

**PREOPERATIVE FACTORS ASSOCIATED  
WITH EXTENDED POSTOPERATIVE  
LENGTH OF STAY IN PATIENTS  
UNDERGOING PRIMARY HIP  
ARTHROPLASTY**

By

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## **DEDICATION**

I dedicate this dissertation to my family. A special feeling of gratitude to my loving wife, Nolufefe Dlamini, without whom this journey would not have been possible. You were my pillar of strength during my postgraduate training years and my hope in times of despair. You are the best, my best!

I also dedicate this dissertation to our sons, Melokuhle and Hlelokuhle Dlamini. You kept me going and became a reason why giving up was never an option. Boys, you are my REASON!

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## LIST OF ABBREVIATIONS

### Overview:

EPLoS Extended postoperative length of stay

### Part 1: Literature review

ICD International Classification of Disease  
OA Osteoarthritis  
RA Rheumatoid arthritis  
AVN Avascular necrosis  
DALYs Disability-adjusted life years  
OECD Organization for Economic Co-operation and Development  
LoS Length of stay  
ASA American Society of Anesthesiologists  
NSAID Non-steroidal anti-inflammatory drug  
EPLoS Extended postoperative length of stay

### Part 2: Submission-ready manuscript

EPLoS Extended postoperative length of stay  
CI Confidence interval  
OR Odds ratio  
FFD Fixed flexion deformity  
VAS Visual Analogue Score  
ASA American Society of Anesthesiologists  
COPD Chronic obstructive pulmonary disease  
UC Unable to compute  
CNBE Could not be established

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## OVERVIEW

Orthopaedic disorders of the hip are becoming more common in many countries around the world, including South Africa. Conservative medical treatment of severe hip disorders might sometimes be ineffective in reducing pain or restoring hip function in some patients. In these patients, surgical intervention, through primary hip arthroplasty, remains the only viable option for reducing pain and restoring hip function.

The increasing demand for primary hip arthroplasty in South Africa poses a problem for many resource-limited orthopaedic units in the country. It is possible that many of these orthopaedic units will be forced to consider fast-track surgery and recovery protocols to cope with the increased demand for primary hip arthroplasty. These protocols aim to shorten postoperative LoS, reduce complications, and allow for more efficient financial expenditure and resource allocation per patient. An understanding of which characteristics are associated with extended postoperative length of stay (EPLoS) in primary hip arthroplasty patients would have important implications for fast-track postoperative protocols being implemented in South African settings. This was the impetus for the current study.

This study was a retrospective chart review involving 185 South African primary hip arthroplasty patients. Univariate and multivariate data analysis were performed to identify crude and independent associations between various characteristics and EPLoS. There were three preoperative risk factors (gender, fixed flexion deformity, patient's maximum walking distance) and one intraoperative risk factor (extended duration of surgery) which were independently associated with EPLoS following primary hip arthroplasty in South African patients.

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# **Part 1: Literature review**

## **1.1. Orthopaedic disorders of the hip**

### **1.1.1. Classification**

Most orthopedic disorders comprise categories of the International Classification of Disease 10<sup>th</sup> (ICD-10) Revision group “Diseases of the musculoskeletal system and connective tissue”.<sup>1</sup> This ICD-10 group includes: arthropathies, systemic connective tissue disorders, dorsopathies, soft tissue disorders, osteopathies, chondropathies, and other unspecified musculoskeletal/connective tissue disorders.<sup>1</sup> In addition, there are various ICD-10 codes for the sequelae injury/trauma to the skeletal system, such as fractures.<sup>1</sup> The most important orthopedic disorders of the hip includes: osteoarthritis (OA), rheumatoid arthritis (RA), avascular necrosis (AVN), fracture, malignancy, and joint infection.<sup>2</sup> Hip pain and functional limitation are frequent presenting features.<sup>3</sup>

### **1.1.2. Prevalence and burden of disease**

The global prevalence of hip disorders such as OA and RA have been estimated from data collected as part of the Global Burden of Disease Study.<sup>4-6</sup> The age-standardized global prevalence of hip OA was estimated at 0.85%, with no significant change noted between 1990 and 2010.<sup>5</sup> Of the 291 conditions investigated as part of the Global Burden of Disease Study, OA was ranked 11th most important contributor to global disability and the 38<sup>th</sup> most important condition related to disability-adjusted life years (DALYs).<sup>5</sup> The global prevalence of RA was estimated at 0.24%, with no significant change in prevalence noted between 1990 and 2010.<sup>6</sup> A systematic review of prevalence studies of hip arthritis in sub-Saharan African settings by Usenbo et al., reported the prevalence of OA in the region to be between 0.4% and 29.7% in the general population, and up to 87% in elderly populations.<sup>7</sup> Hospital-based studies reported the prevalence of OA to be between 0.3% and 14.8%. In the same systematic review, the prevalence of RA in sub-Saharan Africa was reported to be up to 5.7% in population-based studies and 0.7% in hospital-based studies.<sup>7</sup> Rheumatoid arthritis-associated DALYs increased from 3.3 million in 1990 to 4.8 million in 2010, with RA ranked as the 42nd most important cause of global disability.<sup>6</sup> With regard to economics, arthritis (both OA and RA) accounts for considerable healthcare expenditure, with one American study estimating the costs associated with arthritis in 2003 at \$322 billion.<sup>8</sup>

The prevalence of AVN in the general population is difficult to estimate. There are thought to be 20000 to 30000 new cases of AVN in the United States each year.<sup>9</sup> It is estimated that only 10% of all hip arthroplasties are performed in patients with a primary indication for surgery of AVN.<sup>9</sup> More recently, the prevalence of AVN has been progressively increasing in populations with HIV infection.<sup>10</sup> This has economic and resource implications for orthopaedic surgeons in sub-Saharan Africa, which is a region severely impacted by HIV infection.<sup>11</sup>

Trauma/injury continues to be an important cause of morbidity worldwide.<sup>12</sup> Hip fracture is a common pathology associated with trauma/injury to the hip.<sup>2,3</sup> It is the primary indication for a large proportion of hip arthroplasties, with one American database study projecting that 23.8% of all primary hip arthroplasties in 2012 were in

patients with hip fractures.<sup>13</sup> Data from a large cohort consortium of middle-aged and elderly Europeans and North Americans reported that 5964 DALYs (27 per 1000 individuals) were lost due to hip fractures.<sup>14</sup> There are also considerable economic costs associated with this orthopaedic disorder.<sup>15,16</sup>

Malignancies affecting the hip are much rarer than OA, RA, or trauma/injury. A recent audit of 117 patients with solid orthopaedic tumours from a South African setting found that the pelvis and proximal femur were affected in ten patients (8.5%).<sup>17</sup> Six of the ten patients had osteosarcoma (60%), three had chondrosarcoma (30%) and one had fibrosarcoma (10%).<sup>17</sup> In addition, a proportion of bone cancer is the result of metastasis.<sup>18,19</sup> Although malignancy of the bone is not amongst the most important malignancies worldwide in terms of DALYs,<sup>20</sup> it is still a considerable contributor to reduced quality of life.<sup>21</sup> The estimated cost of malignancies affecting bone in the United States is \$12.6 billion.<sup>19</sup> Infection of prosthetic hip devices is an important complication of hip arthroplasty.<sup>22</sup> An average of 1.2% of all primary hip arthroplasties are complicated by infection.<sup>23</sup> In fact, up to 5.5% of revision hip arthroplasties are attributed to infection.<sup>24</sup> The most common microorganism isolated from infected hips are *Staphylococcus aureus* and coagulase-negative staphylococci.<sup>23</sup> In some settings, infection might increase the costs associated with arthroplasty by up to 61%.<sup>25</sup>

### 1.1.3. Risk factors

Risk factors for orthopaedic disorders of the hip include various patient, clinical, and procedural variables. Risk factors for each disorder are presented in Table I.

Table I: Risk factors for orthopaedic disorders of the hip\*

Disorder	Risk factors
Osteoarthritis	Obesity, physical activity, prior injury, genetics
Rheumatoid arthritis	Diet, smoking, hormones, genetics
Osteonecrosis	Femoral head fracture, hip dislocation, radiation, sickle cell disease, Caisson disease, myeloproliferative disorders, corticosteroids, alcoholism, coagulopathy, haemoglobinopathy, dysbaric phenomena, autoimmune disease, smoking, hyperlipidaemia, HIV-antiretrovirals
Hip fracture	Age, gender, race, low bone mass, low body weight, hormones, prior fracture, fall, disability/immobilization, low physical activity, psychotropic/anxiolytic/hypnotic drug use, corticosteroids, micronutrient deficiency, smoking, alcoholism, diabetes
Malignancy	Genetics/hereditary, age, gender, metastasis
Infection (postoperative)	Age, gender, race, indication for surgery, comorbidities, illness severity, trauma, NNIS score, income, preoperative length of stay, surgery duration, hospital and surgeon volume

\*Compiled from various published sources<sup>22,26-31</sup>

## 1.2. Hip arthroplasty

### 1.2.1. Utilization

Hip arthroplasty is one of the most common surgical procedures performed worldwide. Trends in hip arthroplasty utilization across the world have been summarized in a large, multinational database study by Pabinger and Geissler,<sup>32</sup> and a systematic review of the published literature by Singh.<sup>33</sup> In their analysis data from several countries belonging to the Organization for Economic Co-operation and Development (OECD), Pabinger and Geissler reported that the number of hip arthroplasties had increased since 2000.<sup>32</sup> A high level of variation in hip arthroplasty utilization between OECD countries was also observed, with procedure rates ranging from over 200 per 100000 population (United States, Germany, and Switzerland) and 8 per 100000 population (Mexico).<sup>32</sup> Access to care due to economic factors was correlated with hip arthroplasty utilization.<sup>32</sup> The systematic review by Singh also reported an increasing trend in hip arthroplasty over the past three decades.<sup>33</sup> Variation in country rates was attributed to differences in socioeconomic status, health care delivery systems, patient preferences, or the prevalence of osteoarthritis.<sup>33</sup> Ethnic, gender, and country disparities were also reported in the systematic review.<sup>33</sup> Descriptions of hip arthroplasty utilization in African settings are rare. Preliminary results from a survey of South African orthopaedic surgeons found that 4031 hip arthroplasties are performed each year in the country, with fully cemented hip arthroplasty being the most popular choice (58.3% of procedures).<sup>34</sup>

