Bed utilisation trends in selected wards across eight district hospitals in the Cape Town district

Leilah Najjaar

Student Number: 2006009

A mini-thesis submitted in partial fulfilment of the requirements for the degree of Master in Public Health at the School of Public Health, University of the Western Cape

Supervisor: Dr Hanani Tabana

November 2018

10 Keywords:

Average Length of Stay**,** Bed Occupancy**,** Bed Utilisation Rate, District Hospital, Expenditure per Patient Day Equivalent, Overcrowding, Patient Flow, Inpatient Beds, Large District Hospital, Small District Hospital

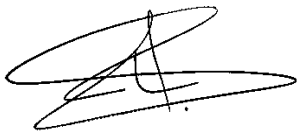
CONTENTS

LIST OF FIGURES

LIST OF TABLES

DECLARATION

I declare that, “Bed utilisation trends in selected wards across eight district hospitals in the Cape Town district”, is my own work and that it has not been submitted for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged by complete references.



Leilah Najjaar 1 October 2018

Acknowledgements

I would like to acknowledge and thank my supervisor, Dr Hanani Tabana, for her continued guidance and support in this journey.

Thank you to the district hospital managers and the information management clerks for granting me access to the data and for being so helpful in clarifying queries with the data.

Thank you to the information management staff at the district office for granting me access and supplying data for the study.

Thank you to the Provincial Department of Health and the Health Impact Assessment unit for granting me approval for the study to take place and permission to access the required data.

To my manager at work, Ms. Juanita Arendse, for her support and guidance throughout the study period and for accommodating me with time off to work on my study.

To my family, especially my husband, Thofier Najjaar and children, Jehaan & Ismaeel, for your continued support and understanding during this time. Without your love and support I would not have been able to complete my studies.

List of Abbreviations

ADR	Adverse Drug Reactions
AEP	Appropriateness Evaluation Protocol
ALOS	Average Length of Stay
BAS	Basic Accounting System
BUR	Bed Utilisation Rate
CEO	Chief Executive Officer
DHS	District Health System
DOH	Department of Health
EC	Emergency Centre
HIA	Health Impact Assessment
HIS	Health Information System
HIV	Human Immunodeficiency Virus
IMR	Infant Mortality Rate
IP	Inpatient
KMC	Kangaroo Mother Care
LOS	Length of Stay
MDG	Millennium Development Goals
MHS	Metro Health Services
MRSA	Methicillin-Resistant Staphylococcus Aureus
NDOH	National Department of Health
NHI	National Health Insurance
PHC	Primary Health Care
PDE	Patient Day Equivalent
SA	South Africa
SDG	Sustainable Development Goals
TB	Tuberculosis
U5MR	Under 5 Mortality Rate
UWC	University of Western Cape
WCG	Western Cape Government
WHO	World Health Organization

Definitions of key terms

BUR: Bed Utilisation Rate (BUR) is a measure of the bed occupancy of available beds and therefore indicates how efficiently a hospital is using its available capacity (WCGH, 2017).

ALOS: Average length of stay (ALOS) refers to the average number of days that patients spend in hospital (WCGH, 2017).

PDE: Patient day equivalent (PDE) is calculated by adding the number of inpatient days plus half the number of day patients plus one-third the numbers of outpatients and emergency room visits. It is a unit of measure which allows comparisons between hospitals (WCGH, 2017).

District hospital: A hospital which receives referrals from and provides generalist support to clinics and community health centres with health treatment administered by general health care practitioners or primary health care nurses (KZN Dept of Health, 2001).

Over and underutilisation: for the purpose of this study over utilisation is BUR above 90% and under utilisation is BUR below 80%. This is based on an ideal BUR of between 80% and 90% (Olukoga, 2007).

Small district hospital: for this study, all hospitals with an inpatient bed number less than the median of 166.5 beds.

Large district hospital: for this study, all hospitals with an inpatient bed number more than the median of 166.5 beds.

ABSTRACT

Background: The largest focus areas for the department of health is ensuring access to quality healthcare. The district health system (DHS) model remains the vehicle used by the district managers to deliver on the health department's goals, objectives and priority focus areas. Strengthening the district health system platform is therefore important to the department to improve access and quality of care to the clients serviced in the province.

The district hospitals play a fundamental role since they support primary health care (PHC) and serve as the entry point to more specialised care. The efficient management of beds in the district hospitals is the key in ensuring access to care and preventing bed blocking. Bed Utilisation Rate (BUR) and Average Length of Stay (ALOS) are indicators used to measure the efficiency of hospital beds. This study provides a description of the trends in bed utilisation within the inpatient wards of eight district hospitals in the Cape Town metro district in the 2016-2017 financial period.

Methodology: To analyse and compare wards a quantitative approach was used. Inpatient ward activity reports for eight district hospitals were accessed from the department of health's routine data collection repository. A total of fifty-five wards were compared across small and large hospitals for BUR and ALOS during the financial year period 1 April 2016 to 31 March 2017. Data entry was done in MS EXCEL and analyses were done using STATA 11.0.

Results: Using the number of inpatient beds the hospitals were divided into small and large district hospitals. Large hospitals also had additional wards such as psychiatry, maternity and obstetrics, gynaecology and high care. BUR for the wards were mostly in line with the BUR target for the hospital with the exceptions of the emergency centre (EC) and casualty overnight wards that remained high in five of the eight hospitals. Paediatrics and neonatal BUR was low when compared with the hospital target. Ideal BUR was between 80-90% but the targets set for the hospitals were not necessarily aligned to this. Instead, BUR was based on a previous year's achievement and was found consistent throughout the year and no seasonal trends were noted. ALOS for the wards were mainly aligned to the hospital target except for maternity and obstetrics, paediatrics and EC acute wards which displayed shorter ALOS. In the medical and psychiatry wards longer ALOS was observed. A total of 4286 deaths took place of which 61% occurred in the medical wards.

Conclusion: Despite some limitations the study aims were met. Although the BUR and ALOS were mostly found to be in line with the targets set, further investigation is needed to address some of the causes of high BUR in the psychiatry, EC and casualty overnight wards. The

relationship between high ALOS and mortality in the medical ward must be determined. It is recommended that a longer study period, e.g. 3-5 years, be conducted to determine trends in ALOS and BUR.

CHAPTER 1: INTRODUCTION

Global Background

In 2015 the UN General Assembly adopted the 2030 Development Agenda titled *Transforming our world: the 2030 Agenda for Sustainable Development*. The Global Sustainable Development Goals (SDG) are aimed at achieving sustainable developments in the social, economic and environmental spheres (WHO, 2017). There are 17 interrelated goals and interdependent with health as a focal point. Almost all the goals are directly or indirectly related to health since health is considered a key human development factor, for example; social, environmental and economic determinants such as education, income and urbanisation have an impact on health and will also benefit from a healthy population (WHO, 2017). The availability of adequate resources is required for the health sector to achieve the SDG health goals to improve access to health care as well as quality of care.

SDGs are a continuation of the Millennium Development Goals (MDGs) the UN member states accepted at a summit in 2000 (Mersha, 2006). The 8 MDGs offered a limited number of human development targets for poverty eradication, health, education, food security and nutrition. Unlike the MDGs the SDGs integrate the three dimensions of sustainable development, namely economic, social and environmental (WHO, 2017). Great lessons were learnt in working toward the MDGs that have now been incorporated into the new 2030 agenda. These are:

- A broader approach to improving health in all countries, including addressing non-communicable diseases, mental health and injuries;
- Emphasis on strengthening health systems;
- Recognition that health affects and is affected by other sectors like education and urban planning.
- A focus on improving equity within and between countries, and not just focusing on aggregate targets;
- Recognition that disease outbreaks, natural disasters and humanitarian crises are a threat to sustainable development.

To achieve SDG 3: Ensure healthy lives and promote well-being for all at all ages by 2030, will require adequate resources for the health sector to improve access to care as well as quality of care be made available.

South African Context

The country is home to an estimated 56,52 million people (Stats SA, 2017). The Gini-coefficient which measures income inequality is the highest in the world at 0.69 (The World Bank, 2018). It increased from 0.6 in 1995 and 0.679 in 2009 (Benatar, 2013).

Figure one below shows the household expenditure per capita when the households are divided into quintiles, 5 equal segments with quintile one having the lowest expenditure per capita and quintile five the highest. In 2015, roughly 60% of total household expenditure was among the quintile five population and only approximately 5% were among quintile one. This confirms the disparity between the rich and the poor in SA.

Figure 1: Share of annual household consumption expenditure by quintiles (2006, 2009, 2011, 2015)

Source: (Statistics South Africa, 2014)

Great success has been made in the expansion of health programmes to prevent mother to child transmission of HIV as well as access to antiretroviral treatment. This is eminent in the life expectancy at birth which has increased since 2007. By 2017 life expectancy at birth was estimated at 61,2 years for males and 66,7 years for females. Life expectancy is increasing, and this might be related to marginal gains in survival rates among infants and children under-five years following the HIV interventions in 2005. The infant mortality rate (IMR) has declined from an estimated 48,1 infant deaths per 1 000 live births in 2002 to 32,8 in 2017. Similarly, the under-five mortality rate (U5MR) declined from 71,3 child deaths per 1 000 live births to 42,4 between 2002 and 2017 (Stats SA, 2017). Life expectancy, infant mortality rate and under-

five mortality rate are global health indicators used to monitor various health changes in the population (Larson and Mercer, 2004). With that said the significant improvements in these indicators since 2006 and 2007 gives an indication of success in the health programmes implemented in South Africa (SA). Despite these improvements large disparities still exist in health and wealth and some of these disparities are amongst the largest in the world (Benatar, 2013)

To address the disparity in healthcare the National Health Insurance (NHI) proposal was brought to SA post the 1994 apartheid era. This was to address poverty, health as well as access to healthcare. The annual per capita healthcare expenditure in the public sector serving 84% of the population was approximately R1 200 vs. R12 000 in the private sector serving 16% of the population. The NHI is an attempt to minimise the inequality gap by improving the public healthcare services, but this would require material as well as human resources in an already financially constrained environment (Benatar, 2013).

In SA, but more specifically in the Western Cape Province, the Health Care 2030 strategic document was developed by the Western Cape Government as a guide to achieving health and signaling the clear shift to promoting and achieving wellness. The priorities set out in the document stem from the Provincial Strategic plan and the National Strategic plans. The Health Care 2030 strategic document priority focus areas for intervention include: 1. Reducing Infectious diseases such as HIV/TB; 2. Improving healthy lifestyles; 3. Preventing injuries and violence; 4. Improving maternal and child health; 5. Strengthening women's health; and 6. Improving Mental Health (Western Cape Government, 2013). The district health system model remains the vehicle used by the district managers to deliver on the Western Cape Department of Health's goals and priority focus areas. Strengthening this platform is a priority to the department to improve access and quality of care to the clients serviced in the province.

The district hospitals play a fundamental role in the district health system as they support primary health care (PHC) and serve as the entry point to more specialised care. District hospitals admit patients with acute and uncomplicated illnesses. More complicated cases are transferred to regional or tertiary hospitals (Massyn *et al*., 2016). District hospitals report on the bed utilisation, length of stay and expenditure per patient day equivalent which are viewed and monitored as an indication of the efficiency in the hospital's bed management and patient quality of care (Hoot and Aronsky, 2008). Too low and too high bed utilisation rates can be an

indication of poor quality of care and can impact on access to hospital health services. The public health impact for delayed entry into hospital care compromised health outcomes, the spread of infectious diseases, increased complexity in the treatment complications and possible death.

Study Setting

Metro Health Services (MHS) is responsible for the rendering of district health services in the City of Cape Town Municipality. The city is home to approximately 4 million inhabitants and an estimated 87% rely on public healthcare (MDHS, 2017). The health services are sub-divided into 8 geographic areas or sub-districts. Services rendered in the MHS include home and community-based care, primary health care, district hospital, specialist and regional hospital services. There are eight district hospitals, at least one in each sub-district, except for the northern sub-district.

