HEALTHCARE WORKERS' KNOWLEDGE ATTITUDE AND PRACTICE IN MANAGEMENT OF PAIN DURING ACUTE PAIN CRISIS IN CHILDREN WITH SICKLE CELL DISEASE IN HOMABAY COUNTY TEACHING AND REFERRAL HOSPITAL-MIXED METHODS STUDY

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2022

DECLARATION

This dissertation is my original work and has not been presented for the award of any degree in any other university.

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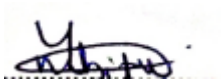
Signature:  **Date: 28th October 2022**

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DEDICATION

I dedicate this work to my parents, although they are no longer in this world their memories continue to regulate my life.

My brother Dr.Omondi Ogada for taking up parental responsibility and for his immense and unwavering support and guidance in my life, am grateful having followed your footsteps you showed me the way.

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2. KENYATTA NATIONAL HOSPITAL
3. HOMABAY COUNTY TEACHING AND REFERRAL HOSPITAL

LIST OF ABBREVIATIONS

DF118	-	Dihydrocodeine
ED	-	Emergency Department
FLACC	-	Face, Leg, Activity, Consolability, Cry
GAG	-	Guanine-adenine-guanine
GTG	-	Guanine-thymine-guanine
HbAS	-	Sickle cell trait
Hbs	-	Sickled Haemoglobin
Hbss	-	Homozygous sickle cell disease
HCWS	-	Health Care Workers
Homabay CH	-	Homabay County Teaching and Referral Hospital
KAP	-	Knowledge, Attitude & Practices
KNH	-	Kenyatta National Hospital
LDH	-	Lactate Dehydrogenase
NSAIDs	-	Non-steroidal Anti-inflammatory Drugs
NSB	-	Normal Saline Bolus
OIH	-	Opioid Induced Hyperalgesia
PRN	-	When Necessary
RBCS	-	Red blood cells
SCD	-	Sickle Cell Disease
UON	-	University of Nairobi
VAS	-	Visual Analog Scale
VOC	-	Vaso-occlusive crisis
WHO	-	World Health Organisation

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ABSTRACT

Background: Sickle cell disease has contributed significantly to mortality rate in children; pain is a regular problem during painful crises. Studies have shown that it is the most common cause for admission in children with sickle cell disease. Pain has significant physiological effects on the body during a painful crisis, and severe painful crises are associated with severe disease complications. There is minimal evidence on the level of knowledge among health care workers regarding pain assessment, use of pain scales/tools, and treatment. Some existing evidence suggests that healthcare workers (HCWs) have misconceptions about opioid use to manage pain.

Study Objective: To assess knowledge, attitude, and practice of health care workers, regarding assessment and treatment of acute pain crisis in children with sickle cell disease in Homabay County Hospital.

Study design and setting: Two-phase study – phase A, observational cross-sectional design, and phase B, a retrospective abstraction of medical records. Data collection methods were concurrent mixed method in phase A where quantitative followed by qualitative data collection (FGDs and KII) was done. Phase B - quantitative data abstracted from medical records. It was conducted in Homabay County Teaching and Referral Hospital (Homabay CH) a county referral hospital in Western Kenya.

Study Methods:

***Phase A*:** pretested questionnaire was administered to HCWs. The study used both knowledge and attitude (K&A) questionnaire (Appendix II). Two FGDS conducted one for clinicians and one for nurses, KII done with four Hcws. The study included HCWs in the paediatrics and medical ward attending to children hospitalized with acute pain crisis (n = 50).Inclusion criteria mentioned HCWs in paediatrics and medical wards, pharmacists and pharmaceutical technologists working in main pharmacy. Exclusion criteria HCWs with less than 6 months of experience and pharmacist/pharmaceutical technologist not working in the main pharmacy.

***Phase B*:** Retrospective evaluation of pain management in children over preceding two years by reviewing medical records. This was done by use of a structured audit tool (Appendix I). To abstract data from patient files and treatment sheets retrospectively.

The study population comprises of children diagnosed with and hospitalized with acute pain crisis in the paediatrics ward and medical ward of HCTRH (N=67). Inclusion criteria Children and adolescents with a diagnosis of aged 6 months to 18 years old hospitalized with acute pain crisis from March 2018 to March 2020 with available medical records. Exclusion criteria children with a diagnosis of SCD hospitalized with other complications, outside the study period, children with missing medical record.

Data Analysis

Phase A: One point was awarded for each correct/appropriate answer and zero for incorrect/unclear response. Total scores were therefore analysed for each HCW, and HCWs who score between 80-100% were considered to have good knowledge, between 60-79% were regarded as a medium/moderate, while those below 60% were deemed to have poor knowledge. This was applied to knowledge on pain assessment, and on treatment of pain.

To explore challenges that HCWs face in implementing optimal pain management for children presenting with acute pain crisis, the study collected qualitative data guided by FGDS and KII. This data was analysed using inductive thematic analysis with the help of NVivo software.

Phase B: For each analgesics that was given morphine, tramadol, ibuprofen, and paracetamol, dosage, route, duration and any inconsistency that occurred in administration was analysed and based on WHO analgesic ladder NSAIDS/paracetamol for mild pain, weak opioid for mild to moderate pain, strong opioid for moderate to severe pain it was decided if it was optimal or suboptimal practice.

Results:

Phase A - We enrolled 50 HCWs, 42 % male and 58% female, by cadre nurses 48%, clinical officers 46% and doctors 6%.70 % of the participants were aged between 21-30 years. Diploma holders 78% and degree being the highest level of education at 22%. By department 56 % medicine department and 44% paediatrics department.

HCWs knowledge regarding pain assessment during acute pain crisis was good as Majority of clinicians 58% and nurses 54% had a good score. Regarding knowledge on pain treatment during acute pain crisis HCWS had a fair knowledge, 88% of nurses had a fair score while 54% of clinician had a fair score. HCWs had a negative attitude on opiate use for treatment of pain in children experiencing an acute painful crisis, specifically fear of side effects such as addiction, respiratory distress, difficulty in weaning off morphine and constipation. *Challenges* that were facing HWCs included opiate drug stock outs, difficulty in accessing morphine when it was available due to administrative barriers, and inadequate pre-service training regarding management of painful SCD crisis.

Phase B - We retrieved files for 67 children for phase B to assess pain practices for children treated for SCD acute pain crisis at the hospital during the preceding two years. HCWs practice was found to be suboptimal no assessment of pain was documented and 60% of children were started on morphine (strong opioid) as initial analgesic weak opioid was not used and NSAID was used as an escalation or combination analgesic rather than initial analgesic.

Conclusions

Health care workers had good knowledge regarding pain assessment during acute painful crisis. HCW's knowledge on pharmacological pain treatment was fair for both the nurses and clinicians, as the majority had a moderate score. Healthcare workers' had a fearful attitude towards use of opiate analgesics during acute pain crisis. Health care workers' practice regarding pharmacologic treatment of acute pain crisis management was suboptimal, despite having good knowledge on treatment. Challenges that HCWs face during acute pain crisis management are stock outs and limited access to stronger analgesics, and inadequate pre service training in management of acute pain crisis.

CHAPTER 1: INTRODUCTION AND REVIEW OF LITERATURE

1.0 Background

Sickle cell disease (SCD) is an inherited disease that runs in families. Homozygosity (the possession of two similar alleles of the same gene) causes sickle cell anaemia. The beta-S (S) allele (chromosome 11p15.5) and wild-type -allele differ at a single location in a DNA sequence (single nucleotide polymorphism (SNP)) in the -globin gene's sixth codon, where GTG is replaced with GAG. Mutation of the haemoglobin tetramer HbS occurs in the erythrocytes of SCD patients when hydrophilic glutamic acid residues are replaced with hydrophobic valine residues.

SCD affects 3.2 million people worldwide, with 43 million having the sickle cell phenotype (carriers of the mutation), and 176,000 die each year due to SCD-related complications (1). Sickling typically starts about six months of age, but it varies from person to person. In some cases, pathological levels of HbS can be reached within 8–10 weeks of birth, and symptoms can develop from there.

Examples include stroke, acute chest syndrome, priapism, and other emergencies. The most significant clinical feature is acute vaso-occlusive pain (2). SCD patients' survival rates have recently increased. Renal dysfunction, seizures, Acute Chest Syndrome (ACS), low fetal haemoglobin levels, and a white blood cell (WBC) count density of more than 15,000 cells per cubic millimetre have all been linked to a lower likelihood of survival in studies. Higher haemoglobin levels, fetal haemoglobin levels, reticulocyte counts, and fewer cases of acute chest syndrome are associated with a better risk of survival at the age of 58 (3).

Some SCD patients died from Pulmonary Hypertension (PHT), unexpected death, renal failure, sepsis, thromboembolism, cardiac causes, cirrhosis, pneumonia or acute chest syndrome, bleeding, and iron overload (4).

Acute pain episodes are a common feature of SCD. They have a financial impact due to the cost of impromptu hospital visits and the regular use of healthcare services due to frequent severe painful crises (5). The main reason for hospital admission is repeated pain episodes.

The number of acute pain episodes per year is a predictor of clinical severity and early death. Patients experiencing acute pain are cared for within an extensive social-cultural complex structure shaped by the patient's, families and health care workers' beliefs and attitudes. It is critical to evaluate healthcare workers' knowledge and attitudes toward pain management in SCD. Inadequate pain assessment leads to ineffective pain management by health care workers; thus, adequate pain assessment and management are critical in improving these patients' quality of care and life (6).

2.1 Epidemiology of Sickle Cell disease

Millions of people worldwide are affected by SCD, with Sub-Saharan Africa bearing the brunt of the burden. Over 4.4 million people have SCD, and over 43 million have the sickle cell trait. Every year, roughly 400,000 children are born with SCD, and more than half of them die before five (7).

According to a hospital-based surveillance comparative study of 34,529 children under the age of 14 in the Kilifi district in 2009, SCD prevalence and mortality were 1.6 percent and 4.5 percent, respectively (Komba et al) (7). HbSS and HbAS were found to be prevalent in 1.6 percent and 17.1 percent of people, respectively, according to Foote et al. (2013) (7). In 2008, a prospective cohort study of 435 children aged 14 to 26 months was carried out in western Kenya; the prevalence of HbSS and HbAS was 0.2 percent and 16.2 percent, respectively (Byrd et al.) (7).

Western Kenya has the highest prevalence rate in Kenya, with 4.5 percent of children born with SCD and 18 percent having the sickle cell phenotype. SCD has contributed significantly to the death rate among children under five due to late diagnosis, educational disparities among care providers, and scarcity of adequate care (8). Around 60–70% of SCD hospitalizations are due to uncontrolled pain (9). The most common symptom of SCD is pain, which is also an essential aspect of children's medical care.

Heterozygous individuals with sickle cell mutation benefit from natural malaria immunity. Since the tropics are high-malaria-endemic areas, the highest prevalence is seen in Sub-Saharan Africa, India's tribal areas, and the Middle East.

Individuals that are homozygous for SCA, on the other hand, are not protected against malaria and are more likely to develop SCD than ordinary people. Unfortunately, most developing countries lack the services required to provide sufficient SCD treatment, contributing to the high mortality rate associated with the disease in these areas. In contrast to developed countries, where SCD patients have a life expectancy of 40-60 years, more than half of infected children die before reaching five years (7).

2.2 Pathophysiology and Clinical Presentation of Sickle Cell Disease

i) Haemoglobinopathy changes in SCD

Thymine for HbS is the product of a single base-pair shift at the -globin gene's 6th codon, thymine for adenine. This modification converts valine instead of glutamine in the sixth residue of the -globin molecule. The sickle cell mutation (s) in both -globin alleles causes sickle cell anaemia (HbSS), also known as homozygous HbSS.

Compound heterozygotes of sickle cell disease have one -globin allele with the sickle cell mutation and the other with a separate gene mutation (-thalassemia).

In sickle cell anaemia, HbS accounts for 90% of total haemoglobin, but only 50% in sickle cell disease. The haemoglobin molecule in Red Blood Cells (RBCs) has a particular shape that enables oxygen to be transferred across the body. Haemoglobin molecules do not interact with one another, while globin-chain mutations are absent. In the presence of HbS, however, the Hb tetramer undergoes a conformational transition.

ii) Vascular occlusion and clinical effects

Intravascular sickling is most common in the post capillary venules. HbS molecules interact with one another in the deoxygenated state, forming rigid polymers that give the RBC its characteristic "sickled shape." The rigid RBCs with reduced flexibility lead to clumping together and blockage of capillary beds in various organs, reduced blood, ischemia, and injury to tissues distal to the capillary bed. The commonest organs affected are those with the vast capillary network, for example, bones, cerebral, kidneys, and lungs. It is a mechanical obstruction function by sickled erythrocytes, platelets, and leukocytes and increased adhesion between these elements and the vascular endothelium. The organs affected mainly by vaso- occlusion, as mentioned above, are the bones, lungs, kidneys, and the brain; thus, the clinical presentation is an acute painful crisis, Acute Chest Syndrome, and stroke. SCD is also an inflammatory disease characterized by nonspecific inflammatory markers such as an elevated baseline white blood cell (WBC) count and cytokines.

iii) Other pathophysiologic effects of sickling

Anaemia and hyperbilirubinemia in SCD are due to Intraerythrocytic changes leading to shortened RBC life span and haemolysis. End products of haemolysis and effects on various organs are – jaundice, anaemia, haemoglobinuria, renal damage and Splenic sequestration (10). Because of their functional asplenia, enhanced bone marrow turnover, and altered complement activation, SCD patients are at risk of infection from encapsulated organisms. The aplastic crisis caused by Parvovirus B19 caused by a disruption in erythropoiesis can result in severe anaemia and cardiovascular decompensation (11).

2.3 Acute pain Crisis

Acute vaso-occlusive pain is a significant complication of SCD (12). The general cause of illness in SCD patients is a vaso-occlusive occurrence, which accounts for most hospitalizations and missed school days. According to some estimates, acute painful crisis emergencies account for up to 95% of hospital admissions.

Vasooclusive events painful pathway comprises multicellular aggregates that block blood flow in small blood vessels, denying oxygen and nutrients to corresponding tissues. The pain can affect any body part and primarily causes generalized pain; however, it is seen in the extremities in children, rather than headache, chest pain, pain in the abdomen, or backache in adults (13).

Dactylitis (hand-foot syndrome) is the first sign of discomfort in sickle cell anaemia babies and young children (occurring in 50 percent of children by their 2nd year of life). It is identified by swelling of the hands and feet, which may be symmetric or unilateral (10).

In the hospital, an acute pain crisis usually lasts seven days. The patient will develop a fever and leucocytosis (an increase in white blood cell count), which is linked to the magnitude of the pain; the higher the haemoglobin and haematocrits, the more likely a vasooclussive events are to happen. Although vasoolusive event may cause leucocytosis, this does not always indicate an infectious process. A thorough examination is expected because these people are highly susceptible to pathogens.

Painful crisis may be caused by several different factors, including physical, psychological, biochemical, and environmental factors. A painful crisis in any age group usually starts with an abrupt onset of pain. The majority of SCD patients present with painful crisis have a range of symptoms, including pain onset, location, consistency, and severity. The severe crisis will last 7 to 10 days and be divided into four stages: prodromal, original, developed and resolving.

The prodromal phase lasts 1–2 days and is characterized by aches, numbness, or paraesthesia in the region that will become painful later. One of the physical signs is the lack of regular eye appearance (loss of lustre or yellowing of the eyes). An increase in erythrocyte density and a decrease in erythrocyte deformability are both significant laboratory values.

The second and initial phase, which lasts two days, is distinguished by increased pain, decreased RBC deformability, an increase in the number of dense cells, an increase in red cell distribution width (RDW), unusual rapid RBC production (reticulocytosis), high WBC count (leucocytosis), and low levels of platelets (thrombocytopenia).

Pain is at its most severe during the third phase, the developed phase. Because of a lack of adequate care, the patient will experience frustration, depression and will complain about hospital personnel. A high temperature, swollen pains, and fluid in the knees will be discovered during the physical examination. White blood cells increment, a reduction in haemoglobin, an increase in reticulocyte count, an increase in LDH, and an increase in C-reactive protein can be found in the laboratory. This is the longest process, lasting 4–5 days on average.

The fourth and final process lasts three days on average. This is the resolving process where individuals begin to display signs of reduced pain, increased RBC deformability, Fibrinogen, Erythrocyte sedimentation rate (the rate at which RBC settle at the bottom of a test tube), platelets, and plasma viscosity. The blood level of sickled RBC is decreased during the final stage. Increased plasma viscosity results in blood clots (hypercoagulable state), responsible for the relapse of another painful crisis. Approximately 16% of hospital admissions for painful crisis are re-admitted with recurrence within one week of discharge. Re-admissions are triggered by discontinuation syndrome, untimely discharge, insufficient pain relief, opioid drug resilience, and opioid-induced hyperalgesia (OIH).

An examination of children admitted to hospitals with painful emergencies shows that patients typically have a blunted response to pain relief after the fourth to the sixth day of admission and are more likely to return to the hospital and be readmitted. The cause of this phenomenon is unclear, but it may be linked to OIH, resistance, or provider inexperience with painful long-term crises. Readmitted patients require special care because they have a higher morbidity and mortality rate. Patients that are in the process of overcoming painful crisis are often undertreated because the pain appears to diminish during this period. Maintaining active pain management, giving patients appropriate discharge instructions to avoid overdose or withdrawal after discharge, and planning for proper follow-up is all-important (13). Patients' symptoms of extreme crippling pain in caregiver accounts are usually in the long bones, back, pelvis, stomach, and abdomen. Symptoms such as Dactylitis may appear as early as six months of age. There are no definitive signs or physical examinations findings that will determine whether or not a person is experiencing vaso occlusive-related pain (11).

2.4 Physiological changes induced by pain in the body

The body responds to pain in various ways via several and interconnected physiological processes such as the neuroendocrine, immune, and sympathetic nervous systems and emotions. Table 1 summarizes these effects.