### 1.2.2. Length of stay following hip arthroplasty: Why is it important?

Length of stay (LoS) in hospital settings refers to the duration of a single hospital admission, calculated as the difference in inpatient days between hospital admission and hospital discharge. Postoperative LoS refers to the number of inpatient days between a surgical procedure and hospital discharge. Extended postoperative LoS is an additional duration of inpatient days above that which would be usually expected for a specific population of surgical patients, and is defined as a LoS following a surgery which is postoperative length of stay  $\geq 75^{\text{th}}$  percentile calculated for the specific surgical population. In general, LoS is used as a metric for quality of care and resource utilization/healthcare expenditure.<sup>35,36</sup> Specifically, increased LoS is associated with suboptimal quality of care and increased resource utilization/healthcare expenditure.<sup>35,36</sup> As such, increased LoS has important implications related to public health planning and the allocation of budgets and resources in hospital settings. In response to the trend towards increased hip arthroplasty utilization in several countries around the world,<sup>32,33</sup> fast-track postoperative protocols have been proposed in some settings to ensure that hospital budgets and resources are more efficiently allocated per patient requiring the procedure.<sup>37</sup> Fast-track protocols in surgical settings are a co-ordinated peri-operative approach aimed at reducing surgical stress and facilitating post-operative recovery. With specific reference to hip arthroplasty, dedicated surgical units have evolved with a well-defined organisational set-up tailored to deliver an accelerated peri-operative course of fast-track surgical procedures aimed at reduction of peri-operative morbidity, physiologically optimised anaesthetic procedures, optimised pain management and aggressive mobilization.<sup>37</sup> The postoperative LoS following standard hip arthroplasty

protocols is usually 7-8 days.<sup>38-40</sup> Studies of fast-track protocols show that postoperative LoS can be successfully shortened to two days in hip arthroplasty patients.<sup>37</sup> Therefore, aspects related to LoS following the procedure have also gained added importance in settings where fast-track postoperative protocols are being developed.

### 1.2.3. Characteristics associated with length of stay following hip arthroplasty

There are a few studies which describe LoS and associated characteristics in well-resourced and resource-constrained settings.<sup>38-40</sup> Older age, higher American Society of Anesthesiologists (ASA) Score, prolonged surgery, long surgical incisions, female gender, low Harris Hip Score, and not using a non-steroidal anti-inflammatory drug (NSAID) are amongst the common characteristics associated with increased LoS following hip arthroplasty (Table II).<sup>38-40</sup> It is possible that some of the preoperative characteristics (ie. Age, ASA score, gender, Harris Hip Score, and NSAIDs) can be used to predict those patients who would benefit/not benefit from fast-track postoperative protocols prior to these patients actually having their procedures. This could reduce postoperative complication rates in settings with fast-track protocols by ensuring only suitable patients are considered for fast-track postoperative protocols.

Table II: Risk factors for increased length of stay following hip arthroplasty

Study authors (Year)	Country	Identified risk factors
Foote et al., (2009) <sup>38</sup>	UK	Morbid obesity, older age, female, higher ASA score, cemented cup, longer surgical incision, omega surgical approach, longer operating time
Abbas et al., (2011) <sup>39</sup>	Pakistan	Older age, female, higher ASA score
Dall et al., (2009) <sup>40</sup>	UK	Older age, female, day of week when surgery performed, year of surgery, comorbidities, NSAIDs not used, aspirin used, smoking status, haemoglobin level, consultant level, Harris Hip Score

### 1.3. Gap in the knowledge

Published LoS data for primary hip arthroplasty patients is sparse, particularly from orthopaedic units in resource-constrained settings. The paucity of published LoS data from these settings might complicate efforts to provide an efficient orthopaedic surgical service in these settings. It is therefore important that the paucity in the knowledge regarding LoS following primary hip arthroplasty in resource-constrained settings be addressed.

### 1.4. Problem statement

There is a triple burden of disease in South Africa which includes communicable disease, non-communicable disease, and trauma/injury.<sup>41</sup> As a consequence of this triple burden of disease, a proportion of the South African population will likely develop hip disorders. Conservative management may not be effective in reducing pain

or improving functional limitation, and surgery might be the only viable option for these patients.<sup>33</sup> Indeed, hip arthroplasty has become one of the most common surgical procedures performed in South Africa, with some orthopaedic surgeons in the country performing up to 43 procedures annually.<sup>34</sup> This is compounded by the lack of qualified orthopaedic surgeons in neighbouring Southern African states, which has resulted in many non-South African patients seeking hip arthroplasty in South Africa.<sup>42</sup> Accelerated or fast-track postoperative care protocols are being considered as a possible method of coping with the increased demand for hip arthroplasty in South Africa.<sup>37,43</sup> These protocols aim to shorten postoperative LoS, reduce complications, and allow for more efficient financial expenditure and resource allocation per patient.<sup>37</sup> Therefore, an understanding of which characteristics are associated with extended postoperative length of stay (EPLoS) in primary hip arthroplasty patients would have important implications for fast-track postoperative protocols being implemented in South African settings.

### **1.5. Study aim and objectives**

The aim of this study was to investigate EPLoS in a sample of South African primary hip arthroplasty patients. The objectives of this study were to: a). Determine the incidence of EPLoS in a sample of South African primary hip arthroplasty patients; and b). Determine which patient, clinical, and surgical characteristics are associated with EPLoS in a sample of South African primary hip arthroplasty patients.

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# **Part 2: Submission-ready manuscript**

(To be submitted for peer-review to the “South African Orthopaedic Journal”)

**Manuscript title:** Incidence and risk factors for extended postoperative length of stay following primary hip arthroplasty in a South African setting

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## **ABSTRACT**

### **Background**

This study sought to determine the incidence of extended postoperative length of stay (EPLoS), and its associated risk factors in South African primary hip arthroplasty patients.

### **Methods**

This was a retrospective chart review study of 185 adults who underwent primary hip arthroplasty at a quaternary South African hospital. Data related to patient, clinical, and surgical characteristics were collected. Postoperative length of stay was calculated as the time (in days) between the dates of surgery and discharge from hospital. We defined EPLoS as any length of stay  $\geq 75^{\text{th}}$  percentile obtained for the entire study population. Data were analysed using univariate and multivariate statistical methods.

### **Results**

The incidence of EPLoS was 28.1% (95% Confidence interval - CI: 22.1-35.0%). Risk factors for EPLoS included: Female gender (Odds Ratio - OR: 4.63, 95% CI: 1.74-12.34;  $p=0.002$ ), missing Thomas Test assessment (OR: 4.80, 95% CI: 1.72-13.34;  $p=0.003$ ), patient's maximum walking distance  $<100\text{m}$  (OR: 3.05, 95% CI: 1.05-8.89;  $p=0.041$ ), and extended duration of surgery (OR: 3.62, 95% CI: 1.31-10.01;  $p=0.013$ ).

### **Conclusion**

We provide a report of EPLoS and several associated risk factors in South African primary hip arthroplasty patients.

## INTRODUCTION

Increased global life expectancy has been linked to an higher burden of musculoskeletal conditions, including hip fracture and osteoarthritis.<sup>1</sup> Untreated musculoskeletal conditions impact quality of life in afflicted patients and also have adverse consequences on healthcare expenditure and resource utilisation.<sup>1</sup> These conditions would therefore have public health significance in resource-limited settings. Aside from non-communicable aetiologies, the global HIV epidemic has also been linked to the growing prevalence of orthopaedic disorders.<sup>2</sup> Conservative medical therapy might not be effective in a large proportion of patients afflicted with orthopaedic hip conditions. Surgical intervention remains the only viable management option in these patients.<sup>3</sup> The effectiveness of primary hip arthroplasty in reversing pain and loss of function associated with orthopaedic hip conditions is well described.<sup>3,4</sup> Utilization of primary hip arthroplasty as a surgical intervention for orthopaedic hip conditions has increased substantially over the past 2-3 decades, with this procedure now considered amongst the most common surgical procedures performed worldwide.<sup>4</sup>

A survey of orthopaedic surgeon members belonging to the South African Orthopaedic Association reported that each member in the country performed up to 43 hip arthroplasties each year.<sup>5</sup> In addition, a lack of surgical expertise and other essential resources in surrounding countries has resulted in a number of patients from these countries being referred to South African hospitals for the procedure.<sup>6</sup> In response to the increasing demand for primary hip arthroplasty, it is possible that many South African orthopaedic surgery units will in future adopt accelerated postoperative care pathways, in which the length of inpatient stay (and subsequent expenditure and resource utilization for each patient) following surgery is reduced.<sup>7,8</sup> An understanding of which patient, clinical, and surgical characteristics are associated with extended postoperative length of stay (EPLoS) in South African primary hip arthroplasty patients would have important future implications for the development of fast-track or accelerated surgical and recovery protocols implemented at orthopaedic surgery units in the country.

Therefore, the objectives of this study were to:

1. Determine the incidence of EPLoS in a sample of South African primary hip arthroplasty patients.
2. Determine which patient, clinical, and surgical characteristics are associated with EPLoS in a sample of South African primary hip arthroplasty patients.

## MATERIALS AND METHODS

### **Study design, study setting, and study population**

This was a retrospective chart review study involving consecutive adult patients who were admitted for primary hip arthroplasty through a dedicated arthroplasty unit at a quaternary level hospital in KwaZulu-Natal, South Africa between 23 September 2014

and 28 July 2016. Inclusion/exclusion criteria for this study are presented in Table I. Potential participants were identified from theatre lists during the specified study period.

Table I: Inclusion and exclusion criteria for the proposed study

Inclusion criteria	Exclusion criteria
Patients aged 18 years or older	Patients younger than 18 years old
Patients who underwent primary hip arthroplasty between 23 September 2014 and 28 July 2016	Patients who did not undergo primary hip arthroplasty between 23 September 2014 and 28 July 2016
Patient not previously included in study	Patient previously included in study

### Data collection

The medical records of all patients included in this study were reviewed and data related to various patient (Demographics), clinical (Comorbidities, presenting diagnosis, Thomas Test with fixed flexion deformity - FFD, etc.), and surgical characteristics (Nature of surgery, anaesthesia, surgical approach, duration of surgery, and perioperative blood transfusion) were collected using case report forms. We also collected data related to the occurrence of serious perioperative complications, which we defined as a Grade III or above perioperative complication when using the Clavien-Dindo classification (Includes: Organ failure, critical care admission, reoperation, and mortality).<sup>9</sup> Postoperative length of stay was calculated as the time (Days) between the date of a patient's operation and the date that the patient was discharged from hospital. The study outcome was EPLoS. This was defined as a postoperative length of stay  $\geq 75^{\text{th}}$  percentile calculated for the entire study population. This definition of EPLoS has been used in similar surgical studies conducted in overseas settings.<sup>10,11</sup> Data were transferred from the case report forms to a Microsoft Excel® spreadsheet in preparation for analysis.