Table 1: Summary Population Data

Source: (MDHS, 2017)

District/Subdistrict	2016 Total projected population	% Dependent population based on 2011 Census	Dependent population 2016
Eastern	585 274	88.3%	516 526
Khayelitsha	396 461	95.0%	376 683
Klipfontein	380 617	91.5%	348 193
Mitchells Plain	537 786	92.6%	498 211
Northern	402 279	78.1%	314 237
Southern	539 265	80.1%	432 126
Tygerberg	546 226	89.7%	489 703
Western	624 533	81.8%	518 223
Cape Town	**4 012 441**	**87.2%**	**3 498 384**

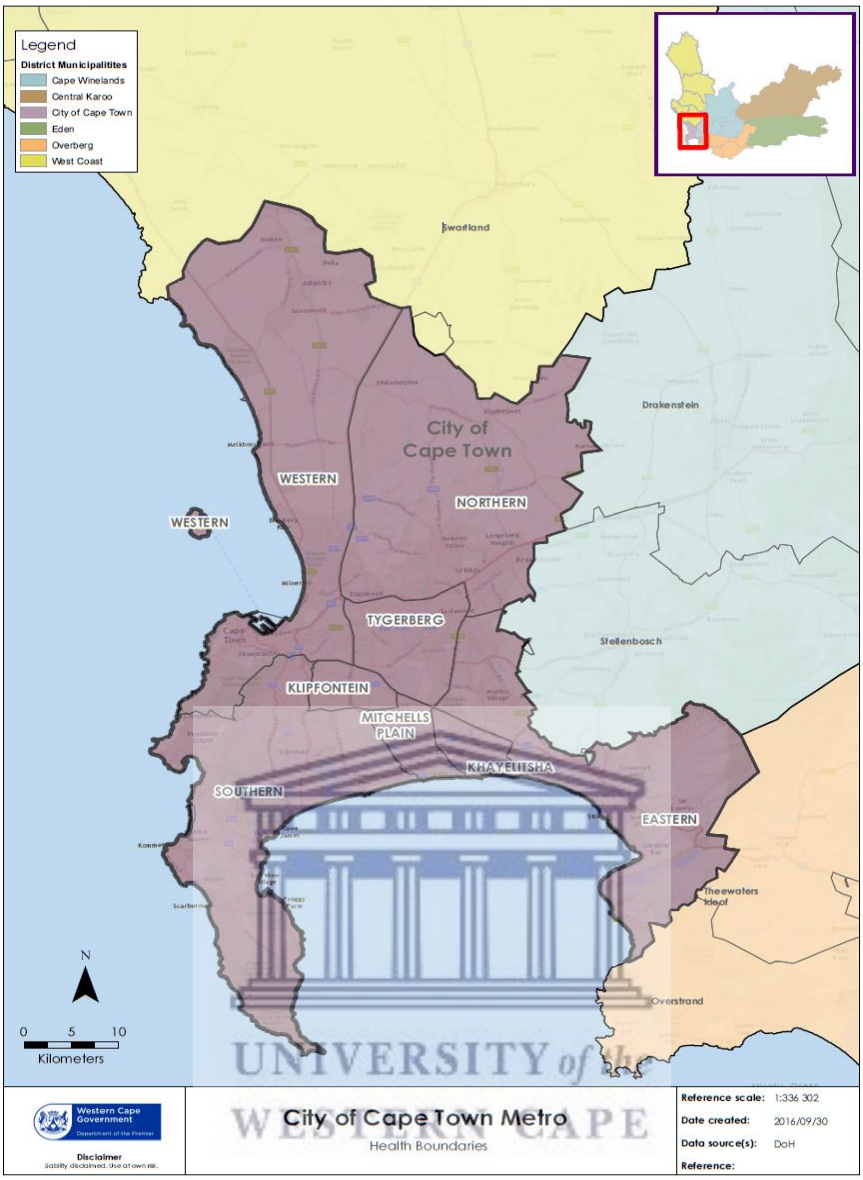


Figure 2: Map of City of Cape Town Health Boundaries

The burden of disease in MHS is dominated by HIV/AIDS, followed by interpersonal violence, ischemic heart disease and TB (WCGH, 2016). A worrying trend is the increase in the people that are presenting with multiple, interacting and compounding health problems.

Table 2: Burden of Disease, Cape Town

RANK	1	2	3	4	5	6	7	8	9	10
CT Eastern	HIV/AIDS (14.6%)	Interpersonal Violence (8.6%)	Tuberculosis (6.6%)	Ischaemic Heart Disease (5.9%)	Cerebrovascular Disease (4.9%)	Road Injuries (4.3%)	Lower Respiratory Infections (4.2%)	Diabetes Mellitus (3.7%)	Trachea/Bronchi/Lung (2.8%)	COPD (2.7%)
CT Khayelitsha	HIV/AIDS (21.4%)	Interpersonal Violence (19.5%)	Tuberculosis (7.1%)	Road Injuries (4.6%)	Lower Respiratory Infections (3.6%)	Diabetes Mellitus (2.7%)	Diarrhoeal Diseases (2.7%)	Cerebrovascular Disease (2.6%)	Preterm Birth Complications (2.3%)	Self-Inflicted Injuries (2.0%)
CT Klipfontein	Interpersonal Violence (14.8%)	HIV/AIDS (12.7%)	Ischaemic Heart Disease (6.9%)	Tuberculosis (5.7%)	Diabetes Mellitus (5.30%)	Cerebrovascular Disease (4.2%)	Trachea/Bronchi/Lung (4.0%)	Lower Respiratory Infections (3.6%)	Road Injuries (3.1%)	COPD (2.80%)
CT Mitchells Plain	HIV/AIDS (14.1%)	Interpersonal Violence (12.0%)	Tuberculosis (5.9%)	Ischaemic Heart Disease (5.7%)	Diabetes Mellitus (5.3%)	Cerebrovascular Disease (4.7%)	Road Injuries (3.9%)	Lower Respiratory Infections (3.5%)	Trachea/Bronchi/Lung (3.3%)	COPD (2.80)
CT Northern	HIV/AIDS (13.5%)	Interpersonal Violence (8.6%)	Ischaemic Heart Disease (7.0%)	Tuberculosis (6.2%)	Road Injuries (5.1%)	Cerebrovascular Disease (4.4%)	Trachea/Bronchi/Lung (4.0%)	Self-Inflicted Injuries (3.8%)	COPD (3.2%)	Lower Respiratory Infections (3.0%)
CT Southern	Ischaemic Heart Disease (8.9%)	HIV/AIDS (7.2%)	Interpersonal Violence (6.8%)	Diabetes Mellitus (6.0%)	Cerebrovascular Disease (5.8%)	Trachea/Bronchi/Lung (5.1%)	COPD (4.1%)	Tuberculosis (3.8%)	Road Injuries (3.7%)	Lower Respiratory Infections (3.2%)
CT Tygerberg	Interpersonal Violence (9.4%)	HIV/AIDS (8.4%)	Ischaemic Heart Disease (8.3%)	Tuberculosis (6.4%)	Cerebrovascular Disease (6.0%)	Diabetes Mellitus (5.3%)	Trachea/Bronchi/Lung (4.8%)	Road Injuries (4.7%)	COPD (4.6%)	Lower Respiratory Infections (2.9%)
CT Western	Interpersonal Violence (9.1%)	HIV/AIDS (9.0%)	Ischaemic Heart Disease (6.7%)	Tuberculosis (6.0%)	Road Injuries (5.5%)	Cerebrovascular Disease (5.2%)	Diabetes Mellitus (4.1%)	Trachea/Bronchi/Lung (3.9%)	Self-Inflicted Injuries (3.4%)	Lower Respiratory Infections (3.3%)
CT Metro	HIV/AIDS (12.3%)	Interpersonal Violence (11.0%)	Ischaemic Heart Disease (6.5%)	Tuberculosis (6.0%)	Cerebrovascular Disease (4.8%)	Diabetes Mellitus (4.5%)	Road Injuries (4.3%)	Trachea/Bronchi/Lung (3.7%)	Lower Respiratory Infections (3.4%)	COPD (3.1%)

Source: (WCGH, 2016)

This quadruple burden of disease places an enormous strain on the health system. For this reason, it is imperative that we constantly strive towards finding ways to deliver a quality health service to the population of Cape Town innovatively. This will require constant monitoring at every level to ensure work processes is optimised and opportunities to improve efficiencies are always identified and presented.

Research Problem

The National Department of Health (NDOH) sets annual targets for the hospital inpatient bed utilisation rate (BUR), average length of stay (ALOS) and expenditure per patient day equivalent (PDE). These indicators are set and monitored at national, provincial, district and lastly hospital level.

The Cape Town district has eight district hospitals with a total of 1574 beds as indicated in Table 3 (MDHS 2016). In the financial year 2015-2016 the annual inpatient BUR was 93.9 per cent (WCGH, 2017) against a target of 86.9 per cent (WCGH, 2015) for the Cape Town district.

The eight district hospitals achieved Inpatient BUR ranging from as low as 66.2 per cent at Hospital B to as high as 127.2 per cent at Hospital C. When the BUR is more than 100 per cent this indicates that the hospital has taken on more patients than they have beds for and can accommodate. Patients may be expected to wait in chairs in such a case. The ALOS for the district in 2015/16 was at 3.7 days (WCGH, 2017) but ranged from 2.2 days at Hospital H to as high as 4.3 at Hospital F and Hospital E. Table 3 also displays the number of usable beds per district hospital and these vary from as little as 31 beds in Hospital H and as many as 391 in Hospital F.

Table 3: Number of beds, Average Length of Stay, Bed Utilization Rate [%] (District Hospital) 2015-2016 (MDHS, 2016)

Hospital (pseudonym)	Usage Beds	Bed Utilization Rate (%)	Average Length of Stay
Hospital D	306	97.0	3.5
Hospital F	391	80.5	4.3
Hospital H	31	83.0	2.2
Hospital C	162	127.2	3.6
Hospital G	184	92.6	3.5
Hospital E	300	85.8	4.3
Hospital A	124	127.0	3.2
Hospital B	76	66.2	2.9

To understand the large variations in the BUR and ALOS across these hospitals the study separates them into small and large district hospitals since not all hospitals are made up of the same number of beds and provide the same services. Psychiatry or intensive medical ward in a district hospital, where patients tend to stay longer, may greatly impact on the overall BUR and ALOS of the hospital. When monitoring occurs at the hospital level and not particularly at the ward level, the information about BUR and ALOS of wards are hidden or not reflected.

Purpose of the Study

The findings of the study provide district managers as well as hospital managers with the trends in ALOS and BUR in the wards of these eight district hospitals and compare the ward level information against the targets set for the hospital.

The study also identifies wards where beds are over or underutilised, as well as identify the specific wards where patients tend to stay longer. If poor bed allocations cause high BUR and ALOS then efficient allocation of beds can lead to improved ALOS and BUR, adding to the better patient management within beds and resource utilisation.

Finally, the findings of the study are meant to inform the necessary operational improvements to ensure maximum efficiencies in the flow of patients in the hospital by hospital and district managers. This study outcomes have the potential to contribute to better quality and access to health services at the eight district hospitals.

CHAPTER 2: LITERATURE REVIEW

Introduction

The literature review describes bed utilisation and length of stay in a hospital setting as well as the many factors affecting these measures. It also discusses the perceived ideal bed occupancy rates and the related effects of too high or too low occupancy rates.

Average length of stay, inappropriate admissions, delays in discharge and overcrowding are all factors affecting bed occupancy rates and is discussed in this chapter.

Bed Utilisation

In the District Health Barometer, the Bed Utilisation Rate (BUR) is described as a measure of the bed occupancy of available beds and therefore indicates how efficiently a hospital is using its available capacity. It is calculated as follows: number of inpatient days added to half the number of day patients and divided by usable bed days. BUR are expressed as a percentage.

Bed occupancy rates, a term used interchangeably with BUR, is also used as a measure to indicate proper patient care (Keegan, 2010). Keegan stated that in order to consider bed occupancy as a useful guide to plan and operationally manage beds in a way that improves patient outcomes, two key questions need be answered; does bed occupancy rate influence patient outcomes? And, what would be an appropriate level of occupancy to aspire to? He then suggested that the occupancy above 85% could adversely affect safety and efficacy in the hospital management of public hospitals in Australia (Keegan, 2010).

In a study done in South Africa where five district hospitals were measured on cost, Olukoga (2007) stated that the hospitals operate most effectively and efficiently at 80%-90% bed occupancy rates, although the bed occupancy for the hospitals in the study only ranged between 39% and 68%.

Jones (2011) described how bed occupancy across wards can differ based on their size, function

and complexity such as seasonal variations. An average occupancy figure such as 85% is interpreted in the context of ward variations. Wards with a low turn-away level[1] such as a maternity ward require a low bed occupancy to ensure sufficient available beds compared to a surgical ward where higher occupancy rate is acceptable due to the ability to schedule the admission of elective surgery. The economies of scale which is based on patient turn-away level is thus important to understand bed queuing models used to calculate bed occupancy (Jones, 2011). Jones concluded by stating that a maximum occupancy in the range of 82% to 85% is required to keep hospital acquired infections to a minimum (Jones, 2011).

According to Olukoga (2007) low bed occupancy rates indicate inefficiency in the operation of the hospital and implies opportunity costs. A low demand for hospital care, the existence of alternate healthcare providers who may be perceived as providing better healthcare service, low catchment area, as well as a poor referral mechanisms, can all be contributing factors to low bed occupancy rates (Olukoga, 2007).

Ensuring the correct number of beds in a hospital and within the wards is a complex task requiring accurate data. In McClean and Millard (1993) where reliable data was available they were able to develop tools which assessed the performance measures based on activity within a hospital and its beds, and hence they improved the efficiency of bed management. This facilitated the more effective use of resources.

In the study done by Holm et al (2013), a hospital bed utilisation simulation and optimisation experiment was conducted in a Norwegian general hospital. When the bed distribution within the hospital was optimised, i.e. beds are reallocated based on where they are needed most, overcrowding of patients was reduced from 6.5% to 4.2%.

In Mclean and Millard (1993) a mathematical bed occupancy modelling package used to separate the pattern of bed occupancy into acute, rehabilitative and long-stay components allowed the planner to assess the effects of change prior to it taking place.

A very simple model using routine data to generate a forecast was used in the Koa and Tung (1981) study done in a public health setting. The model focused on minimising overflow and more accurate bed allocation would thus still require analyses over the forecast.

Kumar and Mo (2010) used a combination of three different models in a hospital in Singapore

[1] The turn-away level is a measure of the chaos, difficulty and effort implied in running the hospital, i.e. ambulances diverted elsewhere, medical patients in surgical beds, cancelled operations, managers and clinicians hastily re- arranging schedules, bed management meetings and general operational complexity. It is assumed that if there is not an available bed then the arriving patient is diverted elsewhere. Turn-away level for maternity and intensive care units needed to be between 0.1% and 1%.

namely; regression modelling which allowed them to forecast the following week's bed occupancy. Secondly, the Poisson bed occupancy model which was used to optimise bed allocation using length of stay and admission data. Lastly, the simulation model was utilized which looked at the flow of the patient through the hospital. This was used to confirm the predictions used with the regression model. The use of the three models provides a valuable tool for bed planning.

