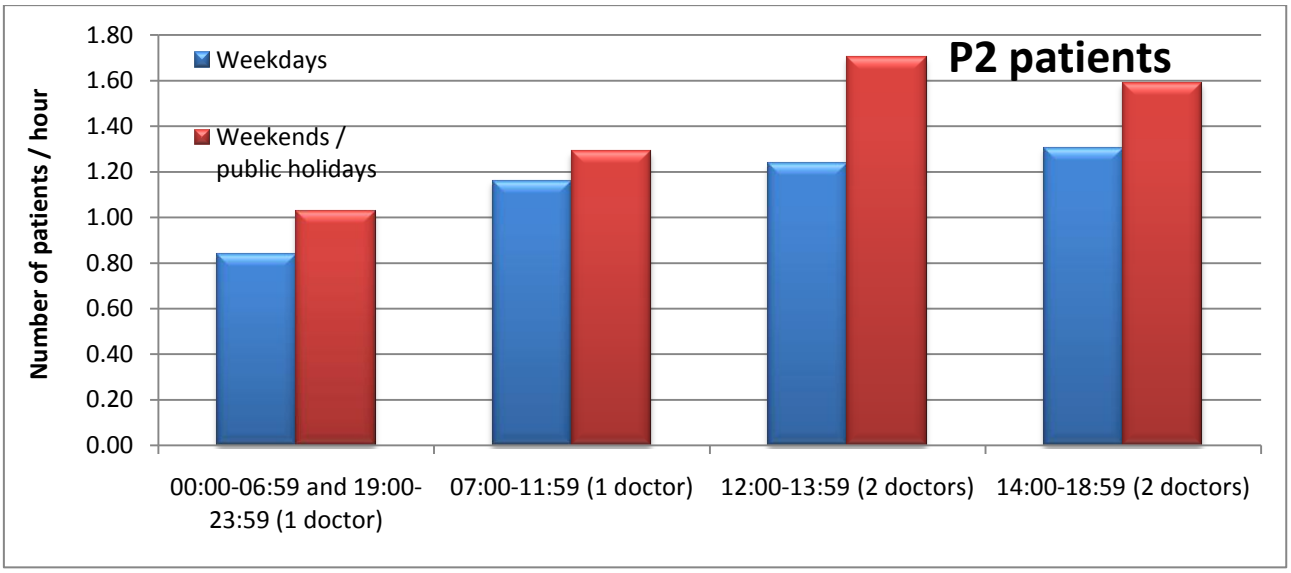

Figure 4-10 Number of patients arriving per hour-P2 patients

Table 4-5 Number of patients arriving per hour-P2 patients

Grouping variables		N	Number of patients per hour			
			mean	standard deviation	95% LCL	95% UCL
overall		913	1.21	0.73	1.16	1.26
weekend / public holiday		268	1.40	0.81	1.30	1.50
weekday		645	1.13	0.67	1.08	1.18
00:00-06:59 and 19:00-23:59 (1 doctor)		233	0.89	0.41	0.84	0.95
07:00-11:59 (1 doctor)		230	1.20	0.67	1.11	1.29
12:00-13:59 (2 doctors)		222	1.37	0.99	1.24	1.50
14:00-18:59 (2 doctors)		228	1.39	0.63	1.31	1.47
weekend / public holiday	00:00-06:59 and 19:00-23:59 (1 doctor)	68	1.03	0.45	0.92	1.14
	07:00-11:59 (1 doctor)	67	1.29	0.73	1.11	1.47
	12:00-13:59 (2 doctors)	66	1.70	1.08	1.44	1.97
	14:00-18:59 (2 doctors)	67	1.59	0.71	1.42	1.76
weekday	00:00-06:59 and 19:00-23:59 (1 doctor)	165	0.84	0.38	0.78	0.90
	07:00-11:59 (1 doctor)	163	1.16	0.64	1.06	1.26
	12:00-13:59 (2 doctors)	156	1.23	0.91	1.09	1.38
	14:00-18:59 (2 doctors)	161	1.30	0.57	1.21	1.39

4.2.4 P3 patients

The frequency distribution of the numbers of patients arriving per hour for P3 patients was fairly normally distributed. The diagnostics of the ANOVA indicated that the variability of the data increased as the number of patients per hour increased. Log, inverse and square root transformations of the data were considered, of which the log and square root transformations were the most successful at stabilising the variance.

The main effect of day type was significant [F (1, 905) = 16.4, p < 0.001]. The numbers of patients arriving per hour on weekends/public holidays was higher across all time periods than the numbers of patients arriving per hour during weekdays. The effect size was small (Cohen's d=0.27).

The main effect of time period was significant [F (3, 905) = 138, p < 0.001]. Post hoc comparisons using the Unequal N HSD test showed the following:

- The numbers of patients arriving per hour at night was significantly lower than during any of the three time periods during the day. The effect sizes were large (Cohen's d= 1.72-1.98).
- There was no significant difference between the numbers of patients arriving per hour in the three daytime time periods.

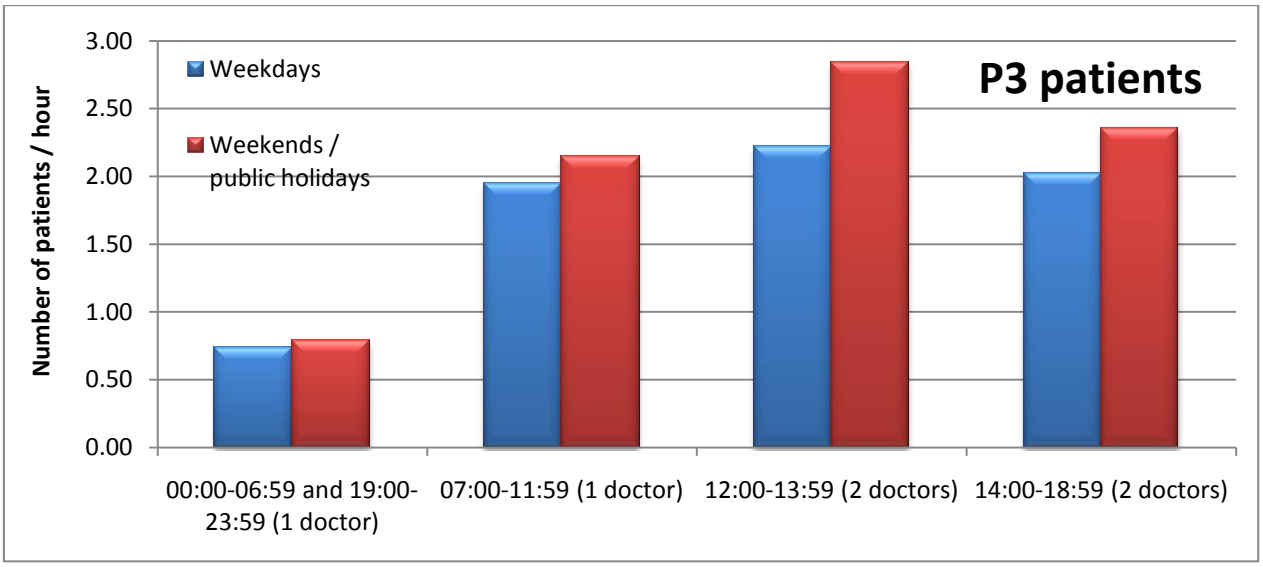

Figure 4-11 Number of patients arriving per hour-P3 patients

Table 4-6 Number of patients arriving per hour- P3 patients

Grouping variables		N	Number of patients per hour			
			mean	standard deviation	95% LCL	95% UCL
overall		913	1.81	1.12	1.74	1.88
weekend / public holiday		268	2.02	1.23	1.88	2.17
weekday		645	1.72	1.06	1.64	1.80
00:00-06:59 and 19:00-23:59 (1 doctor)		233	0.75	0.36	0.71	0.80
07:00-11:59 (1 doctor)		230	2.01	0.87	1.90	2.12
12:00-13:59 (2 doctors)		222	2.40	1.32	2.23	2.58
14:00-18:59 (2 doctors)		228	2.12	0.91	2.00	2.24
weekend / public holiday	00:00-06:59 and 19:00-23:59 (1 doctor)	68	0.79	0.40	0.69	0.88
	07:00-11:59 (1 doctor)	67	2.15	0.86	1.94	2.36
	12:00-13:59 (2 doctors)	66	2.84	1.43	2.49	3.19
	14:00-18:59 (2 doctors)	67	2.35	0.91	2.13	2.57
weekday	00:00-06:59 and 19:00-23:59 (1 doctor)	165	0.74	0.35	0.69	0.79
	07:00-11:59 (1 doctor)	163	1.95	0.87	1.82	2.09
	12:00-13:59 (2 doctors)	156	2.22	1.23	2.02	2.41
	14:00-18:59 (2 doctors)	161	2.02	0.89	1.88	2.16

4.2.5 Follow-up patients

The frequency distribution of the numbers of patients arriving per hour of follow-up patients was positively skewed. The diagnostics of the ANOVA indicated that the variability of the data increased as the number of patients per hour increased. The square root transformations were successful in stabilising the variance.

There was a significant interaction between day type and time period [$F(3, 905) = 31.2$, $p < 0.001$]. The main effects of time period [$F(3, 905) = 159$, $p < 0.001$] and

day type [F (1, 905) = 256, p < 0.001] were also significant. Post hoc comparisons using the Unequal N HSD test showed the following:

- For both day types, the numbers of patients arriving per hour at night was significantly lower than during any of the three time periods during the day. The effect sizes were large (Cohen's d=1.34 to 1.90) (the numbers of patients arriving per hour at night was not significantly different between weekdays and weekends/public holidays);
- For the three daytime time periods, the numbers of patients arriving per hour was significantly higher in each time period for weekdays than for weekends/public holidays. The effect sizes were large (Cohen's d=1.05 to 1.62).
- On weekdays, the numbers of patients arriving per hour was significantly higher in the 07:00-11:59 period than in the 12:00-13:59 period (small effect size, Cohen's d=0.31), and also higher in the 12:00-13:59 period than in the 14:00-18:59 period (large effect size, Cohen's d=1.11). On weekends/public holidays, the numbers of patients arriving per hour was not significantly different in the (07:00-11:59 and 12:00-13:59) or (12:00-13:59 and 14:00-18:59) periods.