### Data analysis

The median length of stay for the study population was calculated and is presented with an interquartile range. The incidence of EPLoS in this study was calculated using conventional epidemiological methods.<sup>12</sup> The incidence of EPLoS in this study is presented as a percentage with 95% confidence intervals (95% CI). Potential associations between various patient, clinical, and surgical characteristics and EPLoS were investigated using univariate ( $\chi^2$  test, or Fishers Exact test) and multivariate (Binary logistic regression) statistical methods. Results for the univariate statistical analysis are presented as frequencies and percentages.

Characteristics with  $p < 0.100$  in the univariate analysis were selected for inclusion in the multivariate statistical analysis. This purposeful selection of variables for inclusion in the multivariate analysis was done to obtain the most parsimonious model possible.<sup>13</sup> Model fit was assessed using a Hosmer-Lemeshow test. Results for the multivariate statistical analysis are presented as odds ratios (OR) with 95% CI. A p-value of  $< 0.050$  was considered to be a statistically significant result. All statistical analyses were

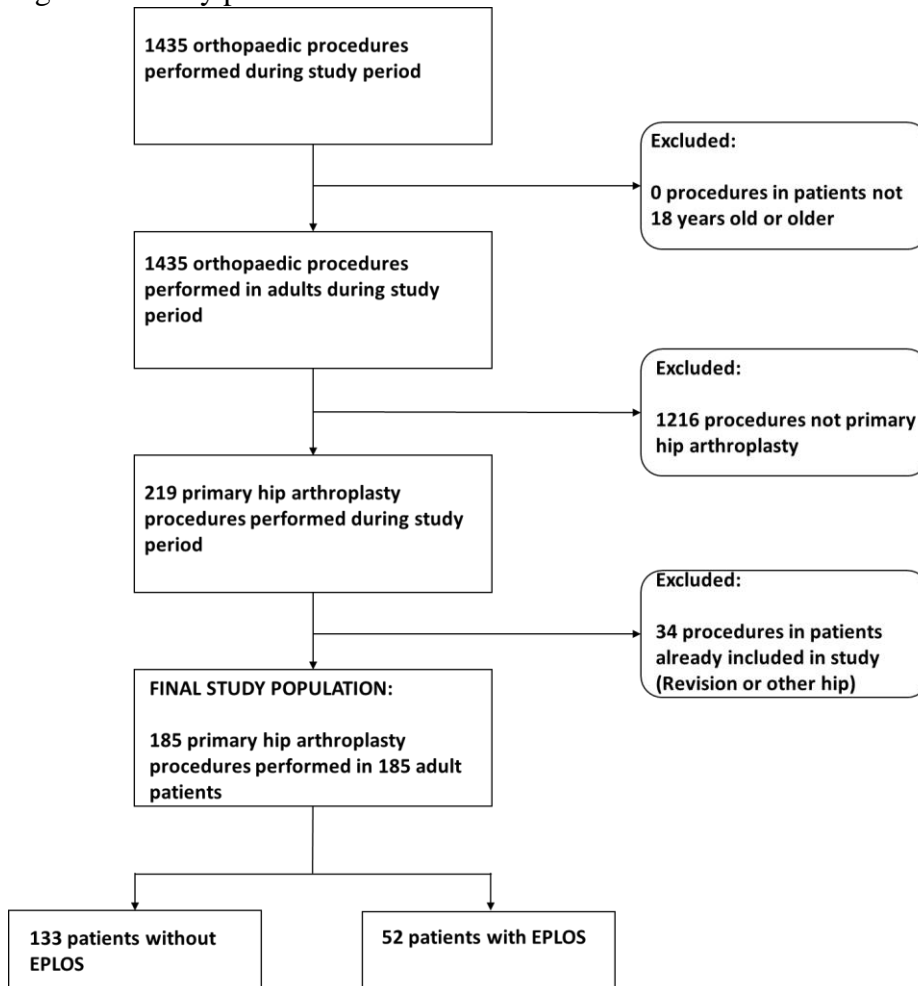
performed using the Statistical Package for the Social Sciences (SPSS) version 24.0 (IBM Corp, USA).

## RESULTS

### Derivation of the study population and the incidence of EPLoS

The derivation of the study population and the incidence of EPLoS in this study is shown in Figure 1. Following the application of our study inclusion and exclusion criteria, our final study population consisted of 185 adult patients who underwent primary hip arthroplasty. The median postoperative length of stay for the study population was 5.0 days (Interquartile range: 3.0-7.0 days). The 75<sup>th</sup> percentile for the study population postoperative length of stay was 7.0 days. A total of 52/185 patients experienced EPLoS following primary hip arthroplasty, with the calculated incidence of EPLoS being 28.1% (95% CI: 22.1-35.0%).

Figure 1: Study profile and incidence of EPLoS



EPLoS: Extended postoperative length of stay

### **Distribution of patient, clinical, and surgical characteristics in the study population**

The distribution of patient, clinical, and surgical characteristics in the study population is shown in Table II. A total of 43/185 patients were elderly (23.2%). There was a higher proportion of female patients versus male patients in the study population (55.1% versus 44.9%, respectively). With regard to comorbidity, 38.4% (71/185) of the study population were classified as having severe systemic disease (An American Society of Anesthesiologists score of  $\geq 3$ ). The most prevalent comorbidities in the study population were hypertension (n/N=86/185, 46.5%), obesity (n/N=84/185, 45.4%), and anaemia (n/N=53/185, 28.6%). Osteoarthritis was the most common presenting diagnosis (n/N=80/185, 43.2%), followed by osteonecrosis (n/N=61/185, 33.0%) and other miscellaneous orthopaedic diagnoses (n/N=44/185, 23.8%). The most frequent miscellaneous diagnoses reported were hip dysplasia (11/44 patients 25.0%), fracture (9/44 patients, 20.5%), ankylosis (8/44 patients 18.2%), and rheumatoid arthritis (7/44 patients, 15.9%). Fixed flexion deformity (As per the Thomas Test) was established for 138/185 patients (74.6%). Overall, 13.5% of the study population were classified as having severe hip deformation (FFD  $>30$  degrees). A total of 138/185 patients (74.6%) used an assistive device for mobilisation. Pain scores (Visual Analogue Score - VAS) could only be established for 121/185 patients (65.4%). A total of 99/185 patients had a VAS  $\geq 7$  (53.5%). We could only establish maximum walking distance for 58.4% (n/N=108/185) of the study population. A total of 52/185 patients (28.1%) could not walk 100m or more. The median duration of surgery for the study population was 100.0 minutes (Interquartile range: 75.0-125.0 minutes). Urgent/emergent surgical procedures were rare in the study population (n/N=3/185, 1.6%). Surgery was performed under general anaesthesia in 96/185 patients (51.9%). The standard posterior approach was used in 123/185 procedures (66.5%). Thirty-five patients (18.9%) experienced surgery of extended duration, which we defined as a surgery with a duration  $\geq 75^{\text{th}}$  percentile calculated for the entire study population. Twenty-six patients in the study population required a perioperative blood transfusion (14.1%). Serious perioperative complications were rare (n/N=5/185, 2.7%).

### **Results of the univariate statistical analysis**

The results of the univariate statistical analysis are also shown in Table II. The proportions of several characteristics were statistically similar ( $p \geq 0.050$ ) between patients who experienced EPLoS and patients who did not experience EPLoS. These characteristics included: Elderly age ( $p=0.130$ ), American Society of Anesthesiologists Score ( $p=0.306$ ), current smoker ( $p=0.061$ ), cardiovascular disease ( $p=0.999$ ), chronic obstructive pulmonary disease ( $p=0.327$ ), HIV ( $p=0.764$ ), diabetes ( $p=0.999$ ), anaemia ( $p=0.970$ ), obesity ( $p=0.807$ ), hypertension ( $p=0.056$ ), mobilisation with an assistive device ( $p=0.937$ ), VAS ( $p=0.774$ ), urgent/emergent surgery ( $p=0.560$ ), general anaesthesia ( $p=0.739$ ), and posterior surgical approach to the hip ( $p=0.216$ ). The proportions of the remaining characteristics were statistically different ( $p < 0.050$ ) between patients who experienced EPLoS and patients who did not experience EPLoS. These characteristics included: Gender ( $p < 0.001$ ), presenting diagnosis ( $p=0.011$ ), FFD ( $p < 0.011$ ), patient's maximum walking distance ( $p=0.009$ ), extended duration of surgery ( $p=0.003$ ), perioperative blood transfusion ( $p < 0.001$ ), and serious perioperative complications ( $p=0.023$ ). We were unable to compute statistics for the characteristic

“renal impairment”, as we found that no patients in our study population actually had this characteristic.

Table II: Distribution of patient/clinical characteristics in the study population and results of the univariate statistical analysis\*

Clinical Characteristic	All patients (N=185)	No EPLoS (n=133)	EPLoS (n=52)	p-value
Age >65 years old				0.130
Yes	43 (23.2)	27 (20.3)	16 (30.8)	
No	142 (76.8)	106 (79.7)	36 (69.2)	
Gender				<0.001
Female	102 (55.1)	60 (45.1)	42 (80.8)	
Male	83 (44.9)	73 (54.9)	10 (19.2)	
ASA score $\geq$ 3				0.306
Yes	71 (38.4)	48 (36.1)	23 (44.2)	
No	114 (61.6)	85 (63.9)	29 (55.8)	
Current smoker				0.061
Yes	42 (22.7)	35 (26.3)	7 (13.5)	
No	143 (77.3)	98 (73.7)	45 (86.5)	
Cardiovascular disease				0.999
Yes	10 (5.4)	7 (5.3)	3 (5.8)	
No	175 (94.6)	126 (94.7)	49 (94.2)	
COPD				0.327
Yes	21 (11.4)	17 (12.8)	4 (7.7)	
No	164 (88.6)	116 (87.2)	48 (92.3)	
HIV				0.764
Yes	40 (21.6)	105 (78.9)	40 (76.9)	
No	145 (78.4)	28 (21.1)	12 (23.1)	
Diabetes				0.999
Yes	17 (9.2)	12 (9.0)	5 (9.6)	
No	168 (90.8)	121 (91.0)	47 (90.4)	
Renal impairment				UC
Yes	0 (0.0)	0 (0.0)	0 (0.0)	
No	185 (100.0)	133 (100.0)	52 (100.0)	
Anaemia				0.970
Yes	53 (28.6)	38 (28.6)	15 (28.8)	
No	132 (71.4)	95 (71.4)	37 (71.2)	
Obesity				0.807
CNBE	11 (5.9)	7 (5.3)	4 (7.7)	
Yes	84 (45.5)	61 (45.8)	23 (44.2)	
No	90 (48.6)	65 (48.9)	25 (48.1)	
Hypertension				0.056
Yes	86 (46.5)	56 (42.1)	30 (57.7)	
No	99 (53.5)	77 (57.9)	22 (42.3)	
Presenting diagnosis				0.011
Other	44 (23.8)	25 (18.8)	19 (36.6)	
Osteonecrosis	61 (33.0)	51 (38.3)	10 (19.2)	
Osteoarthritis	80 (43.2)	57 (42.9)	23 (44.2)	
FFD >30 degrees				0.011
CNBE	47 (25.4)	26 (19.6)	21 (40.3)	
Yes	25 (13.5)	18 (13.5)	7 (13.5)	
No	113 (61.1)	89 (66.9)	24 (46.2)	
Mobilises with assistive device				0.937
Yes	138 (74.6)	99 (74.4)	39 (75.0)	
No	47 (25.4)	34 (25.6)	13 (25.0)	