Average Length of Stay

Average length of stay (ALOS) refers to the average number of days that patients spend in hospital. ALOS calculated as follows: total number of inpatient days during a year plus half the number of day patients, divided by the number of separations (deaths, discharges and transfers out) (Massyn *et al*., 2016).

A persistently long ALOS could indicate that patients are kept in hospital for too many days. If the ALOS is too short, it could point to sub-standard quality of care is afforded to patients and are being discharged without the appropriate care. It may also show that too many patients are being referred to other hospitals without proper investigation. Maintaining a consistent ALOS is vital, both too-long and too-short ALOS warrant further investigation (Massyn *et al*., 2016). A too long or too short ALOS is poorly defined in the literature but the WCGH used 3.5 days as the ideal ALOS.

In a study done by Fine *et al.* (2000) the cost of hospital care on a group of patients with community acquired pneumonia was assessed. The cost was split into room cost and non-room cost. Room costs remained reasonably constant throughout the stay, but non-room cost varied from being high during the first few days and reducing as the patients stay extends. The study concluded that even one day reduction in hospital stay could yield a substantial cost saving for the hospital. A cost reduction is also supported in a patient flow study by Silva (2013) whereby reducing length of stay, the entire patient flow system would become more efficient and enhance patient satisfaction and save costs.

Clarke (1996) on the contrary is not convinced that a reduction in the ALOS is saving the institution any money. The cost remains the same or increases because the number of patients seen increases. So, although the cost per patient may decrease the total cost to the institution may not. And like in Fine *et al.* (2000) the initial cost per day is higher than the last days spent in hospital. Thus, by reducing the stay the cost saving is that of the latter day/s spent in the hospital and not substantial or significant in comparison to the total cost of the patient.

Factors Affecting Bed Utilisation and Average Length of Stay

There are several factors that affect the demand for beds, this include changes in the size and demographics of the population, treatment protocols, epidemiological trends, budget and the availability of alternative patient care facilities (Kao and Tung, 1981).

There are some patient factors which impact on the ALOS. In Schoetz *et al.*(1997) where a group of patients who had colon resection done were assessed for perioperative factors affecting length of stay. Patients over 65 years had an ALOS of 11 days vs. patients younger than 65 years with an ALOS of 9 days. In a study by Rissanen, Aro and Paavolainen (1996) where 10288 hip and 5173 knee replacement patients were assessed on ALOS, also confirmed patient age as well as gender impacting on length of stay (LOS). Gruskay *et al.* (2015) found that elderly patients with widespread systemic disease tend to stay in the hospital longer after surgery.

In a study done by Correia and Waitzberg (2003) assessment of patients for their nutritional status within 72 hours after admission identified malnutrition as an independent risk factor impacting on the patient outcome, length of stay and increased mortality.

Patient Flow

According to Hankey (2017) patient flow has been studied since the 1990's due to its importance and due to the imbalance between hospital demand and capacity. De Silva (2013) has defined patient flow as being heterogenous since not all patient flow methods produce the same outcomes. A person's definition of patient flow is also based on the individual's work environment and different backgrounds (Hankey, 2017). Côté (2000) goes on to describe a clinical vs. an operational definition of patient flow. The clinical definition refers to the progression of the patient's health status whereas the operational definition refers to the institutions operational activities and described as the movement of patients through a set of locations in a healthcare facility.

Patient flow is determined by many factors which includes ALOS and BUR. When patient turn around is low and less beds become available a bottleneck emerges in the patient flow. Other operational factors impacting on ALOS and BUR are over-crowding, inappropriate admissions and delayed discharge. These will be discussed below.

Overcrowding

Overcrowding in hospitals is an ongoing problem and may affect the quality of care as well as

access to health care. A systematic review by Hoot and Aronsky (2008) focused on the causes, effects and solutions of overcrowding in an emergency department in a hospital. Common causes included hospital bed shortages, inadequate staffing, non-urgent visits and inpatient boarding. The common effects of overcrowding were patient mortality, transport delays, treatment delays, ambulance diversion, patient elopement and financial effects (Hoot and Aronsky, 2008).

Keegan (2010) demonstrated an association between bed occupancy and the spread of methicillin-resistant Staphylococcus aureus (MRSA) among patients in hospital. High bed occupancy is also not consistent with good infection prevention control. Hand hygiene practices are compromised during periods of high work load and staff shortages resulting in higher rates of hospital acquired infections (Keegan, 2010). Al-Kandari and Thomas (2009) also noted a significant correlation between new MRSA infections and overall bed occupancy. This would support the statement that overcrowding is a relevant factor in the spread of MRSA in the hospital and even in non-intensive care settings.

The danger in overcrowding in an emergency centre is that it may result in mortality. Blum *et al.* (2008) described how dangerous boarding[2] of patients is during overcrowding. Patients' lives are endangered, medical care may be delayed and if need arise to transport the patient to a different hospital, ambulance diversions are delayed.

Inappropriate Admissions

Zimmer (1974) described how bed utilization emphasis has been placed on long stay patient visits and extended duration of hospitalisation but that attention should be given to the intended short stay patients that are inappropriately admitted to the hospital for the specific level of care they require. A delay in performing in-hospital procedures further contributes to the challenge. A study conducted by Rubin and Davies (1975) surveyed 1010 patients over 60 years and in an acute hospital bed for longer than 4 weeks. The study results showed 4.8% of these patients were inappropriately placed in the hospital bed and the main reason for continuing occupancy in the hospital bed was due to the length of the waiting list for alternative accommodation.

Studies also show that the inappropriate use of acute hospital beds is more common amongst older persons than with the general adult population. This is also referred to as the "bed blocking" effect (McDonagh, Smith and Goddard, 2000).

[2] Boarding refers to holding of the patient after the patient has been admitted but not yet placed in an in-patient bed.

In the UK inappropriate admissions and delayed discharge is very high on the research and policy agenda due to its impact on bed occupancy, the spread of hospital acquired infections and healthcare cost (Hammond, Pinnington and Phillips, 2009). In Hammond, Pinnington and Phillips (2009) where clinicians were recruited to take part in focus group discussions they identified limited capacity of health and social resources, poor communication between primary and secondary care clinicians and cautiousness of clinicians who manage patients at community level to be key factors in inappropriate admissions.

In a descriptive retrospective study by Soria-Aledo *et al.* (2009) in which the Appropriateness Evaluation Protocol (AEP) was applied to a representative sample of 725 hospital admissions and 1350 hospital stays. It was found that 7.4% of admissions and 24.6% of stays were inappropriate.

Adverse drug reactions (ADRs) are a significant cause of hospital admissions and are very often preventable (McDonnell and Jacobs, 2002). In a review done on 437 ADRs, 158 were directly related to hospital admission and approximately 25% of these events were serious to life-threatening. Patient non-compliance, drug interactions, inappropriate dosing and inadequate monitoring of therapy were the main causes of these ADRs. This highlighted the need for multidisciplinary prevention strategies focusing on patient communication and education.

Delayed Discharge

A critical examination of the literature done by Victor et al (2000) indicated that there are four major sets of factors associated with misplacement of hospital beds and delay in discharge: demographic factors, medical/dependency factors, family factors, and organisational/administrative factors. These are grouped into individual and organisational factors. The individual factors may be as a result of the medical condition. Examples include physical disability, stroke, incontinence, dementia or factors compromising the independence of the patient. The availability of a care giver or family support is also a contributing factor.

Victor (1990) suggested that the majority of delays are due to organisational factors such as disagreements between health and social services.

A lack of housing and community support was the most commonly cited reason preventing discharge in the systematic review done by McDonagh et al. (2000).

As mentioned earlier LOS may be related to patient age. This is because elderly patients often require additional resources to facilitate their discharge. Delays in waiting for test results

together with linking with a consultant or organisation to facilitate rehabilitation or continuation of care outside the acute hospital setting were the two main reasons for delayed discharge in Majeed *et al.* (2012).

Expenditure Per Patient Day Equivalent (PDE)

Patient day equivalent (PDE) is calculated by adding the number of inpatient days plus half the number of day patients plus one-third the numbers of outpatients and emergency room visits. The expenditure per PDE is calculated using the expenditure of the hospital retrieved from the Basic Accounting System (BAS). The expenditure includes consumables, lab tests, staffing and all costs related to the provision of healthcare at the hospital. Expenditure per PDE is a ratio between cost and services and this unit of measure also allows one to compare hospital expenditure of similar hospitals with each other (Massyn *et al*., 2016) .

Summary of the Literature Review

In summary, it appears that most of the articles reviewed would consider a bed occupancy rate between 80% and 90% to be ideal. With that said it was also noted that in some wards, for example a maternity ward, lower bed occupancy would be advantageous because patients requiring admission to the maternity ward should not be turned away.

High bed occupancy was found to have an impact on the spread of hospital acquired infections in the hospital since hygiene practices were compromised at times of staff shortages and overcrowding.

There were a number of models and experiments to improve bed usage and to reduce crowding such as those highlighted by Holm et al. (2013), Kao and Tung (1981), McClean and Millard (1993), Kumar and Mo (2010), but it remains extremely challenging and crucial for hospital managers to appropriately and efficiently manage with fewer resources (Mackay, 2001). Patient flow is important to ensure efficiencies in the hospital as well as a better patient experience. When bed occupancy and length of stay is not managed well it may create bottlenecks in the flow of patients throughout the hospital. Overcrowding, inappropriate admissions and delayed discharge of patients affect the BUR and the ALOS as well as cost.

It would thus be of great benefit to hospital managers to monitor these factors affecting BUR and ALOS very closely and to put measures in place to constantly improve and prevent bottlenecks in the flow of patients.

CHAPTER 3: RESEARCH METHODOLOGY

Aim

To describe trends in bed utilisation within selected wards in eight district hospitals in the Cape Town metro district during April 2016 to March 2017.

Objectives

1. To analyse the annual inpatient bed utilisation in hospital wards against the hospital target;
2. To describe the average length of stay in these hospital wards against the hospital target set by the district;
3. To ascertain seasonal trends in the BUR across the hospitals.
4. To identify wards where patient stay is well above the ALOS and where beds are under or over utilised.
5. To describe the number of deaths in the wards of these hospitals.

Study Design

The study was a cross sectional descriptive study of retrospective record reviews using secondary data routinely collected by the Western Cape Government's health information system (HIS). Since the study aimed to describe trends in bed occupancy of wards a quantitative approach was used to analyse and compare wards. Qualitative methods are not considered in the study due to the aim being to describe performance against set targets and to describe the ward level performances.

Population and Sampling

Inpatient wards in the eight district hospitals in the Cape Town district constituted the sample studied. Ideally the study sample is as large as possible and not less than 30 subjects (Bruce, et al. 2008) and for this reason all the inpatient wards were included as part of the study sample. The use of Clinicom, an electronic patient information system, as the health information system of choice was necessary to ensure that all hospitals could produce the standard monthly Inpatient (IP) Ward Activity report.

Virtual wards such as theatres, resus wards, transit lounges together with day wards, empty wards and closed wards were excluded due to the absence of any inpatients and beds within these wards. A total of 84 wards were included for the study period from 1 April 2016 to 31

March 2017.

Data Collection

Approval for the use of the data was obtained from the provincial Health Impact Assessment (HIA) directorate. Thereafter, each individual hospital Chief Executive Officers (CEO) was contacted for access to the 12 monthly IP Ward activity reports for the period 1 April 2016 to 31 March 2017. Registration on the HIS was not necessary to access the reports since hospitals had the reports saved for the auditing purposes. One of the hospitals had an additional requirement of a presentation to the hospital board before granting permission and access to their data. The IP ward activity reports were sent to the researcher in one of two formats, namely pdf or MS excel.

The IP ward activity reports included the hospital name, calendar month, and for each ward: number of operational beds, number of actual beds, number of inpatient days, number of admissions, number of day cases, number of discharges, number of deaths, number of inpatient transferred out, internal ward transferred in, internal ward transferred out, operational occupancy (%), actual occupancy (%), ALOS, total separations and lastly, patient days.

The final 2016/2017 hospital level outputs and targets were provided by the metro district office. This included the ALOS and bed utilisation targets and achievements for each of the eight hospitals for the period at hand and as recorded in the 2016/2017 annual expenditure review.

Data Analysis

Pre-analysis quality control checks were done to identify and correct any errors. There was a potential for an error to be made with the capturing of information from the pdf IP Ward activity reports into the MS Excel electronic format. This was minimised by quality checks performed by two independent individuals, an intern and researcher. The data was transferred onto one consolidated workbook for analysis.

Pseudonyms were allocated to each hospital for confidentiality. Ward names required clarification and standardisation. Clarification was needed since not all ward names were self-explanatory. One hospital's wards were numbered e.g. ward 1A, 1B, 2A, etc. clarification of the ward types was done by contacting the information management officers at the necessary hospitals.

Standardisation of ward names was also required to group similar wards. In appendix A,

Hospital B had two medical wards, namely a male and female medical ward. These two wards were then grouped as one medical ward. Similarly, Hospital E had two surgical wards, namely surgical ward 1 and surgical ward 2. These were also grouped together to standardise and simplify ward types. The total number of wards used in the study was thus reduced from 84 to 55.

Input data was created and consolidated in MS Excel and Stata 11.0 was then used for prevalence data analysis.

Small vs. Large Hospitals

For this study the hospitals were divided into small and large district hospitals. From appendix A it is noted that small and large hospitals do not have the same bouquets of wards and thus not the same group of services or specialities and ultimately complexities. To distinguish between small and large hospitals the inpatient bed numbers were used. All hospitals with an inpatient bed number less than the median of 166.5 were a small district hospital and those with an inpatient bed number above the median, considered as a large district hospital.