Table 1: Physiological changes induced by pain in the body (14)

• Cardiovascular	• Increased heart rate and blood pressure • Increased need for oxygen • Water retention, potential fluid overload
• Respiratory	• Increased respiratory rate • Shallow breathing • Increased risk of infection
• Immune	• Increased susceptibility to infection • Activation of the Hypothalamus-Pituitary-Adrenal axis
• Endocrine	• Increased blood glucose • Increased cortisol production

• Gastrointestinal	• Reduced gastric emptying and intestinal motility • Nausea and vomiting • Constipation
• Urinary	• Urge to urinate/incontinence
• Musculoskeletal	• Tense muscles local to injury • Shaking or shivering • Pilo-erection (goose bumps)
• Neurologic and cognitive	• Anxiety/fear • Depression • Poor concentration • Inhibition or promotion of pain • Increased or decreased sensitivity to pain • Changes in pain processing • Risk of pain becoming chronic

2.5 Evaluation of Pain in Children and Adolescents

To make a definitive diagnosis, a careful, thorough history and physical examination need to be performed: inquiring about the onset, location, radiation, quality, relieving and aggravating factors associated with the current painful episode; any differences between the recent attack and previous episodes; the presence of fever; transfusion history; medications; baseline haemoglobin levels and any out-of-the-ordinary occurrence should be looked into further (13).

During growth, a child learns to distinguish pain sensations, locate them, measure them, and eventually verbalize their painful feeling. Pain changes behaviour, both physiologically and metabolically. Pain is mainly conveyed nonverbally and physically in children under the age of six. Behavioural pain scales measure pain by watching the infant. Others sense discomfort by observing physiological changes. When a child is hungry, afraid, anxious, or cold, he or she may exhibit facial expressions, body movements, and physiological changes.

Owing to a lack of pain assessment instruments, children's pain is often overlooked and undertreated. The child's cognitive growth, clinical context, and pain typology all affect pain assessment. Pain evaluation in children over the age of six is based on self-report, while pain evaluation in children under the age of six is based on behavioural pain scales (of which there are several) (15).

It is critical to conduct additional pain assessments using a standardized tool. The FLACC SCALE (Face, Leg, Cry, Activity, and Consolability), Wong – Baker-faces scale, and other validated tools have been used to assess pain. The Visual Analog Scale (VAS) is another helpful tool (16).

THE FLACC TOOL (The Face, Leg, Cry, Activity, and Consolability)

This is a behavioural tool commonly used with preverbal children. The health care worker observes the child for at least 5-10 minutes to evaluate their pain and fill the chart below and then rates the child's pain according to observation caregiver can help where necessary, a score between 0-2 and range 0-10, the therapeutic threshold of FLACC is 3/10. The Faces, Legs, Activity, Cry, and Consolability (FLACC) scale was recently validated in children aged six months to 5 years suffering from acute pain in different settings, with solid validity standards for acute pain in critically ill children (15). (See Table 2).

Table 2: THE FLACC TOOL (the Face, Leg, Cry, Activity, and Consolability Tool)

THE FLACC TOOL (the Face, Leg, Cry, Activity, and Consolability)	**SCORE**
Face 0-no particular expression or smile 1-occasional grimace or frown, withdrawn or disinterested 2- Frequent to constant frown, quivering chin, clenched jaw	
Legs 0-Normal position or relaxed 1-Uneasy, restless, tense 2-Kicking or legs drawn up	

Activity 0-lying quietly, normal position, moves easily 1-squirming, moving back and forth, tense 2-Arched, rigid, or jerking	
Cry 0-No cry(awake or asleep) 1-moans, occasional complaint 2-Crying steadily, screams or sobs, frequent complaints	
Consolability 0-Content, relaxed 1-Reassured by occasional touching, hugging, or being talked to; distractible 2-Difficult to console or comfort	
Total score (0-10)	

The Wong-Baker Faces pain rating Scale (Wong and Baker, 1988)

Six cartoon faces with a score of 0-10 are used to measure pain in children and adolescents aged 3 to 18 years old. It is fast and straightforward to use because few instructions are needed, and it has been translated into more than ten languages and is freely available. One downside is that smiling in the 'no hurt' face results in higher recorded pain scores than the everyday face, and the 'hurts worst face' contains tears, and not all children cry while in pain (Figure 1).

When demonstrating a pain scale to children, the scale has six numbered faces ranging from 0 to 10. Explain to the child that each represents a person who is happy or unhappy that he or she is not in pain (hurt), is in any pain, or is in a lot of pain:

Ask the child to choose the face that best expresses how he or she is feeling.

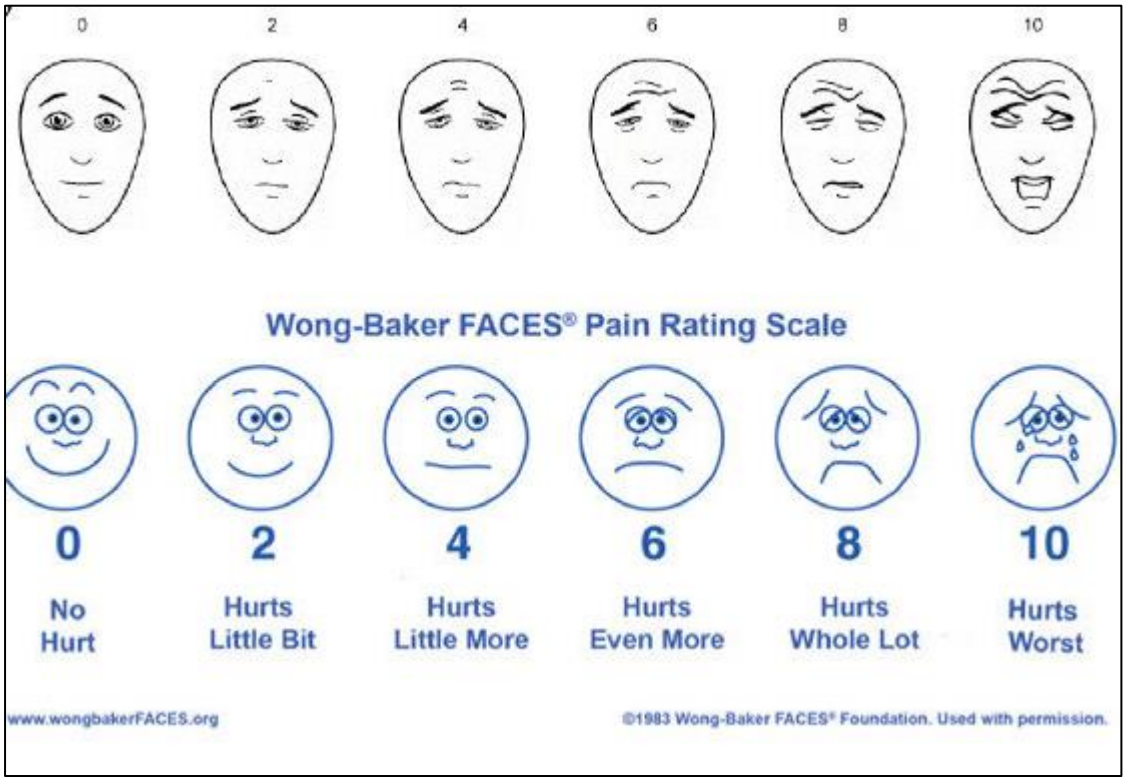

Figure 1: The Wong-Baker Faces pain rating Scale Source: Adapted from Hockenberry et al. (2005) (17)

The Visual Analog Scale

The visual analogue scale (VAS) is a subjective and validated pain scale for severe and persistent pain. Scores are registered by handwriting a mark on a 10-cm line representing a pain scale ranging from "no pain" to "worst pain" (Figure 2). Over the age of four, children may illustrate, verbalize, or draw the painful spot. To find the painful spot, caregivers must track and examine children under the age of four. Children over six years use self-assessment scales because they require perceptual and linguistic abilities. It is advised that children aged 4 to 6 years use a range of self-reporting pain methods (15).

The gold standard and most validated approach is self-reporting using the Visual Analog Scale (VAS). Self-assessment using a VAS is the gold standard for children above the age of six. Children and youth will benefit more from the vertical variant (15).

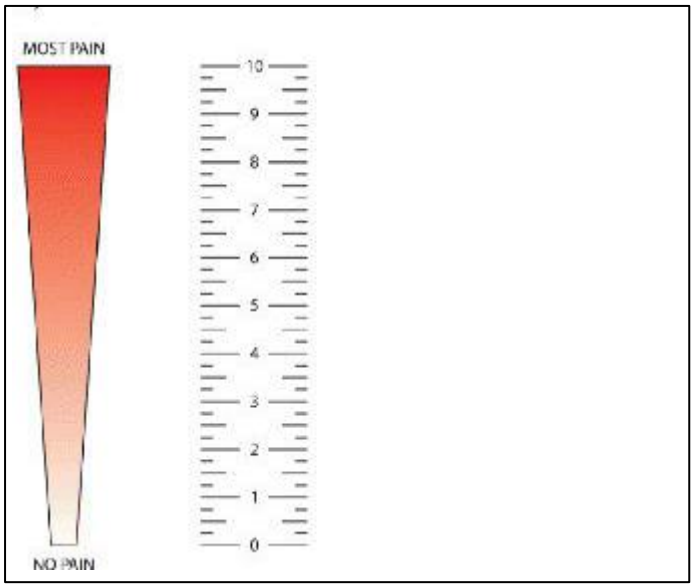

Figure 2: Visual analogue scale for children age six years and above (18)

Numerical pain rating scale

It consists of a graphically illustrated sequence of numbers (for example, 0-10 or 0-100). The lowest number represents no pain, and the highest means the most painful experience imaginable. It is accurate and suitable to use in measuring severe pain in children over eight. The patient is asked to rate his or her pain in three categories: present, best, and worst pain in the last 24 hours (17).

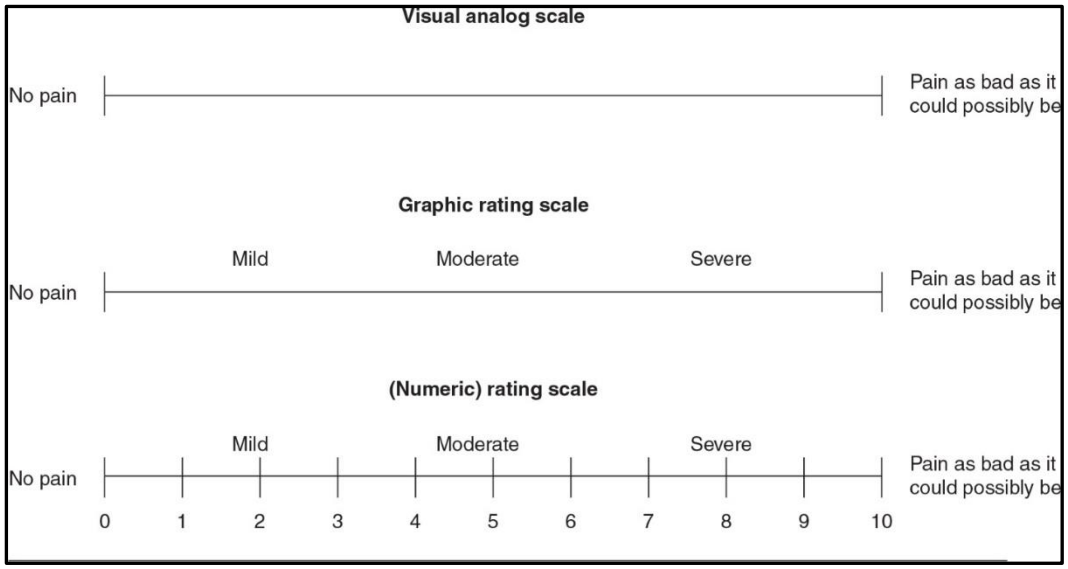

Figure 3: Numerical pain rating scale for children above eight years(18)

2.6 Management of Pain in Children and Adolescents

Adolescents' and children's pain can be managed effectively after a careful pain assessment, pain-relieving intervention and decisions on whether further actions are needed can be made. It's essential to decide which analgesics to use to be able to control pain effectively; route of analgesic administration, frequency and timings of analgesics administration are all considerations that should be made. The following are the pain management guidelines established by the World Health Organization and the American Society of Haematology.

2.6.1 Pharmacological management

The World Health Organization Guideline on pain management

The three-step analgesic ladder described by the WHO also describes the basic principle of pharmacological pain management. The intensity of the pain determines the type of analgesic used. A non-opioid -/+adjuvant analgesic (non-opioid -/+adjuvant) is prescribed for moderate pain. Two analgesics (weak opioid+/-non opioid +/- non-opioid +/- adjuvant) are recommended in the moderate Pain level, while three analgesics (strong opioid+/-non opioid +/- adjuvants) are recommended in the extreme pain step. Paracetamol and Nonsteroidal Anti-inflammatory Drugs (NSAIDs) are examples of non-opioids, while codeine and tramadol are examples of weak opioids and potent opioids (morphine and fentanyl).

According to the WHO analgesic ladder, the basic theory of pain control is 'By the clock, by the mouth, by ladder.' This aids in medicating on a daily basis, using the required administration path, and individualizing care for each patient. To keep pain at bay, administer medication on a continuous or round-the-clock basis rather than on an as-needed basis. By mouth: while the oral route is typically easy, it is not always possible for all patients. By the ladder: prompt drug administration following the analgesic ladder, The prescription selected should be suitable for the seriousness of the pain, it may be appropriate to start at the top of the ladder with severe pain begin with a potent opioid, it is not necessary to start at step one with severe pain when pain is eventually controlled, the patient is then maintained on the effective dose and no need to start at step one with severe pain (19).

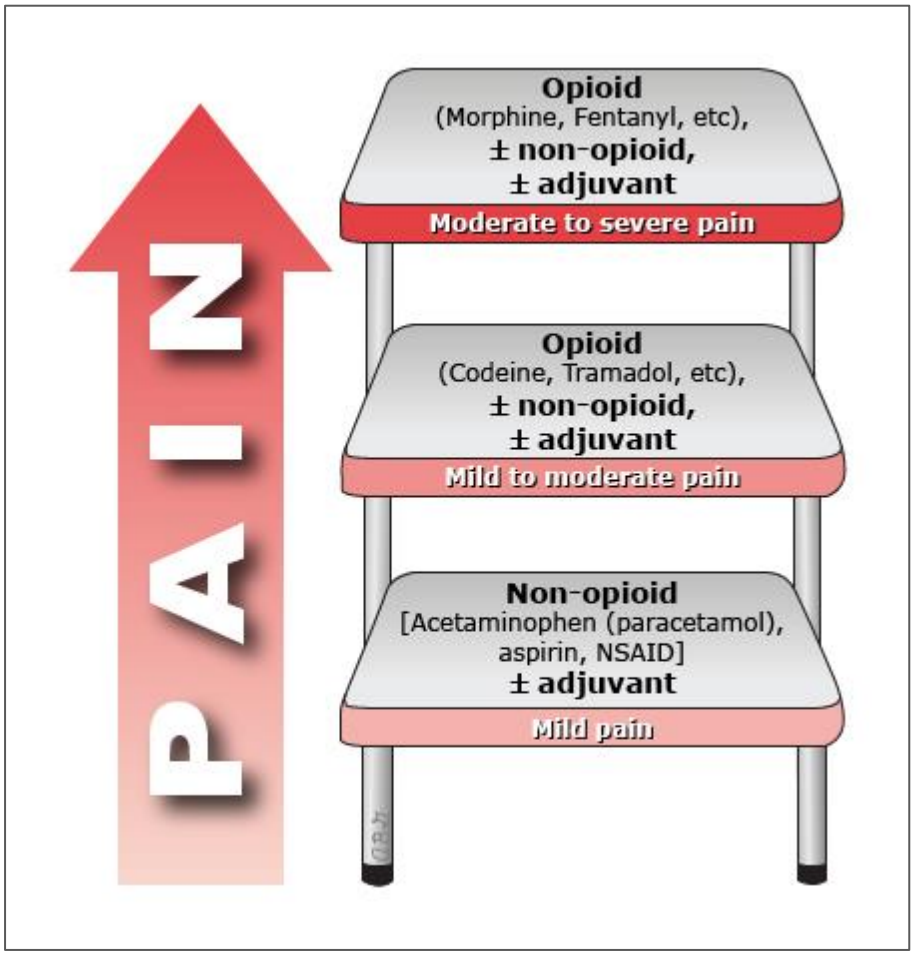

Figure 4:WHO analgesic ladder adapted from the encyclopaedia of pain (19)

American Society of Haematology 2020 guidelines for sickle cell disease: management of acute and chronic pain

Both pharmacological and nonpharmacological modalities are included in the American Society of Haematology 2020 guidelines for SCD treatment of acute and chronic pain, and clinical approaches are personalized to specific patients' needs; there is no universal solution to effective pain management (20).

The difference in recommendations in American Society of haematology guideline in management of acute painful crisis and WHO guide in management of pain is in two areas i.e.

"Subanesthetic analgesic ketamine infusion as an adjunctive treatment of pain that is refractory or is not effectively treated with opioid alone, safe administration of subanesthetic ketamine infusion in hospital inpatient units or centres that have enough

expertise to administer the drug, there is currently no standardized widely accepted definition for the term refractory pain, hence whether dose recommendations range from 0.1 to 0.3 mg/kg/hour, with a maximum of 1 mg/kg/hour."

To relieve acute pain, intravenous fluids 0.9 percent or 0.45 percent regular saline are used in addition to conventional pharmacological management. Extra fluids are regularly administered as an adjunct procedure, regardless of the patient's hydration status; this step helps to delay or stop the sickling process, which aids in pain relief. While this practice has long been advocated, there is no evidence to back it up, resulting in circulatory overload. However, since dehydration is one of the triggers of vaso-occlusive crisis, fluid administration can be helpful in crisis management in this situation (20).