VAS $\geq 7$				0.774
CNBE	63 (34.1)	47 (35.3)	16 (30.8)	
Yes	99 (53.5)	69 (51.9)	30 (57.7)	
No	22 (12.4)	17 (12.8)	6 (11.5)	
Walking distance <100m				0.009
CNBE	77 (41.6)	59 (44.4)	18 (34.6)	
Yes	52 (28.1)	29 (21.8)	23 (44.2)	
No	56 (30.3)	45 (33.8)	11 (21.2)	
Urgent/emergent surgery				0.560
Yes	3 (1.6)	3 (2.3)	0 (0.0)	
No	182 (98.4)	130 (97.7)	52 (100.0)	
Surgery with general anesthesia				0.739
Yes	96 (51.9)	68 (51.1)	28 (53.8)	
No	89 (48.1)	65 (48.9)	24 (46.2)	
Posterior approach to hip				0.216
Yes	123 (66.5)	92 (69.2)	31 (59.6)	
No	62 (33.5)	41 (30.8)	21 (40.4)	
Extended duration of surgery				0.003
Yes	35 (18.9)	18 (13.5)	17 (32.7)	
No	150 (81.1)	115 (86.5)	35 (67.3)	
Perioperative blood transfusion				<0.001
Yes	26 (14.1)	10 (7.5)	16 (30.8)	
No	159 (85.8)	123 (92.5)	36 (69.2)	
Perioperative complication				0.023
Yes	5 (2.7)	1 (0.8)	4 (7.7)	
No	180 (97.3)	132 (99.2)	48 (92.3)	

\*Results expressed as frequencies (%).

p<0.050 was considered a statistically significant result

EPLOS: Extended postoperative length of stay; ASA: American Society of Anesthesiologists; COPD: Chronic obstructive pulmonary disease; UC: Unable to compute; CNBE: Could not be established; FFD: Fixed flexion deformity; VAS: Visual analogue score.

### Results of the multivariable statistical analysis

The results of the multivariable statistical analysis are shown in Table III. Only nine of the characteristics investigated in the univariate analysis met the criteria of p<0.100 for inclusion in the multivariable analysis. These characteristics were gender, being a current smoker, hypertension, presenting diagnosis, FFD, patient's maximum walking distance, extended duration of surgery, perioperative blood transfusion, and serious perioperative complications. Of these characteristics, only four were found to be independently associated with EPLOS. These characteristics were female gender (when compared with males. OR: 4.63, 95% CI: 1.74-12.34; p=0.002), missing Thomas Test assessment (when compared with the reference of Thomas Test FFD  $\leq 30$  degrees. OR: 4.80, 95% CI: 1.72-13.34; p=0.003), patient's maximum walking distance <100m (when compared with the reference of walking distance  $\geq 100$ m. OR: 3.05, 95% CI: 1.05-8.89; p=0.041), and extended duration of surgery (when compared with surgery duration <75<sup>th</sup> percentile obtained for the entire study population. OR: 3.62, 95% CI: 1.31-10.01; p=0.013). The result for the Hosmer-Lemeshow test indicated adequate model fit (p>0.050).

Table III: Results of the multivariate statistical analysis\*

Clinical Characteristic	OR (95% CI)	p-value
<b>Gender</b>		
Female	4.63 (1.74-12.34)	0.002
Male	Reference	-
<b>Current smoker</b>		
Yes	1.15 (0.36-3.66)	0.817
No	Reference	-
<b>Hypertension</b>		
Yes	1.36 (0.59-3.11)	0.470
No	Reference	-
<b>Presenting diagnosis</b>		
Other	2.25 (0.83-6.13)	0.113
Osteonecrosis	0.70 (0.24-2.01)	0.507
Osteoarthritis	Reference	-
<b>FFD &gt;30 degrees</b>		
CNBE	4.80 (1.72-13.34)	0.003
Yes	0.52 (0.14-1.91)	0.326
No	Reference	-
<b>Walking distance &lt;100m</b>		
CNBE	0.48 (0.15-1.53)	0.214
Yes	3.05 (1.05-8.89)	0.041
No	Reference	-
<b>Extended duration of surgery</b>		
Yes	3.62 (1.31-10.01)	0.013
No	Reference	-
<b>Perioperative blood transfusion</b>		
Yes	2.35 (0.80-6.88)	0.120
No	Reference	-
<b>Perioperative complication</b>		
Yes	11.77 (0.95-145.54)	0.055
No	Reference	-

\*Results adjusted for confounders. Only characteristics with  $p < 0.100$  in the univariate statistical analysis included in the multivariable statistical analysis.

$p < 0.050$  was considered a statistically significant result.

OR: Odds ratio; CI: Confidence interval; FFD: Fixed flexion deformity; CNBE: Could not be established.

## DISCUSSION

The median postoperative length of stay in our South African study population was much shorter than that reported for British, American, and Pakistani patient populations undergoing primary hip arthroplasty (Median of 5 days in our study population versus 7-8 days in the other primary hip arthroplasty populations).<sup>10,14-16</sup> South Africa is severely impacted by high levels of non-communicable disease,<sup>17</sup> trauma/injury,<sup>18</sup> and HIV infection,<sup>19</sup> all of which are associated with the development of musculoskeletal/orthopaedic disease.<sup>20-23</sup> This has resulted in a growing demand for hip arthroplasty in the country.<sup>6</sup> However there are staffing and economic challenges in running orthopaedic surgical units in the public sector,<sup>24</sup> and the availability of beds in these public hospitals might also be a concern.<sup>25</sup> In order to cope with the higher demand for hip arthroplasty, some hospitals are beginning to implement fast-track protocols which are aimed at reducing postoperative length of stay while minimising the

rate of post-discharge complications in suitable patients who undergo the surgical procedure.<sup>26</sup> This might possibly explain the difference in median postoperative length of stay following primary hip arthroplasty between South African and overseas populations.<sup>10,14-16</sup> With regard to EPLoS following hip arthroplasty, the literature is scant. However, there is one American study which reported EPLoS in this surgical population.<sup>10</sup> In that study, the 75<sup>th</sup> percentile for the population postoperative length of stay was 14.0 days, which is twice that reported for our study.<sup>10</sup> Furthermore, one-third of the American study population experienced EPLoS.<sup>10</sup> As with our findings for median postoperative length of stay, the discrepancy in EPLoS between the American study population and our South African study population must be viewed in the context of a growing demand for hip arthroplasty in South Africa and the disproportionate availability of healthcare resources between South African and American settings.<sup>27</sup>

We found statistically significant univariate associations between several characteristics (Including: Gender, presenting diagnosis, FFD, patient's maximum walking distance, extended duration of surgery, perioperative blood transfusion, and serious postoperative complications). These findings are not unique to our study. Other overseas studies have reported univariate statistical associations between these/similar characteristics and postoperative length of stay in hip arthroplasty patients.<sup>14,16</sup> We found four characteristics to be independently associated with EPLoS (Including: Gender, FFD, patient's maximum walking distance, and extended duration of surgery). Female gender was found to be associated with an almost five-fold increase in the risk of experiencing EPLoS following primary hip arthroplasty. Abbas et al., reported an almost 2-fold increase in the risk of EPLoS for women undergoing hip arthroplasty in a Pakistani setting.<sup>16</sup> Dall et al., also reported a multivariate statistical association (without describing the magnitude of risk) between female gender and longer postoperative length of stay a British hip arthroplasty population.<sup>14</sup> Therefore our findings for female gender appear, in general, to be in agreement with the published literature. However, the difference in the magnitude of odds ratios for female gender obtained in our study and the study of Abbas et al.<sup>16</sup> requires further investigation. The characteristics FFD and patient's maximum walking distance have not been specifically investigated as potential risk factors for EPLoS following hip arthroplasty in the published literature. However, these characteristics are components of the preoperative Harris Hip Score,<sup>28</sup> which has been shown by Dall et al.,<sup>14</sup> to be associated with length of stay following hip arthroplasty. Specifically, these characteristics appear to be associated with mobility and functional status in patients with hip conditions.<sup>28</sup> In our study, the reason for FFD not being established in some patients was that these patients had severe pain, which is also related to functional status and the ability to ambulate. Therefore, our findings highlight the potential importance of preoperative functional status and ambulation on the postoperative recovery period in South African primary hip arthroplasty patients. Lastly, we found extended duration of surgery to be associated with an almost four-fold higher risk of experiencing EPLoS. This is somewhat in agreement with the British study of Foote et al., who also report extended duration of surgery to be independently associated with a higher risk of EPLoS.<sup>15</sup> However, as with gender, there appears to be a difference in the magnitude of odds ratios for surgery duration between our study and the study of Foote and colleagues.<sup>15</sup> Attempts should be made to reduce the duration of hip arthroplasty in our setting, possibly through the application of benchmarks and optimisation of surgical technique.

The risk factors identified in our study can be incorporated into future risk stratification systems for EPLoS in South African orthopaedic units. Similar risk stratification systems based on identified risk factors for EPLoS following primary hip arthroplasty have been proposed by Abbas et al.,<sup>16</sup> and Foote et al.<sup>15</sup> These risk stratification systems are required to be developed and validated for performance in a separate surgical cohort.<sup>29</sup> This step is beyond the scope of the dataset used in our study, and requires further research.