Table 4: Small and Large district hospitals

	Hospital	Inpatient bed size
Small DH	Hospital H	50
Small DH	Hospital B	70
Small DH	Hospital A	120
Small DH	Hospital C	152
Large DH	Hospital G	181
Large DH	Hospital D	298
Large DH	Hospital E	300
Large DH	Hospital F	361

Table 4 provides the list of small and large district hospitals. Hospital H, B, A and C are the smaller district hospitals with respective bed sizes 50, 70, 120 and 152. The larger hospitals are Hospital G, D, E and F with bed sizes of 181, 298, 300 and 361 respectively.

Validity and Reliability

The validity of data refers to the extent to which measurements measure what it is intended to measure (Ehrlich and Joubert, 2008).

The data obtained was of a satisfactory quality since programmatic and governance processes

in the hospitals and district management contributed to improving the validity of the data. In the hospital, IP ward activity reports were saved after the end of the month and archived for later perusal by the auditor general. In this way reports need not be generated on request but were already available. This also reduced the chance that the data may change.

Two independent data clerks conducted quality checks when the data was captured from the pdf format to the MS Excel format reducing the possibility of capturing errors. There was no need to calculate the sample size since all the wards in the eight district hospitals were included except for those not meeting the inclusion and exclusion criteria.

Ethics Considerations

The study proposal was submitted to the UWC research ethics committee who perused the study for ethical soundness. With minor amendments to the research proposal the committee approved the study and provided the necessary ethics clearance. The Western Cape Department of Health (DOH) is the custodians of the data and thus approval to access and use the data was done through the provincial HIA directorate. Permission was also obtained from the individual hospital CEO's through the HIA directorate.

To maintain confidentiality, pseudonyms were assigned to each hospital. The data that was captured from the pdf IP ward activity reports was done on a password protected computer. All hard copies used in the quality checks were stored in a locked cupboard. After quality checks were conducted the data analysis was done using the pseudonyms. No patient information was used in the study.

CHAPTER 4: Results

This chapter present the findings of the study and focuses on the bed utilisation and average length of stay in individual wards in the eight district hospitals in the Cape Town Metro district.

Description of the Wards

During the data analyses the wards were regrouped to better describe similar wards. An example is, in most hospitals there are male and female surgical wards but for the study surgical wards were described and not as separate female and male wards. The original number of wards in the eight district hospitals was 84. After regrouping there were 55. In Table 5 is a summary of the number of original wards vs. the regrouped wards per district hospital.

Table 5: Number of original wards vs. regrouped wards

Hospital Name	Original Wards	Regrouped wards
Hospital A	5	4
Hospital B	6	5
Hospital C	11	9
Hospital D	15	8
Hospital E	16	10
Hospital F	18	9
Hospital G	8	5
Hospital H	5	5
	84	55

General wards in Hospital A were also categorised as medical wards as per the clarification of the information management (IM) clerk at the hospital. From Appendix A, not all eight hospitals had the same wards. All the hospitals had a medical, surgical casualty overnight and paediatric wards, but the larger hospitals had additional wards such as psychiatry, maternity and obstetrics, gynaecology and high care.

Inpatient Beds per Hospital

To meet objective one of this study, it was necessary to provide a description of the number and type of beds in each hospital. The intention was to use usable beds in the study as opposed to actual beds as it would be a better reflection of the number of beds used in the hospital. This was not possible since not all hospitals routinely recorded usable beds, only actual beds. Thus, not all the hospitals had the data available on usable beds. Actual beds were used in this study. The number of inpatient beds per hospital varied as well as the number of inpatient beds per ward type. The smallest ward type with only three high care beds was found at Hospital G and the largest at District Hospital F with 116 medical beds spread across three different medical wards.

Table 6 displays the descriptive statistics of the inpatient beds for each hospital. Small district hospitals, i.e. Hospital H, B, A and C had the lowest mean inpatient bed numbers per ward type. The larger hospitals, i.e. Hospital G, D, E and F had higher mean inpatient bed numbers per ward type.

Table 6: Inpatient beds per hospital ward type

Hospital	Inpatient Beds	Min	Max	STDEV	Median	Mean
Hospital A	120	6	56	21	29	30
Hospital B	70	5	45	17	6	14
Hospital C	152	3	54	15	12	17
Hospital D	298	14	67	20	33	37
Hospital E	300	6	66	18	29,5	30
Hospital F	361	9	116	34	35	40
Hospital G	181	3	86	33	25	36
Hospital H	50	5	18	5	9	10

Table 7 gives a summary of the number of beds per ward type category, as well as an indication of the types of wards present in each hospital. Only 50% of hospitals had inpatient beds in the Casualty Overnight Ward. Acute beds in the EC were found in 50% of the hospitals. Only 37% of hospitals had separate gynaecology inpatient beds and 20% had high care beds. Only 50% had KMC inpatient beds, 75% had maternity and obstetric inpatient beds and 62% had psychiatry inpatient beds. Most had medical, paediatrics and surgical inpatient beds. Only 1 hospital had dedicated neonatal inpatient beds.

Table 7: Beds per ward type within each hospital.

Ward Type	Hospital A	Hospital B	Hospital C	Hospital D	Hospital E	Hospital F	Hospital G	Hospital H
Casualty Overnight Ward	6	6			27	35		
EC Acute				14	27		15	8
Gynaecology			12		6	12		
High Care			3				3	
Kangaroo Mother Care Ward			6	26	10	10		
Maternity and Obstetrics		8	17	47	42	45		10
Medical /Psychiatry				36				
Medical Ward	56	45	21	67	66	116	86	18

Neonatal Ward						9		
Nursery Ward			10	16	14			
Paediatrics	24	6	17	30	32	30	25	9
Psychiatry Ward		5	12		36	44		
Surgical Ward	34		54	62	40	60	52	5

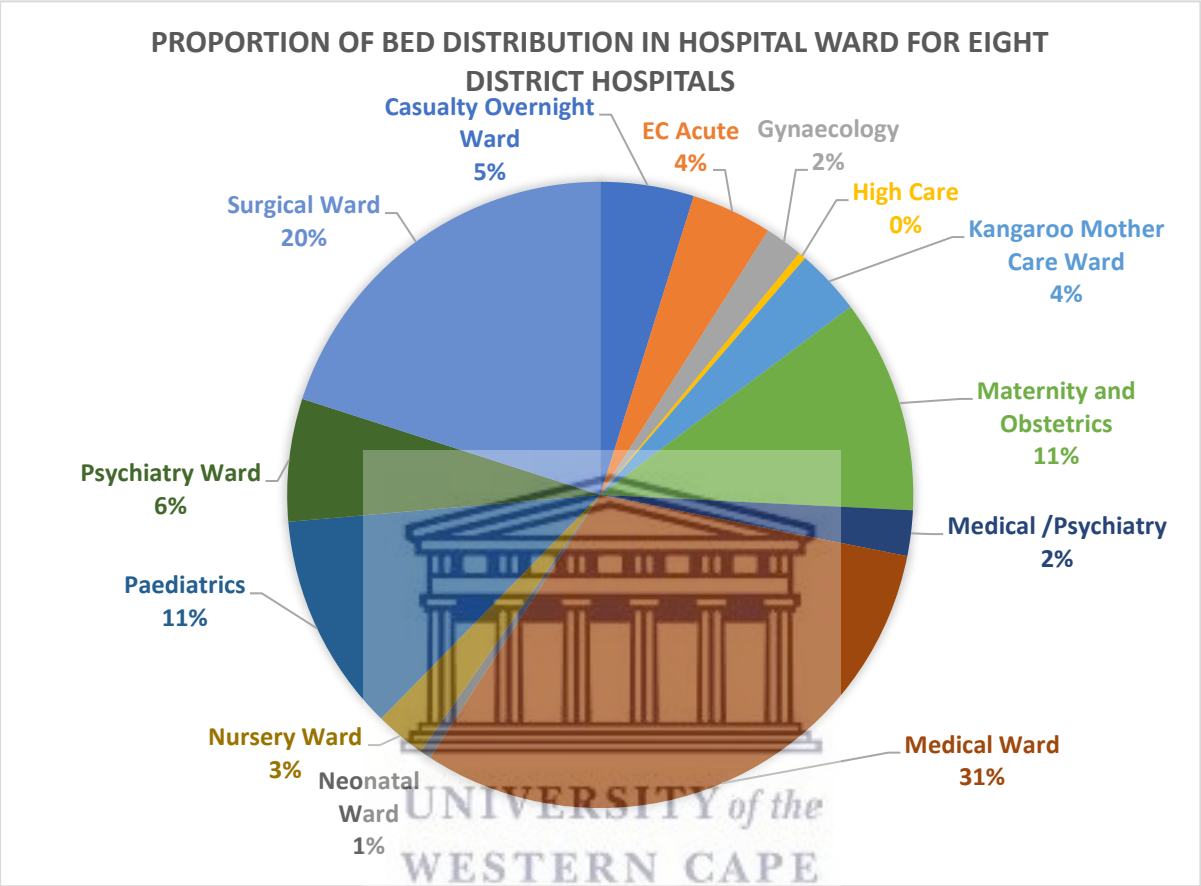


Figure 3: Proportion of bed distribution across hospital wards in eight district hospitals

Figure 3 displays the proportion of inpatient bed distribution amongst the wards in the eight district hospitals. At 31%, medical beds or beds in medical wards make up the largest proportion of all inpatient beds in these hospitals. This excluded the medical beds contained in the mixed ward containing medical and psychiatric beds where it was not possible to distinguish between the two types. The second largest bed type was surgical beds at 20% of all beds. Thereafter followed Maternity and Obstetrics and Paediatric beds at 11% each and then in descending order Psychiatry (6%), Casualty overnight ward (5%), EC acute (4%), KMC (4%), Nursery ward (3%), Gynaecology (2%), Neonatal (1%) and lastly high care (<1%).

Hospital Targets

Table 8: 2016-2017 Fin year -Targets for district hospitals

	ALOS(DAYS)		Bed Utilisation (%)	
Hospital	**Target**	**Achievement**	**Target**	**Achievement**
Hospital A	3,4	3,6	126%	133%
Hospital B	3,5	2,8	89%	70%
Hospital C	3,4	2,9	126%	102%
Hospital D	3,4	3,6	110%	95%
Hospital E	4,2	4,4	90%	86%
Hospital F	4,4	4,6	77%	83%
Hospital G	3,5	3,5	89%	90%
Hospital H	2,7	2,3	118%	74%

To meet objective two of this study, table 8 displays the overall hospital targets for ALOS and bed utilisation as was set out by the district management at the start of the 2016/17 financial year. The actual achievements are what were reported at the end of the financial year in the annual district health expenditure review. The target was based on the previous year's achievement and may not necessarily be the ideal figure. The target is set in relation to the hospital and does not take into consideration individual ward performances, number and types of wards. It is concerning that the bed occupancy targets for 50% of the hospitals are set above the recommended 80-90% optimum bed occupancy rate according to Olukoga (2007). ALOS achievement for the year 2016/17 for Hospital A, D, E and F exceeded the set target. Hospitals B, C and H were below the target and Hospital G achieved the target ALOS.

Bed Utilisation in the Wards

To meet objective three of this study the next section will identify trends in the BUR across the hospitals. Figure 4 and 5 display individual bed occupancy per ward type per month for each of the eight district hospitals. The hospitals were grouped into small and large hospitals. The hospital target was displayed and thus allowed for comparison with each of the ward type occupancy (%). The data presented was for the period April 2016 to March 2017. District hospitals A, B, C and H were grouped together as the small hospitals and D, E, F and G as the large hospitals.

In district hospital A the casualty overnight ward beds were significantly above the hospital target for the entire period. The surgical and medical inpatient bed occupancy was in line with the target and the paediatric inpatient bed occupancy was below the hospital target.

In District Hospital B bed occupancy rates were below the target for most of the wards and during most of the year except for the medical ward that exceeded the hospital bed occupancy target thrice during the 12-month period, in August, January and February. The bed occupancy across the wards fluctuated during the year as opposed to the wards in District Hospital A where they stayed relatively constant. Bed occupancy in the paediatric and maternity and obstetrics units were very low and dropped to below 50% at numerous points throughout the period. The paediatric ward was as low as 20% at the end of the period.

In District Hospital C the bed occupancy target was above 120%. The psychiatric ward achieved bed occupancy rates above the target 3 times during this period. The KMC ward had very low bed occupancy and at times dropped to below 20%. The bed occupancy in the nursery ward was also low and dropped to below 50% at times. Inpatient bed occupancy in maternity and obstetrics, gynaecology, medical, surgical, high care and paediatrics remained relatively constant between 80% and 100%.

In District Hospital H the bed occupancy target was nearly 120%. Most of the wards achieved bed occupancy below the target for most of the year except for the EC acute ward that exceeded the target in February. Bed occupancy in the surgical ward fluctuated during the period and dropped to a low of 0% in May and up to a high of over 90% in March. Occupancy in the maternity and obstetrics and medical wards remained constant. Bed occupancy in the paediatric ward was low but an increase was seen during the August to November period.

Figure 5 displays the bed occupancy for the large district hospitals. In District Hospital D the bed occupancy target was set at 110%. The bed occupancy in the EC acute ward was between 270% and 370% throughout the period. This was significantly above the set target. The other wards remained relatively constant and below the hospital target for the entire period. The paediatric ward dropped to below 50% at times.

In District Hospital E the bed occupancy target was set at 90%. Inpatient bed occupancy for gynaecology and the EC acute ward exceeded the hospital target throughout the period. While most of the wards remained constant with their bed occupancy, the casualty overnight and paediatric wards dropped to less than 50% at various points during the period.