Table 3: Dosage, route and frequency of administration of analgesics used in managing pain in SCD.

Medication and Childs age	**Formulation & route of administration**	**Dose and Frequency**	**Consideration (e.g. when to stop, step up analgesics**
Paracetamol in all ages	Oral and intravenous	10-15mg/kg every 8 hours	When pain subsides
Ibuprofen in all ages	oral	5-10 mg /kg every 8 hours	When pain subsides
Tramadol in children > 12years old	Oral and intramuscular	25 mg/kg every 6 hours not to exceed 400mg/day	When pain subsides
Dihydrocodeine in children all ages 1-4years old 4-12 years old	oral	0.5mg/kg every 4-6 hours. 0.5-1mg/kg every 4-6 hours	When pain subsides

Morphine	oral intravenous and intramuscular	0.2-0.5 mg/kg/dose every 4-6 hours 0.1-0.2 mg/kg/dose every 2-4 hours	When there is a relief from discomfort or when pain is not being handled properly, step up. Stop if pain has subsided or symptoms of respiratory exhaustion or sedation.

Pharmacological pain management is the cornerstone of pain relief in acute painful crises, and the drug options are non-opioid and opioids, or a combination of the two. Boyd et al. (2014) carried out a study in Jamaica to use the drug options used for pain in patients with acute sickle cell painful crisis admitted to the University Hospital of the West Indies (UHWI) Jamaica, were determined using a retrospective study design. From January 2006 to December 2010, 101 patients ages 0-18 years old were enrolled in the study; patients reported 8 sites of pain, namely generalized, abdomen, chest, lower limbs, upper limbs, back, joints, and penile pain; in this study, we get to see the common site for acute painful crisis as reported by the patients.

Hospitalization days ranged from 1 day to more than 14 days, with the most usual site of pain being the lower limbs (44.6 percent) and the least common being priapism (2 percent), and there was no association found between severity of pain and hospitalization days. A pain assessment was performed, which resulted in five classifications based on severity: mild pain, mild to moderate pain, moderate pain, moderate to severe pain, and severe pain. Severe pain was reported 75.2 percent of the time and moderate pain 18.8 percent of the time, with mild pan, mild to moderate pain, and moderate to severe pain each reported 2% of the time. The analgesics used were non-opioid based (NSAIDs, aspirin, paracetamol, or a combination of two of these), and opioid-based (opioid or opioid combined with one or two).

Non-opioids analgesics initial treatment for patients with mild pain and mild to moderate pain being non-opioid based and all these patients had pain resolution of the patients with moderate and moderate to severe pain n=21 most received non-opioid based therapy n=16

and 12 of them having their pain resolved and 9 of them required 2nd line therapy. According to Boyd et al., those who had severe pain n=76, 34 of them, i.e. 45%, had their pain resolved with 1st line therapy, 34 (45%) required additional treatment and 11 of them being 14% required 3rd line therapy. The further assessment of initial therapy showed that most patients with severe pain n=62 received opioid based therapy as 1st line; however, 14, i.e. 22.5%, were initially given non-opioid based therapy. Boyd et al. further showed that most patients n=94(93%) had their pain resolved at the time of discharge. In comparison, 2% of patients admitted with severe pain having their pain unresolved at the time of release, and 5, representing 5% of patients, had to continue with outpatient treatment since their symptoms no longer needed admission(21).

Jason Payne et al. conducted a retrospective study on paediatric patients admitted to an Alabama hospital for a vaso-occlusive crisis (VOC). The emergency room admission time, order entry time for the maximum opioid dosage during hospitalization, and time of discharge orders were all reported to determine the effect of early analgesia on hospitalization outcomes in the sickle cell pain crisis. Patients were graded as infrequent if they required three or fewer VOC admissions in the previous two years, and as regular, they needed more than three VOC admissions in the last two years. More admissions were accounted for using generalized linear modelling. There were 236 admissions for acute pain, with 108 patients observed. The findings revealed that reaching an earlier optimal opioid dose was significantly correlated with a shorter period of hospitalization for both infrequent and regular patients.

Total hospitalization duration was also affected by the time a maximum opioid order was issued, as well as the length of hospitalization after a top analgesic order was placed; regular pain patients who achieved early analgesia had a substantially shorter hospitalization period from the time the top opioid order was placed, while no correlation was observed for infrequent pain patients (22).

Normal Saline Bolus (NSB) use in Paediatric Emergency Departments is associated with worse pain control in children with sickle cell anaemia and vaso-occlusive pain, according to Carden et al. This was a retrospective cohort study of IVF use by physicians practising in a paediatric emergency department setting and pain outcome predictors in paediatric sickle

cell disease patients presenting to the emergency department with uncomplicated, moderate to severe VOE requiring parenteral opioids. The study's goal was to see how a normal saline bolus affected pain scores and emergency department disposition (hospital admission vs discharge). Patients aged 3 to 21 who required parenteral opiates for VOE. Twenty consecutive charts were reviewed from 20 high-volume paediatric EDs (N=400), including 14 Paediatric Emergency Care Applied Research Network (PECARN) sites in the United States and Canada. Age, SCD genotype, and parenteral opioid use were all verified during the chart study. The chart was used to extract information about IVF administration, including bolus usage (defined as 5 ml/Kg IVF provided rapidly over 30–60 minutes). The ED visit also included information on IVF maintenance fluid usage (measured in millilitres per hour), total IV fluid level, pain ratings, and admission outcome. Across the 20 sites, the rate of IVF bolus use ranged from 15 to 100 percent, with 11 sites supplying an IVF bolus to 80 percent of all children with SCD assessed.

Maintenance IVF was administered to 43.5 percent of children in the ED. Patients received 18.29.5 mL/kg of IV fluid on average during their ED stay. Children who earned an NSB were admitted at a higher rate than those who did not (71 percent vs. 59 percent, p=0.01). Since the use of NSB has recently been linked to poor clinical results in non-SCD patients, the findings of this major retrospective study provide evidence to call this ED-based approach in euvolemic patients into question (23).

Table 4: Studies evaluating Health Care Workers on the treatment of pain in children with SCD

Country, Author year)	Study Objective	Study design /population (Age group, sample size)	Key Results
1. Jamaica. Boyd et al. 2014	To ascertain the drug choices used to treat pain in patients with acute sickle cell painful crisis.	Retrospective study design children 0-18 years N=101	54 % with mild to severe pain who received non-opioid medication had their pain addressed, while 46% required further treatment.
2. United States of America, Alabama. Jason Payne et al. 2018	Early analgesia on hospitalization outcome for sickle cell pain crisis	Retrospective study N=236 Age 0.5-19 years	Frequent admissions mean length of hospitalization 104.8 (± 78.8) hours. infrequent admissions mean length of hospitalization of 90.6 (± 63.8) hours (p=0.24). frequent pain admissions were discharged a mean of 66.9 (± 55.3) hours after receiving their maximum opioid dose which is similar to those with infrequent admissions, who were discharged 61.1 (± 43.8) hours later (p= 0.67)
3. United States of America, North Carolina. Carden et al. 2019	Normal saline bolus in children with acute pain crisis in emergency department	Retrospective cohort study N=321 Age 3-21 years	Admission rate was significantly higher in children who received NSB compared to those not treated with a bolus (71% vs. 59%, p=0.01. Patients who received NSB had 1.8 odds of being admitted

2.6.2 Non- pharmacological treatment of pain in SCD

Non-pharmacological interventions should supplement pharmacological modalities in the management of sickle cell disease pain because recurrent and frequent pain episodes can be linked with psychological issues such as low self-esteem, poor school performance due to absenteeism during painful crises, social isolation, depression, poor peer and family

relationships, and co-morbidity (24). Massage, yoga, transcutaneous electrical nerve stimulation (TENS), and guided audio-visual relaxation are other non-pharmacologic pain management modalities (20). In North Carolina, Hants Williams conducted a study to review nonpharmacological approaches for pain in SCD. The study aimed to identify and synthesize nonpharmacological therapies for pain relief of any kind and origin in people with SCD. A literature review was conducted using PsycINFO, PsycARTICLES, PubMed, CINAHL, and Embase. Databases were searched using the following terms: sickle cell disease, pain, and nonpharmacological therapies. Based on their methodological quality, interventions were categorized into three types: Peer-support community therapy, educational/psychological therapies, and skill-based therapies. The study looked at 28 nonpharmacological treatments for people with SCD. In these trials, a wide variety of nonpharmacological treatments were tested. Twelve studies found substantial changes in pain, three studies found no difference in pain or a pain-related outcome between experimental and control conditions, and one study found a negative or adverse intervention effect. Approximately half of the research examined efficacy in pain reduction, suggesting that patients can use nonpharmacological treatments to relieve pain with some success (1).

2.6.3 Knowledge of Health Care Workers on Management of Pain

The experience, attitudes, and skills of those who provide pain relief decide its efficiency." HCWs are the backbone of hospital work daily. Pain assessment and care in children are critical components of paediatric practice. A lack of information about the tools and techniques for assessing discomfort in infants and a lack of awareness among health care providers of the value of proper pain control and treatment affects pain management (25).

2.6.4 Studies Evaluating HCWs Knowledge on Assessment of Pain in Children

Ahassan MAA et al. conducted a study of Sudanese paediatrics residents in Sudan. The research was carried out in nine major paediatric hospitals that are certified for resident training, and it was designed to be prospective, descriptive, and cross-sectional. The study aimed to evaluate the awareness, attitude, and practice of paediatric residents on pain assessment and paediatric issues. The primary outcome measures were awareness of tools used to measure pain intensity in children, knowledge and practice on measures aimed at controlling perioperative pain in children, knowledge and practice on pain medications such as opioids, paediatric pain perception attitude, and the importance of proper pain

management in paediatrics, and a semi-structured questionnaire was distributed to 174 residents. 70% of residents had never received any formal training, education, or learning session on paediatric pain assessment and management, and 60% were unaware of pain assessment tools/scales. 40% of those polled were aware of pain assessment tool scales. More than 88 per cent of the residents reported that pain assessment scales/tools were not available at hospitals, and 35 percent believed that dependence was highly likely when morphine was given for less than 48 hours. Half of the respondents also thought that addiction was common in those treated with opiates for pain relief, and one-third believed that long-term oral opioids were not appropriate for these children. 5% of respondents also admitted that despite having indications such as sickle cell pain crisis and cancer-related pains, opioids were never prescribed during their rotation. In general, there was a positive attitude toward the importance of pain control in children, with 75% agreeing (25).

In another study, Yaqoob et al. (2015) conducted a cross-sectional descriptive survey titled Nurses' knowledge and attitudes toward pain assessment and management for adult sickle cell disease patients during the sickling crisis in the Kingdom of Bahrain. The study was conducted in one of the government hospitals in the kingdom of Bahrain in an adult SCD ward, with 30 staff nurses working in that ward recruited. The study's goal was to assess the level of knowledge and attitudes of nursing staff regarding pain assessment and management of patients with SCD during the sickling crisis in the ward mentioned. According to the study, the average knowledge score was 15.8 out of 33. (47.8 percent out of 100 percent). They indicated that staff nurses had inadequate knowledge and a negative attitude toward SCD pain assessment and management. The questionnaire used focused on three areas: pain assessment, nurses' perceptions of pain management, and pharmacological intervention. The Nurses' Knowledge and Attitude Survey questionnaire regarding Pain (KASRP) was used, which included multiple-choice questions and True/False questions totalling 33 in number. Poor knowledge of morphine dosage and administration was demonstrated, whereas excellent knowledge of analgesic combinations was demonstrated by correct responses given to the questions that were asked in the questionnaire used (26).

In Norway, Moutte et al. conducted a study titled Physicians' use of pain scales and treatment protocols by children and adolescents in emergency primary care. This cross-

sectional study aimed to learn more about how emergency primary care physicians assessed and dealt with pain in children and adolescents. The outcome of the measure was the use of a pain scale, weight, and age while dosing pain medication. Moutte et al. discovered in their study that the VAS pain scale was used by 59 percent of physicians in children aged 9-19 years, 23 percent of physicians in children aged 3-8 years, and 3 percent of physicians in children younger than three years old. On the other hand, 63% of physicians used child weight when estimating dosage for pain medications in these patients. They reported relying on parents' reported weight and rarely measuring the child's weight at attendance. It was also discovered that 76 percent of physicians studied in Norway, and 49 percent of physicians had less than five years of experience in their practice. This study generally shows that pain scales/tools were rarely used in children under the age of eight (16).

Table 5: Studies evaluating HCWs Knowledge on assessment of pain

Country,1st Author and year	**Study tittle**	**Study/design population(age group,sample size)**	**Key results**
1.Sudan Ahassan MAA et al. 2017.	knowledge, attitude and practice of Sudanese Paediatric Residents	cross-sectional study. N=174 paediatrics Residents.	60% unaware of any pain assessment scale. Of the 40 % who were aware of pain scales, 16 percent could not name appropriate pain scales. 58% considered Opioids to be contraindicated for pain relief in children, and pain management in children was viewed positively by 75%.
2.Kingdom of Bahrain, Hasan Yaqoob et al.2015	Nurses' knowledge and attitudes toward pain assessment and management for adult sickle cell disease patients during sickling crisis	cross-sectional study. N=30 Nurses 31-40 years	Inadequate awareness and attitudes toward SCD pain assessment and treatment. 48% had insufficient knowledge of Morphine dose administration and very strong understanding of analgesic combinations

3.Norway, Moutte et al. 2015.	The use of a pain scale and management protocols by physicians in emergency primary care for children and adolescents	Cross sectional study. N=75 emergency primary care physicians. average age 37 years old	In patients aged 9 to 19 years, 59 percent of physicians used VAS. It was used by 23% of children aged 3 to 8, and 3% of children under the age of 3. 63 % of physicians used child's weight to calculate needed medication dosage instead of age.

2.6.5 Knowledge Attitude and Practices on Pain Management.

Zahra J. 2015 conducted a study titled Knowledge and attitudes of healthcare workers at Kenyatta National Hospital on pain assessment and management in children at Kenyatta National Hospital to assess the knowledge and attitudes of different healthcare workers on pain assessment and management in children. Health workers answered correctly 16 of the 34 questionnaire items, yielding a mean score of 47.2 percent, indicating a substantial information deficit. Years of clinical experience with more years were associated with lower survey scores, inadequate awareness and attitudes of pain assessment in children, and inadequate knowledge of pharmacologic pain treatment (27). Fearon et al. studied residents at the Benioff Children's Hospital Oakland in the United States. This study aimed to determine pediatric residents' attitudes toward opioid use in SCD pain management.

This urban medical centre's 88 residents were given a survey. This survey was completed by 53 residents (60 percent). Participants were divided into two groups: those with more experience and those with less experience. The more experienced group had seen 21 SCD patients (45.3 percent); each of these groups reported tolerance and dependency as major barriers to opioid use in SCD. Residents with less experience showed a substantially higher barrier to tolerance (52.8 percent) and dependence (45.3 percent) than those with more experience. Addiction was also listed as an obstacle by 16.7 percent vs. 51.7 percent. On attitudes, less experienced people scored 44.8 percent, while more experienced people scored 29.2 percent. 62.3 percent of residents said it was difficult to care for SCD patients, 11.3 percent of patients with SCD over-reported their pain. Five residents were interviewed, and themes were organized into three categories: provider barrier, patient-level barrier, and facilitator of care barrier. Provider barriers included fear of overprescribing, a lack of resources, and difficulties in managing pain due to its subjectivity. Patient barriers included psychosocial difficulties, discrimination, and stigma. Access to pain plans in the electronic medical record is one of the facilitators of care barriers (28).

Another study, Nurses' Attitudes and Practices in Sickle Cell Pain Management was conducted by Pack-Mabien et al. in Alabama. The study's goal was to determine whether nurses' attitudes influence their practice when caring for patients with sickle cell pain episodes. In this study, it was discovered that 63% of participants believed drug addiction

develops during SCD pain treatment. Individuals with addiction can still have acute pain episodes, according to 97 percent of respondents, and drug addiction should not be a nursing concern, according to 87 percent. Thirty-nine percent were hesitant to administer high opiate doses, and 59 percent cited an insufficient pain assessment tool as a barrier (6).

Table 6: Studies evaluating HCWs knowledge, attitude and practices on pain management

Country,1st Author and year	**Study tittle**	**Study/design population(age group,sample size)**	**Key results**
Kenya Zahra j, 2015	Knowledge and attitudes of healthcare on pain assessment and management in children,	cross-sectional survey 96 HCWs	Health staff correctly answered 16 of the 34 questionnaire questions, yielding a mean score of 47.2 percent, suggesting a significant knowledge gap.
United states in California Fearon et al,2019	Paediatric Residents' Perceived Barriers to Opioid Use in Sickle Cell Disease Pain Management	mixed methods N=53 25–34 years Paediatrics residents	53% reported resistance capability and 45% reported dependence as significant barriers to opioid use. It was impossible to treat for patients with SCD, according to 62.3 percent of residents.
United States Alabama Pack-Mabien et al.2001	Nurses' Attitudes and Practices in Sickle Cell Pain Management	Survey. N=106. 20 -39 years	63% believed drug abuse occur during scd pain. Drug abuse should not be a nursing problem, according 97%. 39% reluctant to administer high opioid doses, and 59% cite an insufficient pain assessment method as an obstacle.

CHAPTER 2: Study Justification, Research Question and Study Objectives

2.1 Study Justification

During an episode of painful crisis, pain is a big concern, and statistics indicate that it is the primary cause of admission of children with sickle cell disease. Pain is also linked to a lower health-related quality of life, which leads to higher healthcare costs—increased healthcare costs at the individual, family, and government levels. In addition, frequent and increased hospitalizations due to pain episodes are a key predictor of early mortality (29). Pain during a painful crisis has major physiological consequences in the body. A severe painful crisis is associated with critical disease complications and the harmful effects of unrelieved pain in children. To gain a better understanding of pain measurement tools. There is a significant knowledge gap among HCWs regarding pain assessment, use of pain scales/tools, and management, particularly regarding opioid use to manage pain (6). The study results will form the basis for the recommendation of routine pain management training programs during painful crises in effect promote proper pain management in during acute pain crisis and improve quality of life and reduce healthcare cost and duration of stay in hospital during admission.