There were several characteristics which were not found to be associated with EPLoS during the univariate statistical analysis, or following inclusion in the multivariable statistical analysis. There are two explanations for the lack of statistical association between these characteristics and EPLoS in our study. Firstly, it might be possible that these characteristics, while identified as risk factors in overseas settings, are genuinely not associated with EPLoS in South African hip arthroplasty patients. Discordance in clinical risk factors between overseas/South African surgical populations and other postoperative outcomes has been described elsewhere.<sup>30</sup> It might be worthwhile to involve overseas collaborators with access to overseas patient data in future research such that valid comparisons of risk factors between our settings can be made. Secondly, it is possible that a larger sample size than 185 patients would be required to investigate the impact of these characteristics on EPLoS. A potential solution to this would be a collaborative study involving as many hospitals which offer orthopaedic surgical services as possible.

Our study had several strengths. Our study is, to the best of our knowledge, the only South African study which specifically investigates EPLoS following primary hip arthroplasty. Another strength of our study is that we included data on HIV infection in our statistical analyses. This is important as the prevalence of HIV is usually much lower in American and British populations,<sup>19</sup> and so our study provides important information on the impact of this characteristic in settings with a high burden of HIV infection. The final strength of our study is that while our sample size appeared modest, it still allowed for us to perform a multivariable statistical analysis to determine independent risk factors for EPLoS without any serious violation of statistical rules of thumb.<sup>31</sup> Our study also had several limitations. Firstly, as this study was conducted at a single, dedicated arthroplasty unit in a quaternary level hospital with standardized pre and postoperative protocols in place, it might be argued that our study findings lack generalisability. As for our solution for the challenge related to the lack of statistical association between several characteristics and EPLoS, we recommend that collaborative studies involving hospitals at various levels of service delivery are conducted to determine the generalisability of our study findings. In addition, we were unable to investigate the impact of Harris Hip Score in our study due to poor documentation of this characteristic in the patient medical records. We did however find that components of the Harris Hip Score were statistically associated with EPLoS, and it is therefore possible that the composite Harris Hip Score might also be associated with EPLoS. Prospective research wherein data collection for the Harris Hip Score is standardised is required. Finally, we did not report the impact of EPLoS on healthcare expenditure or post-discharge complications. These outcomes can only be appropriately investigated through the conduct of prospective research studies.

In conclusion, we found several risk factors for EPLoS following primary hip arthroplasty in South African patients. These risk factors included gender, FFD, patient's maximum walking distance, and extended duration of surgery. Further research is required to confirm our study findings, as well as address the limitations identified in our study.

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### **Compliance with ethics guidelines**

This study was approved by the University of KwaZulu-Natal Biomedical Research Ethics Committee (Protocol: BE526/17). No benefits of any form have been received from a commercial party related directly or indirectly to the subject of this article.

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# **Appendix 1: Study protocol**

# **Preoperative factors associated with extended postoperative length of stay in patients undergoing primary hip arthroplasty**

Master of Medicine (MMed) Research Proposal

Short title: Length of stay after hip arthroplasty

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## **BACKGROUND:**

Increased global life expectancy has been linked to an higher burden of musculoskeletal conditions, including hip fracture and osteoarthritis.<sup>1</sup> Untreated musculoskeletal conditions impact quality of life in afflicted patients and also have adverse consequences on healthcare expenditure and resource utilization.<sup>1</sup> These conditions would therefore have public health significance in resource-limited settings. Aside from noncommunicable aetiologies, the global HIV epidemic has also been linked to the growing prevalence of orthopaedic disorders.<sup>2</sup> Conservative medical therapy might not be effective in a large proportion of patients afflicted with orthopaedic hip conditions. Surgical intervention remains the only viable management option in these patients.<sup>3</sup> The effectiveness of primary hip arthroplasty in reversing pain and loss of function associated with orthopaedic hip conditions is well described.<sup>3,4</sup> Utilization of primary hip arthroplasty as a surgical intervention for orthopaedic hip conditions has increased substantially over the past 2-3 decades, with this procedure now considered amongst the most common surgical procedures performed worldwide.<sup>4</sup>

A survey of orthopaedic surgeon members belonging to the South African Orthopaedic Association reported that each member in the country performed up to 43 hip arthroplasty procedures a year.<sup>5</sup> In addition, a lack of surgical expertise and other essential resources in surrounding countries has resulted in a number of patients from these countries to be referred to South African hospitals for the procedure.<sup>6</sup> In response to the increasing demand for primary hip arthroplasty, it is possible that many South African orthopaedic surgery units will in future adopt accelerated postsurgical care pathways, in which the length of inpatient stay (and subsequent expenditure and resource utilization for each patient) following surgery is reduced.<sup>7,8</sup>

An understanding of which preoperative patient/clinical characteristics are associated with extended postoperative length of stay (EPLOS) in a South African setting would contribute toward assisting public health specialists and orthopaedic surgeons deciding on which patients are likely to benefit or not benefit from accelerated postsurgical care pathways, thereby facilitating improved patient management and allocation of resources in these settings.

**AIM:**

The aim of this study will be to determine which preoperative patient/clinical characteristics are associated with EPLOS in a sample of South African primary hip arthroplasty patients.

**METHODS:***Study design, study setting, and study population:*

This will be a retrospective chart review study of adult ( $\geq 18$  years old) patients who were admitted for primary hip arthroplasty at the Inkosi Albert Luthuli Central Hospital (IALCH) in Durban, South Africa between 01 January 2014 and 01 August 2016. .

The 846-bed hospital provides healthcare services, including surgical services, at a tertiary level to residents of KwaZulu-Natal Province, South Africa.

Inclusion/exclusion criteria for the study are presented in Table 1. Potential participants will be identified from the theatre lists during the specified study period.

Table 1. Inclusion and exclusion criteria for the proposed study

<i>Criteria Number</i>	<i>Inclusion Criteria</i>	<i>Exclusion Criteria</i>
1	Patients aged 18 years or older	Patients younger than 18 years old
2	Patients who underwent primary hip arthroplasty at IALCH between 01 January 2014 and 01 August 2016	Patients who did not undergo primary hip arthroplasty at IALCH between 01 January 2014 and 01 August 2016
3	Patient not previously included in study	Patient previously included in study

*Sample size and sampling strategy:*

A brief review of operating room schedules shows that there were 216 consecutive eligible patients during the study period. All 216 patients will be included in the final analysis of this study. This sample size is adequate for conducting the planned statistical analysis if sample size rules of thumb are observed.<sup>9</sup>

*Data source and data management:*

The electronic medical records of these 216 patients will be reviewed and data related to various preoperative patient and clinical characteristics will be collected and entered onto a de-identified, password protected database in preparation for statistical analysis. The specific variables to be collected are provided in a data collection form in Appendix 1. We will define the preoperative period as the time between hospital admission and surgical incision. These preoperative patient and clinical characteristics were selected as they were collected as variables in similar research studies from elsewhere in the world. All variables listed in Appendix 1 are routinely recorded in the clerking/doctors progress notes for each patient. Preoperative comorbidity will be considered present if it was diagnosed by a physician prior to surgery. Whether the procedure was elective or not, and the type of anaesthesia used prior to surgical incision is routinely reported in the doctors operative note. Postoperative length of stay will be calculated as the time (in days) between the date of the operation and the date of hospital discharge. The study outcome will be EPLOS, which will be defined as a postoperative length of stay which is longer than 75<sup>th</sup> percentile for the study population. This outcome has been used in other studies of investigating EPLOS.<sup>10,11</sup>

*Statistical analysis:*

The incidence of EPLOS will be calculated using conventional epidemiological methods. Potential statistical associations between various preoperative patient, clinical characteristics will be determined through univariate (Mann-Whitney test, chi-squared test, or Fishers exact test) and multivariable (Regression analysis) statistical methods. Results for the univariate analysis will be presented as medians with interquartile ranges or frequencies and percentages, where appropriate. Results for the multivariable analysis will be presented as beta-coefficients with 95% confidence intervals. A p-value <0.05 will be considered statistically significant. All statistical analyses will be performed using the Statistical Package for the Social Sciences version 24.0 (IBM Corp, USA).

*Study approval:*

This is a sub-analysis of data being collected as part of a larger surgical quality improvement research initiative, which has already received approval from the University of KwaZulu-Natal Biomedical Research Ethics Committee (BE595/16). Approval/a waiver from the University of KwaZulu-Natal Biomedical Research Ethics Committee will still be sought prior to commencing this specific sub-analysis.

**POTENTIAL IMPACT OF RESEARCH:**

This study will provide important information to public health specialists and orthopaedic surgeons which will allow for improved patient management, and allocation of healthcare expenditure and healthcare resources for South African primary hip arthroplasty patients.

**DISSEMINATION OF STUDY RESULTS:**

The results of this research will be made available to the scientific community through publication in an accredited, peer-reviewed medical journal. The results of the research will also be reported to the KwaZulu-Natal Department of Health. A lay summary of the results will also be made available on selected print and electronic media, where possible.

**PROPOSED WORK PLAN (WITH REFERENCE MAY 2017- MAY 2018):**

Complete draft protocol	■						
Submit proposal to ethics and postgraduate committee		■					
Ethics & postgraduate committee approval		■					
Commence data collection				■			
Commence data analysis and prepare thesis						■	
Submit thesis for examination							■
	May-Jun	Jul-Sep	Oct-Nov	Dec-Mar			Apr-May

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## Variables to be collected from patient electronic medical records

Participant Number (For office use only): \_\_\_\_\_

1. Age at hospital admission (In years): \_\_\_\_\_
2. Gender (Male or female): \_\_\_\_\_
3. Indication for surgery (Specify): \_\_\_\_\_
4. Body mass index (in kg/m<sup>2</sup>): \_\_\_\_\_
5. American Society of Anesthesiologists Score: \_\_\_\_\_
6. Harris Hip Score: \_\_\_\_\_
7. Visual analogue score: \_\_\_\_\_
8. Time between initial orthopaedic clinic visit and operation date (in days): \_\_\_\_\_
9. Number of crutches/assistive device used to mobilize: \_\_\_\_\_
10. Maximum distance patient can walk (in metres): \_\_\_\_\_
11. Fixed flexion deformity (degrees): \_\_\_\_\_
12. Physician-diagnosed medical comorbidities (Yes/No)
  - Diabetes: \_\_\_\_\_
  - Hypertension: \_\_\_\_\_
  - Cardiovascular disease: \_\_\_\_\_
  - Asthma/obstructive pulmonary disease: \_\_\_\_\_
  - HIV: \_\_\_\_\_
  - Tobacco use: \_\_\_\_\_
  - Anaemia: \_\_\_\_\_
  - Renal disease: \_\_\_\_\_
13. Preoperative chronic medications (Yes/No)
  - Aspirin: \_\_\_\_\_
  - Statin: \_\_\_\_\_
  - Nonsteroidal anti-inflammatory drugs: \_\_\_\_\_
  - Other (specify): \_\_\_\_\_
14. Elective surgery (Yes/No): \_\_\_\_\_
15. Anaesthetic induction using general anaesthesia (Yes/No): \_\_\_\_\_
16. Date of operation (DD/MM/YYYY): \_\_\_\_\_
17. Date of hospital discharge (DD/MM/YYYY): \_\_\_\_\_
18. Postoperative length of stay (days): \_\_\_\_\_

## **Appendix 2: Journal guidelines**

## INSTRUCTIONS FOR AUTHORS

- [Scope and Policy](#)
- [Formatting of Submissions](#)
- [Instructions for Reviewers](#)
- [Manuscripts Submission](#)

### Scope and Policy

The scope of publication encompasses all orthopaedic surgery sub-disciplines including paediatric orthopaedics, hip, knee, tumour and sepsis, spine, shoulder and elbow, foot and ankle and hand surgery. In addition the journal addresses the subjects of orthopaedic service delivery, teaching, training and research. Publications should influence orthopaedic care on our continent.