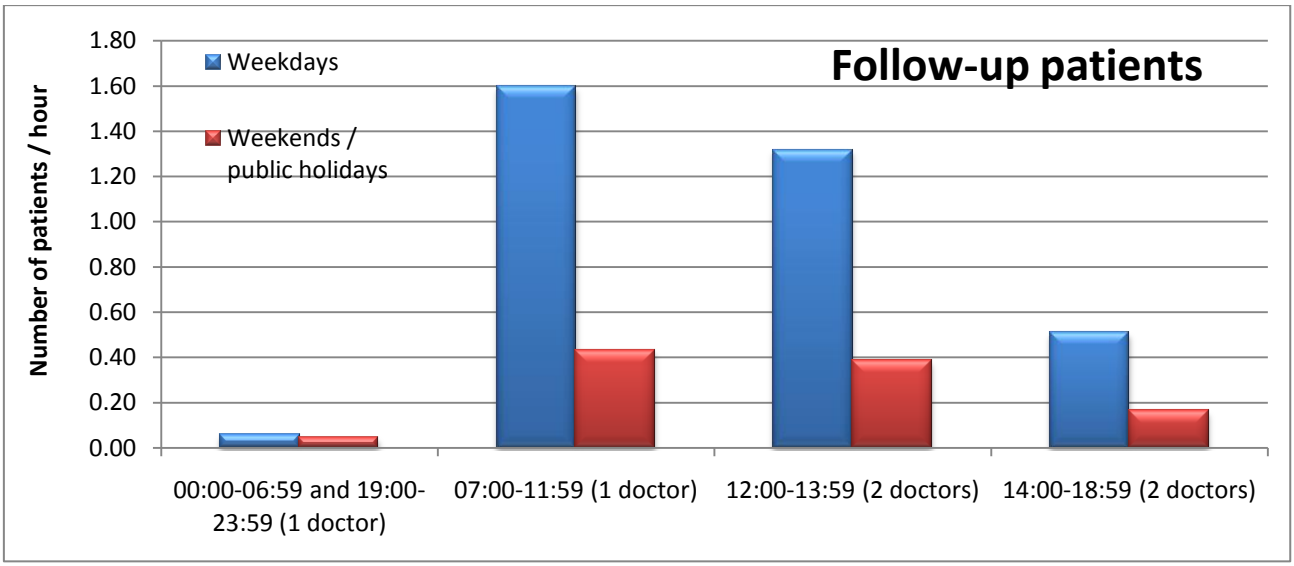

Figure 4-12 Number of patients arriving per hour- follow-up patients

Table 4-7 Number of patients arriving per hour – follow-up patients

Grouping variables		N	Number of patients per hour			
			mean	standard deviation	95% LCL	95% UCL
overall		913	0.69	0.83	0.63	0.74
weekend / public holiday		268	0.26	0.37	0.21	0.30
weekday		645	0.86	0.90	0.79	0.93
00:00-06:59 and 19:00-23:59 (1 doctor)		233	0.06	0.08	0.04	0.07
07:00-11:59 (1 doctor)		230	1.26	0.89	1.14	1.37
12:00-13:59 (2 doctors)		222	1.04	0.96	0.91	1.17
14:00-18:59 (2 doctors)		228	0.41	0.37	0.36	0.46
weekend / public holiday	00:00-06:59 and 19:00-23:59 (1 doctor)	68	0.05	0.07	0.03	0.06
	07:00-11:59 (1 doctor)	67	0.43	0.39	0.34	0.53
	12:00-13:59 (2 doctors)	66	0.39	0.52	0.26	0.51
	14:00-18:59 (2 doctors)	67	0.16	0.20	0.12	0.21
weekday	00:00-06:59 and 19:00-23:59 (1 doctor)	165	0.06	0.09	0.04	0.07
	07:00-11:59 (1 doctor)	163	1.60	0.82	1.47	1.72
	12:00-13:59 (2 doctors)	156	1.32	0.97	1.16	1.47
	14:00-18:59 (2 doctors)	161	0.51	0.37	0.45	0.57

4.3 Analysis of triage-to-doctor waiting times

The triage-to-doctor waiting times are tabulated with respect to day type, time of day, priority group and their combinations in Table 4.8. As discussed previously, the distribution of the waiting times was very positively skewed. Therefore, the estimates of the mean and the 95% confidence intervals of the mean were based on a square-root transformation of the data which greatly improved the approximation to the normal distribution of the data. This transformation of the data was also used in the subsequent ANOVA of the waiting time data.

The data were analysed by an Analysis of Variance (ANOVA) with the waiting time as the dependent variable and day type, time period, priority group, as well as the interactions between them, as the independent variables.

ANOVA assumes that the observations are normally and independently distributed. The observations (the waiting times) were assumed to be independent.

The diagnostics of the ANOVA indicated that the variability of the data increased as the waiting time increased. The square root transformation of the data was not very successful at stabilising the variance. Since it is obvious that the waiting times of the P1 patients were significantly shorter than those of the P2, P3 and follow-up patients, it was decided to analyse these two groups separately.

Table 4-8 Triage-to-doctor waiting times with respect to day type, time of day, priority group and their combinations.

Grouping variables		N	Waiting time in minutes					
			median	minimum	maximum	mean	95% LCL	95% UCL
Overall		16714	40	0	475	40	40	41
weekday		11794	43	0	475	37	36	38
weekend / public holiday		4920	36	0	305	42	41	42
00:00-06:59 and 19:00-23:59 (1 doctor)		4843	34	0	335	34	33	35
07:00-11:59 (1 doctor)		5191	45	0	475	45	44	46
12:00-13:59 (2 doctors)		2165	50	0	370	47	45	49
14:00-18:59 (2 doctors)		4515	40	0	374	40	39	41
P1		222	0	0	135	3	2	4
P2		6071	30	0	370	31	30	32
P3		7895	50	0	475	50	49	51
follow-up		2526	45	0	340	42	41	44
weekday	00:00-06:59 and 19:00-23:59 (1 doctor)	3293	35	0	335	35	33	36
	07:00-11:59 (1 doctor)	3876	48	0	475	47	46	48
	12:00-13:59 (2 doctors)	1503	50	0	370	47	45	50
	14:00-18:59 (2 doctors)	3122	45	0	374	41	39	42
weekend / public holiday	00:00-06:59 and 19:00-23:59 (1 doctor)	1550	30	0	220	32	30	33
	07:00-11:59 (1 doctor)	1315	37	0	305	39	37	41
	12:00-13:59 (2 doctors)	662	50	0	285	46	43	50
	14:00-18:59 (2 doctors)	1393	39	0	255	37	36	39
weekday	P1	143	0	0	80	3	2	4
	P2	4043	30	0	370	31	30	32
	P3	5371	50	0	475	51	50	53
	follow-up	2237	45	0	340	44	42	46
weekend / public holiday	P1	79	0	0	135	2	1	4
	P2	2028	30	0	255	30	29	32
	P3	2524	45	0	305	46	44	47
	follow-up	289	30	0	285	32	28	36

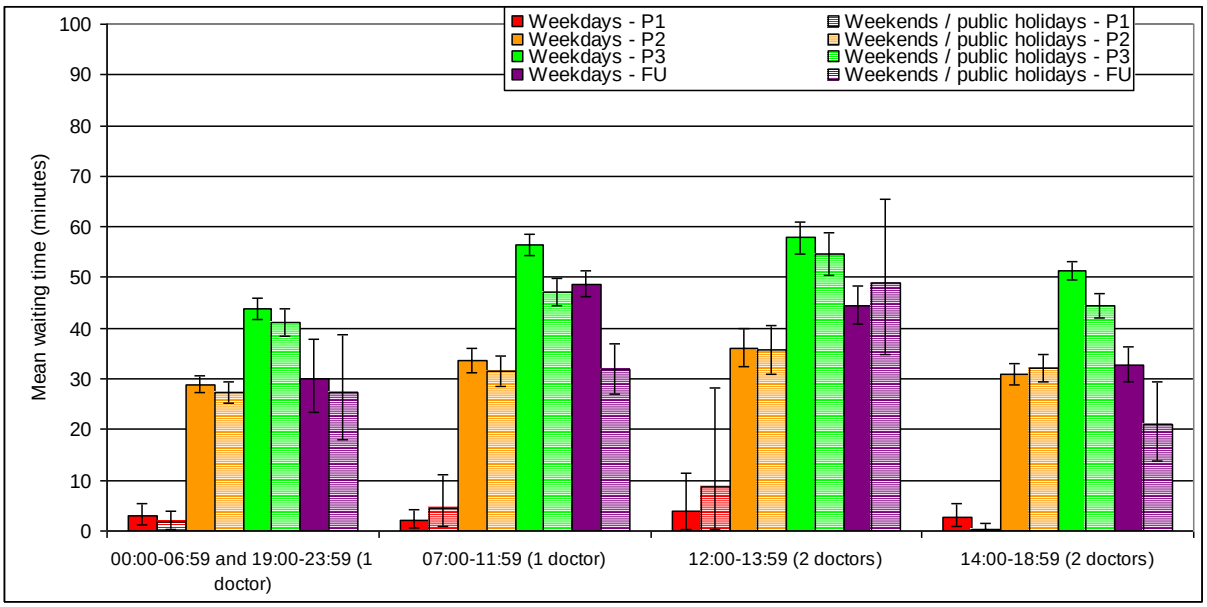

Figure 4-13 Triage-to-doctor waiting times with respect to day type, time of day, priority group and their combinations.

Inspection of the cumulative waiting time curves (Figures 4-14,4-15,4-16) for the three main variables (priority groups, day type and time periods) confirms that priority groups account for the biggest difference in waiting times.