The study can help recognize information gaps and consider some factors that affect optimal painful crisis management. In general science would draw knowledge provided by this study and use as a basis for additional research

2.2 Research Question

What are HCWs' awareness, behaviours, and procedures about pain assessment and care of children with sickle cell disease who present to Homabay County Hospital with an acute painful crisis?

2.7.3. Study Objectives

Broad objective

To evaluate HCWs knowledge, attitude, and practices regarding pain assessment and pharmacological treatment of pain in acute painful crisis in children and adolescents with SCD presenting at Homabay County Referral Hospital.

Primary Objectives

1. To determine among HCWs working in Homabay County Referral Hospital their level of knowledge on the assessment of acute pain in children and adolescents with SCD presenting with acute pain crisis.
2. To determine among HCWs working in Homabay County Referral Hospital their knowledge and attitudes regarding the pharmacological treatment of acute pain in children and adolescents with SCD presenting with acute pain crisis.

Secondary objective

3. To evaluate practices regarding pharmacological treatment of pain in children and adolescents with SCD presenting with acute painful crisis at Homabay County Referral Hospital through retrospective review of medical records.
4. To explore challenges that HCWs face in implementing optimal management of pain for children presenting with acute painful crisis.

CHAPTER 3: METHODS

3.1 Study design

The study had two phases - an observational crossectional survey of HCWs (phase A) and a retrospective audit of medical records phase (phase B)

Mixed methods was employed in phase A since the study had a quantitative (quan) arm and a qualitative arm.The quantitative data collection began 1st followed by qualitative (qual) which began 1 month after quantitative data collection started. We employed explanatory concurrent mixed method.

3.2 Study site

The research was conducted in Homabay County Teaching and Referral Hospital (Homabay CH), a level 4 hospital located in Homabay County, in Rangwe Constituency. The facility is open 24 hours with a bed capacity of 300. Among the services provided are Anti-retroviral Therapy, family planning, community-integrated management of childhood illness and inpatient department services, paediatrics, surgical, obstetrics, and gynaecology. Every Friday, a haematology clinic is held at the facility where children and adolescents with SCD are followed up by close monitoring. Approximately 900 children and adolescents with SCD are being monitored at the facility, with at least ten admitted monthly due to painful crisis. The hospital has qualified medical personnel, including consultants in various specialities, medical officers, clinical officers, nurses, pharmacists, pharmaceutical technologist and interns – and it also serves as a teaching facility for students at Kenya Medical Training College in Homabay.

3.3 Study Setting

The county has a population of 1,131,950 residents and an area of 3,154.7 square kilometres. In 2016, the Kenya National Bureau of Statistics registered a crude birth rate of 66.2 per 1000 people. According to the 2011 Homabay Multiple Indicator Cluster Survey. Before the report, the mortality rates for neonates, children, and children under five were 26, 51, and 130 deaths per 1000 live births, respectively, after ten years. Over the same period, the approximate infant mortality rate is 57 deaths per 1000 children who reach their first birthday (30).

Homabay County has the highest HIV prevalence in the country, at 26%, and it is located in a malaria-endemic region, with intense malaria transmission all year, complicating survival for Homabay's rural poor, with women and children under the age of five being the most vulnerable (31).

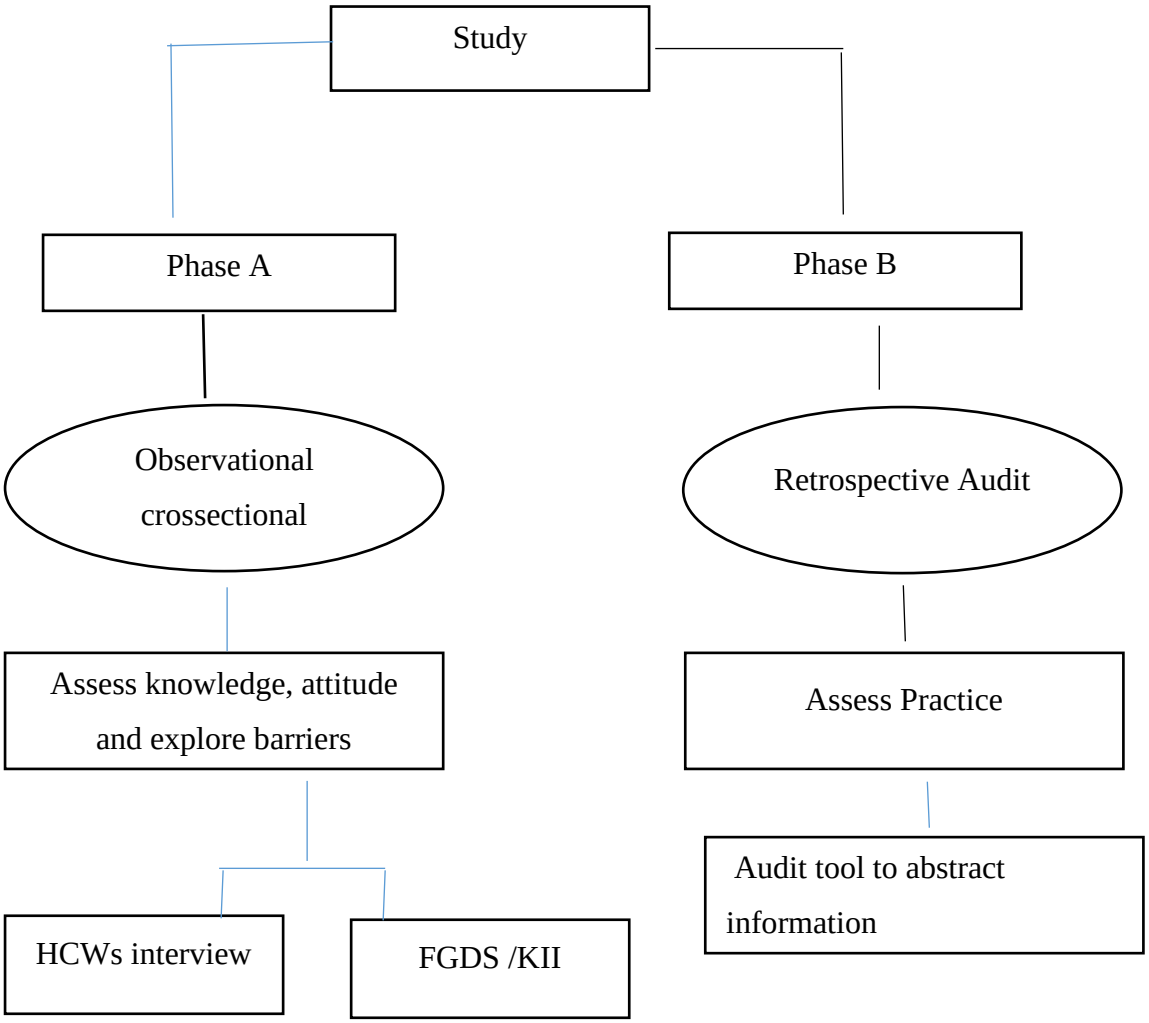

Figure 5: Flow diagram showing study design

3.5 Phases of the study

The methods used in the study were divided into observational crossectional phase and retrospective audit phase.

In the observational cross-sectional phase (phase A), we used both quantitative and qualitative methods to determine the knowledge and attitudes of health workers in pain assessment and in the pharmacological treatment of pain in acute painful crisis in children and adolescents using quantitative methods through a structured questionnaire. We used

qualitative methods to gain deeper insight into the HCW attitudes and the challenges faced by HCWs in implementing the best practices.

In the retrospective health records audit phase (phase B), we reviewed the medical records of SCD children who were hospitalized during the preceding two years(March 2018- March 2020) to evaluate the practice of HCWs in pharmacologic treatment of pain of children who were hospitalized during the last two years – this data provided insight into study objective 3.

3.6 Phase A: HCWs evaluation of Knowledge and Attitudes

This phase involved quantitative and qualitative data collection methods and provided insight into objective 1, 2 & 4. We administered a semi-structured questionnaire to the HCWs to determine their knowledge and attitudes, then gave didactic training on the topic.

3.6.1 Study population

The study population constituted health care workers (Doctors, Nurses, Clinical Officers and pharmacists / pharmaceutical technologists) who attend to the children with SCD at Homabay CH.

Inclusion criteria for HCWs

1. Nurses, clinical officers, doctors and pharmacists / pharmaceutical technologists
2. In paediatrics and medical ward during the study period in Homabay County Teaching and Referral Hospital. This is because children up to 12 years old are admitted in paediatric wards and from 13 years to 18 years are admitted in medical wards
3. Pharmacists and pharmaceutical technologist working in the main pharmacy

Exclusion criteria for HCWs

1. Health care worker with less than six months of experience
2. Health care workers with less than six months of stay in the mentioned wards
3. Health care workers who have never attended to children hospitalized with acute pain crisis.

4. Pharmacist and pharmaceutical technologist not working in the main pharmacy

3.6.2 Sample size HCWS

The study used Fisher's et al.; 1998 formula as stated below to calculate the number of HCWs to include in the study assuming proportion of 0.5 for maximum sample size;

$$N = \frac{Z^2 P(1-P)}{d^2}$$

Where:

n_0 = the sample size for large population

Z = the normal standard deviation at the required confidence level of 1.96

d = the level of statistical significance set at 0.05

P = the proportion of the characteristics being measured (0.5).

$$n_0 = \frac{1.96^2 * 0.50\ (1.0-0.50)}{0.05^2}$$

n = 385

The total number of HCWs in paediatrics and medical ward is 58. The study used the finite correction factor to compute the final sample size to achieve the desired outcome.

$$n = \mathrm{n0}\left(\frac{\mathrm{N}}{\mathrm{N}+\mathrm{n0}}\right)$$

$$n = 385\left(\frac{58}{58+385}\right)$$

n = 50

3.6.5 Definitions of Outcomes of Interest

The K&A questionnaire captures questions about the Knowledge and Attitude of the HCWs. The score obtained by the respondents were representative of the two dimensions. HCWs workers who scored between 80-100% were considered to have Good Knowledge and Attitude; those who scored between 60-79% were regarded as a moderate, while those who scored below 60 were deemed to have insufficient knowledge and attitude.

3.6.4 Evaluation of HCWs K & A

The study used a semi-structured questionnaire (Appendix II) to evaluate Knowledge & Attitude the Knowledge and Attitude questionnaire is a custom questionnaire, and the questions are from literature and domain knowledge. Different questionnaire were administered to the nurses and doctor, and each questionnaire had three section, section one for demographics, section two has questions assessing for knowledge on pain assessment and section three had questions assessing for knowledge on pharmacological treatment of pain. The questions for knowledge on pain assessment were the same for both the nurses and the doctors while questions assessing for knowledge on pharmacological treatment of acute pain crisis were different for the two cadres.

3.6.6 Study Procedures

In phase A, the study was interested in evaluating HCWs KAPs towards treatment, and here, the researcher used the K&A questionnaire (Appendix II). The information obtained in the retrospective phase complemented the data obtained used the K&A questionnaire to get reliable results.

In addition, the researcher was interested in understanding the challenges that HCWs face in implementing the best practices. An interview guide (Appendix III) was used to collect qualitative data from HCWs working in the pharmacy and paediatrics ward of Homabay Teaching and Referral hospital this included one pharmacist incharge,one paediatrician and 2 pharmaceutical technologist as Key informants in the key informant interview. The study also conducted FGDs in an open setting while observing social distancing as a measure to control the spread of the COVID-19 pandemic. The study conducted a separate FGDs for the doctors/clinicians and the nurses.

For both groups, i.e. doctors/clinicians and nurses, the study used 8 participants since they are assumed to be well knowledgeable about the topic of interest. These participants were selected purposively based on experience and willingness to participate in the discussion. The FGDs was conducted by the principal investigator with the help of a trained research assistant who is a registered clinical officer alongside, each FGDs lasted about 60 minutes, before the discussion started, we started with introduction and participants were reminded about ground rules which included respecting each other opinion, one participant to talk at

a time, to switch their phones off and ask for clarification in case they did not understand any question, purpose of the study and were informed that the discussion was being recorded and would be kept confidential and only used for study purpose, the recorder then switched on after they voluntarily consented. This audio were then recorded and transcribed verbatim. The FGDs were conducted in English and participants were given a choice to express their views in any language they are comfortable with, however they were all comfortable with English and expressed their views. This participants were involved in detailed discussion about the challenges facing the treatment of acute pain crisis in children and adolescent, discussion then ended by the moderator thanking the participant for participating and reassuring them that the information given will be kept confidential.

A key informant interview was conducted with one pharmacist in charge, one paediatrician and two pharmaceutical technologist. The researcher approached the participants and after consenting were welcomed informed the purpose of study and assured of confidentiality and the participant welcomed to give their opinion and challenges in acute pain management in children and adolescent, participant were requested and informed about the session being recorded and upon consenting the recorder switched on and participant therefore engaged in the discussion and finally the discussion ended by thanking the participants and re assured about confidentiality on the information.

This was done till saturation was reached and the KII stopped due to saturation. The responses were then recorded and transcribed later for analysis. Lastly, the study provided didactic training on the topic.

The study used a recording device to record the participants' responses in both the FDGs and the KIIs. These recordings were then transcribed before data analysis began.

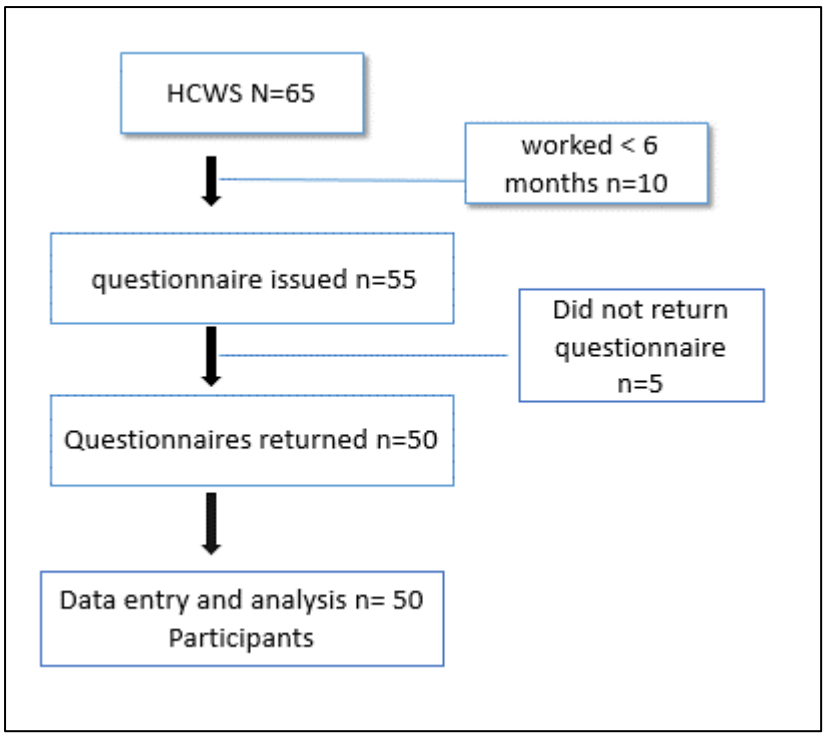

Figure 6: Screening and enrolment Phase A

3.4 Data collection

The study used both secondary and primary data, and a pilot test done for the questionnares.This pilot test was conducted among HCWs n=20,10 clinicians and 10 nurses and the process helped the researcher to identify potential problems with the survey implementation and led in minor modifications of the questionnaire. In addition it helped to identify questions that were difficult and not clear for the respondents to understand, realignment of the questionnaire, clarifying

3.7.7 Data management and analysis phase A.

To evaluate HCWs knowledge, attitudes, and practices on the treatment of pain among children admitted with pain during painful crisis in SCD, the study used both the K&A questionnaire (Appendix II) and the audit tool (Appendix I). The study gave 1 point for each correct/appropriate answer and 0 for a wrong/incorrect/unclear response. HCWs who score between 80-100% were considered to have good knowledge – in assessment or treatment of pain – those who scored between 60-79% were regarded as having moderate, while

those who scored below 60% were considered to have poor knowledge/poor/negative attitude/suboptimal practice. A test of independence (Chi-square or Fisher's exact test) was used to test if there were any differences in knowledge between the different cadres.

To explore challenges that HCWs face in implementing optimal treatment of pain for children presenting with acute painful crisis, the study collected qualitative data guided by FGDS. This data was then analysed using inductive thematic analysis with the help of NVivo software.

3.7 Phase B: Abstraction of medical records to evaluate practice on pharmacological pain management in children with SCD over preceding two years

3.7.1 Study population

The study population comprised of children diagnosed with SCD and hospitalized with acute painful crisis in the paediatrics ward and medical ward of Homabay County Hospital.

Inclusion criteria

- Children with a diagnosis of SCD aged from 6 months to 18 years old
- Hospitalized with acute pain crisis during the preceding two years (2018-2020)
- With available hospital file and treatment sheet record.

Exclusion criteria

- Children with a diagnosis of SCD hospitalized for other illnesses that do not have any pain.
- Death within one hour of admission
- Children with missing medical record on key outcome variables.