The *South African Orthopaedic Journal* aims to advance the knowledge of all aspects of musculoskeletal medicine through publication of:

- Original research articles.
  - Clinical research
  - Basic science and theoretical research
- Review articles.
- Invited expert opinions.
  - A review of significant local or international publications journal article or cluster of articles dealing with a similar topic for the purpose of conveying a useful message.
- Editorials.
- Letters to the editor.
  - Forum to raise issues or debate aspects of previously published papers.

#### Criteria for publication

- The article falls within the scope of the journal.
- Methods, statistics, and other analyses are performed to a high technical standard and are described in sufficient detail.
- Results reported have not been published elsewhere.
- Conclusions are presented in an appropriate fashion and are supported by the data.
- The article is presented in an intelligible fashion and is written in standard English (British usage).
- The research meets all applicable ethical standards.
- The article adheres to guidelines provided in the instructions for authors section.

#### Guidelines for authorship

- Each author should participate and is responsible for the content and design of the study, the preparation of the manuscript and its revisions, and final approval.
- Other 'contributors' can be acknowledged at the end of the manuscript together with their contribution.
- Authors of manuscripts representing a multi-centre study may list members of the group in the footnote on the title page of the published article and their affiliations are listed in an appendix.
- The authors should clearly indicate the predominant surgeon or surgeons who have contributed patients to the study.

#### Registration of clinical trials

- A clinical trial is defined as any research study that prospectively assigns human participants or groups of humans to one or more health-related interventions to evaluate the effects of health outcomes. Interventions include drugs, surgical procedures, devices, behavioural treatments, dietary interventions, and process-of-care changes.
- Clinical trials should be registered in a public trials registry in accordance with International Committee of Medical Journal Editors recommendations.
- Trials must be registered and approved by the relevant authorities before the onset of patient enrolment.
- The Medicines Control Council (MCC) reference number and the SA National Clinical Trial Register (SANCTR) registration number should be included at the end of the abstract of the article.
- Purely observational studies (those in which the assignment of the medical intervention is not at the discretion of the investigator) do not require registration.

#### Reporting guidelines

- All articles should be prepared in accordance with the guidelines relevant to the study design that was used (listed below):

<a href="#">Randomised trials</a>	<a href="#">CONSORT</a>
<a href="#">Observational studies</a>	<a href="#">STROBE</a>
<a href="#">Systematic reviews</a>	<a href="#">PRISMA</a>
<a href="#">Case reports</a>	<a href="#">CARE</a>
<a href="#">Qualitative research</a>	<a href="#">SRQR</a>
<a href="#">Diagnostic / prognostic studies</a>	<a href="#">STARD</a>
<a href="#">Quality improvement studies</a>	<a href="#">SQUIRE</a>
<a href="#">Economic evaluations</a>	<a href="#">CHEERS</a>
<a href="#">Animal pre-clinical studies</a>	<a href="#">ARRIVE</a>
<a href="#">Study protocols</a>	<a href="#">SPIRIT</a>

- Randomised trials should be accompanied by a flow diagram that illustrates the progress of patients through the trial, including recruitment, enrolment, randomisation, withdrawal and completion, and a detailed description of the randomisation procedure.

#### Role of funding source

- Authors are requested to identify who provided financial support for the conduct of the research and/or preparation of the article and to briefly describe the role of the sponsor(s), if any, in study design; in the collection, analysis and interpretation of data; in the writing of the report; and in the decision to submit the article for publication. If the funding source(s) had no such involvement, then this should be stated.

### Formatting of Submissions

#### Text formatting

- Use Helvetica or Arial font, size 11.
- Use double line spacing throughout the document.
- Number the pages of the blinded manuscript consecutively.
- Use italics for emphasis.
- When referring to an article with multiple authors please use the following format: Rabinowitz *et al.* published their retrospective review.
- Do not use field functions.
- Use tab stops or other commands for indents, not the space bar.
- Use the table function, not spreadsheets, to make tables.

- Use the equation editor or MathType for equations.
- Save your file in docx format (Word 2007 or higher) or doc format (older Word versions).

#### Headings

- Use no more than three levels of displayed headings.

#### Abbreviations

- Define abbreviations and acronyms at first mention and use consistently thereafter.

#### Units

- Follow internationally accepted rules and conventions: use the international system of units (SI). If other units are mentioned, please give their equivalent in SI.

#### Figures

- Figures should be numbered consecutively with illustration Arabic numbers 1, 2, 3, etc.
- The figure should be listed in the text as follows: ... wound irrigation and splinting (*Figure 1*).
- Figures should be clear and easily understandable with a full descriptive legend stating any areas of interest and explaining any markings, letterings or notations. All figures should be understandable without the main text.
- For radiographs please ensure you state the view used and the time point at which it was taken, as well as the demographic details of the patient if applicable.
- Figures should not be imbedded in the text file, but should be submitted as separate individual files. Each figure should be a separate file, entitled Figure 1, Figure 2, etc.
- Remove all markings, such as patient identification, from radiographs before photographing.
- All line or original drawings must be done by a professional medical illustrator.
- We accept a maximum of six figures.
- Do not submit any figures, photos, tables, or other works that have been previously copyrighted or that contain proprietary data unless you have obtained and can supply written permission from the copyright holder to use that content.

#### Tables

- Tables should carry uppercase Roman numerals, I, II, III, etc.
- Tables should always be cited in the text in consecutive numerical order.
- The table should be identified in the text as follows: Details of results are listed in *Table I*. Or, alternatively, ... high-energy trauma that is often associated with these fractures (*Table II*).
- Tables should be used to present information in a clear and concise manner. All tables should be understandable without the main text.
- For each table, please supply a table heading explaining the components of the table.
- Identify any previously published material by giving the original source in the form of a reference at the end of the table heading.
- Footnotes to tables should be indicated by superscript lower-case letters and included beneath the table body.
- Please submit tables as editable text and not as images. They should be created using the Table tool in Word.
- Do not embed tables in the text file, but submit them as separate individual files. Each table should be a separate file, entitled Table I, Table II, etc.
- We accept a maximum of eight tables.
- Do not duplicate information given already in the text.
- Do not submit any figures, photos, tables or other works that have been previously copyrighted or that contain proprietary data unless you have obtained and can supply written permission from the copyright holder to use that content.

#### References

- References should be numbered consecutively in the order that they are first mentioned in the text and listed at the end in numerical order of appearance.
- Identify references in the text by Arabic numerals in superscript after punctuation.
- References should not be a listing of a computerised literature search but should have been read by the authors and have pertinence to the manuscript.
- Authors should add DOIs to all references in articles.
- Accuracy of references is the author's responsibility and the author is to verify the references against the original documents.
- Manuscripts in preparation, unpublished data (including articles submitted but not in the press) and personal communications may not be included in the reference listing. They may be listed in the text in parentheses only if absolutely necessary to the contents and meaning of the article.
- The titles of journals should be abbreviated according to the style used in Index Medicus, obtainable through the website <http://www.nlm.nih.gov/shool>
- The following format should be used for references:

##### *Journal article:*

Sidhu GS, Ghag A, Prokuski V, Vaccaro AR, Radcliff KE. Civilian gunshot injuries of the spinal cord: a systematic review of the current literature. *Clin Orthop Relat Res* 2013;471:3945-55.

Ideally, the names of all authors should be provided, but the usage of 'et al.' in long author lists (more than six authors) will also be accepted: Fong K, Truong V, Foote CJ, et al. Predictors of nonunion and reoperation in patients with fractures of the tibia: an observational study. *BMC Musculoskelet Disord* 2013;14:103.

##### *On-line journal article:*

Caetano-Lopes J, Lopes A, Rodrigues A, et al. Upregulation of inflammatory genes and downregulation of sclerostin gene expression are key elements in the early phase of fragility fracture healing. *PLoS One* 2011;6:e16947.

##### *Web reference (with authors):*

Cierny G, DiPasquale D. Adult osteomyelitis protocol. [http://www.osteomyelitis.com/pdf/treatment\\_protocol.pdf](http://www.osteomyelitis.com/pdf/treatment_protocol.pdf). (date last accessed 05 March 2013).

##### *Web reference (no authors listed):*

No authors listed. International commission on radiological protection. <http://www.icrp.org> (date last accessed 20 September 2009).

##### *Chapter in a book:*

Young W. Neurophysiology of spinal cord injury. In: Errico TJ, Bauer RD, Waugh T (eds). *Spinal Trauma*. 3rd ed. Philadelphia: JB Lippincott; 1991: 377-94.

##### *Dissertation:*

Borkowski MM. Infant sleep and feeding: a telephone survey of Hispanic Americans [dissertation]. Mount Pleasant (MI): Central Michigan University; 2002.

##### *Abstract:*

Peterson L. Osteochondritis of the knee treated with autologous chondrocyte transplantation [abstract]. ISAKOS Congress, 2001.

#### **Structure and content of submission**

- We accept a maximum of 3500 words including the abstract and body of the text (excluding references).
- Exceptions to this rule may be made for systematic reviews and meta-analysis, at the discretion of the Editor-in-Chief.
- Please follow the following structure when preparing your submission.
  - Title page (Title, authors and affiliations, corresponding author and declarations)

- Blinded manuscript (Abstract, key words, introduction, methods, results, discussion, funding sources, conflict of interest statement, ethical statement, acknowledgements and references)
- Tables (with headings), each as a separate file.
- Figures (with legends), each as a separate file.

#### Title page

##### *Title*

- The title should be concise and informative.