In District Hospital F the bed occupancy target was set at 77%. The surgical, medical and psychiatry inpatient bed occupancy remained above the target throughout period.

There is a clear outlier in May when the psychiatry bed occupancy increased to nearly 180%. While bed occupancy in the wards of district hospital F remained constant throughout the period it dropped to as low as 20% at times in the paediatric and the gynaecology wards.
In district hospital G the target was set at 89%. The paediatric and high care inpatient bed occupancy remained constant and below target for the entire period. The medical and surgical inpatient bed occupancy also remained constant throughout the year and exceeded the target only twice during the period. As was the case in District Hospital D the EC acute ward was the outlying ward and achieved bed occupancy rates significantly above the target during this 12-month period.

In summary, the bed occupancy across the wards in these eight district hospital remained constant. EC and casualty overnight wards occupancy rates were high in five (A, D, E, G, H) of the eight hospitals. In two of the eight hospitals (C & F) occupancy in the psychiatry beds were high. Bed occupancy in the neonatal and paediatric wards remained low compared to the hospital targets.

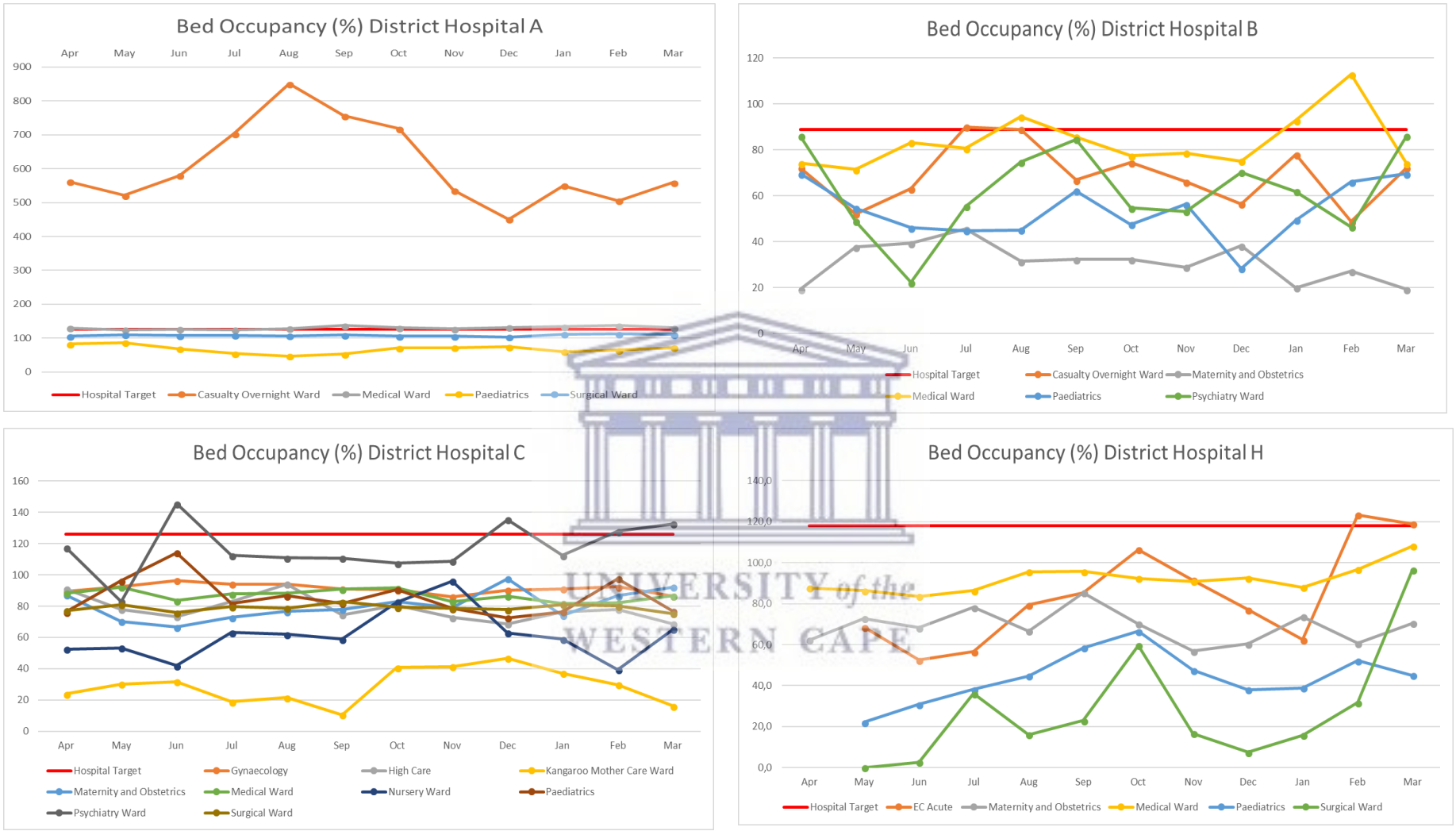


Figure 4: Bed Occupancy (%) Small District Hospitals April 2016-March 2017

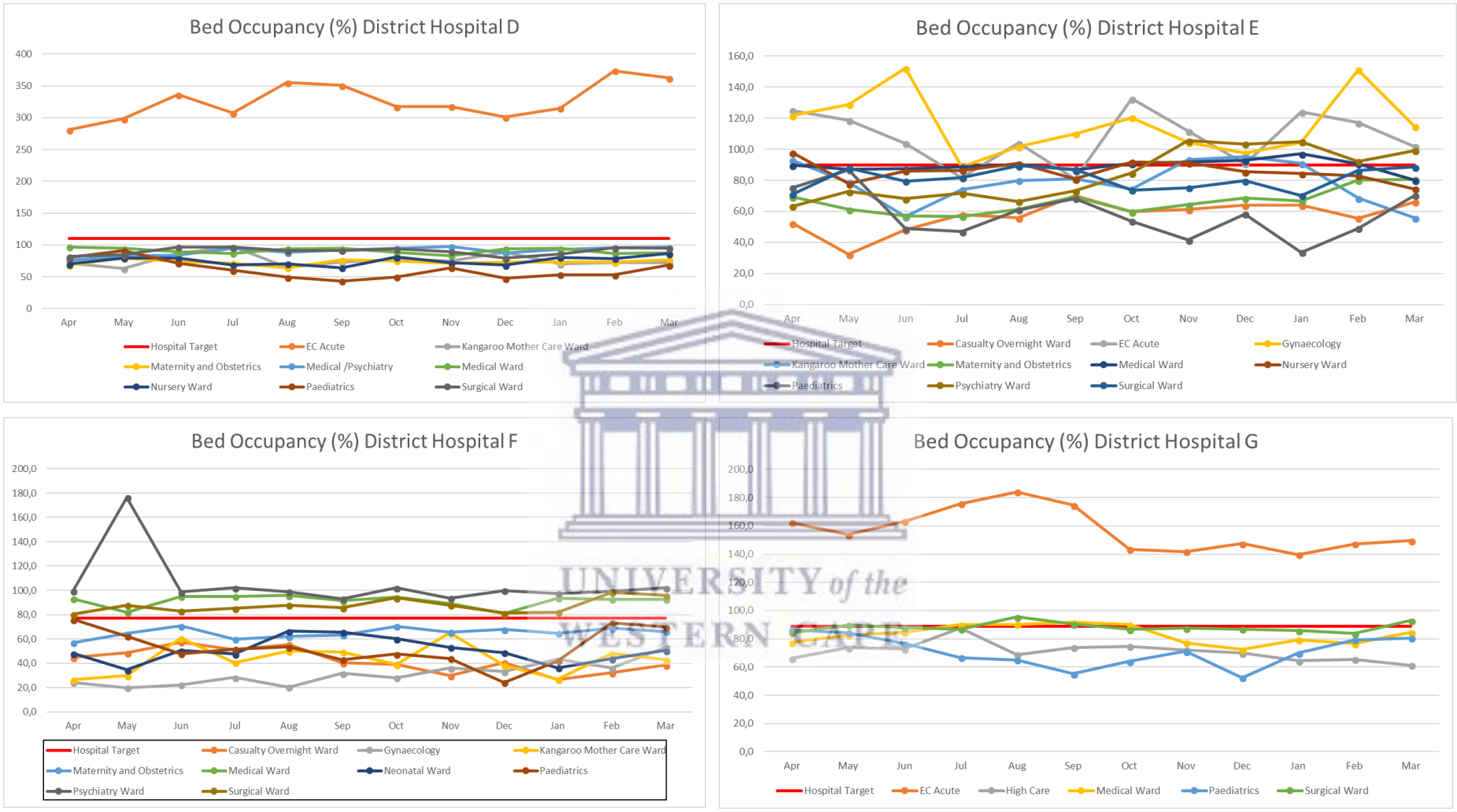


Figure 5: Bed Occupancy (%) Large District Hospitals April 2016-March 2017

ALOS in the Wards

To meet objective four of this study this next section will identify wards where the patient stay is well above the ALOS. Figure 6 and 7 display the ALOS per ward type per month for the eight district hospitals. The hospitals were grouped into small and large hospitals. The hospital target was displayed and thus allowed for comparisons with each ward type ALOS. The data presented was for the period April 2016 to March 2017. District hospitals A, B, C and H were grouped together as the small hospitals and D, E, F and G as the large hospitals.

In Figure 6 the ALOS for District Hospital A was at a target of 3.4 days. The ALOS for the paediatric, surgical and casualty overnight wards seem to have remained constant and below the target for most of the period. The casualty overnight ward was the ward with the lowest length of stay at only one day. Patients stayed long in the medical ward and ALOS reached up to 12 days during October and March.

ALOS target in District Hospital B was at 3.5 days for the period. In the psychiatry and medical wards patients stayed longer than the 3.5 days and up to 10 days in the psychiatry ward. The ALOS in the paediatric ward was around 2 days and in maternity and obstetrics as well as the casualty overnight ward around one day or less. The ALOS was constant for most of the wards except the psychiatry ward which fluctuated throughout the period.

The target ALOS in district hospital C was 3.4 days. Patients stayed longer than the target ALOS in the psychiatry, gynaecology, medical wards as well as the nursery.

Length of stay in the maternity and obstetrics and the paediatrics ward was shorter than the target of 3.4 days. ALOS was constant throughout the wards apart from two marked increases; one in the KMC ward during February and one in the psychiatry ward during June.

District hospital H had the lowest ALOS target among the eight district hospitals at only 2.7 days. In this hospital, patients in the paediatric and medical wards stayed longer whereas patients in the EC acute, maternity and obstetrics and surgical wards stayed shorter than the targeted 2. 7 days. The ALOS in the paediatric ward fluctuated throughout the period where wards such as EC acute and maternity and obstetrics remained constant.

District hospital D had a target ALOS of 3.4 days. Patients stayed longest in the mixed medical/psychiatry ward starting out at less than 8 days at the beginning of the period and ending at more than 14 days at the end of the 12-month period. This is followed by the medical, surgical, KMC and nursery wards all with an ALOS higher than the hospital target. ALOS in maternity and obstetrics and EC acute were constant and low at less than 2 days.

ALOS target for district hospital E was 4.2 days. Length of stay in gynaecology, maternity and

obstetrics and the surgical ward was constant and below the hospital target. Length of stay in the nursery and medical wards was constant and slightly above the targeted 4.2 days. In this hospital patients stayed longer in the KMC ward, the EC acute and longest in the psychiatry ward. ALOS in the psychiatry ward fluctuated throughout the period and was as long as 20 days in July 2016.

District hospital F had the highest ALOS target at 4.4 days. In the medical and psychiatry ward patients stayed longer than the targeted for 4.4 days. In the psychiatry ward ALOS was as long as 18 days in February. ALOS in the maternity and obstetrics, neonatal, paediatrics as well as surgical wards were below the targeted duration of stay and was constant throughout the period.

In district hospital G the target ALOS was 3.5 days. Patients stayed for shorter periods in the EC acute and paediatric wards whereas longer duration of stay was seen in the medical and high care wards.

In summary, patients stayed longer periods in the medical and psychiatry wards. Shorter ALOS was observed in the maternity and obstetrics, paediatrics and EC acute wards.