3.7.2 Sample size

The sample size was computed with reference to the two primary objectives – prevalence of adequate knowledge on pain assessment and on pain management in children admitted with acute pain crisis. The study used Fisher's et al., 1998 formula as stated below to calculate the number of children to include in the study;

$$n = \frac{Z^2 P(1-P)}{d^2}$$

Where:

n = the minimum desired sample size

Z = the normal standard deviation at the required confidence level of 1.645

d = the level of statistical significance set at …0.10

P = the proportion of the characteristics being measured. P was set at 0.50 as there are no existing studies in resource limited settings on HCW knowledge on assessment and treatment of pain in children in acute painful crisis and 0.5 would give maximum sample size.

$$n = \frac{1.645^2 * 0.50\ (1.0 - 0.50)}{0.10^2}$$

n = 67

3.7.3 Definition of key outcomes

Appropriate pain assessment: The use of pain assessment tool/scales in this case Wong-Baker FACES pain rating scale for assessing pain in children. Wong Baker pain rating scale was chosen because of its graphical presentation and can be used in children up to 18 years of age.

Correct treatment of pain: This will be based on the WHO ladder for pain management drugs dosing, route and frequency of administration. The choice of analgesics is determined by pain severity. Correct pain management is defined as follows:

- In **mild pain, Step 1** analgesic (non-opioid recommended)
- In **moderate pain, Step 2** analgesics (weak opioid+/-non opioid +/- non-opioid are recommended)
- In **severe pain, step 3,** analgesics (strong opioid+/-non opioid are recommended. Non-opioids include paracetamol and Non-steroidal Anti-inflammatory Drug (NSAIDs), weak opioids consist of codeine and tramadol, and strong opioids consist of morphine and fentanyl)

Definitions of correct dosing and frequency for each analgesic are indicated in table 8

Table 7: Defining correct pharmacologic treatment of acute pain

Medication	Formulation & route of administration	Dose and Frequency	Consideration (e.g. when to stop, step up analgesics
Paracetamol	Oral and intravenous	10-15 mg/kg 8 hourly	When pain free
Ibuprofen	Oral	5-10 mg /kg every 8 hourly	When pain free
Tramadol	Oral and intramuscular	25 mg 6 hourly not to exceed 400mg/day	When pain free
Dihydrocodeine	Oral	30 mg 6 hourly	When pain free
Morphine	Oral	0.2-0.5 mg/kg /dose every 4-6 hours for oral.0.1-0.2 mg/kg /dose every 2-4 hours	Step up during breakthrough pain and when pain is not adequately controlled. Stop when pain-free and in case of respiratory depression or sedation

Sickle cell disease: confirmed diagnosis of SCD status using haemoglobin electrophoresis test.

Acute pain crisis: SCD child with acute onset pain interfering with everyday activities, pain mostly in the back, long bones, pelvis, upper and lower limbs, abdominal pain or swelling in both hands and feet (dactylitis).

3.7.4 Study procedures

The first step taken was proposal development which entailed framing the overall study design, data collection tools and a data analysis plan. In the retrospective phase, the researcher aimed to evaluate practice of HCWs in the assessment and Practice in the pharmacological treatment of pain among children admitted with pain during acute pain crisis in SCD at Homabay county teaching and referral hospital. Random sampling approach was used to select files, and Screening of eligible files was done by the researcher with the help of research assistant, screening for eligibility by checking the completeness of the file, ineligible files were replaced using random sampling and screening for eligibility repeated until we had 67 files. All this was done at the study site. This was achieved by using an audit tool (Appendix I) to abstract data from patient files and treatment sheets retrospectively. The nurses' cardex notes were checked to obtain the information, and the progressive clinician/doctors notes, and the treatment sheets were also checked. The key variables abstracted were documented pain, the severity of pain documented, the medication given, the dosage and route of administration, interval and duration of administration.

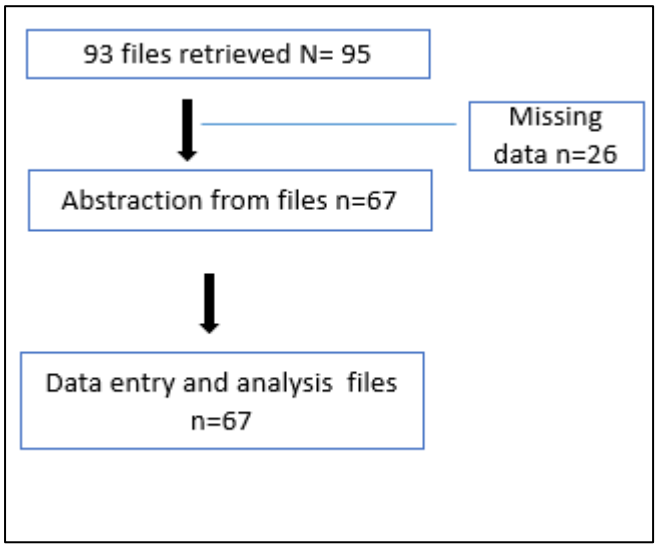

Figure 7: Flow diagram Screening and enrolment phase B

3.7.5 Data management and analysis for phase B of the study

To evaluate HCWs practice on the assessment and pharmacological treatment of pain among children admitted with pain during acute pain crisis in SCD, the study gave 1 point for each correct/appropriate answer and 0 for a wrong/unclear response – as mentioned in the prospective phase. Similarly, HCWs who score between 80-100% were considered to have

good practices regarding pharmacological treatment of pain; those between 60-79% will be regarded as medium/average, while those who scored below 60% were considered to have suboptimal practice.

Ethical consideration

Regarding privacy and confidentiality, coding of patients, information was done to protect privacy. Information gathered were held in confidence by the principal investigator and was only used for study purposes.

Before the analysis started permission was sought from the UON/KNH Ethics Research Committee to collect and analyse data. Throughout the study, strict confidentiality was maintained. Before starting the study, copies of the application, informed consent forms, and any subsequent changes to either document were submitted to the designated committee for written approval. Before data collection, informed consent was obtained from study participants, i.e. HCWs.

Confidentiality was observed and no harm anticipated and no direct monetary benefits to the participants nor financial implications transferred to participants in this study. As part of capacity building, the study provided didactic training on HCWs to equip them with up-to-date knowledge on pain assessment and pharmacological treatment in acute painful crisis in children and adolescents.

The participants' data and information was stored in soft copies, protected from unauthorized persons using a password, and hard copies kept under lock and key. The investigator was the only authorized person to access this information. Didactic training on assessment and treatment of acute pain crisis for capacity building.

Regulatory Approvals

The proposal was submitted to the University of Nairobi/Kenyatta National Hospital Ethics Research Committee for approval and clearance to conduct this study. We also seek approval from the Homabay County Hospital to carry out the research.

CHAPTER 4. RESULTS

4.1 Phase A: HCWs Knowledge regarding pain assessment

4.1.1 Characteristics of the study population (HCWs).

A total of 50 Hcws participated in this study, 42 % were male and 58% female, by cadre nurses were 48%, clinical officers 46% and doctors 6%.70 % of the participants were aged between 21-30 years of age. Those with diploma were 78% and degree being the highest level of education at 22%.By department 56 % from medicine department and 44% paediatrics department.

Table 8: Characteristics of the Health Care Workers (N = 50)

Characteristic	Detail	Frequency	Percent
Cadre	Doctor	3	6%
	Clinical officer	23	46%
	Nurse	24	48%
Age in years	21 – 30	35	70%
	31 - 40	14	28%
	> 40	1	2%
Sex	Male	21	42%
	Female	29	58%
Level of education	Diploma	39	78%
	Degree	11	22%
Department	Paediatrics	22	44%
	Medicine	28	56%

4.1.2 HCWs knowledge on pain assessment during acute pain crisis in children

5 questions were asked on pain assessment, clinicians n=26 those who got all the questions correct 5/5 were 4, 11 clinicians scored 4/5, 9 scored 3/5, 1 clinician scored 2/5 and 1 scored 1/1. In general 58 % of clinicians had a good score on pain assessment, 35% fair score, 8% scored poorly.

Nurses n=24 their scores were as follows 3 scored 5/5, 10 scored 4/5, 9 scored 3/5, 1 nurse scored 2/4/5 and 1 scored 1/5.In general 54% had a good score,38% fair score and 8% poor score.

Table 9: Knowledge questions on assessment of pain

Knowledge question on assessment of pain
1. Knows Wong Baker faces pain rating scale used in which age group
2. Knows Rating in Wong Baker faces pain rating scale
3. Matches faces in Wong Baker pain rating scale with interpretation
4. Able to assess pain severity
5. Able to identify pain assessment tools

Table 10: Clinician's scores on knowledge questions about pain assessment

n=26		
Correct Scores	**Frequency**	**Percent**
5/5	4	15
4/5	11	42
3/5	9	35
2/5	1	4
1/5	1	4

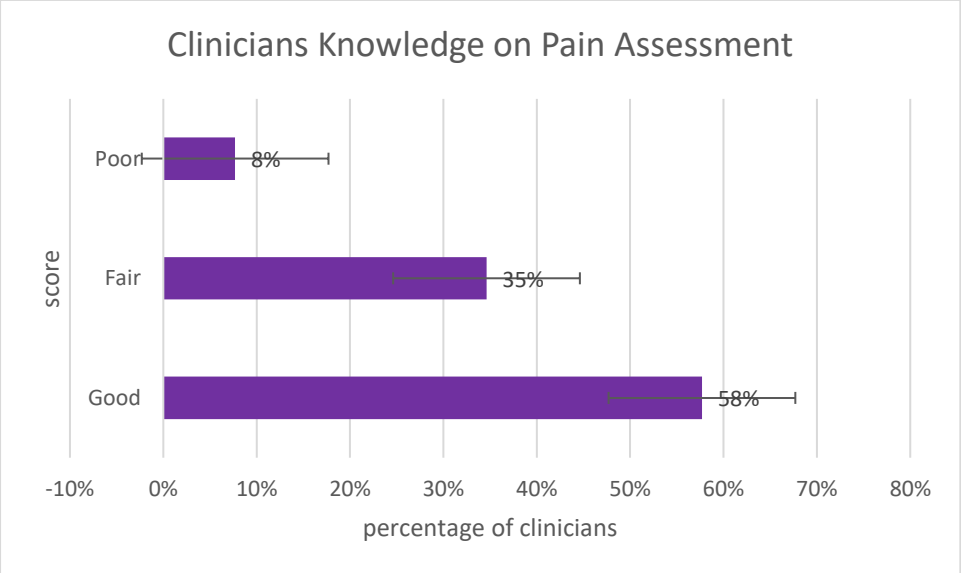

Figure 8: Clinicians Knowledge on Pain Assessment

Table 11: Nurses scores on knowledge questions about pain assessment

n=24		
Scores	**Frequency**	**Percent**
5/5	3	13
4/5	10	42
3/5	9	38
2/5	1	4
1/5	1	4

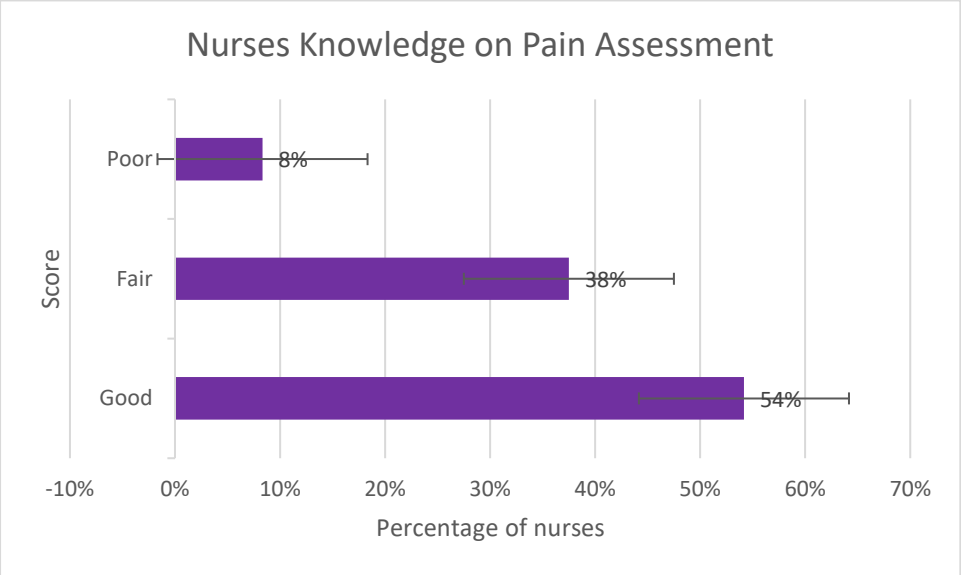

Figure 9: Nurses Knowledge on Pain Assessment

Table 12: Overall Statistical Significance

	Correct	Incorrect	Odds Ratio	P-value
Clinicians	19	7		
Nurses	18	6	14.04(3.33,59.3)	0.876914

4.1.3. HCWs Knowledge regarding pharmacological treatment of acute pain crisis in children with SCD

Knowledge of Health care workers on pharmacologic treatment of acute painful crisis in children with sickle cell disease (clinicians and Nurses)

None of the clinicians scored 10/10, 4 clinicians scored 9/10, 8 clinicians 8/10, 5 scored 7/10, 6 scored 6/10 and 3 scored 5/10.In general 54% of clinicians had a fair score and 46% had a good score.

Table 13: Clinicians' knowledge questions on pharmacological treatment of pain

Knowledge question on pharmacological treatment of pain	Correct (%)
1. Taking a Childs weight into consideration is key	96
2. Knows Paracetamol Dosage in children	96
3. Knows Duration of analgesia for morphine	42
4. Knows morphine dose should be adjusted in response to pain	89
5. Knows peak effect time for morphine given orally	58
6. Knows Sedation always proceeds opioid related respiratory depression	69
7.Able to prescribe morphine correctly	46
8. Knows correct dosage of morphine	81
9. Knows frequency of morphine administration	89
10. Aware Dihydrocodeine is contraindicated in children <12 years	42

Table 14: Clinicians scores

n=26		
Scores	**Frequency**	**Percent**
10/10	0	0
9/10	4	158
8/10	8	31

7/10	5	19
6/10	6	23
5/10	3	12
4/10	0	0
3/10	0	0
2/10	0	0
1/10	0	0

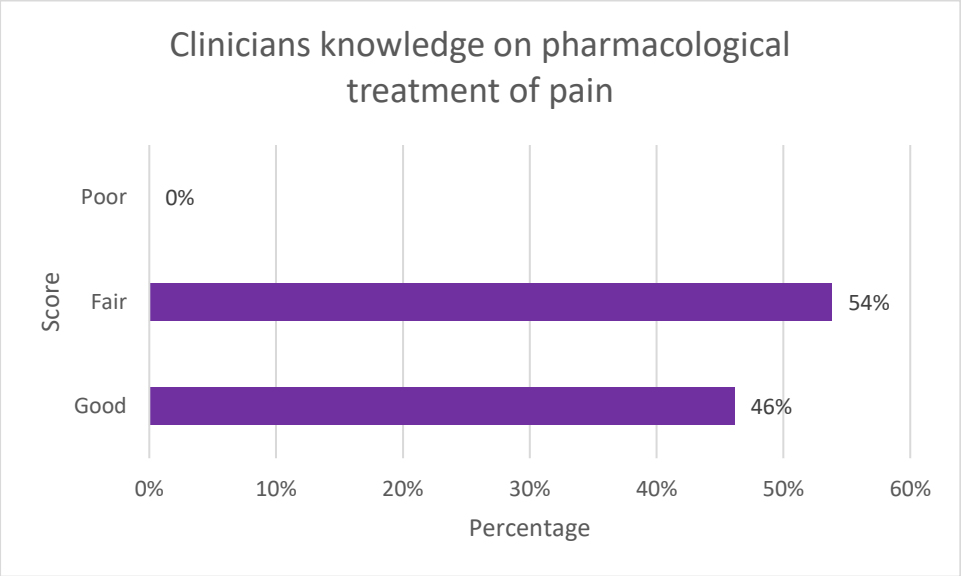

Figure 10: Clinicians Knowledge on Pharmacological treatment of pain

For nurses none scored 6/6, 2 scored 5/6, 10 scored 4/6, 11 scored 3/6, 1 nurse scored 2/6 and none score 0/6.In general 88% had a fair score, 8% good and 4% poor.

Table 15: Nurses knowledge questions on pharmacological treatment of pain

Knowledge question on pharmacological treatment of pain	Correct (%)
1. Knows use of combination of analgesics in WHO pain ladder	96
2. Knows vital signs changes are not reliable to measure pain severity	25

3. Aware about respiratory depression n as a rare complication in children and adolescents receiving opioids over a long period	21
4. Aware about history of substance not a risk of morphine addiction	50
5. Aware about recommended route of morphine	83
6. Understands that a child should not have to endure pain before being given analgesics	92

Table 16: Nurses score

n=24		
Scores	**Frequency**	**Percent**
6/6	0	0
5/6	2	8
4/6	10	42
3/6	11	46
2/6	1	4
1/6	0	0

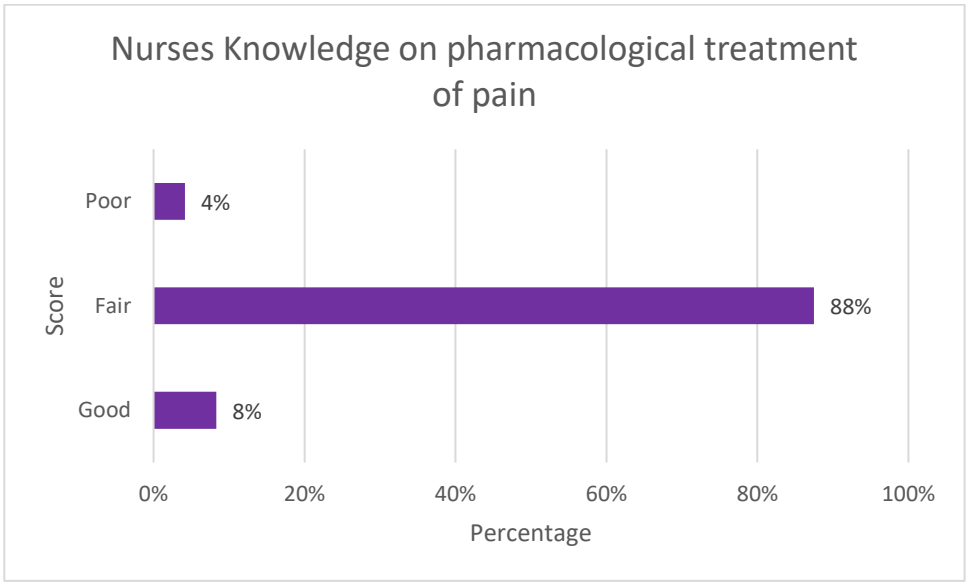

Figure 11: Nurses Knowledge on Pharmacological Treatment of Pain

4.2 Phase B: Evaluation of HCWs Practice on acute pain crisis management in children over preceding two years- Quantitative results

4.2.1 Evaluation of practices regarding pharmacological treatment of pain in children presenting with acute painful crisis in Homabay County Referral Hospital through retrospective review of medical records.