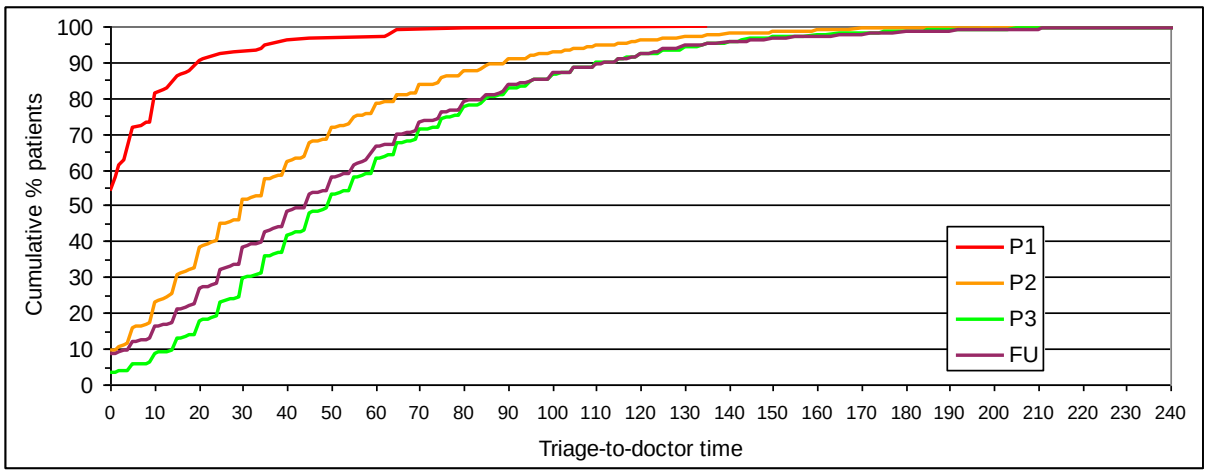

Figure 4-14 Cumulative waiting time curve for priority groups

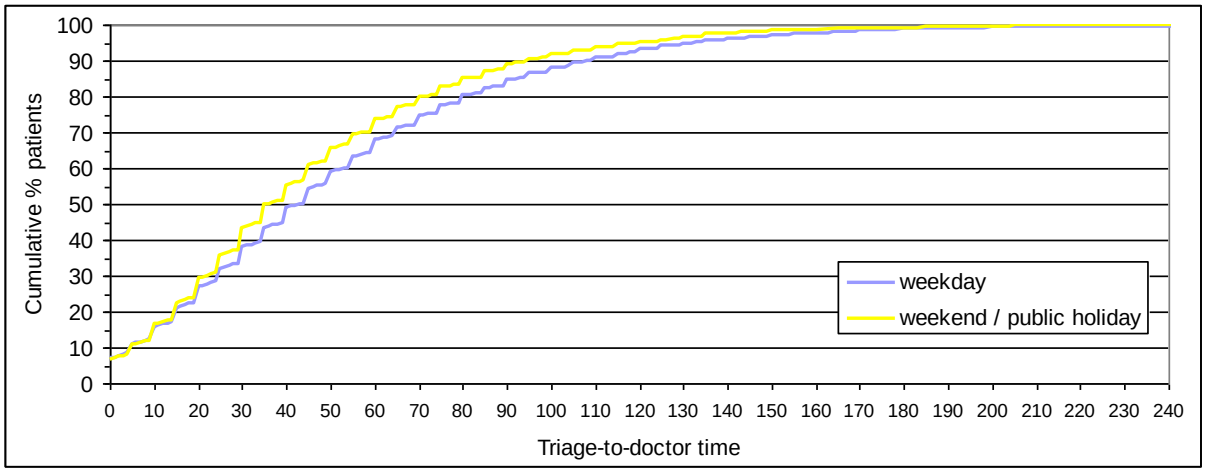

Figure 4-15 Cumulative waiting time curve for day type

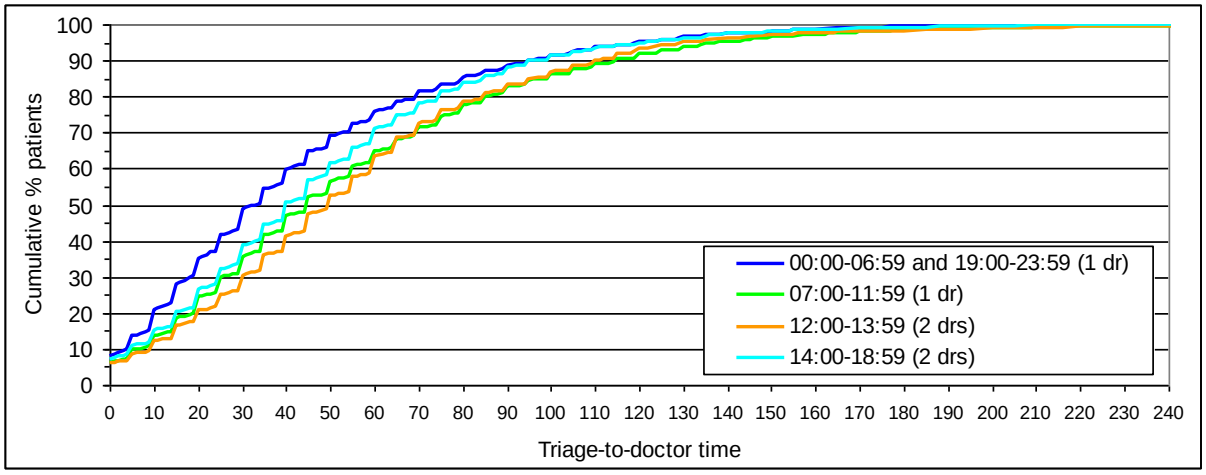

Figure 4-16 Cumulative waiting times for time of day

4.3.1 P1 patients

There was no difference between day type or time period on the waiting time of P1 patients. The average waiting time for P1 patients was 3±1 minutes. The median waiting time was 0 minutes, i.e. (at least) 50% of patients were attended to immediately.

4.3.2 P2, P3 and follow-up patients

There was a significant interaction between day type and time period [F (3, 16468) = 4.77, p = 0.003], between day type and priority [F (2, 16468) = 5.07, p = 0.006] and between time period and priority [F (6, 16468) = 3.78, p = 0.001]. Post hoc comparisons using the Unequal N HSD test (used since there were unbalanced groups) showed the following:

- Day type and time period interaction
    - For each time period except 07:00-11:59, the waiting times were not different for the two day types. For the 07:00-11:59 time period, patients arriving during the week waited longer than patients arriving on weekends / public holidays. The difference in mean waiting times is 47-39=8 minutes, and the effect size is near zero (Cohen's d=0.19).The average waiting time for time period (for each day type) may be read from Table 4.8

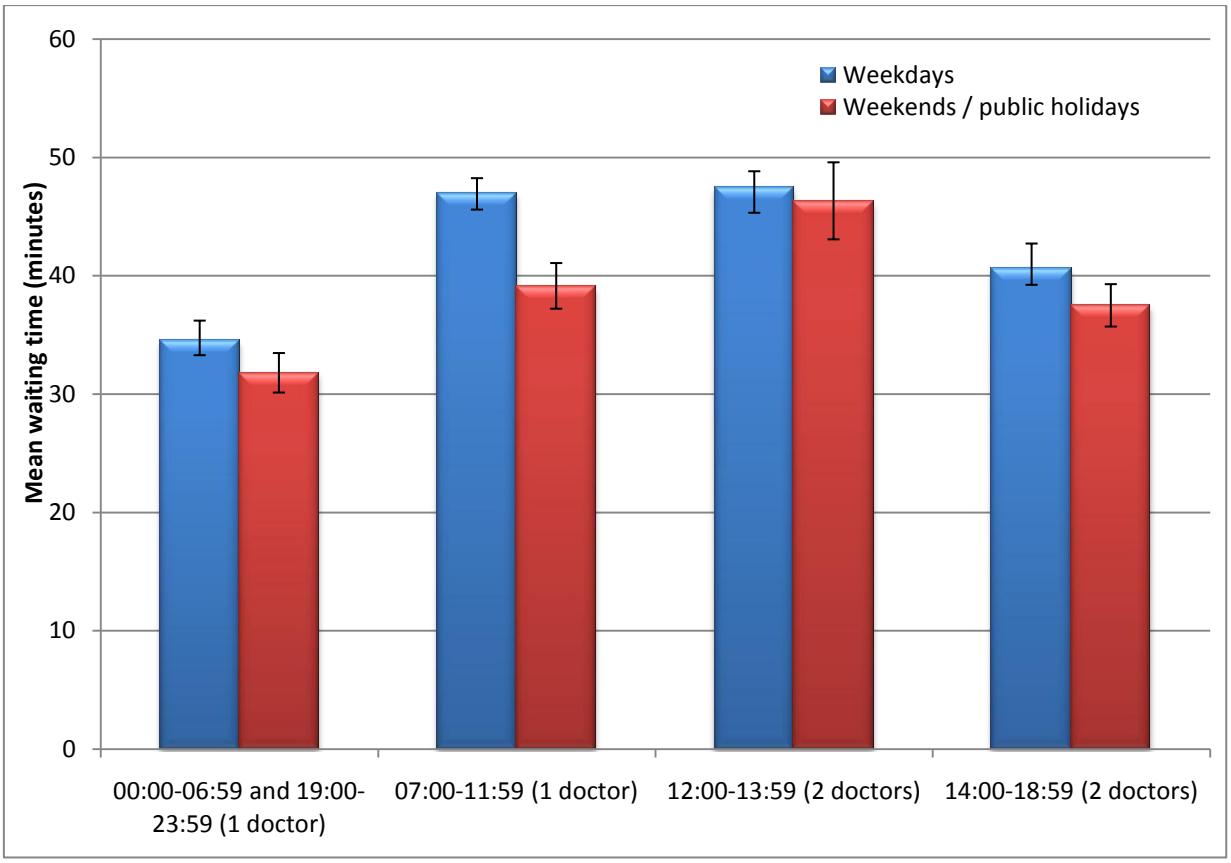

Figure 4-17 Day type and time period interaction

- Day type and priority interaction
  - On weekdays, P3 and follow-up patients waited longer than on weekends / public holidays. P3 patients waited an average of 51-46=5 minutes longer (near zero effect: Cohen's d=0.15), while follow-up patients waited an average of 44-32=12 minutes longer during the week than on weekends / public holidays (small effect: Cohen's d=0.30).
  - During the week, average waiting times were in the order P2 < follow-up < P3, whereas on weekends / public holidays, average waiting times were in the order P2 = follow-up < P3. In other words, there was no significant difference between the waiting times for P2 and follow-up patients on weekends / public holidays, whereas during the week, follow-up patients, on average, waited longer than P2 patients. The

average waiting time for each patient priority group (for each day type) may be read from the table 4.8.

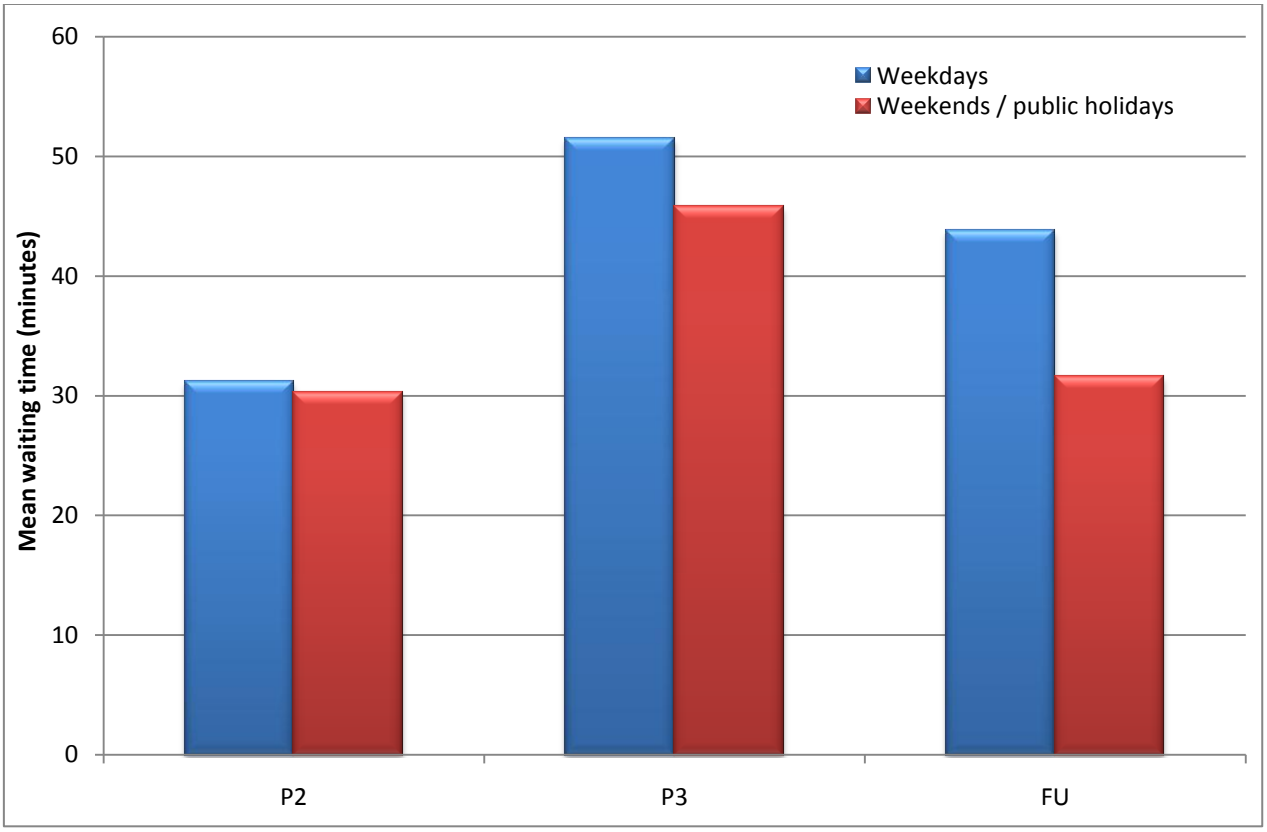

Figure 4-18 Day type and priority interaction

- Time period and priority interaction
    - In general, the mean waiting times were in the order P2 < follow-up < P3, but in the time periods 00:00-06:59 / 19:00-23:59 and 14:00-18:59 there was no significant difference between the waiting times of P2 and follow-up patients.
    - For P2 patients, the waiting time was less in the night than in the 07:00-11:59 and 12:00-13:59 time periods. The mean waiting times increased from 28 (night) to 33 (07:00-11:59) and then 36 (12:00-13:59) minutes

over these time periods. The effect sizes were near zero and small respectively (Cohen's d=0.14 and 0.22 respectively).