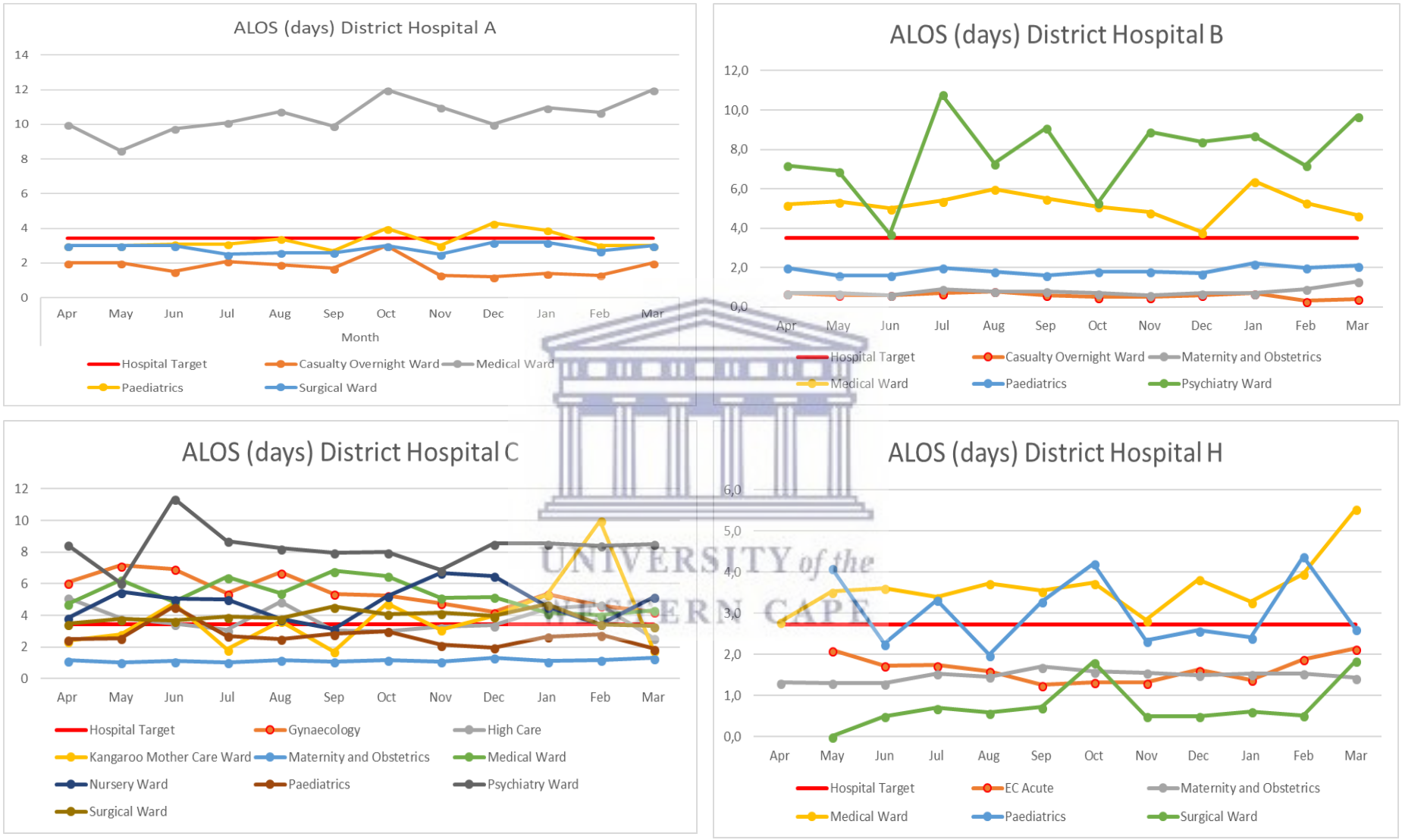


Figure 6: ALOS Small District Hospitals April 2016-March 2017

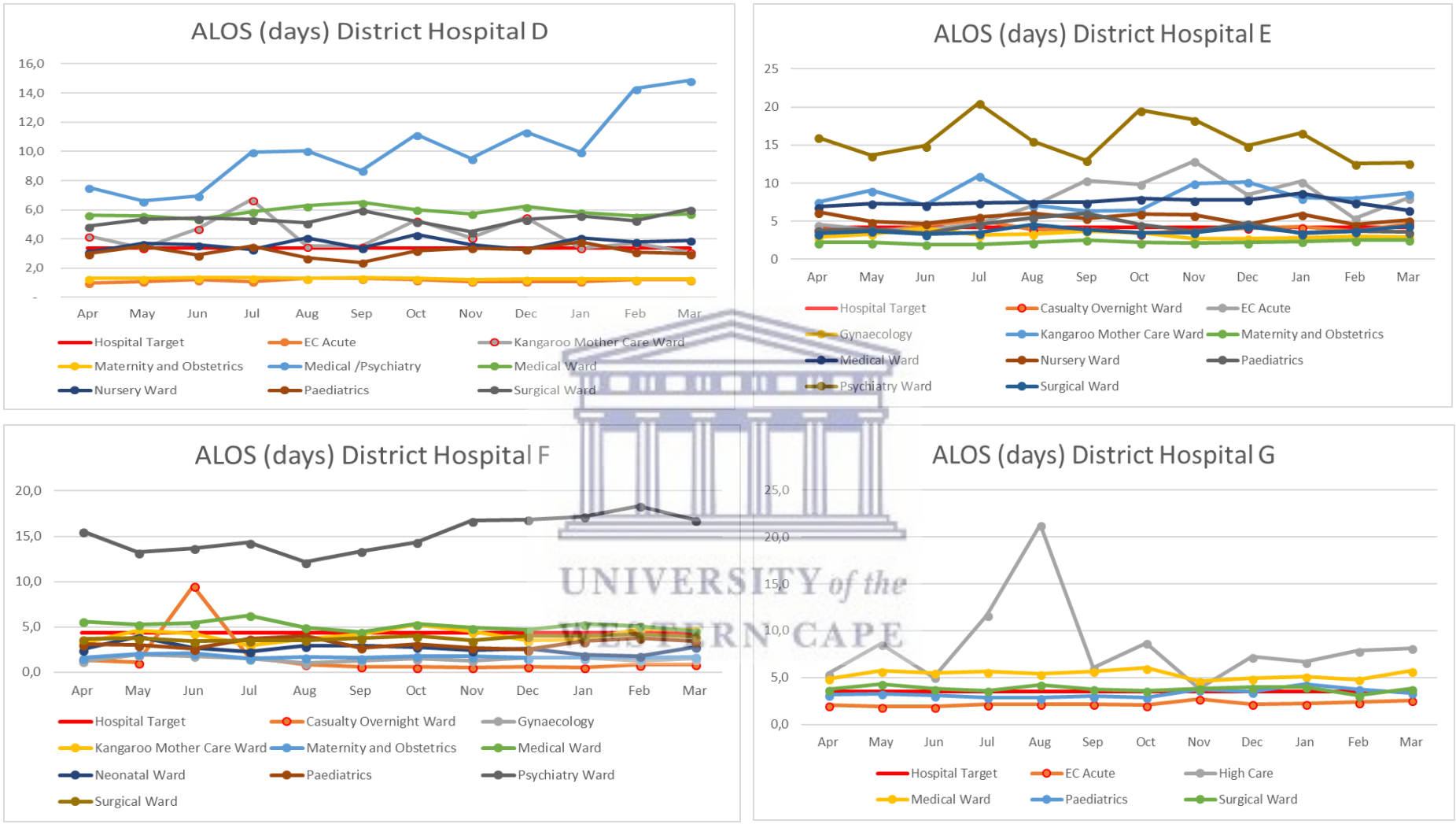


Figure 7: ALOS Large District Hospitals April 2016-March 2017

Deaths in Wards

To meet objective five of this study, death in the wards are described in the next section.

A total of 4286 deaths occurred in the wards across eights district hospitals for the period April 2016 to March 2017. Of all the deaths, 61% took place in the medical ward followed by the surgical ward (14%), EC acute (10%), casualty overnight (9%). The remaining 5% were from the other wards. Table 9 shows a breakdown of the number of deaths per ward type.

Table 9: Number of deaths in wards

Total Deaths in eight hospital wards	**Freq.**	**Percent**
Psychiatry Ward	0	0%
Kangaroo Mother Care Ward	4	0%
Medical /Psychiatry	4	0%
Neonatal Ward	7	0%
Paediatrics	8	0%
Maternity and Obstetrics	14	0%
Nursery Ward	54	1%
High Care	65	2%
Gynaecology	71	2%
Casualty Overnight Ward	395	9%
EC Acute	442	10%
Surgical Ward	602	14%
Medical Ward	2620	61%
Grand Total	4286	100%

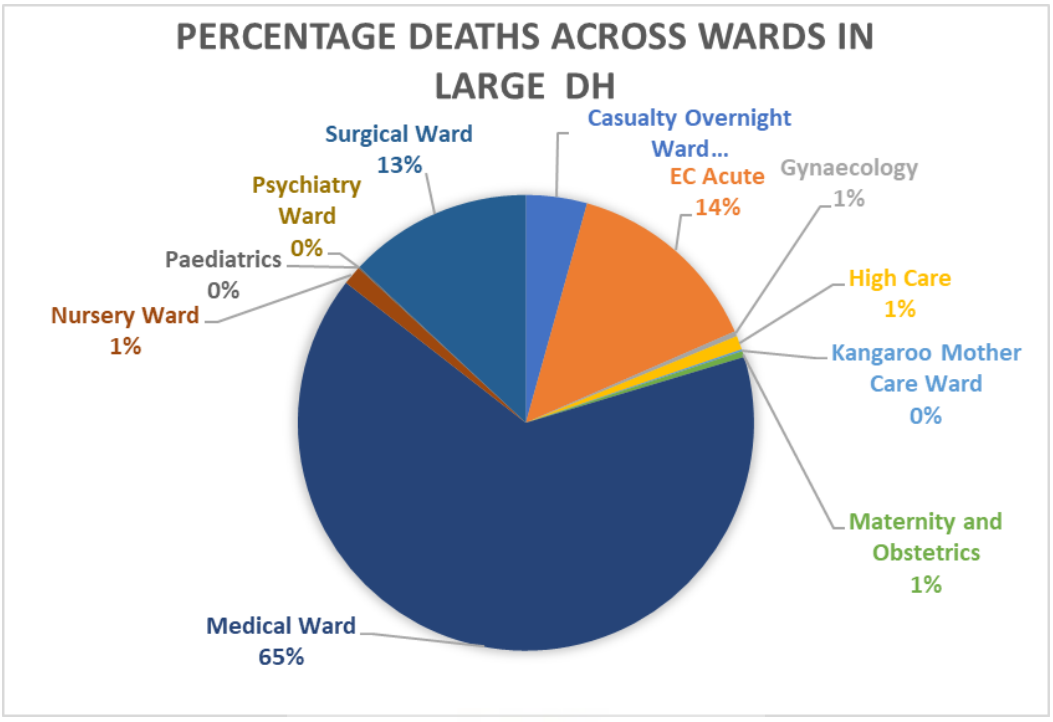


Figure 8: Deaths per ward in large hospitals

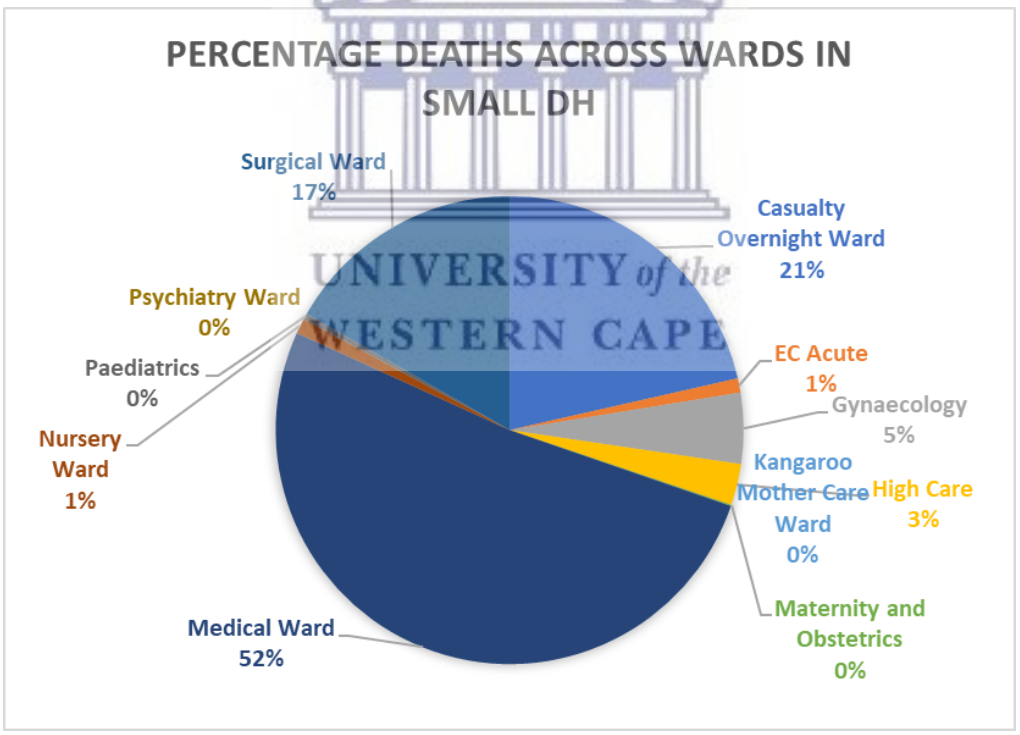


Figure 9: Deaths per ward in small hospitals

In the large district hospitals (figure 8) deaths in the medical wards was 65%. This was more than the proportion of medical ward deaths in all the hospitals combined (61%). The proportion of deaths in medical wards in the small hospitals was less at 52% (figure 7) but still high. In

the smaller district hospitals, the proportion of deaths in the medical wards was smaller than in large district hospitals but the proportion of deaths in surgical, casualty overnight, gynaecology and high care was bigger when compared to the large district hospitals.

CHAPTER 5: DISCUSSION

Discussion

The aim of the study was to describe trends in bed utilisation in the wards of eight district hospitals in the Cape Town metro district by describing the bed occupancy and ALOS in the wards of these hospitals. The hospitals varied in size from as small as 50 inpatient beds in Hospital H to as large as 361 inpatient beds in Hospital F. The hospitals were thus categorised into small and large district hospitals. The intention was also to show trends in the wards based on bed occupancy and identify wards where beds were over or underutilised.

Bed occupancy appeared high and often exceeded 100%. BUR, calculated as the number of inpatient days added to half the number of day patients and divided by usable bed days, was expressed as a percentage (Massyn *et al*., 2016). BUR can exceed 100% when the ALOS is long and it subsequently increases the overall inpatient days. A large number of day patients can also increase the BUR although these patients do not spend long periods in the hospital. The hospital target for each hospital varied and was based on the previous year's performance. Since bed occupancy was used as a measure of patient care (Keegan, 2010) the ideal bed occupancy rate should be between 80-90% (Olukoga, 2007). The bed occupancy across the wards remained constant but too high in certain wards such as the EC acute, casualty overnight and psychiatry wards.