##### *Author names and affiliations*

- Please provide the following information for each author:
  - Full names and surname, as well as title
  - Qualifications
  - Affiliation and address
  - ORCID ID (see Article Submission section)
- Please check that all names are accurately spelled.
- Indicate all affiliations with a lower-case superscript letter immediately after the author's name and in front of the appropriate affiliation details.
- Provide the full postal address of each affiliation, including the country name and, if available, the e-mail address of each author.

##### *Corresponding author*

- Clearly indicate who will handle correspondence at all stages of refereeing and publication, including post-publication.
- Ensure that the e-mail address and permanent address is given and that contact details are kept up to date by the corresponding author.
- Please note that the corresponding author's contact details will be provided in the final article.
- Provide the following information for the corresponding author:
  - Full names and title
  - Affiliation
  - Physical address
  - Postal address
  - Telephone Number
  - E-mail address

##### *Declarations*

Authors are to insert a section at the end of the title page entitled declarations. Following the declarations all authors need the to sign the document (please provide name of author, signature and date). The following statements are required under the declarations section:

##### a. Authorship

The authors confirm that all authors have made substantial contributions to all of the following:

- The conception and design of the study, or acquisition of data, or analysis and interpretation of data
- The drafting the article or its critical revision for important intellectual content
- Final approval of the version to be submitted.

##### b. Sound scientific research practice

The authors further confirm that:

- The manuscript, including related data, figures and tables has not been previously published and is not under consideration elsewhere
- No data have been fabricated or manipulated (including images) to support conclusions.
- This submission does not represent part of a single study that has been split up into several parts to increase the quantity of submissions and submitted to various journals or to one journal over time (e.g. 'salami-publishing').

##### c. Plagiarism

The authors confirm that the work submitted is original and does not transgress the plagiarism policy of the journal.

- No data, text or theories by others are presented as if they were the authors' own.
- Proper acknowledgements of others' work has been given (this includes material that is closely copied, summarised and/or paraphrased); quotation marks are used for verbatim copying of material.
- Permissions have been secured for material that is copyrighted.

##### d. Conflict of interest statement

A conflicting interest exists when professional judgement concerning a primary interest (such as the patient's welfare or the validity of research) may be influenced by a secondary interest (such as financial gain or personal rivalry). It represents a situation in which financial or other personal considerations from authors, reviewers or editors have the potential to compromise or bias professional judgment and objectivity. It may arise for the authors when they have a financial interest that may influence their interpretation of their results or those of others. Examples of potential conflicts of interest include employment, consultancies, stock ownership, honoraria, paid expert testimony, patent applications/registrations, and grants or other funding. All potential conflicts of interest need to be declared. The conflict of interest statement should list each author separately by name, i.e.,

'John Smith declares that he has no conflict of interest. Paula Taylor has received research grants from Drug Company A. Mike Schultz has received a speaker honorarium from Drug Company B and owns stock in Drug Company C.'

If multiple authors declare no conflict, this can be done in one sentence.

##### e. Funding sources

All sources of funding should be declared. Also define the involvement of study sponsors in the study design, collection, analysis and interpretation of data; the writing of the manuscript; and the decision to submit the manuscript for publication. If the study sponsors had no such involvement, this should be stated.

##### f. Compliance with ethical guidelines

- For all publications:

'The author/s declare that this submission is in accordance with the principles laid down by the Responsible Research Publication Position Statements as developed at the 2nd World Conference on Research Integrity in Singapore, 2010.'

Available from:

<http://publicationethics.org/resources/international-standards-for-editors-and-authors>

Institutional Review Board (IRB) ethical approval must have been given if the study involves human subjects or animals. Please provide the approval number. IRB documentation should be available upon request.

'Prior to commencement of the study ethical approval was obtained from the following ethical review board: *Provide name and reference number*'

- For studies with human subjects include the following:

'All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.'

'Informed written consent was or was not obtained from all patients for being included in the study.'

- For studies with animals include the following sentence:

'All institutional and national guidelines for the care and use of laboratory animals were followed.'

- For articles that do not contain studies with human or animal subjects: 'This article does not contain any studies with human or animal subjects.'
- If doubt exists whether the research was conducted in accordance with the Helsinki Declaration, the authors must explain the rationale for their approach, and demonstrate that the institutional review body explicitly approved the doubtful aspects of the study. If any identifying information about patients is included in the article, the following sentence should also be included: Additional informed consent was obtained from all patients for which identifying information is included in this article.

The Helsinki Declaration 2008 can be found at <http://www.wma.net/en/30publications/10policies/b3/>

#### Blinded manuscript

#### *Abstract*

- A structured abstract (maximum of 350 words), summarising the most important points in the article is required.
- The abstract consists of four paragraphs with the subheadings:
  - Aims (it is unnecessary to include an introductory section)
  - Patients and methods
  - Results
  - Conclusion
- References should be avoided. Avoid uncommon abbreviations. If essential they must be defined at their first mention in the abstract itself

#### *Key words*

- Immediately after the abstract, provide a maximum of six key words, using standard searchable terms. These key words will be used for indexing purposes.

#### *Level of evidence*

- Level 1 to 5.
- Please follow the level of evidence guidelines provided by the Oxford Centre for Evidence-Based Medicine (OCEBM); version 2.1.
- Available from: OCEBM Levels of Evidence Working Group. 'The Oxford Levels of Evidence 2'. Oxford Centre for Evidence-Based Medicine. <http://www.cebm.net/index.aspx?o=5653>

#### *Introduction*

- The introduction should contextualise the study by providing the background to the research; explain the problem that is to be addressed and provide the rationale for the study.
- Briefly outline the relevance of the study with respect to the current literature. Avoid a detailed literature survey or a summary of the results.
- The last sentence should outline the research question or hypothesis.

#### *Patients (or Materials) and methods*

- State the methods, outcome measures, and selection criteria. The following aspects need to be described:
  - The study design and research methodology
  - Whether randomisation (with methods) was applied
  - If case controlled, how the controls were selected
  - The time period under review
  - Number of patients/subjects under investigation and why this number was chosen
  - Inclusion and exclusion criteria
  - Case and outcome definitions
  - A description of the procedure or intervention, including post-operative protocol
  - The outcome measures or scores used
  - The minimum follow-up period
  - Statistical analysis paragraph. This should be included at the end of this section to detail statistical tests and package used, the reasons why these tests were used, and what p-value was considered statistically significant. A power analysis is recommended for studies comparing two or more groups.
- Provide sufficient detail so that another researcher can replicate the study.
- The reader should understand from this description all potential sources of bias such as referral, diagnosis, exclusion, recall or treatment bias. This includes the manner in which investigators selected the patients. Consecutive inclusion implies all patients with a given diagnosis are included, while selective implies patients with a given diagnosis but selected according to certain explicit criteria (e.g., state of disease, choice of treatment).
- Do not describe standard procedure for common operations. Only include new procedures or adaptations to standard procedure.
- If you name any specific product, then it requires the name, city and state/country of the manufacturer.
- Present information in the narrative format and use the past tense.
- Where relevant, tables or figures may be included to provide information more clearly.
- Generally, no data should be presented in this section.

#### *Results*

- Describe the relevant results and analysis thereof.
- Provide details of the number of patients included and excluded, as well as the reason for exclusion.
- It is important to state the follow-up period (mean and range).
- The results can be broken down into separate sections, e.g. Treatment, Functional outcome, Complications, etc.
- Tables may be used but avoid repeating data reported in the text in the tables.
- All appropriate data should be presented as means with ranges, not with standard deviations (SDs). Medians should only be used when the data is skewed, accompanied by an interquartile range (IQR).
- Avoid using percentages in studies involving well under 100 subjects.
- All results must be backed up with p-values or survivorship analysis. All Kaplan-Meier data should be presented with the confidence intervals. Always present exact absolute p-values, whether significant or not, unless  $p < 0.001$ .
- However, p-values do not always convey the entire picture and where relevant the confidence interval will also be required (in addition to the power of the study reported in the methods section).

#### *Discussion*

- The question or hypothesis stated at the end of the introduction should be discussed and either supported or rejected.
- The results must be interpreted clearly and any deficiencies expressed. All possible confounding factors, sources of bias, or weaknesses in the study should be identified.
- Explore the significance of the results of the work, rather than repeating the results.
- The discussion must point out the relevance of the work described in the paper and its contribution to current knowledge.
- Explain what can be deduced from the results and how will it affect clinical practice.
- Include a review of the relevant literature, placing the results of the study in the context of previous work in this area.
- Discussion of relevant prior research and references must be concise. Avoid extensive citations and discussion of published literature but put emphasis on previous findings that agree (or disagree) with those of the present study.
- Do not repeat the introduction.
- Present the limitations of the study and suggest how the study could have been improved for a future study.
- Avoid making inferences from non-significant trends unless you believe your study is adequately powered to answer the question; in that case, provide a power analysis.

#### *Conclusion*

- Provide a summary statement which conveys the conclusions of the findings.

- Do not draw conclusions not supported by the data obtained from the specific study presented.

#### *Conflict of interest*

- 'Author A.B. (*use initials of relevant author, not full name in order for the document to remain blinded*) has received research grants from Company A. Author B.C. has received a speaker honorarium from Company X and owns stock in Company Y. Author C.D. is a member of committee Z.'
- If no conflicts of interest exist, state this as follows: 'The authors declare they have no conflicts of interest that are directly or indirectly related to the research.'

#### *Ethical statement*

- For studies involving human subjects please include an ethical statement as follows: 'All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.'
- For animal studies please include the following ethical statement: 'All applicable international, national, and/or institutional guidelines for the care and use of animals were followed.'
- If the study did not involve human or animal subjects state that: 'This article does not contain any studies with human participants or animals performed by any of the authors.'
- Please also include an informed consent statement: 'Informed consent was obtained from all individual participants included in the study.'
- Or alternatively, for retrospective studies, please add the following sentence: 'For this study formal consent was not required.'
- If identifying information about participants is available in the article, the following statement should be included: 'Additional informed consent was obtained from all individual participants for whom identifying information is included in this article.'

#### *Funding sources*

- List all funding sources as follows: 'This work was supported by the xxxx (grant numbers xxxx, yyyy).'
- When funding is from a block grant or other resources available to a university, college or other research institution, submit the name of the institute or organisation that provided the funding.
- If no funding was received, state as follows: 'No funding was received for this study.'

#### *Acknowledgements*

- Acknowledgements should be placed at the end of the discussion and before the references.
- In this section persons who were involved but did not earn authorship can be acknowledged.
- Statements should be brief. A person can be thanked for assistance or for comments.
- Should not include contributions by editors or referees.

#### *References*

- Please refer to the section on Formatting of submissions.