- For P3 patients, the waiting times increased in the order night < 14:00-18:59 < 07:00-11:59 ~ 12:00-13:59. The mean waiting times increased from 43 (night) to 49 (14:00-18:59) and then to 54 (07:00-11:59) and 57 (12:00-13:59) minutes respectively. The largest differences of a mean waiting time of 11 and 14 minutes were small effect sizes (Cohen's d=0.26 and 0.34 respectively) while the difference between the night and 14:00-18:59 periods was a near zero effect (Cohen's d=0.16).
- For follow-up patients, the waiting time in the night and 14:00-18:59 periods was significantly lower than in the other two time periods (bearing in mind that there were very few follow-up patients in the former time periods). The waiting times increased from 29 and 31 minutes for the former time period, respectively, to 47 and 45 minutes for the 07:00-11:59 and 12:00-13:59 periods respectively. The differences were all small effects (Cohen's d 0.36-0.42).

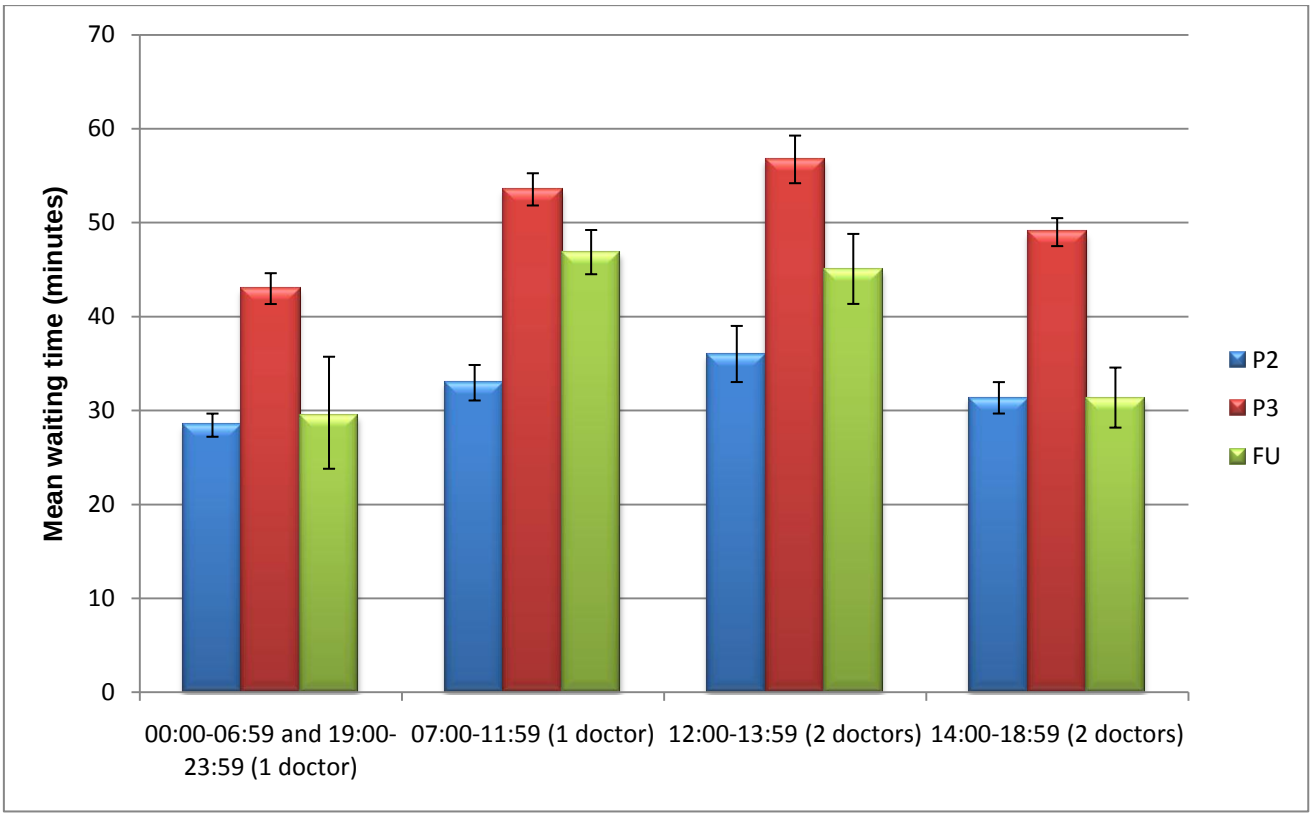

Figure 4-19 Time period and priority interaction

4.4 Analysis of triage-to-doctor waiting times grouped according to time limits

Overall almost 40% of patients waited 30 minutes or less, while most almost 70% of patients waited 60 minutes or less. 6% of patients waited more than 2 hours.

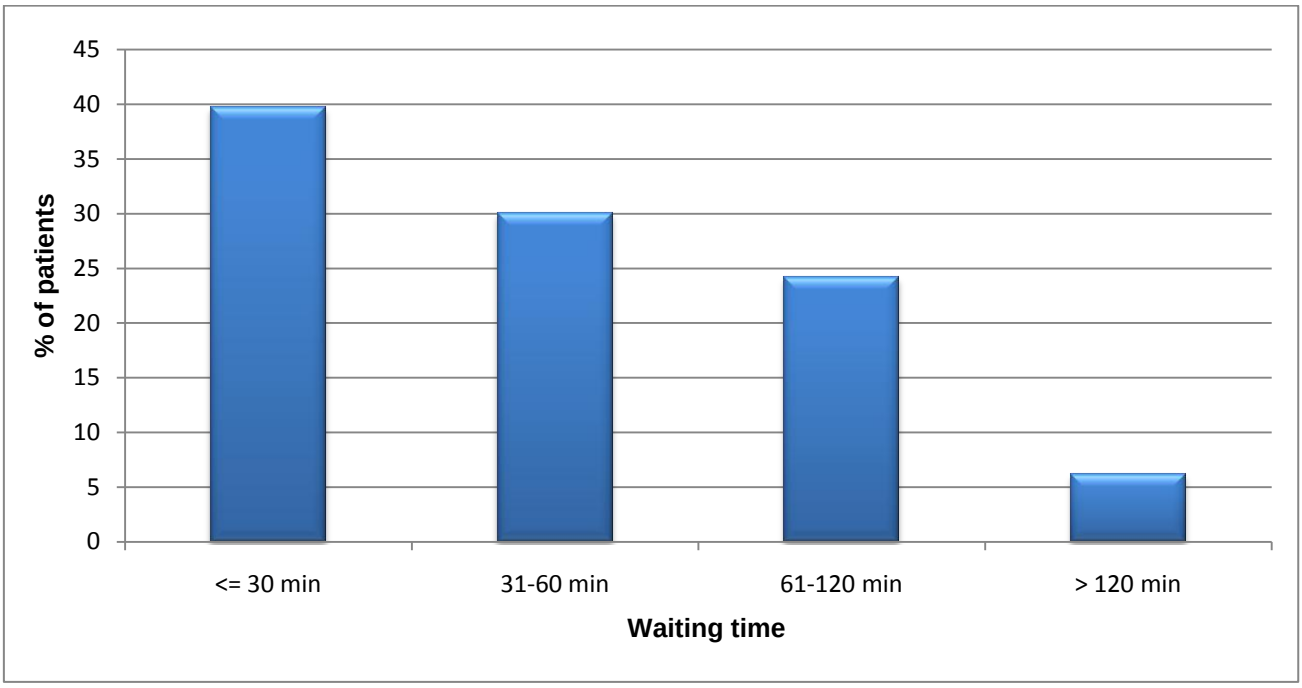

Figure 4-20 Triage-to-doctor waiting times

There was a weak association (Pearson's X^2 test, p<0.001; Cramer's V=0.14*) between patient priority and waiting time. P1 and P2 patients tended to wait for shorter times than P3 and follow-up patients.

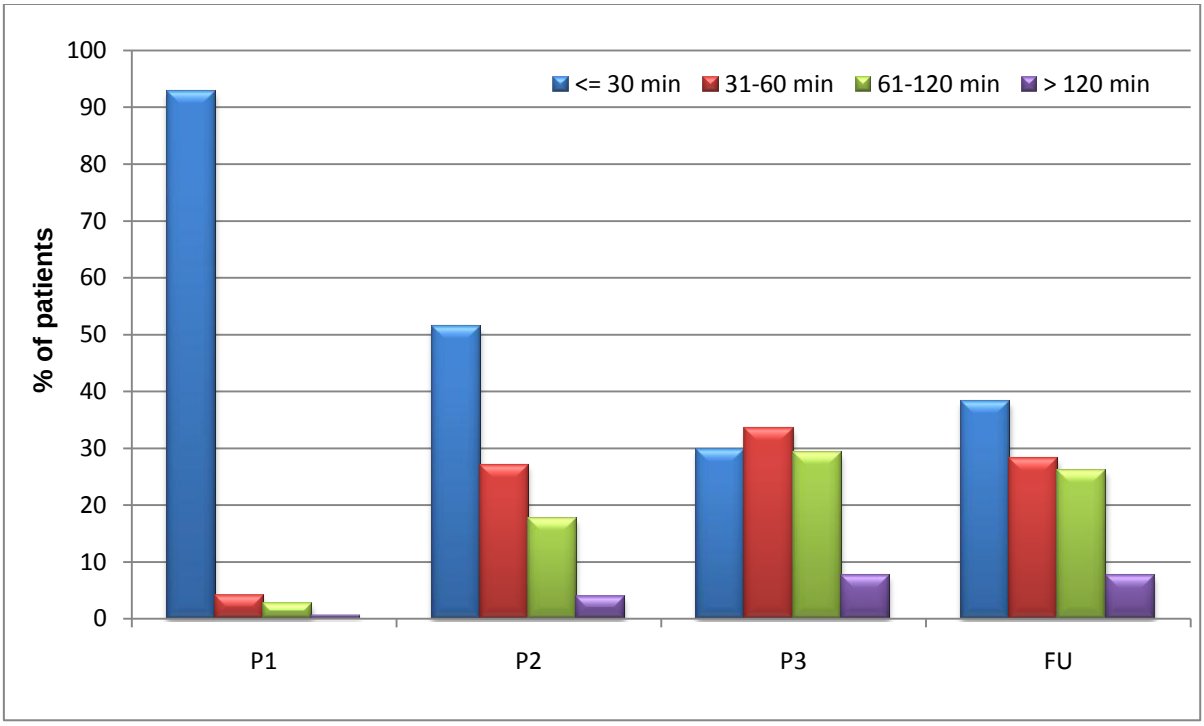

Figure 4-21 Triage-to-doctor waiting times according to priority

* Cramer's V:

>0.5	high/strong association
0.3 to 0.5	moderate association
0.1 to 0.3	weak association
0 to 0.1	little if any association