When viewing ALOS at hospital level it varied between 2.3 and 4.6 days. The study showed that ALOS at the ward level ranged from less than one day to over 20 days in one of the psychiatric wards. The bed occupancy and the ALOS during the study period showed no obvious seasonal trends. The number of deaths occurring in the wards were analysed and the most deaths took place in the medical wards where ALOS remained above the target ALOS.

In five (hospitals A, D, E, G, H) of the eight hospitals the bed occupancy in the EC and casualty acute wards remained significantly above the target for most of the 12-month period. Some months it was as high as 850%.

Although EC acute and casualty overnight made up for only a small proportion of the beds in the hospitals, 4% and 5% respectively, it is still imperative to manage the beds efficiently to avoid overcrowding and allow for access to appropriate medical care according to Hoot and Aronsky (2008). The EC or casualty wards are important entry points in the healthcare system and often patient who arrive at these ECs and casualty departments are in need of urgent or life-threatening medical assistance. The danger of high bed occupancy in ECs include overcrowding which leads to mortality (Blum *et al.*, 2008).

In two of the four psychiatry wards the bed occupancy was high and up to 350% in Hospital F during May 2016. Psychiatry beds made up 6% of all the inpatient beds in these district hospitals and were found in 4 of the 8 district hospitals. The reasons for this high bed occupancy need further investigation as it threatens quality of care as well as access to district level health care in an already overburdened health system. The literature review described inappropriate admissions, patient flow, and increases in bed demand, changing epidemiology of the population and delayed discharges as the major factors influencing the bed occupancy. According to the Western Cape government a lack of beds at step-down facilities and referral hospitals played a big role in the high bed occupancy at these district hospitals (MDHS, 2016).

In the large district hospitals bed occupancy was lowest in the paediatric wards. The ALOS was on or below the hospital target for most months thus indicating that the patients in these wards did not stay excessively long periods. At times the bed occupancy reached up to 80% and thus considering that the ideal bed occupancy is between 80% and 90% it would not be recommended to move beds out of these wards due to possible under utility. Overall the paediatric beds accounted for 11% of inpatient beds in the eight district hospitals.

The study revealed that ALOS in medical and psychiatry wards were significantly higher than the hospital targets and most other wards. In one psychiatry ward the ALOS was as high as 20 days (Hospital E) and the highest ALOS amongst the medical wards was 12 days (Hospital A). A persistently long ALOS indicated that patients were staying in these wards for too long. According to the literature possible reasons for long stay included delays in discharge, referral to next level of care is not available or quality of medical care may not be optimum. This study did not investigate the reasons for the prolonged in hospital stay but it certainly warrants further investigation, especially the psychiatric wards which also showed high bed occupancy rates (Massyn *et al*., 2016).

Shorter ALOS, which ranged between 1 and 2 days, was observed in the maternity and obstetrics, paediatrics and EC acute wards. According to Clarke (1996) this does not

necessarily indicate that the level of care was optimum. If the ALOS is too short patients may be leaving without the appropriate treatment or be inappropriately diverted to the next level of care, e.g. in this case that would be to the community health centre or clinic. A shorter duration also increases the expenditure per PDE as the initial cost per day was higher than the last days spent in hospital and when the ALOS is reduced the cost of the latter, less costly, days are reduced thus increasing the overall expenditure per PDE (Clarke, 1996). Maternity and obstetrics, paediatrics and EC acute wards accounted for 11%, 11% and 4% respectively of the total inpatient beds. No specific seasonal trends in ALOS were noted across the 12-month period.

The number of deaths that took place during the study period were analysed and it was found that 61% of the deaths, were occurring in the medical wards. 14% were occurring in surgical 10% and 9% respectively in the EC acute and casualty wards and the remaining 5% in all the other wards, namely psychiatry ward, KMC ward, medical /psychiatry, neonatal ward, paediatrics, maternity and obstetrics, nursery ward, high care and gynaecology. Medical wards were also found to have high ALOS and the EC acute and casualty wards which together accounted for 19% of totals death were found to have high bed occupancy rates. This was a cause for concern since ALOS and bed occupancy are both measures used to monitor the quality of care and access to care (Hoot and Aronsky, 2008). This warrants further investigation by health managers to determine causes for the prolonged length of stay and reasons for overcrowding in the concerned wards. There may also be a relationship between poor bed management and mortality in the medical, EC acute and casualty overnight wards. This however was not addressed in this study.

In the larger hospitals the proportion of deaths in the medical wards was 65%, slightly more than the overall 61%. In the smaller hospitals it was slightly less at 52%. This may be due to the different specialities offered at the small vs. large hospitals but will require further investigation.

Limitations

The use of secondary datasets in this study offered advantages such as speed and cost-efficiency but also presented limitations such as incomplete or insufficient information. The researcher intended to compare usable beds with actual beds as the two are not always identical but not all wards collected both data elements. The IP ward reports did not include the ward

expenditure and it could have been more meaningful to compare the amount of resources allocated to each ward.

CHAPTER 6: CONCLUSION & RECOMMENDATIONS

Conclusion

The bed occupancy as well as ALOS were described in the eight district hospitals within the Cape Town metro district and compared to the targets set for the financial year 2016-2017. Although in this study no specific seasonal trends were noted, a review over a longer period e.g. 5years might be useful in understanding such trends. ALOS and bed occupancy in most wards were found to be constant and in line with the target although a few findings were concerning, including, high occupancy rates in the psychiatry, EC and casualty overnight wards as well as too high ALOS in medical and psychiatry wards. There is a need for further investigations to determine the reasons for the high bed occupancy and ALOS in these hospitals.

Recommendations

The study findings showed some areas of concern in the BUR and ALOS among certain wards in these eight district hospitals. There may also be a relationship between poor bed management and mortality in the medical, EC acute and casualty overnight wards. The study would therefore recommend the following:

1. Review similar trends over a longer period, e.g. over 3 to 5 years in order to determine if there is any consistency
2. Conduct further research to investigate the possible relationship between high bed occupancy and mortality in the ward.
3. Investigate the relationship between high ALOS and mortality in the wards.
4. For district management to start reviewing ward level data to gain insight into the ward pressures.
5. Investigate and address the causes of the high bed occupancy at the psychiatry, EC and casualty overnight wards. This can be done by the district management through operational research.
6. Conduct a follow-on study that will consider the resources allocated to the various wards to determine efficiency and effectiveness in the bed management of individual wards.

REFERENCES

1. Al-Kandari, F. and Thomas, D. (2009) 'Perceived adverse patient outcomes correlated to nurses' workload in medical and surgical wards of selected hospitals in Kuwait', Journal of Clinical Nursing. John Wiley & Sons, Ltd (10.1111), 18(4), pp. 581–590. doi: 10.1111/j.1365-2702.2008.02369.x.
2. Benatar, S. (2013) 'The challenges of health disparities in South Africa', South African Medical Journal, 103(3), pp. 154–155.
3. Blum, F. C. et al. (2008) 'Crowding : High-Impact Solutions', (April).
4. Borg, M. (2003) 'Bed occupancy and overcrowding as determinant factors in the incidence of MRSA infections within general ward settings', Journal of Hospital Infection, 54(4), pp. 316–318. doi: https://doi.org/10.1016/S0195-6701(03)00153-1.
5. Bruce, N., Pope, D. and Stanistreet, D. (2008) A Practical Interactive Guide to Epidemiology and Statistics.
6. Clarke, A. (1996) 'Why are we trying to reduce length of stay? Evaluation of the costs and benefits of reducing time in hospital must start from the objectives that govern change.', Quality and Safety in Health Care, 5(3), pp. 172–179. doi: 10.1136/qshc.5.3.172.
7. Correia, M. I. T. D. and Waitzberg, D. L. (2003) 'The impact of malnutrition on morbidity, mortality, length of hospital stay and costs evaluated through a multivariate model analysis.', Clinical nutrition (Edinburgh, Scotland). Elsevier, 22(3), pp. 235–9. doi: 10.1016/S0261-5614(02)00215-7.
8. Côté, M. (2000) 'Understanding patient flow', Decision Line, (March), pp. 8–10.
9. Ehrlich, R. and Joubert, G. (2008) Epidemiology: A research manual for South Africa. 2nd edn.
10. Fine, M. J. et al. (2000) 'Relation between length of hospital stay and costs of care for patients with community-acquired pneumonia', The American Journal of Medicine. Elsevier, 109(5), pp. 378–385. doi: 10.1016/S0002-9343(00)00500-3.
11. Gruskay, J. A. et al. (2015) 'Clinical Study Factors affecting length of stay after elective posterior lumbar spine surgery: a multivariate analysis', The Spine Journal, 15, pp. 1188–1195. doi: 10.1016/j.spinee.2013.10.022.
12. Hammond, C. L., Pinnington, L. L. and Phillips, M. F. (2009) 'A qualitative examination of inappropriate hospital admissions and lengths of stay', BMC Health Services Research. BioMed Central, 9(1), p. 44. doi: 10.1186/1472-6963-9-44.

13. Hankey, G. (2017) ‘Patient Flow Management in a South African Academic Hospital : The Groote Schuur Hospital (GSH) Case’, (March), p. 155.
14. Holm, L. B., Lurås, H. and Dahl, F. A. (2013) ‘Improving hospital bed utilisation through simulation and optimisation’, International Journal of Medical Informatics. Elsevier Ireland Ltd, 82(2), pp. 80–89. doi: 10.1016/j.ijmedinf.2012.05.006.
15. Hoot, N. R. and Aronsky, D. (2008) ‘Systematic Review of Emergency Department Crowding: Causes, Effects, and Solutions’, Annals of Emergency Medicine, 52(2), p. 126–136.e1. doi: 10.1016/j.annemergmed.2008.03.014.
16. Jones, R. (2011) ‘Hospital bed occupancy demystified’, British Journal of Healthcare Management. MA Healthcare London , 17(6), pp. 242–248.
17. Jones, R. (2011) ‘Hospital bed occupancy demystified’, British Journal of Healthcare Management, 17(6), pp. 2432–249. doi: 10.12968/bjhc.2011.17.6.242.
18. Kao, E. P. C. and Tung, G. G. (1981) ‘Bed Allocation in a Public Health Care Delivery System Author (s): Edward P . C . Kao and Grace G . Tung Published by : INFORMS Stable URL : http://www.jstor.org/stable/2631116 REFERENCES Linked references are available on JSTOR for this article : You m’, 27(5), pp. 507–520.
19. Keegan, A. (2010) ‘Hospital bed occupancy: more than queuing for a bed’, The Medical Journal of Australia Medical Journal of Australia, 193(5), pp. 25–729. Available at: https://www.mja.com.au/system/files/issues/193_05_060910/kee10033_fm.pdf (Accessed: 13 April 2018).
20. Kumar, A. and Mo, J. (2010) ‘Models for bed occupancy management of a hospital in Singapore’, Proceedings of the 2010 International Conference on Industrial Engineering and Operations Management, pp. 242–247. Available at: https://pdfs.semanticscholar.org/8f04/bfe37f23ea8f157a5e86885f206a11c81a2b.pdf (Accessed: 26 August 2017).
21. KZN Dept of Health (2001) Definitions of Health Facilities. Available at: http://www.kznhealth.gov.za/definitions.htm (Accessed: 18 August 2018).
22. Larson, C. and Mercer, A. (2004) ‘Global health indicators: an overview.’, CMAJ : Canadian Medical Association journal = journal de l’Association medicale canadienne. Canadian Medical Association, 171(10), pp. 1199–200. doi: 10.1503/cmaj.1021409.
23. Mackay, M. (2001) ‘Practical experience with bed occupancy management and planning systems: an Australian view.’, Health care management science. Kluwer Academic Publishers, 4(1), pp. 47–56. doi: 10.1023/A:1009653716457.

24. Majeed, M. U. et al. (2012) 'Delay in discharge and its impact on unnecessary hospital bed occupancy', BMC Health Services Research, 12(1). doi: 10.1186/1472-6963-12-410.
25. Massyn N, Peer N, English R, Padarath A, Barron P, D. C. (2016) District Health Barometer 2015_16.
26. McClean, S. and Millard, P. (1993) 'Patterns of Length of Stay After Admission in Geriatric Medicine: An Event History Approach', The Statistician, 42(3), p. 263. doi: 10.2307/2348804.
27. McDonagh, M. S., Smith, D. H. and Goddard, M. (2000) 'Measuring appropriate use of acute beds', Health Policy, 53(3), pp. 157–184. doi: 10.1016/S0168-8510(00)00092-0.
28. McDonnell, P. J. and Jacobs, M. R. (2002) 'Hospital Admissions Resulting from Preventable Adverse Drug Reactions', Annals of Pharmacotherapy. SAGE Publications, 36(9), pp. 1331–1336. doi: 10.1345/aph.1A333.
29. MDHS (2016) District Health Expenditure Review 2016 / 17 Report.
30. MDHS (2017) 'District Health Expendicture Review City of Cape Town 2016/2017', p. 2016.
31. Mersha, T. (2006) 'Output and performance measurement in outpatient care', Omega. BioMed Central, 17(2), pp. 159–167. doi: 10.1016/0305-0483(89)90007-8.
32. Olukoga, A. (2007) 'Unit costs of inpatient days in district hospitals in South Africa', Singapore Medical Journal, 48(2), pp. 143–147. Available at: http://smj.sma.org.sg/sma_web/smj/4802/4802a6.pdf (Accessed: 14 April 2018).
33. Rissanen, P., Aro, S. and Paavolainen, P. (1996) 'Hospital-and Patient-Related Characteristics Determining Length of Hospital Stay for Hip and Knee Replacements', International Journal of Technology Assessment in Health Care. Cambridge University Press, 12(02), pp. 325–335. doi: 10.1017/S0266462300009661.
34. Rubin, S. G. and Davies, G. H. (1975) 'Bed Blocking by Elderly Patients in General-Hospital Wards', Age and Ageing. Oxford University Press, 4(3), pp. 142–147. doi: 10.1093/ageing/4.3.142.
35. Schoetz, D. J. et al. (1997) '"Ideal" length of stay after colectomy', Diseases of the Colon & Rectum. Springer-Verlag, 40(7), pp. 806–810. doi: 10.1007/BF02055437.
36. De Silva, D. (2013) 'Improving patient flow across organisations and pathways', The Health Foundation, (19), p. 40.