#### Tables and figures

- Table and figures should not be imbedded in the text file, but should be submitted as separate individual files. Each table should be a separate file, entitled Table 1, Figure 2, etc.
- Each table and figure should be provided with a heading or legend.
- Please refer to the 'Formatting of submission' section for further guidelines.

## **Instructions for Reviewers**

### **Introduction**

- Comprehensive, high-quality, blinded peer review is essential to maintain an adequate publication standard.
- Peer reviewers are orthopaedic surgeons or physicians from other disciplines who possess special expertise and who have demonstrated their willingness to perform timely and thorough manuscript reviews for the journal. Guest reviewers are invited if unique experience or knowledge is required on a specific topic.
- Reviewers are asked to follow the structure and guidelines described below.
- A methodological review is conducted for papers that have received a favourable content review and are being considered for publication.
- Please also see our peer review policy

### **General guidelines**

- When you receive the invitation to review please consider the following question:
  - Do you have time to complete the review before the deadline?
  - Are you familiar enough with the content area and/or methods to provide a high-quality review?
  - Do you have any potential conflicts of interest?

If you are unable to review for any of these reasons please reply promptly to the invitation e-mail in order to for another reviewer to be appointed.

- Please attempt to complete your review within the provided deadline. If you will not be able to complete your review in time, please contact the Editorial Office.
- A well-organised, detailed, thoughtful review will often be passed on to the authors.
- Make your review as objective and evidence-based as possible. Perform a literature search on the topic in order to familiarise yourself with the current literature on the topic (OVID, Google Scholar and Pubmed, at least).
- Your review can be as critical as you judge necessary. Always provide constructive criticism. Your comments should be helpful to the author(s) and should never be demeaning or pejorative. The authors are likely to have put a huge amount of time and energy into their work. Disparaging comments are not helpful.
- Do not spend a lot of time correcting language, grammar or spelling. If errors in these areas interfere with the overall message, make a general comment to this effect. If a specific error confuses a point, make a specific comment.
- Please keep the content of the manuscript confidential.
- Please avoid including a signature or any other ways of identifying you as a reviewer.
- If you have any concerns please contact the section editor directly.
- Follow a systematic procedure to review the manuscript and to write your review (see below).

### **Structure of review**

- Recommendations following review
  - Reject (resubmission not recommended)
  - Reject and resubmit
  - Major revision required
  - Accepted with minor revision
  - Accepted as is
- Summary

- Summarise the article in a short paragraph. The aim is to demonstrate your understanding of what the work is about.
  - Briefly state your understanding of the research question and methodology.
- General comments
  - Please provide a paragraph for this to put the study in the context of previously reported information.
  - Is it relevant to clinical practice in South Africa?
  - Is the relevance to the South African orthopaedic surgeon discussed?
- Specific comments
  - Title
  - Abstract
  - Level of evidence
  - Introduction
  - Methods
  - Results
  - Discussion
  - Conclusion
  - References
  - Illustrations
  - Tables
  - Organisation
  - Language, punctuation, grammar and spelling
- Further requirements:
  1. Was the research question clearly elucidated in the introductory section?
  2. Was sufficient detail provided in the methods section so that another researcher can replicate the study?
  3. Was the statistical methodology employed sound?
  4. Were subject recruitment procedures, and inclusion and exclusion criteria accurately described?
  5. Was the follow-up period adequate?
  6. Were the limitations of the study adequately explored?
  7. Was the conclusion supported by the data presented in the study?
  8. Were all necessary references provided?
  9. Was the necessary ethical standard maintained?
  10. Does the article satisfy the requirements set out in the Instructions for authors section?

Note: If the answer to any of these questions is no, the paper should either be rejected, rejected and resubmitted, or returned to the authors for major revision.

#### Specific comments

This part of the review should consist of a detailed listing of your specific concerns with the manuscript. Each item in the list should refer to a specific location in the text (including the page, paragraph and line numbers). Your specific, precise comments will be valuable to the authors when they revise their work. Constructive criticism will be appreciated. In addition to the text, the following elements of the manuscript should be assessed.

- Title
  - Does it clearly describe the subject of the paper?
- Abstract
  - Is it an accurate, succinct reflection of the aims, methods, results and conclusion?
- Level of evidence
  - Is the proposed level of evidence appropriate?
  - Please follow the level of evidence guidelines provided by the Oxford Centre for Evidence-Based Medicine (OCEBM); version 2.1.
  - Available from: OCEBM Levels of Evidence Working Group. 'The Oxford Levels of Evidence 2'. Oxford Centre for Evidence-Based Medicine. <http://www.cebm.net/index.aspx?o=5653>
- Introduction
  - Is it an unbiased introduction to the topic?
  - Is an adequate background given?
  - Does it mention the relevance of the research question?
  - Do the authors give a research question or hypothesis?
  - Are the aims and objectives communicated clearly?
- Methods
  - Was the methodology employed appropriate for the research question that was posed?
  - Could the study be replicated with the details given?
  - Was the sampling described?
  - Are the inclusion and exclusion criteria adequate?
  - Is the statistical analysis sufficiently and correctly described and is it appropriate?
- Results
  - Do the results address the research questions?
  - Are there unnecessary duplications (i.e. results in text also shown in tables)?
  - Are the results described logically and in a clear fashion?
- Discussion
  - Is a logical and meaningful interpretation of the results made?
  - Is the interpretation of the results within the boundaries of the study limitations?
  - Are the results brought into context with current knowledge and evidence?
  - Has it been done in a balanced manner?
  - Did the authors describe the implications of the findings?
  - Is there a statement made regarding the generalisability of the findings?
  - Are limitations given adequately?
- Conclusion
  - Is there a clear and logical summary of the findings?
  - Is the conclusion scientifically valid in terms of the results that were presented?
  - Do the authors give suggestions for future research?
  - Is a take-home message given?
- References
  - Is the bibliography adequate and was all relevant literature discussed (without being excessive)?
  - Have all the important statements been referenced?
- Illustrations
  - Do illustrations support the main point of the article?
  - Are all the illustrations appropriate and necessary? If not, which ones would you delete?
  - Are the legends adequate?
- Tables
  - Are all the tables necessary, or could several tables be combined?
  - Are clarifications or additional columns needed?
  - Please suggest changes if you believe that they would help the author to present the information more clearly.
- Organisation
  - Is the organisation of the manuscript satisfactory?
  - Does the text provide the reader with all the information that is needed in each section?

- Language, punctuation, grammar and spelling
  - Is this of an acceptable standard?

#### Decision categories

- Reject and resubmission not recommended

This means that the paper is considered inadequate for publication in the journal, either because the quality is too poor, or because the paper is out of scope for the journal, or because of ethical problems (duplicate submission, self-plagiarism or plagiarism). List two or three major reasons why you believe the manuscript should be rejected. If you are recommending a rejection of the manuscript it is neither necessary nor desirable to complete a comprehensive specific comments section as these are intended to help the authors who are invited to revise their submission.

- Reject and resubmit

This is relevant in the following situations:

- The submission is incomplete.
- The submission fails to comply with the Instructions for authors guidelines.
- The content of the paper could potentially be of interest but the paper has too many deficits to expect that it will be of sufficient quality to allow publication following major revision. Compared to a simple 'reject' decision, this is a signal to the authors that they may have an interesting idea but that they need to write a new paper and not to try to enhance the existing one.

- Major revision

This implies that in its present state the paper is below standard for publication and requires substantial revision. However, the reviewer believes that the authors can correct these deficiencies. Reasons may include lack of putting the work into perspective, lack of sufficient experimental validation, or serious flaws in the way the work is presented or justified, etc. A major revision decision is in no way a commitment to ultimately accept a revised version of the paper for publication. If the revised version of a paper has not addressed the initial concerns and still raises major concerns after major revision, it is probably better to reject it than to extend the reviewing process.

- Accepted with minor revision

This means that the major aspects of the paper are considered to be of sufficient quality for publication. This is actually a commitment to ultimately publish the paper, provided that the authors adequately answer the remaining concerns (which should be relatively minor) and correct the relevant language/grammar/spelling problems.

- Accepted as is

Article is suitable for publication as is, without further revision or corrections. This decision is not typically used following the first review but frequently applied to papers after minor/major revision.

## Article Submission

### Submission declaration and verification

With the submission of an article the authors confirm that:

- The work described has not been published previously (except in the form of an abstract or as part of a published lecture or academic thesis or as an electronic preprint). Please see our ethics policy for more information.
- That it is not under consideration for publication elsewhere.
- The content of the article is the sole work of the author(s) and that the article has been prepared with cognisance of our plagiarism policy.
- That its publication is approved by all authors and tacitly or explicitly by the responsible authorities where the work was carried out, and that, if accepted, it will not be published elsewhere in the same form, in any other language.


### Prior to submission

- Please familiarize yourself with the policies of the SAOJ.
- Please read Instructions to Authors prior to submission. It will also be beneficial to familiarize yourself with the Instructions for Reviewers section.
- It is the responsibility of the authors, and not the reviewers, to ensure that the language, grammar, or spelling is acceptable for publication.
- Crosscheck all references to ensure that the bibliography is accurate.

### Submission procedure

- On submission of your article the ORCID (Open Researcher and Contributor ID) identifier of all authors will be required. ORCID provides a persistent digital identifier that distinguishes you from every other researcher and supports automated linkages between you and your professional activities ensuring that your work is recognized. To register and find more information please visit: <http://orcid.org>
- All correspondence will be sent by e-mail.
- Articles can be submitted by e-mail to: [pat@saorthopaedicjournal.com](mailto:pat@saorthopaedicjournal.com).

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## **Appendix 3: Study approvals**



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KWAZULU-NATAL  
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YAKWAZULU-NATALI

20 September 2017

Dr N Dlamini (201293607)  
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[ndlamini@uqn.ac.za](mailto:ndlamini@uqn.ac.za)

Protocol: Preoperative factors associated with extended postoperative length of stay in patients undergoing primary hip arthroplasty

Degree: MMed

BREC Ref No: BE526/17 (Substudy of BE595/16)

#### EXPEDITED APPROVAL

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 08 August 2017.

The conditions have been met and the study is given full ethics approval as a sub-study of the BREC approved study BE595/16 and may begin as from 20 September 2017.

This approval is valid for one year from 20 September 2017. To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2015), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at: <http://research.ukzn.ac.za/research-ethics/biomedical-research-ethics.asp>.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be RATIFIED by a full Committee at its next meeting taking place on 10 October 2017.

We wish you well with this study. We would appreciate receiving copies of all publications arising out of this study.

Yours sincerely



Professor J Tsoke-Dzengweni  
Chair, Biomedical Research Ethics Committee

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