There was a weak association (Pearson's X^2 test, p<0.001; Cramer's V=0.06) between day type and waiting time. Patients tended to wait longer during the week than on weekends / public holidays (compare <= 30 min and 61-120 min categories)

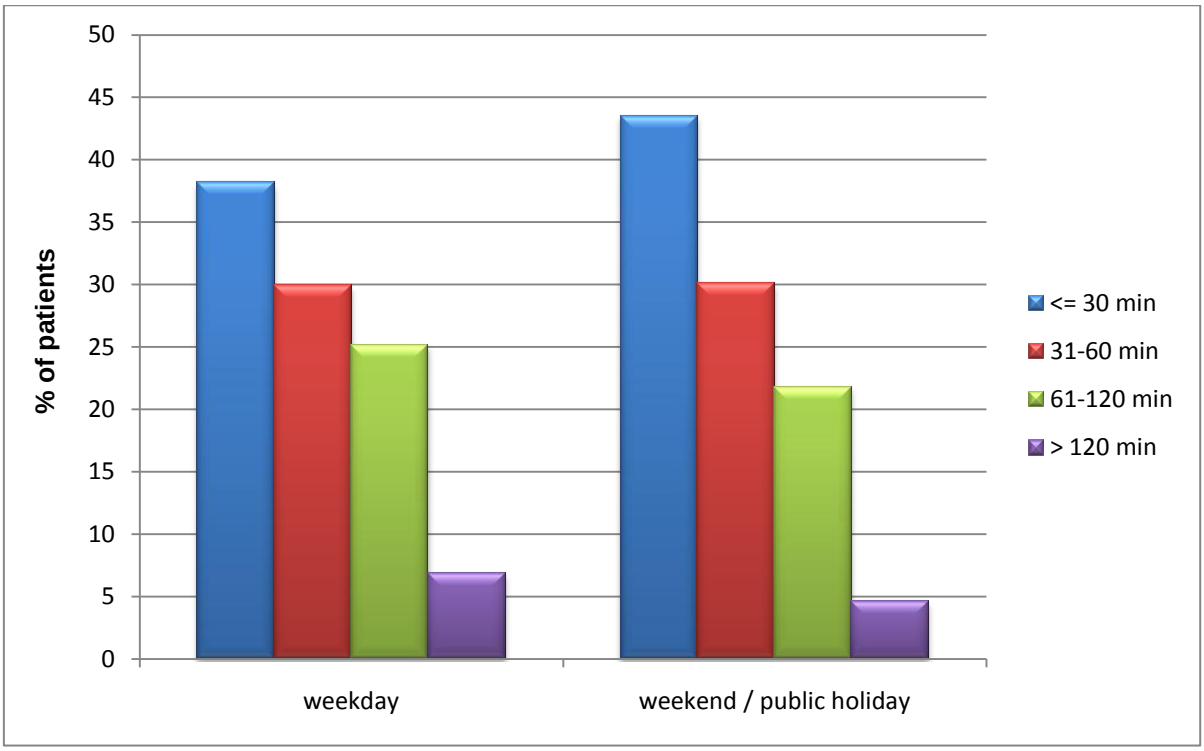

Figure 4-22 Triage-to-doctor waiting times according to day type

There was a weak association (Pearson's X^2 test, p<0.001; Cramer's V=0.08) between time period and waiting time. Patients tended to wait longer during the day (especially the 07:00-11:59 period) than during the night.

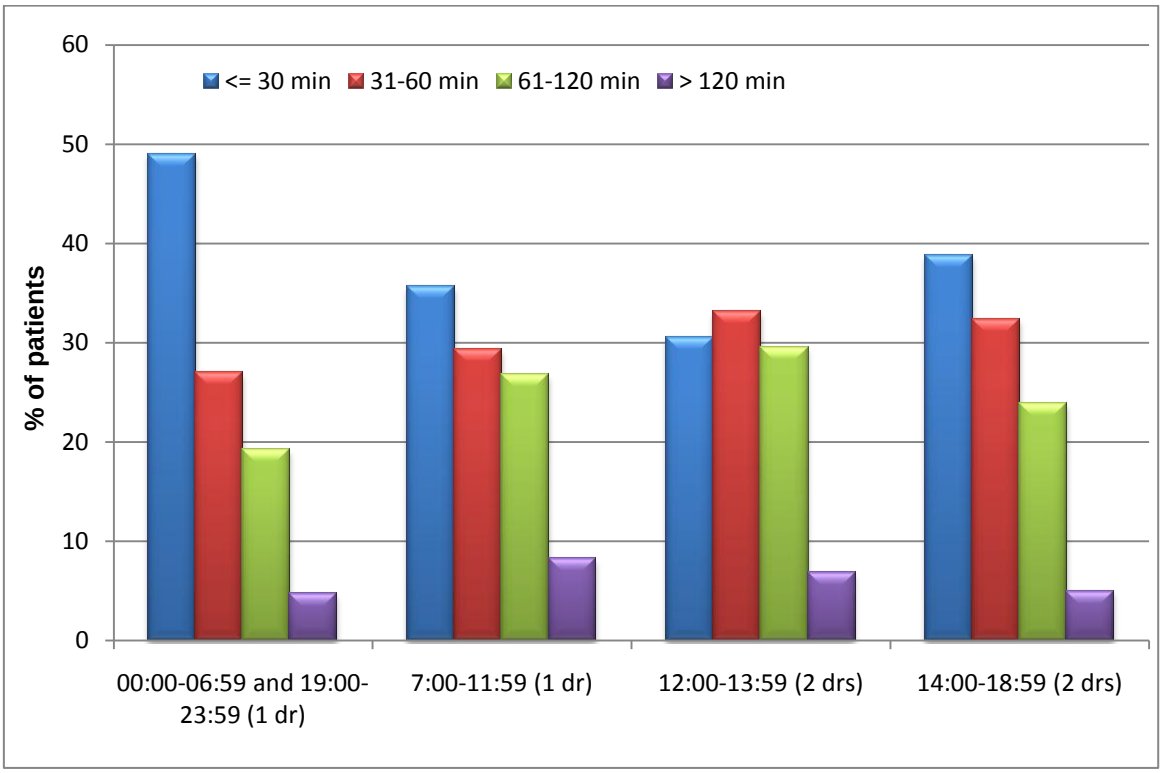

Figure 4-23 Triage-to-doctor waiting times according to time period

4.5 Call-outs

During the study period there were eight occasions when an additional doctor was called out to assist in the ED because of long waiting times. There were also nine occasions when the dayshift doctor on duty stayed for at least one additional hour to assist with heavy patient loads. These occasions were all in the early evening time period.

Chapter 5 DISCUSSION

Patient dissatisfaction related to perceived prolonged triage-to-doctor waiting times at the Dogwood Hospital ED was the main initiating factor of this research. In order to determine if patient dissatisfaction about waiting times was actually warranted, this research was conducted to identify the actual triage-to-doctor waiting times experienced by patients at the Dogwood Hospital ED. It was vital to look at factors that could affect these waiting times, namely priority groups, the average number of patients arriving at different times of the day, the average number of patients presenting on weekdays and weekends/public holidays and the average number of patients presenting per hour.

5.1 Patient Priority Groups

The breakdown of patients according to priority groups is shown in the Results section in Figure 4.1. Priority 3 patients comprised nearly half (47%) of all patients visiting the Dogwood Hospital ED. The substantial use of EDs by non-urgent low acuity (Priority 3) patients, as was found here, has been shown in several studies.[68-70] An assumption may be made that this excessive use of EDs by low acuity patients could lead to overcrowding and therefore prolonged waiting times. No study has found a convincing association between low acuity utilisation and ED overcrowding[71] however. On the contrary, it has been found that ED overcrowding is associated with higher acuity patients, especially those requiring admission.[72] A delay to moving admitted (hospitalised) patients out of the ED is possibly one of the largest contributors to increased waiting times in the ED.

Treating low acuity patients, however, requires treatment space and staff time, both of which could otherwise be utilised to treat other patients. It has therefore been postulated that treating low acuity patients distracts ED personnel from the treatment of more acutely ill patients, leading to longer delays for those patients and hence to worsened crowding.[71] Some studies have found that crowding may be alleviated by diverting low acuity patients away from EDs.[61, 73-77] In a study by Schull *et al*, however, it was found that reducing the number of low-complexity ED patients was unlikely to reduce waiting times for other patients or lessen crowding.[71] The causes of prolonged waiting times are thus complex and may be difficult to establish.

5.2 Average number of patients arriving at the ED at different times of the day

The breakdown of the average number of patients arriving at different times of the day (as measured by the triage time) is displayed in the Results section in Figure 4.2. The average number of patients per hour began to rise from 08:00-08:59 and peaked between 10:00-10:59. Since the reason for presentation at different times was not recorded, the explanations are open to speculation.

The reason for the rise between 08:00-08:59 was most likely because patients may have waited for morning traffic to settle or may have dropped their children off at school before driving to the hospital. With the increased number of vehicles on the road during peak traffic, an associated increased number of road traffic accidents results in patients arriving at hospital during these time periods. Another reason for this rise is that follow-up patients, particularly injury on duty follow-up

patients, tend to present to the ED first thing in the morning so that they can go to work after their check up.

The peak between 10:00-10:59 may be attributed to the fact that employees or employers present to work first thing in the morning to attend to urgent matters and then make their way to the hospital. During these time periods there was only one doctor on duty so it would therefore be expected that the triage-to-doctor waiting times be prolonged in the morning period.

Hodkinson and Wallis[78] showed similar results in a study performed in a secondary hospital in South Africa. This hospital was a public sector hospital that, like others, served a growing population with a high incidence of HIV and tuberculosis, as well as a high level of trauma. Even though this hospital and the population it served differed vastly from that of the Dogwood Hospital, a private hospital, their study also revealed that the peak hour of presentations was between 10:00 and 11:00. No explanation for this was given for this trend. Their study did, however, reveal that the acuity levels of patients increased through the day. In the mornings there were more patients with a green acuity level and in the afternoons there were more patients with yellow and orange acuity levels. The highest proportion of patients with a red acuity level was between 00:00 and 04:00.

For many years the Dogwood Hospital ED functioned with only one doctor on duty for any given period. As a result of increased complaints about prolonged triage-to-doctor waiting times, prior to the period of this study, the managers of the

Dogwood Hospital ED elected to place a second doctor in the ED between 12:00 and 19:00. The idea of placing a second doctor in the ED was an attempt to decrease the triage-to-doctor waiting times. No research had been carried out to identify the cause of prolonged waiting times. The managers of the Dogwood Hospital ED anticipated that that adding a second doctor at a specific time period would reduce the triage-to-doctor waiting times. The time period chosen was based on an estimation of patient numbers arriving at the Dogwood Hospital ED, rather than on true statistics. In section 5.5.3 it will be discussed if this intervention could be shown to be of any benefit.