37. Soria-Aledo, V. et al. (2009) 'Associated Factors and Cost of Inappropriate Hospital Admissions and Stays in a Second-Level Hospital', American Journal of Medical Quality. SAGE PublicationsSage CA: Los Angeles, CA, 24(4), pp. 321–332. doi: 10.1177/1062860609337252.
38. Statistics South Africa (2014) Poverty Trends in South Africa: An examination of absolute poverty between 2006 and 2011, Statistics South Africa.
39. Stats SA (2017) 'STATS SA Mid-year population estimates 2017', (July).
40. The World Bank (2018) The World Bank In South Africa. Available at: http://www.worldbank.org/en/country/southafrica/overview (Accessed: 25 April 2018).
41. Victor, C. R. (1990) 'A survey of the delayed discharge of elderly people from hospitals in an inner-London health distric', Archives of Gerontology and Geriatrics, 10(2), pp. 199–205. doi: 10.1016/0167-4943(90)90019-3.
42. WCGH (2016) NORTHERN TYGERBERG SUB-STRUCTURE Annual Operational Plan 20162017.
43. WCGH (2017) Annual Performance Plan 2017/18. Cape Town.
44. Western Cape Government (2013) 'Healthcare 2030', pp. 1–160.
45. WHO (2017) 'From MDGs to SDGs'. Available at: http://www.who.int/mediacentre/events/meetings/2015/MDGs-SDGs-Summary.pdf?ua=1.
46. Zimmer, J. G. (1974) 'Length of stay and hospital bed misutilization', Medical Care. Lippincott Williams & Wilkins, 12(0025–7079 (Print)), pp. 453–462. doi: 10.2307/3762916.

APPENDICES

APPENDIX A: Standardisation of ward names per hospital

Original Ward Name	Regrouped Ward Name	Hospital Name
Casualty Overnight	Casualty Overnight Ward	Hospital A
A General Ward	Medical Ward	
E General ward		
C Paeds/Neonates Ward	Paediatrics	
D Surgical	Surgical Ward	
Overnight Ward	Casualty Overnight Ward	Hospital B
Maternity Ward	Maternity and Obstetrics	
Female Ward	Medical Ward	
Male Ward		
Paediatric Ward	Paediatrics	
Psychiatric Ward	Psychiatry Ward	
G Ward/Private	Gynaecology	Hospital C
High Care	High Care	
Kangaroo Mother Care Ward	Kangaroo Mother Care Ward	
M Maternity and Obstetrics	Maternity and Obstetrics	
E General Medicine Ward	Medical Ward	
Nursery Ward	Nursery Ward	
P Paediatrics	Paediatrics	
Psychiatry Ward	Psychiatry Ward	
A Surgical Male	Surgical Ward	
B Surgical Female		
D Ward		
EC Acute Ward	EC Acute	Hospital D
6A-Kangaroo Care (&Gynae)	Kangaroo Mother Care Ward	
3A-Hospital Maternity Antenatal	Maternity and Obstetrics	
3B-Maternity postnatal		
1A-Medical/Psychiatry Female	Medical /Psychiatry	
1B-Medical/Psychiatry Male		
2A-Intensive Medical/Surgical	Medical Ward	
4A-Medical		
4B-Medical		
5A-Private Medical		
3E-Baby Room	Nursery Ward	
4C Paediatrics Medical/Surgical	Paediatrics	
2B-Surgical	Surgical Ward	
5A-Private Surgical		
5B-Surgery Ortho & Gynae		
Overnight Ward EMC	Casualty Overnight Ward	Hospital E
EC Majors Adults	EC Acute	
EC Majors Paeds		
EC Psychiatric Ward		
Gynaecology	Gynaecology	

Kangaroo Care	Kangaroo Mother Care Ward	
Antenatal Ward	Maternity and Obstetrics	
Post Natal Ward		
Medical Ward 1	Medical Ward	
Medical Ward 2		
Nursery	Nursery Ward	
Paediatric Ward	Paediatrics	
Female Psychiatric Ward	Psychiatry Ward	
Male Psychiatric Ward		
Surgical Ward 1	Surgical Ward	
Surgical Ward 2		
EC Overnight Adult ICD	Casualty Overnight Ward	Hospital F
EC Overnight Medical Adult Ward		
EC Overnight Paeds ward		
Gynaecology	Gynaecology	
KMC	Kangaroo Mother Care Ward	
Antenatal Ward	Maternity and Obstetrics	
Maternity Post Natal		
Medical Female	Medical Ward	
Medical Male		
MPH Carnation		
Neonatal Ward	Neonatal Ward	
Paediatric Ward	Paediatrics	
Mental Health Female	Psychiatry Ward	
Mental Health Male		
Surgical Female	Surgical Ward	
Surgical Female Orthopaedic		
Surgical Male		
Surgical Male Orthopaedic		
Emergency Ward	EC Acute	Hospital G
High Care Unit	High Care	
Sandes Medical Female Total	Medical Ward	
Sandes Medical Male Total		
Wright Ward Total		
Currie Children	Paediatrics	
Currie Surgical Female	Surgical Ward	
Currie Surgical Male		
Emergency Centre	EC Acute	Hospital H
Maternity Ward	Maternity and Obstetrics	
Medicine	Medical Ward	
Paediatric	Paediatrics	
Surgical	Surgical Ward	
84	55	8

APPENDIX B: Approval letter 1

Western Cape Government
Health

STRATEGY & HEALTH SUPPORT
Health.Research@westerncape.gov.za
tel: +27 21 483 0866 fax: +27 21 483 9895
5th Floor, Norton Rose House,, 8 Riebeek Street, Cape Town, 8001
www.capegateway.gov.za

REFERENCE: WC_201711_018
ENQUIRIES: Dr Sabela Petros

University of the Western Cape

Robert Sobukwe Road

Bellville

Cape Town

7530

For attention: Mrs Leilah Najjar, Dr Hanani Thabani

Re: **Bed utilisation trends** in selected wards across eight district hospitals **in the Cape Town district.**

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research.

Please contact following people to assist you with any further enquiries in accessing the following sites:

Victoria Hospital	Dr Graeme Dunbar	**021 799 1211**
Mitchells Plain Hospital	Mr Hans Human	**021 377 4306**
Helderberg Hospital	Dr Werner Viljoen	**021 850 4704**

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activities at requested facilities are not interrupted.
2. Researchers, in accessing provincial health facilities, are expressing consent to provide the department with an electronic copy of the final feedback (**annexure 9**) within six months of completion of research. This can be submitted to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).
3. In the event where the research project goes beyond the *estimated completion* date which was submitted, researchers are expected to complete and submit a progress report

(**Annexure 8**) to the provincial Research Co-ordinator

(Health.Research@westerncape.gov.za).

4. The reference number above should be quoted in all future correspondence.

Yours sincerely

DR A HAWKRIDGE

DIRECTOR: HEALTH IMPACT ASSESSMENT

DATE: 21/11/2017.

APPENDIX C: Approval letter 2

Western Cape Government
Health

STRATEGY & HEALTH SUPPORT
Health.Research@westerncape.gov.za
tel: +27 21 483 0866 fax: +27 21 483 9895
5th Floor, Norton Rose House,, 8 Riebeek Street, Cape Town, 8001
www.capegateway.gov.za

REFERENCE: WC_201711_018
ENQUIRIES: Dr Sabela Petros

University of the Western Cape

Robert Sobukwe Road

Bellville

Cape Town

7530

For attention: Mrs Leilah Najjar, Dr Hanani Thabani

Re: **Bed utilisation trends in selected wards across eight district hospitals in the Cape Town district.**

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research.

Please contact following people to assist you with any further enquiries in accessing the following sites:

Eerste River Hospital	**Dr Adele Anthony**	**021 902 8019**
False Bay Hospital	**Dr Wendy Waddington**	**021 782 1121**

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activities at requested facilities are not interrupted.
2. Researchers, in accessing provincial health facilities, are expressing consent to provide the department with an electronic copy of the final feedback (**annexure 9**) within six months of completion of research. This can be submitted to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).
3. In the event where the research project goes beyond the *estimated completion* date which was submitted, researchers are expected to complete and submit a progress report

(**Annexure 8**) to the provincial Research Co-ordinator

(Health.Research@westerncape.gov.za).

4. The reference number above should be quoted in all future correspondence.

Yours sincerely

A J HAWKRIDGE.

DR A HAWKRIDGE

DIRECTOR: HEALTH IMPACT ASSESSMENT

DATE: 24/11/2017.

APPENDIX D: Approval letter 3

Western Cape Government
Health

HEALTH IMPACT ASSESSMENT
HEALTH RESEARCH SUB DIRECTORATE
Health.Research@westerncape.gov.za
Tel: +27 21 483 0866 fax: +27 21 483 9895
5th Floor, Norton Rose House,, 8 Riebeek Street, Cape Town, 8001
www.capegateway.gov.za)

REFERENCE: WC_201711_018
ENQUIRIES: Dr Sabela Petros

University of the Western Cape

Robert Sobukwe Road

Bellville

Cape Town

7530

For attention: Mrs Leilah Najjar, Dr Hanani Thabani

Re: **Bed utilisation trends** in selected wards **across eight district hospitals in the Cape Town district.**

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research.

Please contact following people to assist you with any further enquiries in accessing the following sites:

Wesfleur Hospital	**Dr Ziefred McConey**	**021 571 8052**
Karl Bremer Hospital	**Dr De Vries Basson**	**021 918 1205**

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activities at requested facilities are not interrupted.
2. Researchers, in accessing provincial health facilities, are expressing consent to provide the department with an electronic copy of the final feedback (**annexure 9**) within six months of completion of research. This can be submitted to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).
3. In the event where the research project goes beyond the *estimated completion* date which was submitted, researchers are expected to complete and submit a progress report

(**Annexure 8**) to the provincial Research Co-ordinator

(Health.Research@westerncape.gov.za).

4. The reference number above should be quoted in all future correspondence.

Yours sincerely

DR A HAWKRIDGE

DIRECTOR: HEALTH IMPACT ASSESSMENT

DATE: 6/12/2017.

APPENDIX E: Approval letter 4

Western Cape Government
Health

HEALTH IMPACT ASSESSMENT
HEALTH RESEARCH SUB DIRECTORATE
Health.Research@westerncape.gov.za
Tel: +27 21 483 0866 fax: +27 21 483 9895
5th Floor, Norton Rose House, 8 Riebeek Street, Cape Town, 8001
www.capegateway.gov.za

REFERENCE: WC_201711_018
ENQUIRIES: Dr Sabela Petros

University of the Western Cape

Robert Sobukwe Road

Bellville

Cape Town

7530

For attention: Mrs Leilah Najjar, Dr Hanani Thabani

Re: **Bed utilisation trends in selected wards across eight district hospitals in the Cape Town district.**

Thank you for submitting your proposal to undertake the above-mentioned study. We are pleased to inform you that the department has granted you approval for your research.

Please contact following people to assist you with any further enquiries in accessing the following sites:

Khayelitsha District Hospital	**Dr Moses Witbooi**	**021 360 4386**

Kindly ensure that the following are adhered to:

1. Arrangements can be made with managers, providing that normal activities at requested facilities are not interrupted.
2. Researchers, in accessing provincial health facilities, are expressing consent to provide the department with an electronic copy of the final feedback (**annexure 9**) within six months of completion of research. This can be submitted to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).
3. In the event where the research project goes beyond the *estimated completion* date which was submitted, researchers are expected to complete and submit a progress report (**Annexure 8**) to the provincial Research Co-ordinator (Health.Research@westerncape.gov.za).

4. The reference number above should be quoted in all future correspondence.

Yours sincerely

AT HAWKRIDGE.

DR A HAWKRIDGE

DIRECTOR: HEALTH IMPACT ASSESSMENT

DATE: 28/2/2018.

APPENDIX F: Ethics letter UWC

UNIVERSITY of the WESTERN CAPE

OFFICE OF THE DIRECTOR: RESEARCH
RESEARCH AND INNOVATION DIVISION

Private Bag X17, Bellville 7535
South Africa
T: +27 21 959 2988/2948
F: +27 21 959 3170
E: research-ethics@uwc.ac.za
www.uwc.ac.za

16 November 2017

Ms L Najjaar
School of Public Health
Faculty of Community and Health Sciences

Ethics Reference Number: BM17/9/10

Project Title: Bed utilisation trends in selected wards across eight-district hospital in the Cape Town district.

Approval Period: 16 November 2017 – 16 November 2018

I hereby certify that the Biomedical Science Research Ethics Committee of the University of the Western Cape approved the scientific methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report in good time for **annual renewal.**

The Committee must be informed of any serious adverse event and/or **termination of** the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

PROVISIONAL REC NUMBER -130416-050