Table 17: Characteristics of children whose files were retrieved

Characteristic	Detail	Frequency	Percent
Sex	Male	38	57
	Female	29	43
Age in years	0-4	34	51
	5-9	20	30
	10-14	13	19

Table 18: Location of pain, pain severity assessment and sources of information retrieved

Characteristic	Detail	Frequency	Percent
Location of pain	Abdominal	9	13
	Chest	2	3
	Generalised	28	42
	lower limbs	21	31
	upper limbs	7	11
Pain Severity Assessed	Yes	0	0
	No	67	100
Source of treatment information	Treatment sheet	5	8
	Treatment sheet, Patient notes, Nurse cardex	62	93

Table 19: Analgesics given, dosage/route, duration analgesic given and deviation that occurred in analgesic administration

Initial Analgesic Given	Correct Dosage/Route		Duration	Deviation that Occurred in Administration	
Morphine(n=40)	Yes	37	Too Short 3 Correct 24 Too Long 12	inconsistent timing of dose Missed doses Missed doses, inconsistent timing of dose	1 3 1 9 3
	No	3			
Ibuprofen, Morphine(n=7)	Yes	7	Too Short 1 Correct 4 Too Long 2	inconsistent timing of dose Missed doses Missed doses, inconsistent timing of dose	3 2 0
	No	0			
Paracetamol, Morphine(n=9)	Yes	9	Too Short 0 Correct 7 Too Long 2	inconsistent timing of dose Missed doses Missed doses, inconsistent timing of dose	1 3 2
	No	0			
Ibuprofen, Tramadol, Morphine(n=1)	Yes	1	Too Short 1 Correct 0 Too Long 0	inconsistent timing of dose Missed doses Missed doses, inconsistent timing of dose	0 1 0
	No	0			
Ibuprofen(n=3)	Yes	3	Too Short 1 Correct 1 Too Long 1	inconsistent timing of dose Missed doses Missed doses, inconsistent timing of dose	0 0 1
	No	0			
Ibuprofen(n=3)	Yes	3	Too Short 1 Correct 1 Too Long 1	inconsistent timing of dose Missed doses Missed doses, inconsistent timing of dose	0 0 1
	No	0			
Paracetamol(n=6)	Yes	5	Too Short 2 Correct 3 Too Long 1	inconsistent timing of dose Missed doses Missed doses, inconsistent timing of dose	1 0 0
	No	1			
Paracetamol, Ibuprofen(n=1)	Yes	1	Too Short 0 Correct 1 Too Long 0	inconsistent timing of dose Missed doses Missed doses, inconsistent timing of dose	0 1 0
	No	0			

Morphine (strong opioid) was started n=40 as initial analgesics, 37 received correct dosage of morphine and was given correct route, 24 of the children received morphine appropriate days while 12 were given for too long and 4 for a short duration of time.19 missed their dosages, 13 dosages were given at inconsistent timing while 3 had both inconsistent dosage timing and missed dosage.

Ibuprofen (NSAID) n=3 as initial analgesic, correct dosage and route 3, short duration 1, correct duration 1 and long duration 1, both inconsistent and missed dose 1.

Paracetamol and morphine n= 9, 7 were given appropriate duration, inconsistent timing 1, missed dose 3, both inconsistent and missed dose 2.

Ibuprofen morphine and tramadol (NSAID, weak opioid, strong opioid) n=1, was given correct route and dosage 1, short duration 1 and missed dose 1

Paracetamol n=6,5 doses given correctly route and dosage, too short duration 2,too long 1,3 received appropriate duration,1 inconsistent timing of dose

Paracetamol and ibuprofen n=1, correct route and dose 1, was given for correct duration, inconsistent timing of dose 1.

Tramadol (weak opioid) none.

4.3 Qualitative Results (FGDs and KII)

To explore challenges that HCWs face in implementing optimal management of pain for children presenting with acute pain crisis and to further explore Hcws attitude on the subject.

Two FGDs were done separately, one for clinician with 8 participants and one for nurses with 8 participants and their characteristics summarized in the table below.

Four KII were also done with paediatrician, pharmacist in charge, and 2 pharmaceutical technicians.

Table 20: Characteristics of HCWs who participated in FGDs and KIIs

Characteristic	Detail	Frequency	Percent
Cadre	Doctor	2	10
	Clinical officer	7	35
	Pharmacist	1	5
	Pharmaceutical technicians	2	10
	Nurses	8	40
Age in Years	21-30	6	30
	31-40	10	50
	> 40	4	20
Sex	Male	12	60
	Female	8	40
Level of education	Diploma	14	70
	Masters	1	5
	Degree	5	25
Department	Paediatrics	11	55
	Pharmacy	3	15
	Medicine	6	30

Table 21: Themes and quotes from FGDs and KII

Main themes	Theme explained	Quotes to support themes
Frequent morphine stock out	It was noted that morphine was out of stock most of the times and this affects care of patients following this increased frequent stock outs	*"sometimes our pharmacy will run short of these Opioids so it forces the patients to go have them from the outside pharmacy, and sometimes you will see these patients are financially unstable, and this Morphine somehow it's an emergency, you see it becomes very hard to administer the drug in pain management".* **FGD, clinician, male**
Gap in pre-service training	Gap in pre service training on management of acute pain crisis, HCWs were not comfortable to manage acute pain crisis after their formal training	"*thank you very much, it's truly has been challenging usually the people who train in different parts of Kenya where we get rare cases of sickle cell so when we came back to this lakeside, lakeside it required more mentorship and experience to come up with good rich of management*". **FGD, clinician, male**
Difficulty in accessing morphine in the pharmacy when available	Opioid access in the pharmacy appears to take a long process thus long waiting time for the patient to get analgesics	"*okay, the challenge I have seen, when you prescribe a morphine for example, they always need either a registered clinician either to write the number before they give out the morphine, so it's not easy to get the Morphine, maybe the patient is in severe pain but they still need somebody from somewhere else to come and write the number just to get the drug, I think that is one of the challenges I have seen."* **FGD, clinician, male**

Role in opioid safety	To educate patients on side effects of morphine and ensure all clinicians prescribe morphine correctly	*prescriber may not be sure of what is there in the pharmacy or not be sure of the dosage, so you may find a child has been prescribed 10mg per ml that is high does, so we may hold the prescription to consult, then again we ring the prescriber to ask him/her why she /he prescribed this for this patient, if she explains to us if these is okay and again we feel these is not okay, we will again inquire more before giving it out, yes*”**. KII, Pharmacy, male**

4.3.1 Main themes from the qualitative analysis

Frequent opiate stock outs

It was noted that morphine was out of stock most of the times and this affects care of patients following this increased frequent stock outs

“I think I concur with Doc it’s a bit challenging, yes because the one you find that as she was saying, you find the drugs may not be available, unto that attitude of the patients towards the management may also contribute to some extent of the management, why, when you tell maybe a patient okay times a drug may be out of stock, you tell the patient go and buy these we really need it, it’s very urgent because in pain management we don’t have to hesitate, yeah, there is no time for hesitation or thinking about what do we do next if these one doesn’t fail, it a matter of caring urgently and when the parent or whoever is there as a caretaker of the patient fails to turn up and say if it’s not there, let me go and buy our pain management may fail, so it’s challenging”

FGD, clinician, male

*“*sometimes our pharmacy will run short of these Opioids so it forces the patients to go have them from the outside pharmacy, and sometimes you will see these patients are financially

unstable, and this Morphine somehow it's an emergency, you see it becomes very hard to administer the drug in pain management*".* **FGD, clinician, male**

Difficulty in accessing morphine in the pharmacy when available

Opioid access in the pharmacy appears to take a long process thus long waiting time for the patient to get analgesics and mostly this happen with access to the pharmacy. This is due to difficulty in accessing morphine when available due to administrative barriers

Regulation requires clinicians license number different formulation dosage sometimes only adult dose formulations is available

"*yeah, we have concerns, because since it's a controlled drug, we only give it to patients after it has been prescribed and the prescription must have the details of the prescriber, registration number included and also the diagnosis of the patient, must also be there, we will be able to know that since we will be noting them down, so that is the concern*". **KII, pharmacy, male**

"*that one happens since sometimes you find the prescriber is not sure of the dosage or the formation of the drug like Morphine we have one milligram per one ml, and again we have 10mg per ml, so the prescriber may not be sure of what is there in the pharmacy or not be sure of the dosage, so you may find a child has been prescribed 10mg per ml that is high does, so we may hold the prescription to consult, then again we ring the prescriber to ask him/her why she /he prescribed this for this patient, if she explains to us if these is okay and again we feel these is not okay, we will again inquire more before giving it out, yes*". **KII, Pharmacy, male**

"okay, the challenge I have seen, when you prescribe a morphine for example, they always need either a registered clinician either to write the number before they give out the morphine, so it's not easy to get the Morphine, maybe the patient is in severe pain but they still need somebody from somewhere else to come and write the number just to get the drug, I think that is one of the challenges I have seen." **FGD, clinician, male**

"I don't have anything new to add except maybe to stress on the point of the prescription part, maybe a qualified person prescribes and goes away so when you are going to get most of the time it's us who prescribe to they are called the prescriptions, but now you don't have this registration number so from my experience it delays even the start of medication because you

have to try and reach out and others are not comfortable just dishing out their licenses, so it's also a gap plus the stock-outs". **FGD, nurse, female**

"*I just wanted to add that it also depends on the availability of that Morphine, you may not have it you may have an option and maybe perhaps what the doctor has assessed is totally different with what the nurse accesses that it does not warrant the patient to get Morphine, so it can also be discussed and changed*". **Nurse, FGD, female**.

Gap in pre service training.

It also emerged that HCWs were not comfortable to manage acute pain crisis after their formal training as supported by quotes below there is Gap in pre service training on management of acute pain crisis, HCWs were not comfortable to manage acute pain crisis after their formal training

"*To manage acute pain crisis was challenging after my college because training was theory as indicated by nurses, it is more of on job training, you see when you read from the book or you have just read it without seeing the patient and now here you see the patient practically the patient is in severe pain, you feel somehow challenged on managing the pain, yeah, and that's the point*". **FGD, clinician, male**

"thank you very much, it's truly has been challenging usually the people who train in different parts of Kenya where we get rare cases of sickle cell so when we came back to this lakeside, lakeside it required more mentorship and experience to come up with good rich of management". **FGD, clinician, male**

"*actually maybe on my side what I can say is a little bit challenging because from what I used to know like for example these one sickle cell crisis from what I used to know was just super rehydration, I didn't know of Morphine and these one came when I was doing my locum at a clinic, a peripheral clinic I just did the super-rehydration forgetting of the fluid overload forgetting and other things, little did I know I had to us Morphine, so it was challenging on my side*". **FGD, clinician, female**

"I can say it has been an on job thing because in school it's not that detailed so it's about interest once you are in the field then it's about how aggressive you are, so for me it has been

an on job so for me I cannot really say the kind of knowledge I have now is the same as the one I acquired at school, so the on job thing is really helpful". **FGD, Nurse, female**

"so I can say it's an on job thing because even in knowledge I feel maybe those time of school we didn't see much of these cases so when I graduated and I happened to manage them now, you know what you do on job you get more equipped than in school because in school you only do the theory and I can say that currently am more equipped but after training I wasn't that much". **FGD, nurse, male.**

"*I want to say that I was not comfortable, for the first time I was not comfortable, why, just the same way I said the other time, sickle cell patient does not just come with that pain, there is something accompanying them, if you find any child with acute chest syndrome you will find at one point there is some Pneumonia coming in here, if you find another one coming with very severe pain you do BS you will find there is some malaria coming in here, so already these child or these patient is coming in with two different things that need to be managed, you manage malaria you leave the pain still you have not sorted out the patient, you manage the pain you leave malaria, there is nothing you have done and for you to come to your senses and think that,ooh there must be something that must trigger these thing, you see that it needs some experience you can just get out of school and think you have to think over and about, yes so me for the first time I was really challenged but everything is getting well***". FGD, clinician, male**

"as for me, children older I will not have any issue giving Morphine but with neonates it's a bit tricky because there is those like there is once we one gave Morphine as a fear as the timely dose we could give but we saw some adverse reaction to this neonate, that to me giving Morphine to neonates am still fifty fifty with it". **FGD, nurse, male**

Role in opioid safety

Educate patients on side effects of morphine and ensure clinicians prescribe morphine as required.

"*prescriber may not be sure of what is there in the pharmacy or not be sure of the dosage, so you may find a child has been prescribed 10mg per ml that is high does, so we may hold the prescription to consult, then again we ring the prescriber to ask him/her why she /he prescribed*

this for this patient, if she explains to us if these is okay and again we feel these is not okay, we will again inquire more before giving it out, yes". **KII, Pharmacy, male**

HCWS attitude on management of acute pain crisis

HCWs had a negative attitude in management of acute pain crisis

1. Fear of addiction to morphine. Negative attitude concerning a child being addicted to morphine when they cry or report to be in pain despite getting several doses of morphine which the HCWs expect to have cleared the pain and not to require more opioids.

2. Fear of morphine side effects such as respiratory distress, constipation and difficulty in weaning off morphine

3. There was laxity on the HCWs side on actual administration of opioids when prescribed the time taken to go and collect the drug and administer it

4. There was a negative attitude towards children who sometimes HCWs say they pretend to be in pain so as to be absent from school

5. Parents seem to over report or exaggerate their children pain this was reported by HCWs who seem not to be concerned about a parent/caregiver when they report their child's pain

5.Previous history of drug abuse in adolescents will make a HCWs not to give morphine to a child in pain crisis since they think it will make the adolescent more addicted and HCWs doesn't think this adolescent deserve to use morphine below are quotes from FGDs and KII to support

Fear of addiction

Fear of addiction to morphine thus there is fear in giving high doses of morphine to patients and clinicians are fearing that weaning off morphine becomes difficult due to addiction

"*Opioids, yes, one we are very aware they are very addictive, they are very addictive and their prolonged use also comes with their own consequences and this is someone they uses these drug for some time, tapering down and weaning them off becomes a challenge, so take something like Morphine a child wants to go home with Morphine which is very dangerous what if others realizes these is a very nice drug and they start using it, that's already a drug addict in the community, you see that, yeah and they will always try to compensate, if they don't get it*

they will have to compensate on if there is, in case of any other drug that may substitute they will have to go for it because failure to use it they will feel some hangover and other things, so my real concern is to check again on the dispensing and use of these drug". **FGD, clinician, male**

Respiratory distress and other side effects

Fear of a child getting respiratory distress was a concern while a child is being given morphine, other complications constipation and this affects acute pain treatment as a child who deserves treatment with morphine will not get it, other complications such as constipation and difficulty in weaning off morphine.

"*well we do have concern actually, it's quite challenging, you may be managing a sicklier in painful crisis, you give Morphine it come an overdose, goes to respiratory distress, you don't have an antidote, when you don't have oxygen administration becomes a challenge, you don't know what to do next so as Morphine is being availed, or these other Opioid can the antinode too be availed in cases of overdoses and sensitivity reaction*". **FGD, nurse, female**

"I *am concern we do give these Morphine yes, some are written PRN, but you can administer morphine and the next one hour the child is still crying of pain, so I don't know whether its addiction or the patient keeps on crying, you adjust the doses but the patient will not respond, so you think of psychological, addiction, so is still a challenge".* **FGD, nurse, female**

Poor clinical judgement

Poor clinical judgement as sometimes the one administering the analgesic use their own judgement instead of what has been prescribed and the one dispensing the analgesics specifically morphine decides to change what has been prescribed

"*I think another great challenge is the change of prescription, you find you have prescribed as a clinical officer or as the MO who is there but on reaching the pharmacy, because you know cant prescribe and at the same time go with the prescription to the pharmacy, you will give the nurse, go get the drug and bring, you find that when they get to the pharmacy there is a change*

in prescription that comes in and you even wonder why such is happening, maybe you have your personal reasons why you were prescribing such a drug of these amount but they want to bring it down thinking that maybe you over prescribed or things of that sort, I mean change of prescription is another challenge we have in our pharmacy". **FGD, clinician, male**

There was laxity on the HCWs side on actual administration of opioids when prescribed the time taken to go and collect the drug and administer it "…*say laxity on our side as the staffs, you will find out maybe you have prescribed morphine but now when it comes to the nurse to go and maybe collect the Morphine from the pharmacy, they take time until they see this patient is really in pain…",* **FGD, clinician, female**

"*you will find out that maybe you have just prescribed that morphine but you have not documented it clearly in the treatment sheet, so maybe this patient or you had a break through does but you didn't document it so you will find out like these patient is just getting the previous dose he was getting instead of getting additional break through dosage*".**FGD, clinician, female**

*"Okay, my concern when an opioid is prescribed to a child or adolescent, first of all I won't just give it, I will have to look at the condition of that patient, if the patient qualify I will give but he/she doesn't, I will further inquire or consult before giving it out***". KII, Pharmacy, male**.