5.3 Average number of patients arriving at the ED on weekdays *vs*. weekends and public holidays

The average number of patients arriving at the Dogwood Hospital ED on weekdays when compared to weekends and public holidays is shown in the Results section in Figure 4.4. There was a slight increase of approximately four patients per day (6%) on weekends/public holidays compared to weekdays. This increased use of EDs on weekends is echoed in a study performed by Schoenfeld and Mckay in 2010. Schoenfeld and Mckay sought to compare patterns of ED use on weekends with weekdays and to analyse the differences between these two groups. Their study also suggested that more patients utilise the ED on the weekends for low acuity problems. Reasons for this were thought to be due to a variety of social and environmental factors. Working patients with low acuity illnesses or injuries may choose to visit the ED on the weekend instead of missing work for a weekday doctor's appointment. The elderly and children may also have to visit the ED on the weekend as they may be dependent on a working relative to

take them to the doctor. Doctors' offices and walk-in clinics are less likely to be open on weekends than on weekdays, forcing people to seek care for low acuity conditions in EDs.[79]

The six percent increase in patient numbers per day on weekends/public holidays found in this study may not seem to be significant, but there were no or few follow-up patients booked on weekends and public holidays at the Dogwood ED. This suggests that the majority of patients presenting to the ED on weekends/public holidays were new patients. Consultations for new patients consume more time than those for follow-up patients. Based on these findings it would be expected that the triage-to-doctor waiting times on weekends and public holidays would be longer than during the week, although analysis of the triage to doctor waiting times did not show this (see section 5.5.2).

5.4 Number of patients arriving per hour (NPH)

A common cause of ED overcrowding is "exit block" from the ED. "Exit block" or alternatively "access block" is a situation in which the patient is denied access to an inpatient bed from the ED.[80] ED overcrowding may also be attributed to "entry block" which is a situation where overwhelming numbers of patients present to an ED in a short space of time. The resultant overcrowding results in entry to the ED becoming functionally blocked. This occurs regardless of the number of beds available in the hospital.[80] The number of patients arriving per hour (NPH)

therefore has an important role to play in the triage-to-doctor waiting times. Averages, however, can be misleading as is shown in the example below:

> Between 09:00 and 10:59 each day an average of 11 patients presented to the ED during this study period. If they were spaced equally in that time then waiting times would be expected to be short and uniform (depending on the acuity of the patient mix, of course). If, however, all 11 patients presented within a 10 minute period around 10am then the waiting times for some would be short, but may be protracted for others (again depending on the acuity of the patients).

5.4.1 All patients

The frequency distribution of the numbers of patients arriving per hour (per time period, for each day) was slightly positively skewed (see Figure 4.8 and Table 4.3 in the Results section) i.e. a high proportion of patients had a short waiting period and a small number had a longer waiting period. There was a significant association between day type and time period and the numbers of patients arriving per hour. The main effect of time period was also significant i.e. when controlling for other significantly associated independent variables (averaging across the levels of any other these variables, such as day type) the effect of time period was significantly associated with patient presentations. For both day types (weekday and weekend/public holiday), the numbers of patients arriving per hour at night (00:00-06:59 and 19:00-23:59) was significantly lower than during any of the three time periods during the day. The numbers of patients arriving per hour at night was not significantly different between weekdays and weekends/public holidays. This night time finding was also noted in a study by Banerjea and Carter in which 68%

of patients presented to the ED between the hours of 9am- 9pm and only 10% of the daily census of patients arrived during the night (midnight-6am).[81] Night time is a time of the day that most people are at home and asleep and out of "harm's way". This may account for the low numbers of patients arriving per hour at night. Due to crime problems in South Africa, people may not have felt safe to leave their homes at night and were therefore more likely to go to the ED during the day, even if their injury or illness occurred at night. It would be expected that the triage-to-doctor waiting times at night would be shorter than during the day (See section 5.5 below).

On weekdays, the numbers of patients arriving per hour during the 07:00-11:59 and 12:00-13:59 periods was not significantly different, but both these periods had higher numbers of patients arriving per hour than the 14:00-18:59 and the night time periods. Based on these findings as well as the fact that there was only one doctor on duty during the 07:00-11:59 time slot, it would be expected that the triage-to-doctor waiting times between 07:00-11:59 would be longer than any other period (see section 5.5 below).

The second doctor arrived at 12:00 by which time the triage-to-doctor waiting times were already most likely prolonged. Since the numbers of patients arriving per hour between 12:00-13:59 is still as high as it was between 07:00-11:59, and because of the probability of a back log of patients from 07:00-11:59, the triage-to-doctor waiting times between 12:00-13:59 are expected to remain prolonged. (See section 5.5 below)

By contrast, on weekends/public holidays, the numbers of patients arriving per hour during the 07:00-11:59 period was significantly lower than during the week. This was most likely due to the fact that very few or no follow-up patients were booked on weekends or public holidays and fewer road traffic accidents occurred in this time period. The numbers of patients arriving per hour during the other two daytime periods were not significantly different to those during the week. Despite these differences, there were still slightly higher numbers of patients seen on weekends over the 24hour period. Based on these findings it would be expected that the triage-to-doctor waiting times during 07:00-11:59 on weekends/public holidays would be shorter than on weekdays (see section 5.5 below).

5.4.2 P1 patients

The frequency distribution of the numbers of patients arriving per hour for P1 patients was positively skewed (see Figure 4.9 and Table 4.4 in the Results section) as might be expected, as there were many time periods in which the number of P1 patients arriving per hour was zero. There was no significant effect of day type, time period or the interaction between day type and time period on the number of P1 patients. The low numbers of P1 patients make this analysis unreliable, however.

5.4.3 P2 patients

Weekends and public holidays afford people the opportunity to partake in recreational or sporting activities therefore they are more at risk of getting injured on these days. The close proximity of the Dogwood Hospital ED to equestrian,

cycling and race track facilities results in a high influx of injured P2 patients on weekends/public holidays, especially in the afternoons when these events take place. Alcohol and drug abuse is more common on weekends and public holidays resulting in related injuries (e.g. motor vehicle accidents, interpersonal violence and falls).

Elderly people, particularly those that live in retirement homes, are often visited by family members on weekends/public holidays. It is during these visits that illnesses are detected. The experience at the Dogwood ED is that general practitioners and specialists are not available on these days therefore the utilisation of the ED is increased. This may result in the high influx of medical patients on weekends/public holidays. Younger people may tend to ignore their symptoms during the week due to work commitments and it is only when they have free time, such as on weekends/public holidays, that they decide to seek medical attention.

This study demonstrated that numbers of patients arriving per hour for P2 patients on weekends/public holidays was higher across all time periods than the numbers of patients arriving per hour during weekdays (see Figure 4-10 and Table 4-5 in the Results section). Therefore, the main effect of day type was significant. The effect of time period was also significant as the numbers of patients arriving per hour at night for P2 patients was significantly lower than during any of the three time periods during the day. Based on these findings it would again be expected that the triage-to-doctor waiting times on weekends and public holidays would be longer than during the week (see section 5.5 below).

5.4.4 P3 patients

As in the P2 group, the numbers of patients arriving per hour on weekends/public holidays was higher across all time periods than the numbers of patients arriving per hour during weekdays (see Figure 4-11 and Table 4-6 in the Results section). The reasons for this would in all likelihood be the same as described in the P2 group. Therefore, the effects of day type and of time period were significant. The numbers of patients arriving per hour at night was significantly lower than during any of the three time periods during the day. There was no significant difference between the numbers of patients arriving per hour in the three daytime time periods. It would again be expected that the triage-to-doctor waiting times on weekends and public holidays would be longer than during the week (see chapter 5.5 below).

5.4.5 Follow-up patients

There are two types of patients that are classified as follow-up patients in this study: those that have scheduled appointments (which are generally arranged for during office hours) and those that return with problems. Clearly those unscheduled follow-up patients are likely to have a much higher acuity than those with appointments and may re-present at any time of the day or night. These patients were not able to be differentiated in this study.

For both day types, the numbers of patients arriving per hour at night was significantly lower than during any of the three time periods during the day (the numbers of patients arriving per hour at night was not significantly different between weekdays and weekends/public holidays). The reason for this is that very

few or no follow-up patients are booked during the night, although some do arrive outside of their appointment times, at their own convenience.

For the three daytime time periods, the numbers of patients arriving per hour was significantly higher in each time period for weekdays than for weekends/public holidays (see Figure 4-12 and Table 4-7 in the Results section). This was due to the fact that very few or no follow-ups were booked on weekends or public holidays (although as above, some do arrive outside of their appointment times, at their own convenience). On weekdays, follow-up patients were generally given appointments from 10h00 until 14h00, however many did not follow these appointments and presented to the ED first thing in the morning. Their reasons for doing this were that they could go to work after their consultation. These factors would explain the significantly higher numbers of patients arriving per hour in the 07:00-11:59 and 12:00-13:59 time periods. This high influx of follow-up patients on weekdays especially between 07:00-11:59 with one doctor on duty may have resulted in prolonged triage-to-doctor waiting times (see section 5.5 below).

5.5 Actual triage to doctor waiting times

Section 5.4 above contains the description and exploration of the patterns of patient presentations to the Dogwood ED with the resultant predicted expectations of triage-to-doctor waiting times based on these patterns alone. The actual triage-to-doctor waiting times are tabulated with respect to day type, time of day, priority group and their combinations in Table 4.8 in the Results section. Approximately 70% of patients had a triage-to-doctor waiting time of less than one hour while almost 24% of patients waited between one and two hours and about six percent

waited more than two hours. Inspection of the cumulative waiting time curves (Figures 4-14 to 4-16 in the Results section) for the three main variables (priority groups, day type and time periods) confirms that priority groups account for the biggest difference in waiting times. This is the point of triage and indicates that it was effectively applied in this study population.

5.5.1 P1 patients

There was no difference between day type or time period on the waiting time of P1 patients. The median waiting time was 0 minutes, which means that at least 50% of patients were attended to immediately. This corresponds to the target treatment times stipulated by the SATS. Some P1 patients were not seen immediately, which is why the study data revealed an average waiting time for P1 patients of 3±1 minutes.

Numerous factors may be responsible for this:

- The record-keeping may not have been precisely accurate.
- The ED doctor may have been occupied with another P1 patient.
- The ED doctor may have been resuscitating in one of the wards and may not have been present in the ED at the time of arrival of the P1 patient.
- The P1 patient may have had stable vital signs which would have allowed the ED doctor to complete the task he/she was busy with.
- The P1 patient may have been categorised a P1 only due to the mechanism of injury and may therefore have had stable vital signs and not actually required urgent attention.

5.5.2 P2, P3 and follow-up patients

It was postulated that the triage-to-doctor waiting times on weekends for P2 and P3 patients would be prolonged based on the numbers of patients arriving per hour as well as because consultations with these types of patients are generally longer than with follow-up patients. Even though the numbers of P2 and P3 patients arriving per hour on weekends/public holidays was slightly higher for each time period except 07:00-11:59, the waiting times were not significantly different for the two day types (see Figure 4-17 in the Results section). Despite the fewer follow-up patients on weekends or public holidays and the slightly larger influx of P2 and P3 patients on these days, there was no change in waiting times.

For the 07:00-11:59 time period however, patients arriving during the week waited longer than patients arriving on weekends / public holidays. Reasons for this are that on weekdays for all patients, the numbers of patients arriving per hour during the 07:00-11:59 and 12:00-13:59 periods was higher than the afternoon and evening time periods. It was also noted that there were more follow-up patients during this period on weekdays than on weekends / public holidays: the “sudden” arrival of these patients in the morning shift may have led to an “entrance-block” phenomenon with subsequent prolongation of waiting times. During the 07:00-11:59 period there was only one doctor on duty which presumably also contributed to a backlog of patients and longer waiting times. The data suggests that the pattern of presentation of patients may be more important than the averages within a time-period and more important than a distinction between follow-up or fresh P2 or P3 cases.

On weekdays, P3 and follow-up patients waited longer than on weekends and public holidays (see Figure 4-18 in the Results section). As previously mentioned, there were many more follow-up patients on weekdays, so their longer waiting times are can be explained. However, there were actually slightly fewer P1, P2 and P3 patients during the week, so the longer waiting times of the P3 patients were probably not as a result of a greater volume of higher acuity patients. Even a single high-acuity patient (such as a patient requiring cardiopulmonary resuscitation) or a low-acuity patient that required a significant amount of the doctor's time (such as a psychiatric patient or a patient with a complex wound that required repair) may have consumed the time of the ED doctor and caused a delay in patient throughput and therefore waiting times. This information would not be evident from the available data. Other possible reasons that the P3 patients waited longer may have been because the beds in the ED were occupied with the large numbers of follow-up patients.

During the week, average waiting times were in the order P1 < P2 < follow-up < P3, whereas on weekends / public holidays, average waiting times were in the order P1< P2 = follow-up < P3 (see Figure 4-18 in the Results section). In other words, there was no significant difference between the waiting times for P2 and follow-up patients on weekends / public holidays, whereas during the week follow-up patients, on average, waited longer than P2 patients. This might easily be explained if the follow-up patients seen on weekends were generally unscheduled and therefore of a higher acuity than follow-up patients seen during the week. These re-presenting patients would probably also be triaged higher and therefore prioritised over P3 patients.

These findings support the correct implementation of the fundamental triage principle that Priority 2 patients should be seen before lower priority patients.

For P2 patients, the waiting time was lower in the night than in the morning and early afternoon time periods (see Figure 4-19 in the Results section). A reason for this may be that the numbers of patients arriving per hour at night for all patients was significantly lower than during any of the time periods during the day. The mean waiting times increased from 28 minutes at night to 33 minutes (07:00-11:59) to 31 minutes (14:00-18:59) and then 36 minutes (12:00-13:59) over these time periods. Comparing these times to the target times set out by the SATS, it appears that if the average waiting times of P2 patients fell into the yellow category (target time to treatment less than 60 minutes), then they were seen within an acceptable target time. However if the average waiting times of P2 patients fell into the orange category (target time to treatment less than 10 minutes), they would not have been seen in the designated target time. The lack of distinguishing orange and yellow patients was a limitation of this study.

For P3 patients, the waiting times increased in the order: night < late afternoon < morning < early afternoon (see Figure 4-19 in the Results section). The mean waiting times increased from 43 minutes (night) to 49 minutes (14:00-18:59) to 54 minutes (07:00-11:59) and to 57 minutes (12:00-13:59) respectively. There was only one doctor on duty from 07h00-11h59 and the numbers of patients arriving per hour during this time period was higher than during the 14h00-18h59 time slot and night time slot. This, together with the high influx of follow-up patients during this time slot on weekdays, would certainly account for the longer waiting times for

P3 patients during 07:00-11:59 – this would again have represented the “entrance-block” phenomenon. The numbers of patients arriving per hour between 12:00-13:59 were still as high as it was between 07:00-11:59, and because of the probability of a backlog of patients from 07:00-11:59, the longer mean waiting times between 12:00-13:59 are the end result. The actual mean waiting times were still within acceptable parameters, although it is more often the perceived waiting time (or waiting times that are out of keeping with patients’ expectations) that leads to complaints.

For follow-up patients, the waiting time in the night and late afternoon periods was significantly lower than in the other two time periods, considering the fact that there were very few follow-up patients in the former time periods (see Figure 4-19 in the Results section). Most follow-ups are seen in the morning. The waiting times increased from 29 minutes and 31 minutes for the night and late afternoon periods, respectively, to 47 minutes and 45 minutes for the morning and early afternoon periods respectively. The explanation for this is likely the same as for the P3 patients, as well as the fact that after-hours follow-up patients are probably unscheduled patients with a higher acuity than those arriving for an arranged appointment.

5.5.3 The Second Doctor

In an attempt to deal with prolonged waiting times in the Dogwood ED, the managers placed a second doctor in the ED every day from 12:00 until 19:00 some years before the study period. As noted above the mean waiting times for

P2, P3 and follow-up patients were the longest in the morning and early afternoon timeslots. Reasons for this were discussed.

The prolonged waiting times in the morning could be attributed to the presence of only one doctor, however, a second doctor arriving at 12:00, did not make a difference in the mean waiting time until the later afternoon. In fact the mean waiting times of P2 and P3 patients between 12:00-13:59 were longer than those for 07:00-11:59. Explanations for this finding could be that by the time the second doctor arrived, there was a backlog of patients in the ED from the morning period (in which the numbers of patients arriving per hour was high and only one doctor was on duty). On arrival, the second doctor would examine all the unseen patients from the 07:00-11:59 time slot and the first doctor would continue with the work up and discharge of patients he would have already seen. The numbers of patients arriving per hour between 12:00-13:59 remained as high as it was between 07:00-11:59, so the longer waiting times between 12:00-13:59 were therefore sustained until the later afternoon despite two doctors working.

The mean waiting times between 14:00-18:59 were shorter than for 07:00-11:59 and 12:00-13:59. It could not be determined whether this was due to the presence of a second doctor or because the numbers of patients arriving per hour between 14:00-18:59 was lower that the former time periods or because the backlog of patients from the morning would have been dealt with. There were significantly fewer follow-up patients between 14:00-18:59, so this may have accounted for the shorter mean waiting times.

Due to the numerous variables affecting triage-to-doctor waiting times it has unfortunately not been possible in this study to prove if the addition of a second doctor has had direct effect on the triage-to-doctor waiting times, although it appears likely as if it did. A staggering of the arrival of the follow-up patients or an earlier arrival of the second doctor might reduce the waiting times of the morning and early afternoon.

5.6 The frequency distribution of triage-to-doctor waiting times

In a survey by Veith *et al*, patients believed the appropriate waiting time for ED care to be less than one hour and satisfaction decreased significantly if waits exceeded one hour.[39] The frequency distribution of triage-to-doctor waiting times in this research is shown in Figure 4.5, Figure 4.6 and Table 4.1 in the Results section which shows that most waiting times were short, while few waiting times were long. Almost 40% of patients waited 30 minutes or less to see a doctor while almost 70% of patients waited 60 minutes or less. Approximately 24% waited between one and two hours and only 6% of patients waited more than two hours. In the study by Fernandes *et al*, 53% of patients left the ED dissatisfied within one hour and 75% within 2 hours of registration.[34]

Based on these findings, it can be assumed that 30% of patients in this study could have become dissatisfied with their waiting times as they had waited more than one hour before seeing a doctor. Approximately 70% of the patients in this study waited less than one hour so it is unlikely that dissatisfaction would arise in this group. There is limited information in the literature with which to compare these findings.

5.7 Call-outs

Each of the occasions that an additional doctor was either called into the unit, or stayed late to work in the ED (a total of 17 occasions out of 243 days (6.9% of days) was because of a sudden influx of patients or because of a major trauma incident. This lends further credibility to the suspicion that an “entrance-block” phenomenon was the greatest cause of prolonged waiting times in this study.

5.8 Limitations of this study

1. This study was a retrospective study. Sources of error due to confounding and bias are more common in retrospective studies.
2. The quality of the data may have had an impact on this study. Analysis of the data detected missing entries, duplicate entries and incorrect entries.
3. Poor or inaccurate time keeping by the nursing staff member assigned to the particular patient for whatever reason.
4. Timing on records were not validated by a second party.
5. This study was conducted in a private hospital only therefore the findings of this study may not be representative of those of a public hospital ED. Public hospital EDs function differently to those in private hospitals and have different population demographics.
6. Patients that were triaged but left without being seen were not included.
7. Other factors such as the occupancy of the hospital, admission rates, delays caused by clerical matters and detailed patient information were not recorded, which may have had a material impact on patient waiting times.

5.9 Strengths of this study

1. This was the first study done in the private sector in South Africa
2. Large sample size was included, 16 714 records were researched
3. Research was inexpensive to conduct.
4. This research is reproducible in any other emergency department within the hospital group, as the data capturing method is the same.

Chapter 6 CONCLUSION

The waiting times of Priority 1 and Priority 2 patients were shorter than those for Priority 3 and follow-up patients.

The majority of Priority 1 patients were seen immediately or within a few minutes of triage on weekdays, weekends/public holidays and during all time periods. This complies with the target times set out by most triage groups and shows that these patients were appropriately dealt with. It is therefore, unlikely that Priority 1 patients in this study were dissatisfied with their waiting times.

Priority 2 patients waited less than Priority 3 patients on weekdays, weekends/public holidays and during all time periods. These findings show that the Dogwood ED was compliant with the triage principles set out by international and local triage groups. Unfortunately, Priority 2 patients at the Dogwood ED were not divided into orange and yellow categories as stipulated by the SATS, it was not possible to determine accurately if their waiting times were in keeping with the target times set out by SATS. Priority 2 mean waiting times across all time periods were all within the SATS target time for the yellow category of one hour, but were substantially higher than the SATS target time of 10 minutes for the orange category. Priority 2 patients in this study may or may not have been satisfied with their waiting times.

Priority 3 patients comprised the largest percentage of all patients presenting to the Dogwood Hospital ED and in this study seemed to be the most adversely affected group with respect to waiting time. Priority 3 patients waited the longest

out of all patients on both weekdays and weekends/public holidays as well as during all time periods. This was an acceptable finding with regards to triage principles. During the week, Priority 3 patients waited the longest in the 07:00-11:59 and 12:00-13:59 time periods. This was probably because of the high influx of follow-up patients during these time periods. Priority 3 patients also waited longer on weekdays than on weekends/public holidays which was also attributed to the high numbers of follow-up patients during the week. The mean waiting times for Priority 3 patients across all time periods complies with the target time of four hours set by the SATS. Although patients in this group are of low acuity, they still expect to be seen by a doctor in a reasonable time period. It was likely that patient dissatisfaction was high in this group of patients.

Follow-up patients in this study waited less than Priority 3 and longer than and/or equal to Priority 2 patients. The reason for this was that follow-up patients are given appointments and the staff of the Dogwood ED feel obliged to try and keep the appointment times for these patients. Follow-up patients present in large numbers during weekday mornings and are often seen prior to priority 3 patients. Follow-up patients therefore had a great impact on the triage-to-doctor waiting times of priority 3 patients. Complaints often arise in this group as they expect to be seen on the time given to them on their appointment card.

In general all patients tended to wait longer during the week than on weekends/public holidays. All patients tended to wait longer during the day than during the night. These findings are attributed to the high number of follow-up patients presenting to the ED on weekday mornings.

Overall this study revealed that for 70% of patients the triage-to-doctor waiting time was less than 1 hour. Almost 24% of patient waited between one and two hours and about six percent waited more than two hours. Most patients in this study were seen by a doctor within the target times set by the SATS however numerous studies suggest that patients believe that the acceptable triage-to-doctor waiting time is approximately one hour. In this study patient dissatisfaction would most likely have arisen in 30% of patients.

Recommendations

The high number of follow-up patients presenting to the Dogwood Hospital ED on weekdays and particularly between the 07:00-11:59 and 12:00-13:59 time periods may be responsible for the prolonged triage-to-doctor waiting times during these periods. A recommendation would be to fast track these patients within the ED or in a separate area of the hospital.