"*first the dosage, we check the dosage and the dosage, after the dosage we will check the patient, who the patient is looking at the details of the patient, after that will look at the dosage what has been prescribed if it's right we will release it but if we question the dosage as per details of the patient, we will raise a concern".* **KII, pharmacy, male**

"the other concern I think I may have when prescribing opioids for children and adolescents like Doc said the history, is there history of drug use, yes not only the Opioids is there a history especially adolescents is there a history of drug use and if there is history of drug use, let's say narcotics drugs. **FGD", clinician, male**

"my feeling if morphine is to be given every four hours, then it should be so, other than you wait until the patient start experiencing pain is when you give Morphine". **FGD, clinician, male**

"*I will urge all of us to be responsible, let's just be responsible because there is no way you can tell me this child need Morphine I prescribe today the child is being given the full dosage of Morphine then tomorrow you come to me with the same prescription you need morphine, where did that morphine go, so me I think the regulation has to be strict maybe to be more strict so be most straight, yeah, I won't say maybe they soften on that*. **FGD, clinician, female**

Parents seem to over report or exaggerate their children pain this was reported by HCWs who seem not to be concerned about a parent/caregiver when they report their child's pain

"Caregivers/parents, Some especially informed parents or medic parents usually resist that is why it is important to talk to them i.e. provide them with literacy on sickle cell while others have beliefs on medication e.g. injection rather than oral medication and they will refuse the child to be given oral medication because it the injection that works best".**FGD clinician**

"*patient has been admitted in the ward and maybe the father or the mother is a medic or a nurse, and according to the person who was treating the patient who has graded the pain has graded the pain and has decided maybe on a Tramadol then they find the parent of the child because he/she is a medic, he wants Morphine, so with him, he feels like the pain is not being managed correctly".* **FGD, clinician, male**

"*Sometimes you find is the caregiver who is in much pain than the sick child, and they want you to treat the pain aggressively*" **FGD clinician male.**

"*when they stand and resist and you know we also have patient rights, when they stand and resist especially leave alone the medic, medics may understand but someone who is fully informed with no medical knowledge, my friend managing such people is not easy and they resist, they even make noise in the ward that you are mismanaging their patient and the child is* also in pain

FGD nurse male.

4.4 Solutions from FGDS and KII

1. Need for CMEs on giving morphine

2. Need to counsel and educate care givers mostly family centred care should be applied

3. Need to re assessing patients pain and grade the pain after giving analgesics

"*that is, I think we also need to look, give a lot of CMEs to our nurses, that they should know the percentages, then they get changes, they should know the right time to give and confirm with the doctor on how to consider adjusting dosages, Morphine dosages in time and to work*". **FGD, clinician, male**

"*maybe another thing, lets observe our clients or our patients like lets monitor these pain after every one hour, four hours or after every dosage of Morphine, after giving it maybe something like thirty minutes, go and assess, how is these pain, maybe is it improving or is it worsening even after you have done maybe the breakthrough dose*" **FGD, Clinician female**

"I think each and every patient has to be managed like specifically with how they presented and how you initiated that Morphine, I think that is the way". **FGD, clinician, female**

"*what I want to urge maybe my colleagues or in future may be done, let's be trained on how to also maybe counsel these caregivers because most of them you feel like when you are a mother when your child goes through that pain you also experience the same pain, so let's reassure these caregivers, lets also put them into concern like when we are giving this morphine, let's reassure them and also tell them to purchase the naloxone…."* **FGD, clinician, female**

"I would also want to add on top of the antidotes that we never have, the other drugs that go with morphine, like when the morphine we know it reduces the intestinal motility, so the drug that goes with it, the laxative I think they could also look into that, and another concern, not all of us are vast with the updates and not all of us have that interest or rather to look at books, maybe the habit of holding CMEs every now and then is a Phase, so this is also a concern, thank you". **FGD, nurse, male**

"*okay, I think on the opioids the prescribers and the clinician nurses, there should be education or they should have some kind of training on the dosage, on the uses, on the effects, I feel most*

of the prescribers are not aware of the exact dosage so they just do prescribing, and sometimes we feel like when we go to confirm, on check with them it feel like there we are delaying, we are giving them a double work so I suggest we should have a training or education for health care providers, it will help very much”**. KII, pharmacy, male**

“*maybe we can add on that, maybe the CMEs we need to be taken through maybe that grading pain and then like we make it a routine because even we are having the staff maybe are being changed, there is a rotation, maybe these one will help in improving on our way of grading pain and the management”.* **FGD, clinician, female**

CHAPTER 5: DISCUSSION

This study is the first of its kind in western Kenya to examine the level of knowledge, attitudes and practices of HCWs towards pain assessment and pharmacological treatment of children and adolescents with in acute pain crises. The quality of pain treatment depends on the HCW's knowledge, attitude and practice and each health care worker is forming a cornerstone in the management of acute pain crisis. HCWs make and implement the decision concerning pain management; thus, effective pain management is related to HCWs Knowledge, attitude and practice. Acute pain crisis management needs a multidisciplinary team and in order to adequately alleviate pain in this children HCWs are key.

Acute pain crisis is also the most common complication of, and pain affects the quality of life and children's activity.

From this study, the Health Care Workers' knowledge of pain assessment during acute pain crisis was found to be good since the majority of HCWs had a good score clinicians 58% had a good score while nurses majority scored 54%.However there is no statistical significance difference between the clinicians score and nurses score as p value was 0.8769 Comparing to a study done in Bahrain, Nurses 'knowledge and attitudes toward pain assessment and management for adult sickle cell disease patients during sickling crisis Yaqoob et al. 2015 (26)

Yaqoob et al the results the study showed that staff nurses had poor knowledge and negative attitudes toward pain assessment and management during pain crisis. The findings showed no significant difference in knowledge in relation to nationality, level of education, years of experience and previous training courses or workshops on pain management. The difference in the results could be due to study site, and study population. This study included clinicians while the other study only had nurses.

A study done in Sudan Alhassan et al. showed there was a significant gap of knowledge among pediatric residents regarding pain assessment and management in children, which was reflected as lack of awareness of pain assessment tools/scales in children and distorted knowledge about children opioid use. The attitude towards pain management in children was generally positive among these residents (25)

Knowledge on the pharmacological treatment of acute pain in clinicians was found to be fair for the clinicians who 54% scored fair and 46% scored well, for nurses majority the score was fair as 88% had a fair score. A study done in Benioff children's hospital by Fearon et al. 2019, among pediatric residents showed providers were concerned about addiction and tolerance to opioids when managing patients with acute pain crisis (28).

A similar study by Fearon et al. showed that pediatric providers had more positive attitudes toward patients with than adult providers (28).

HCWs attitude in this study was found to be negative. This is different from previous research by Fearon et al. perhaps because the study population had both health care workers working in pediatrics and medicine department while Fearon only included pediatrics residents these are people who are passionate about children and work with children everyday unlike in this study.

The practice was found to be poor in this study as no assessment of pain severity was documented in the patients files, while in most cases, the children were started on morphine(strong opioid) in 60% of the patient as the initial analgesics, tramadol (weak opioid) was not used and ibuprofen(NSAID) was used for escalation when more painkillers needed. This is different from other studies for example, in Jamaica, a study showed that 54% of cases of acute painful crisis with mild to severe pain had their pain resolved/addressed with non-opioid analgesics, while 46% of the patients required further treatment with opioids analgesics (21).Strong opiate such as morphine was widely used as an initial analgesic despite frequent stock out because caregivers were given prescriptions and could get the drug outside the hospital.

In Thematic analysis, challenges that were facing HWCs included fear of side effects of morphine. Morphine stock outs and a gap in pre service training. The mentioned side effects were, fear of addiction, respiratory distress difficulty in weaning off morphine and constipation. A study done in Alabama by Pack-Mabien et al. among nurse's attitudes and practice on managing sickle cell pain crisis showed that the nurses believed that addiction to opioids was prevalent and feared administering high doses of opioids, though the concern about addiction decreased as nurse age increased $p<0.005$. Nurse reluctance to give opioids, narrow range of

analgesics and belief that most sickle cell patients were drug addicts were barriers identified by Pack-Mabien.

Pack-Mabien findings are similar to this study as also stock-outs were a significant challenge. In his study, some of the generated solutions to the identified barriers were education on sickle cell disease and pain assessment and management. These findings are similar in that in this study, some generated solutions were continuous medical education to HCWs (6).In regards to research direction further studies are needed to assess knowledge attitude and practice toward non-pharmacological treatment of pain, as this study focused on pharmacological treatment only.

Dissemination of Results

The study findings were presented first to the UON department of Pediatric child health, KNH/UON ERC, after completion of the manuscript, it will be sent to an academic journal for approval of publication to reach a broader public and for further dissemination, discussion, and policy interventions and advocacy for children living with SCD.

Study Strengths and limitations

Strengths

The study conducted a pilot test of the data collection tool the questionnaire in order to test them.

Approach using various study methods allows for robust data collection, in-depth data and provide multiple view point

Interviews were not restrictive and could be guided and redirected in real time.

Limitations

Since the study used retrospective data for the medical records abstraction phase, we anticipate missing information on a couple of critical variables due to the clinical staff's incomplete documentation. This was mitigated using both patient files and treatment sheets to get data on all the essential variables.

Moderator bias which was mitigated by the moderator being neutral with no non-verbal communication during the FGDs and KII discussion

We may not be able to generalize our results and small sample size is likely to bias our findings

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

1. Health care workers had good knowledge regarding pain assessment during acute painful crisis

2. HCW's knowledge on pharmacological pain treatment was fair for both the nurses and clinicians, as the majority had a moderate score

3. HCWs had a negative/fearful attitude towards use of opiate analgesics during acute pain crisis in children, specifically fear of side effects such as addiction, respiratory distress, difficulty in weaning off morphine and constipation.

4. Health care workers' practice regarding pharmacologic treatment of acute pain crisis management was suboptimal, despite having good knowledge on treatment, the actual implementation of the knowledge is poor.

5. Challenges that were facing HWCs included opiate drug stock outs, difficulty in accessing morphine when it was available due to administrative barriers, and inadequate pre-service training regarding management of painful SCD crisis.

6.2 Recommendations

1. HCWs/Hospitals should ensure a reliable supply of the needed analgesics, especially opioids, both morphine and tramadol, to manage pain adequately.
2. There is a need for regular refresher training to be made practical to enable HCWs to implement and practice what they already know and continuous medical education on opioid use.
3. Dissemination of guidelines to enable reference and implementation of the guidelines to help improve practice.
4. Integration of acute pain crisis management in the pre service training
5. This research recommends further studies to explore why there is a gap in the actual implementation of pain management while the knowledge is sufficient.

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APPENDICES

APPENDIX I: AUDIT TOOL TO EXTRACT INFORMATION FROM THE MEDICAL FILES

SECTION A: IDENTIFICATION SECTION		
Qn101: Date of data collection	_____/_____/_____	dd/mm/yyyy
Qn102: Name of enumerator	_____	Insert your name
Qn103: Questionnaire ID	_____	Insert questionnaire ID
SECTION B: BIO DATA		
Study ID	_____	Insert Study ID
Date of Birth	_____/_____/_____	dd/mm/yyy
Date of Admission	_____/_____/_____	dd/mm/yyy

Age in years and months	_____	Insert Age in Years & Months
Sex	1. Male 2. Female	Select one
Ward	1. Paediatrics 2. Medical	Select one
SECTION C – PART A: CLINICAL INFORMTION		
Qn301: Presenting complaints?		
Qn301a: Pain	**1. Yes** **2. No**	**Select one**
Qn301a1: If Yes to pain, Location of pain	1. Lower limbs 2. Upper limbs 3. Hands 4. Feet 5. Chest 6. Other specify _____	Select one
Qn301a2: If Yes to pain, Duration of pain in days:	_____ days	Insert
Qn301b: Easy Fatigability	**1. Yes** **2. No**	**Select one**
Qn301c: Yellowness of the eyes	**1. Yes** **2. No**	**Select one**
Qn302: Weight in kgs	_ _____ Kgs.	Weight in Kgs. Leave blank if no weight documented
SECTION C - PART B: OTHER RELEVANT CLINICAL INFORMATION		

Qn303: HB	_____	Insert
Qn304: Number of hospitalisations in previous 3 years	_____	Insert
Qn305: Date and age of hospitalisations:	Age _____	Date _____/_____/_____
	Age _____	Date _____/_____/_____
	Age _____	Date _____/_____/_____
	Age _____	Date _____/_____/_____
PHARMACOLOGIC TREATMENT ABSTRACTION		
Qn306: Source of treatment information	1. Treatment sheet 2. Patient notes 3. Nurse Cardex 4. Other specify_____	Select one
Qn307: Analgesics list	1. Paracetamol IV/ oral 10-15mg/kg 8 hourly 2. Ibuprofen 5-10 mg/kg orally 8 hourly 3. Tramadol p.o/im 25mg 6 hourly not to exceed 400mg /day 4. Dihydrocodeine oral 1-4 yrs 0.5mg/kg 4-6 hourly,4-12 yrs 0.5-1mg/kg 4-6 hourly (maximum 30mg) 5. Morphine oral 0.2-0.5 mg/kg/dose 4-6 hourly. I.V/I.M 0.1-0.2 mg/kg/dose 2-4 hourly	Select all that apply

DRUG A		
Day prescribed	_____/_____/_____	dd/mm/yyyy
Day of admission:	1. Day 2 2. After Day2, Specify day _____	
Dose in MG / kg / dose	_____	Insert
Dose /kg interpretation:	1. Within acceptable dose range 2. Low 3. High	Select one
Frequency of dosing prescribed	Every _____ hours	
Frequency acceptable?	1. Yes 2. Too low 3. Too frequent	Select one
ASSESSMENT OF ACTUAL ADMINISTRATION BY NURSING STAFF		
Was the drug given as prescribed?	1. Yes 2. No	Select one
If No, what deviations occurred?	1. Missed doses 2. Inconsistent timing of dosing 3. Other, specify _____	Select one
Duration given	1. _____ days 2. Not documented	
Criteria for stopping documented?	1. Yes 2. No	Select one
If Yes specify below	_____	
If No	1. NA 2. Not documented	Select one
Escalation done?	1. Yes 2. No	Select one
Criteria for escalation documented?	1. Yes 2. No	Select one
If Yes specify below	_____	
If No	1. NA 2. Not documented	Select one

DRUG B		
Day prescribed	_____/_____/_____	dd/mm/yyyy
Day of admission:	1. Day 2 2. After Day2, Specify day _____	
Dose in MG / kg / dose	_____	Insert
Dose /kg interpretation:	1. Within acceptable dose range 2. Low 3. High	Select one
Frequency of dosing prescribed	Every _____ hours	
Frequency acceptable?	1. Yes 2. Too low 3. Too frequent	Select one
ASSESSMENT OF ACTUAL ADMINISTRATION BY NURSING STAFF		
Was the drug given as prescribed?	1. Yes 2. No	Select one
If No, what deviations occurred?	1. Missed doses 2. Inconsistent timing of dosing 3. Other, specify _____	Select one
Duration given	1. _____ days 2. Not documented	
Criteria for stopping documented?	1. Yes 2. No	Select one
If Yes specify below	_____	
If No	1. NA 2. Not documented	Select one
Escalation done?	1. Yes 2. No	Select one
Criteria for escalation documented?	1. Yes 2. No	Select one
If Yes specify below	_____	
If No	1. NA 2. Not documented	Select one

DRUG C		
Day prescribed	_____/_____/_____	dd/mm/yyyy
Day of admission:	1. Day 2 2. After Day2, Specify day _____	
Dose in MG / kg / dose	_____	Insert
Dose /kg interpretation:	1. Within acceptable dose range 2. Low 3. High	Select one
Frequency of dosing prescribed	Every _____ hours	
Frequency acceptable?	1. Yes 2. Too low 3. Too frequent	Select one
ASSESSMENT OF ACTUAL ADMINISTRATION BY NURSING STAFF		
Was the drug given as prescribed?	1. Yes 2. No	Select one
If No, what deviations occurred?	1. Missed doses 2. Inconsistent timing of dosing 3. Other, specify _____	Select one
Duration given	1. _____ days 2. Not documented	
Criteria for stopping documented?	1. Yes 2. No	Select one
If Yes specify below	_____	
If No	1. NA 2. Not documented	Select one
Escalation done?	1. Yes 2. No	Select one
Criteria for escalation documented?	1. Yes 2. No	Select one
If Yes specify below	_____	
If No	1. NA 2. Not documented	Select one

DRUG D		
Day prescribed	_____/_____/_____	dd/mm/yyyy
Day of admission:	1. Day 2 2. After Day2, Specify day _____	
Dose in MG / kg / dose	_____	Insert
Dose /kg interpretation:	1. Within acceptable dose range 2. Low 3. High	Select one
Frequency of dosing prescribed	Every _____ hours	
Frequency acceptable?	1. Yes 2. Too low 3. Too frequent	Select one
ASSESSMENT OF ACTUAL ADMINISTRATION BY NURSING STAFF		
Was the drug given as prescribed?	1. Yes 2. No	Select one
If No, what deviations occurred?	1. Missed doses 2. Inconsistent timing of dosing 3. Other, specify _____	Select one
Duration given	1. _____ days 2. Not documented	
Criteria for stopping documented?	1. Yes 2. No	Select one
If Yes specify below	_____	
If No	1. NA 2. Not documented	Select one
Escalation done?	1. Yes 2. No	Select one
Criteria for escalation documented?	1. Yes 2. No	Select one
If Yes specify below	_____	
If No	1. NA 2. Not documented	Select one