If fast tracking is not possible, then it would be advisable to spread the follow-up patient appointments over a longer time period rather than giving them appointments between 10:00 and 14:00 only. It must be emphasised to these patients that they should adhere to their appointment times in order for this to be effective.

Irrespective of triage status, all patients should be kept up to date with regards to the waiting times in the ED. A dedicated staff member of the ED should be assigned this job. This practice is supported by the literature[32] and may alleviate agitation brewing in the waiting area.

Staff of the ED needs to be professional and courteous at all times. Staff rudeness is a common cause of patients leaving without being seen.

Waiting room facilities including amenities for children can be addressed in order to make the waiting times bearable.

Introducing a second doctor during the week in morning time period would theoretically help decrease waiting times. With the large influx of follow-up patients in this time period, however, the beds in the ED may become saturated and no new patients can be examined. Bringing the second doctor in earlier than 12:00 on certain days has already been introduced into the Dogwood Hospital ED, however no research has been conducted in order to assess the effectiveness of this measure.

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APPENDIX 1 Data collection sheet etc

	Pt no	R	O	Y	G	F/U	Triage time	File time	Dr time	Triag/File	Trige/Dr
1											
2											
3											
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APPENDIX 2 Human Research Ethics Committee clearance

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
R14/49 Dr C Piccolo

CLEARANCE CERTIFICATE	**M10448**
PROJECT	How Long Before I See a Doctor?" An Analysis of Triage-To-Doctor Waiting Times in an Emergency Department in a Johannesburg Private Hospital
INVESTIGATORS	Dr C Piccolo.
DEPARTMENT	Division of Emergency Medicine
DATE CONSIDERED	30/04/2010
DECISION OF THE COMMITTEE*	Approved unconditionally

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 03/05/2010 **CHAIRPERSON** .....
(Professor PE Cleaton-Jones)

*Guidelines for written 'informed consent' attached where applicable
cc: Supervisor : Dr M Well

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University.
I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the Committee. **I agree to a completion of a yearly progress report.**

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES...

APPENDIX 3 The Adult SATS score

ADULT TRIAGE SCORE							© South African Triage Group 2008	
	3	2	1	0	1	2	3	
Mobility				Walking	With Help	Stretcher/ Immobile		Mobility
RR		less than 9		9-14	15-20	21-29	more than 29	RR
HR		less than 41	41-50	51-100	101-110	111-129	more than 129	HR
SBP	less than 71	71–80	81-100	101-199		more than 199		SBP
Temp		Cold OR Under 35		35-38.4		Hot OR Over 38.4		Temp
AVPU		Confused		Alert	Reacts to Voice	Reacts to Pain	Unresponsive	AVPU
Trauma				No	Yes			Trauma
over 12 years / taller than 150cm								

Colour	RED	ORANGE	YELLOW	GREEN	BLUE
TEWS	7 or more	5-6	3-4	0-2	DEAD
Target time to treat	Immediate	less than 10 mins	less than 60 mins	less than 240 mins	
Mechanism of injury		High energy transfer			
Presentation		Shortness of breath - acute		ALL OTHER PATIENTS	DEAD
		Coughing blood			
		Chest pain			
		Haemorrhage - uncontrolled	Haemorrhage - controlled		
	Seizure - current	Seizure - post ictal			
		Focal neurology - acute			
		Level of consciousness reduced			
		Psychosis / Aggression			
		Threatened limb			
		Dislocation - other joint	Dislocation - finger or toe		
		Fracture - compound	Fracture - closed		
	Burn – face / inhalation	Burn over 20%	Burn - other		
		Burn - electrical			
		Burn - circumferential			
		Burn - chemical			
		Poisoning / Overdose	Abdominal pain		
	Hypoglycaemia - glucose less than 3	Diabetic - glucose over 11 & ketonuria	Diabetic - glucose over 17 (no ketonuria)		
		Vomiting - fresh blood	Vomiting - persistent		
		Pregnancy & abdominal trauma or pain	Pregnancy & trauma		
			Pregnancy & PV bleed		
Pain		Severe	Moderate	Mild	
	Senior Healthcare Professional's Discretion				

APPENDIX 4 The Child SATS score

CHILD TRIAGE SCORE								© South African Triage Group 2008
	3	2	1	0	1	2	3	
Mobility				Walking	With Help	Stretcher/ Immobile		Mobility
RR	less than 15	15-16		17-21	22-26	27 or more		RR
HR	less than 60	60-79		80-99	100-129	130 or more		HR
Temp		Cold OR Under 35		35-38.4		Hot OR Over 38.4		Temp
AVPU		Confused		Alert	Reacts to Voice	Reacts to Pain	Unresponsive	AVPU
Trauma				No	Yes			Trauma
3 to 12 years old / 96 to 150 cm tall								

COLOUR	RED	ORANGE	YELLOW	GREEN	BLUE
TEWS	7 or more	5-6	3-4	0-2	DEAD
Target time to treat	Immediate	less than 10 mins	less than 60 mins	less than 240 mins	
Mechanism of injury		High energy transfer			
Presentation	Drooling	Shortness of breath			
		Stridor			
		Wheeze			
		Haemorrhage - uncontrolled	Haemorrhage - controlled		
	Seizure - current	Seizure - post ictal			
		Focal neurology - acute			
		Level of consciousness reduced			
		Exhaustion			
		Purpura			
		Dislocation - other joint	Dislocation - finger or toe	ALL OTHER PATIENTS	
		Fracture - compound	Fracture - closed		
	Burn – face / inhalation	Burn over 10%	Burn - other		
		Burn - electrical			
		Burn - circumferential			
		Burn - chemical			
		Poisoning / Overdose	Abdominal pain		
	Hypoglycaemia – glucose less than 3	Diabetic - glucose over 11 & ketonuria	Diabetic - glucose over 17 (no ketonuria)		
		Dehydration	Vomiting - persistent		
		PR bleeding	Inappropriate history		
Pain		Severe	Moderate	Mild	
	Senior Healthcare Professional's Discretion				

APPENDIX 5 The Infant SATS score

INFANT TRIAGE SCORE © South African Triage Group 2008								
	3	2	1	0	1	2	3	
Mobility				Normal for age		Stretcher/ Immobile		Mobility
RR	less than 20	20-25		26-39		40-49	50 or more	RR
HR	less than 70	70-79		80-130		131-159	160 or more	HR
Temp		Cold OR Under 35		35-38.4		Hot OR Over 38.4		Temp
AVPU				Alert	Reacts to Voice	Reacts to Pain	Unresponsive	AVPU
Trauma				No	Yes			Trauma
younger than 3 years / smaller than 95cm								

COLOUR	RED	ORANGE	YELLOW	GREEN	BLUE
TEWS	7 or more	5-6	3-4	0-2	DEAD
Target time to treat	Immediate	less than 10 mins	less than 60 mins	less than 240 mins	DEAD
Mechanism of injury		High energy transfer			
Presentation	Drooling	Shortness of breath		ALL OTHER PATIENTS	
	Stridor	Wheeze			
		Haemorrhage - uncontrolled	Haemorrhage - controlled		
	Seizure - current	Seizure - post ictal			
		Focal neurology - acute			
		Level of consciousness reduced			
		Floppy infant			
		Purpura			
		Dislocation - other joint	Dislocation - finger or toe		
		Fracture - compound	Fracture - closed		
			Unable to weight bear		
	Burn – face / inhalation	Burn over 10%	Burn - other		
		Burn - electrical			
		Burn - circumferential			
		Burn - chemical			
		Poisoning / Overdose	Abdominal pain		
	Hypoglycaemia - glucose less than 3				
		Dehydration	Vomiting - persistent		
			Not feeding		
			Not urinating		
		PR bleeding	Inappropriate history		
			Prolonged or uninterrupted crying		
Pain		Severe	Moderate	Mild	
	Senior Healthcare Professional's Discretion				

APPENDIX 6 Letter of permission to conduct research at Dogwood Hospital

(Hospital group details redacted as per their requirements)

Hospital

Tel: +27 (0) 11
Fax: +27 (0) 11
Cnr . & Roads, South Africa
PO box , Rivonia, , South Africa
www. co.za

4 July 2011

LETTER OF PROVISIONAL PERMISSION TO CONDUCT RESEARCH IN A FACILITY

Dear Dr. Christian Piccolo

Research to be conducted at Hospital

It is with pleasure that we inform you that your application to conduct research on "How long before I see a Doctor?" – An analysis of Triage-to-Doctor waiting times in an Emergency Department in a Johannesburg Private Hospital.

At Hospital has been successful, subject to the following:

i. All information with regards to will be treated as confidential.
ii. name will not be mentioned without written consent from the Academic Board of
iii. Where name is mentioned, the research will not be published without written consent from the Academic Board of
iv. A copy of the research will be provided to once it is finally approved by the tertiary institution, or once complete.
v. All legal requirements with regards to patient rights and confidentiality will be complied with.
vi. Approval by the Research Committee.

We wish you success in your research.

Yours faithfully,

Robert Jordaan
Hospital Manager
Hospital

APPENDIX 7 Research approval from hospital group research committee.

(Hospital group details redacted as per their requirements)

Limited

Tel: + 27 (0)11
Fax: Corporate +27 (0)11
76 Street, Corner Street, Sandton, South Africa
Private Bag 2010, South Africa

RESEARCH COMMITTEE FINAL APPROVAL OF RESEARCH

Approval number: MED-2012-0001

Dr C Piccolo

E mail: piccolo@casualty.co.za

Dear Dr Piccolo

RE: "HOW LONG BEFORE I SEE A DOCTOR?" AN ANALYSIS OF TRIAGE-TO-DOCTOR WAITING TIMES IN AN EMERGENCY DEPARTMENT IN A JOHANNESBURG PRIVATE HOSPITAL

The above-mentioned research was reviewed by the Research Committee's delegated members and it is with pleasure that we inform you that your application to conduct this research at Hospital, has been approved, subject to the following:

i) Research may now commence with this FINAL APPROVAL from the Academic Board of (Research Committee).

ii) All information with regards to will be treated as confidential.

iii) name will not be mentioned without written consent from the Academic Board of (Research Committee).

iv) All legal requirements with regards to patient rights and confidentiality will be complied with.

v) Insurance will be provided and maintained for the duration of the research. This cover provided to the researcher must also protect both the staff and the hospital facility from potential liability

vi) In accordance with MCC approval, that medicine will be administered by or under direction of the authorised Trialist

vii) The research will be conducted in compliance with the GUIDELINES FOR GOOD PRACTICE IN THE CONDUCT OF CLINICAL TRIALS IN HUMAN PARTICIPANTS IN SOUTH AFRICA (2000)

viii) must be furnished with a STATUS REPORT on the progress of the study at least annually on 30th September irrespective of the date of approval from Academic Board of (Research Committee) as well as a FINAL REPORT with reference

to intention to publish and probable journals for publication, on completion of the study.

ix) A copy of the research report will be provided to once it is finally approved by the tertiary institution, or once complete.

x) has the right to implement any Best Practice recommendations from the research.

xi) reserves the right to withdraw the approval for research at any time during the process, should the research prove to be detrimental to the subjects. or should the researcher not comply with the conditions of approval.

We wish you success in your research.

Yours faithfully

Prof
Full member: Research Committee & Medical Practitioner evaluating research applications as per Management and Governance Policy
Date: 9/2/2012

Chairperson: Research Committee
Limited ( )
Date: 13/2/2012