DRUG E		
Day prescribed	_____/_____/_____	dd/mm/yyyy
Day of admission:	1. Day 2 2. After Day2, Specify day _____	
Dose in MG / kg / dose	_____	Insert
Dose /kg interpretation:	1. Within acceptable dose range 2. Low 3. High	Select one
Frequency of dosing prescribed	Every _____ hours	
Frequency acceptable?	1. Yes 2. Too low 3. Too frequent	Select one
ASSESSMENT OF ACTUAL ADMINISTRATION BY NURSING STAFF		
Was the drug given as prescribed?	1. Yes 2. No	Select one
If No, what deviations occurred?	1. Missed doses 2. Inconsistent timing of dosing 3. Other, specify _____	Select one
Duration given	1. _____ days 2. Not documented	
Criteria for stopping documented?	1. Yes 2. No	Select one
If Yes specify below	_____	
If No	1. NA 2. Not documented	Select one
Escalation done?	1. Yes 2. No	Select one
Criteria for escalation documented?	1. Yes 2. No	Select one
If Yes specify below	_____	
If No	1. NA 2. Not documented	Select one

APPENDIX II: SEMI STRUCTURED QUESTIONNAIRE FOR PAIN ASSSESSMENT & TREAMENT (K&A Questionnaire) FOR NURSES

SECTION A: IDENTIFICATION SECTION		
Qn101: Date of data collection	_____/_____/_____	dd/mm/yyy
Qn102: Name of enumerator	_____	Insert your name
Qn103: Questionnaire ID	_____	Insert
SECTION B: DEMOGRAPHIC INFORMATION		
Qn201: Cadre	1. Nurse 2. Clinical officer 3. Doctor	Select one
Qn202: Age	_____	Insert age
Qn203: Gender	1. Male 2. Female	Select one
Qn204: Marital status	1. Living with a partner 2. Single	Select one
Qn205: Department	3. Paediatrics 4. Medical	Select one
Qn206: Level of Education	1. Certificate 2. Diploma 3. Bachelor's Degree 4. Master's Degree	Select one
SECTION C: PAIN ASSESSMENT IN CHILDREN AND ADOLESCENTS (NURSES)		
Qn301: Wong Baker faces pain rating scale can be used to assess pain in all the following except?	a) Children b) Adolescents c) Adults d) Neonates	Select one
Qn302: Wong Baker pain rating scale is numbered from?	a) 0-10 b) 0-5	Select one

	c) 10-20 d) 0-20	

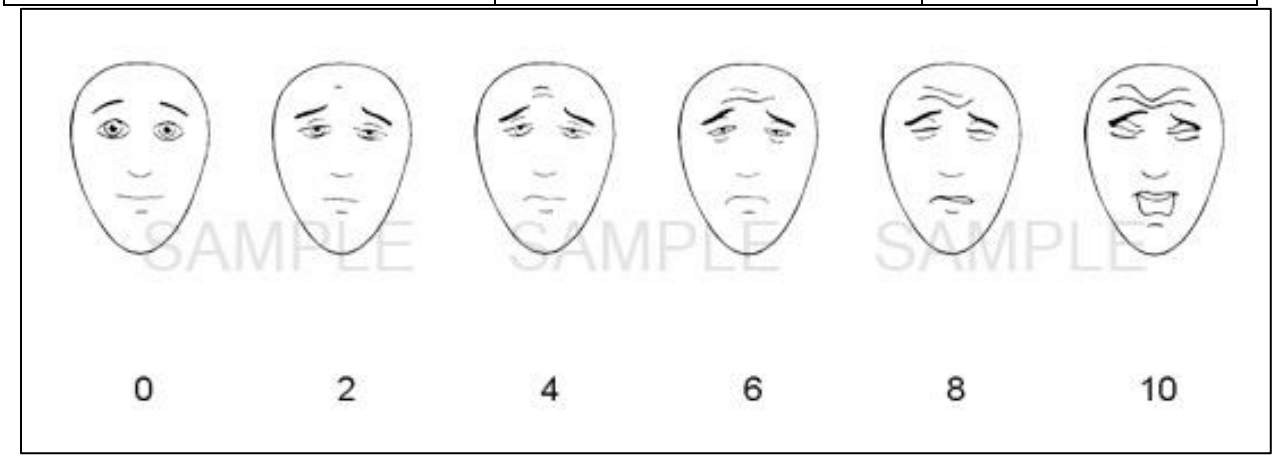


Figure 12: Wong Baker faces pain rating scale

Qn303: Match the faces in the figure above (Figure 1) with corresponding pain severity	Match the faces accordingly with interpretation numbered		
	Face	Your response (Refer to interpretation in the next column)	Interpretation
	Face 0		1. Hurts little bit
	Face 2		2. Hurts little more
	Face 4		3. Doesn't hurt
	Face 6		5. Hurts even more
	Face 8		6. Hurts a whole lot
	Face 10		7. Hurts worst
Qn304: A 3 years old child presents with both swollen hands and feet (Dactylitis) how will you rate their pain on initial assessment based on the figure above (Figure 1)?	1. Face 0 2. Face 2 3. Face 4 4. Face 6 5. Face 8 6. Face 10		Select one
Qn305: The following are pain	1. Wong Baker faces scale		Select all that apply

assessment tools that can be used for pain assessment in children and adolescents	2. Visual analog scale 3. Numeric pain rating scale 4. FLACC tool	

SECTION D: ASSESSING KNOWLEDGE ON PHARMACOLOGICAL TREATMENT OF PAIN (TRUE AND FALSE QUESTIONS)		
Qn401: The WHO pain ladder suggests using single analgesic agents rather than a combination when pain severity is classified as severe.	1. True 2. False 3. I don't know	Select one
Qn402: Changes in vital signs are reliable measure to verify child and adolescent statement that he /she is in pain	1. True 2. False 3. I don't know	Select one
Qn403: Respiratory depression is a rare complication in children and adolescents receiving opioids analgesics over a long period of time.	1. True 2. False 3. I don't know	Select one
Qn404: Children and Adolescents with a history of substance abuse and have used morphine previously, should not be given morphine for their pain because they are at a high risk for addiction.	1. True 2. False 3. I don't know	Select one
Qn405: The recommended route of administration of morphine to a child with prolonged pain is oral.	1. True 2. False 3. I don't know	Select one
Qn406: Children and adolescents with pain should be allowed to endure as much pain as possible prior to giving them analgesics.	1. True 2. False 3. I don't know	Select one

APPENDIX III: SEMI STRUCTURED QUESTIONNAIRE FOR PAIN ASSSESSMENT & TREAMENT (K&A Questionnaire) FOR CLINICIANS (DOCTORS AND CLINICAL OFFICERS)

SECTION A: IDENTIFICATION SECTION		
Qn101: Date of data collection	_____/_____/_____	dd/mm/yyy
Qn102: Name of enumerator	_____	Insert your name
Qn103: Questionnaire ID	_____	Insert
SECTION B: DEMOGRAPHIC INFORMATION		
Qn201: Cadre	4. Nurse 5. Clinical officer 6. Doctor	Select one
Qn202: Age	_____	Insert age
Qn203: Gender	3. Male 4. Female	Select one
Qn204: Marital status	3. Living with a partner 4. Single	Select one
Qn205: Department	5. Paediatrics 6. Medical	Select one
Qn206: Level of Education	5. Certificate 6. Diploma 7. Bachelor's Degree 8. Master's Degree 9. Above Master's Degree	Select one
SECTION C: PAIN ASSESSMENT IN CHILDREN AND ADOLESCENTS (NURSES)		
Qn301: Wong Baker faces pain rating scale can be used to assess pain in all the following except?	1. Children 2. Adolescents 3. Adults 4. Neonates	Select one

Qn302: Wong Baker pain rating scale is numbered from?	1. 0-10 2. 0-5 3. 10-20 4. 0-20	Select one

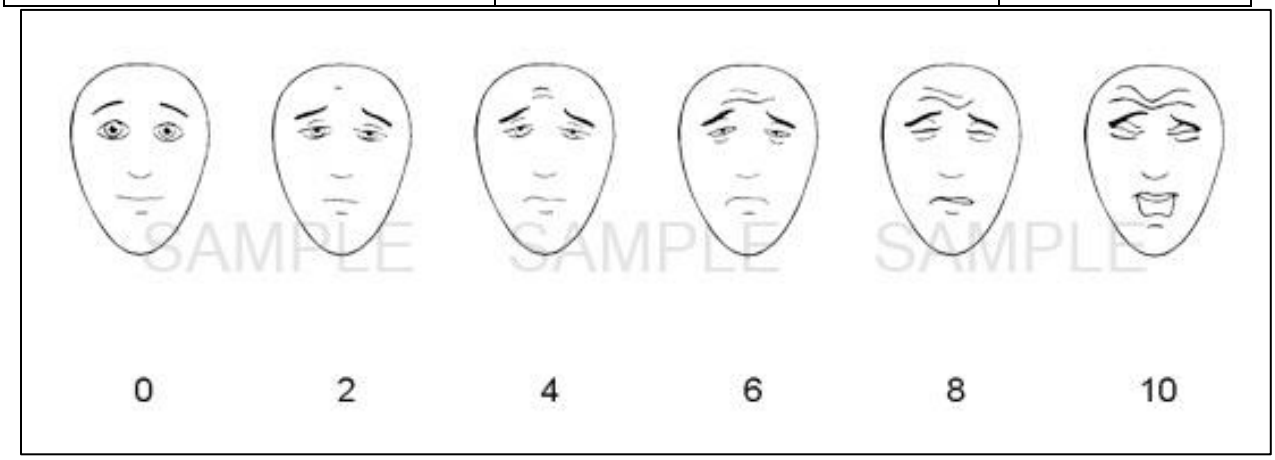


Figure 13: Wong Baker faces pain rating scale

Qn303: Match the faces in the figure above (Figure 1) with corresponding pain severity	Match the faces accordingly with interpretation numbered		
	Face	Your response (Refer to interpretation in the next column)	Interpretation
	Face 0		1. Hurts little bit
	Face 2		2. Hurts little more
	Face 4		3. Doesn't hurt
	Face 6		5. Hurts even more
	Face 8		6. Hurts a whole lot
	Face 10		7. Hurts worst
Qn304: A 3 years old child presents with both swollen hands and feet (Dactylitis) how will you rate their pain on initial assessment based on the figure above (Figure 1)?	7. Face 0 8. Face 2 9. Face 4 10. Face 6 11. Face 8 12. Face 10		Select one
Qn305: The following are pain	5. Wong Baker faces scale		Select all that apply

assessment tools that can be used for pain assessment in children and adolescents	6. Visual analog scale 7. Numeric pain rating scale 8. FLACC tool	

SECTION D: ASSESSING KNOWLEDGE ON PHARMACOLOGICAL TREATMENT OF PAIN (TRUE AND FALSE QUESTIONS)		
Qn401: Taking Childs weight into consideration is key when prescribing analgesics.	4. True 5. False 6. I don't know	Select one
Qn402: Paracetamol should be prescribed at 10-15mg/kg in children	1. True 2. False 3. I don't know	Select one
Qn403: The usual duration of analgesia of morphine given is approximately 5-6 hours	1. True 2. False 3. I don't know	Select one
Qn404: After the initial recommended dose of morphine, subsequent doses should be adjusted in accordance with individual pain responses.	1. True 2. False 3. I don't know	Select one
Qn405: 1-2 hrs is the peak effect time for morphine given orally?	1. True 2. False 3. I don't know	Select one
Qn406: Sedation always precedes opioid related respiratory depression.	1. True 2. False 3. I don't know	Select one
Qn407: Is there maximum dosage beyond which morphine cannot be given?	1. True 2. False 3. I don't know	Select one
Qn408: The initial oral dosage of morphine to a child who has never used morphine before is 0.1-0.2 mg/kg/dose.	1. True 2. False	Select one

	3. I don't know	
Qn409: Oral morphine should be administered 4 hourly.	1. True 2. False 3. I don't know	Select one
Qn410: Dihydrocodeine given as an analgesic is contraindicated in children younger than 12 years old.	1. True 2. False 3. I don't know	Select one

APPENDIX IV: QUESTIONS TO GUIDE FOCUS GROUP DISCUSSIONS

Part 1 Nurses

1. Do you think older children reliably report their pain? State your answer with reasons
2. When doctors prescribe analgesics such as morphine when do you give them to the children in pain?
3. How do you feel giving the analgesics as many times as prescribed by doctors to children and adolescents in acute painful crisis?
4. Do you feel comfortable giving prescribed opioids to children with acute painful crisis? State your answer with reasons
5. How does it feel to take care of a patient with in acute painful crisis?
6. What are some challenges you face to access analgesics such as opioids
7. How prepare/ equipped were you to manage acute painful crisis in children and adolescents after your formal training?
8. Do you have any concerns when dealing with a patient in acute painful crisis? State your concerns
9. Do you have any concerns with the parents or care givers when handling their children during acute painful crisis

Part 2 Clinical officers, and Doctors

10. How is it to take care/attend to children and adolescents with acute painful crisis?
11. What are some of your concerns when prescribing opioids for children and adolescents in acute painful crisis?
12. What are some of the challenges you face to access opioids in you facility
13. What is your feeling about individualized pain plans for children and adolescents with during acute painful crisis?
14. How comfortable were you after your formal training to manage a child/adolescents in acute painful crisis
15. Do you have any difficulty in relating to or understanding the acute pain in? State your difficulty?
16. What are your concerns about opioid regulation measures

17. What are some of your concerns when a child or adolescents report to you that they have pain
18. How do you feel about having or not having a guideline in place in management of acute painful crisis?
19. Do you have any concerns with the parents or care givers when handling their children during acute painful crisis

Part 3 Pharmacists / Pharmaceutical Technologists

1. Which analgesics are available in the pharmacy? Tick ones available

- ☐ Paracetamol
- ☐ Ibuprofen
- ☐ Tramadol
- ☐ Dihydrocodeine
- ☐ Morphine

2. How long does it take you to release analgesics from the pharmacy after being ordered?

3. Do you routinely release opioids such as morphine? Yes/No if no why?

4. Which challenges do you face when you have to release analgesics such as opioids?

5What are some of your concerns with opioids when prescribed to children and adolescents

6. Do you have any concerns when dispensing the ordered/ prescribed analgesics? State your concerns

7. What are your concerns about opioid regulation measures?

8. What do you think is your role to promote opioid safety?

9. What is your feeling about opioid misuse?

10. Do you sometimes interfere with prescribers' opioid treatment plan or delay ability to access opioids if so how and why?

APPENDIX V: CONSENT FORMS

CONSENTING PROCEDURE

Suitable participants were taken through the contents in the information sheet, including the purpose of the study, procedures employed, voluntary study participation, potential benefits and risks, and participants' choice to withdraw at any time from the study without any consequences. The eligible research participants could seek clarifications on whatever aspects of the study were unclear to them. Both verbal and written approval was sought from the appropriate participants before the beginning of the interviews.

CONSENT EXPLANATION (ENGLISH VERSION)

I. Purpose

My name is Edith Juma Ogada, a postgraduate student at the University of Nairobi department of paediatrics and child health. I am inviting you to participate in a study I am conducting in this unit. The purpose of this study is to obtain your experience as a Health care worker in the management of acute painful crisis in children and adolescents with sickle cell disease. This study is being conducted in this facility with permission from the management of the hospital. I am requesting you to participate in this study since you are one of the Health care worker offering services at this facility.

II. Risks

There is no physical harm that will be inflicted on you during this process since it does not involve an invasive procedure, but there are minimal risks to you for participating in this study. There is a possibility that some of the questions you will be asked may make you uncomfortable. Should this happen, feel free to inform the researcher.

III. Benefits

This study may not benefit you directly but your participation and the findings from this study will provide important information that will be used to improve care for children and adolescents with sickle cell disease presenting with acute painful crisis

IV. Voluntary Participation and Withdrawal

When you consent to participate in this study, your participation in the study is completely voluntary. You are free to decline participating in the study or withdraw at any point. Your decision will not lead to any form of victimization or bias in your place of work.

V. Confidentiality

Some questions may involve providing personal information but the information provided will be kept confidential and anonymous. Your personal particulars will not be included in the questionnaire or any written reports from this study. The researcher will use a recording device to record participant views during the Focus Group Discussions and the Key Informant

Interviews. These recordings will be treated with utmost confidentiality and all the information collected will be saved in password protected files and computers.

VI. Contact Persons

Should you have any questions or concerns about the content of this study or your rights as a participant in this study, feel free to contact the researcher, Dr Edith Juma Ogada, University of Nairobi, College of Health Sciences Department of Paediatrics and Child Health. Mobile number 0710503708; email – eddyjoshogada@gmail.com. The lead supervisor Professor Elizabeth Maleche Obimbo, University of Nairobi, College of Health Sciences Department of Paediatrics and Child Health, mobile no 0722720402,email lisaobimbo@gmail.com. You may also contact the Chairperson of Ethics and Research Committee, KNH/UON through the following address: University of Nairobi, College of Health Sciences, P. O. Box 19676-00202 Nairobi or Tel no. +2542726300 Ext 44102.

CONSENT FORM (ENGLISH VERSION)

I. Confirmation of consent

I confirm that I have read the consent information and received an explanation on the purpose and benefits of the study. I have had a chance to ask all questions regarding the study. I hereby voluntarily agree to participate.

Name: ……

Sign: …….. Date: ……

Researcher ……. ……

Sign: …….. Date: ……

II. Contact Persons

Should you have any questions or concerns about the content of this study or your rights as a participant in this study, feel free to contact the researcher, Dr Edith Juma Ogada, University of Nairobi, College of Health Sciences Department of Paediatrics and Child Health. Mobile number 0710503708; email – eddyjoshogada@gmail.com. The lead supervisor Professor Elizabeth Maleche Obimbo, University of Nairobi, College of Health Sciences Department of Paediatrics and Child Health, mobile no 0722720402, email lisaobimbo@gmail.com. You may also contact the Chairperson of Ethics and Research Committee, KNH/UON through the following address: University of Nairobi, College of Health Sciences, P. O. Box 19676-00202 Nairobi or Tel no. +2542726300 Ext 44102.

APPENDIX VI: STUDY TIMELINES

The study took a period of 13 months (Month1 to Month 13)

Table 22: Study timelines

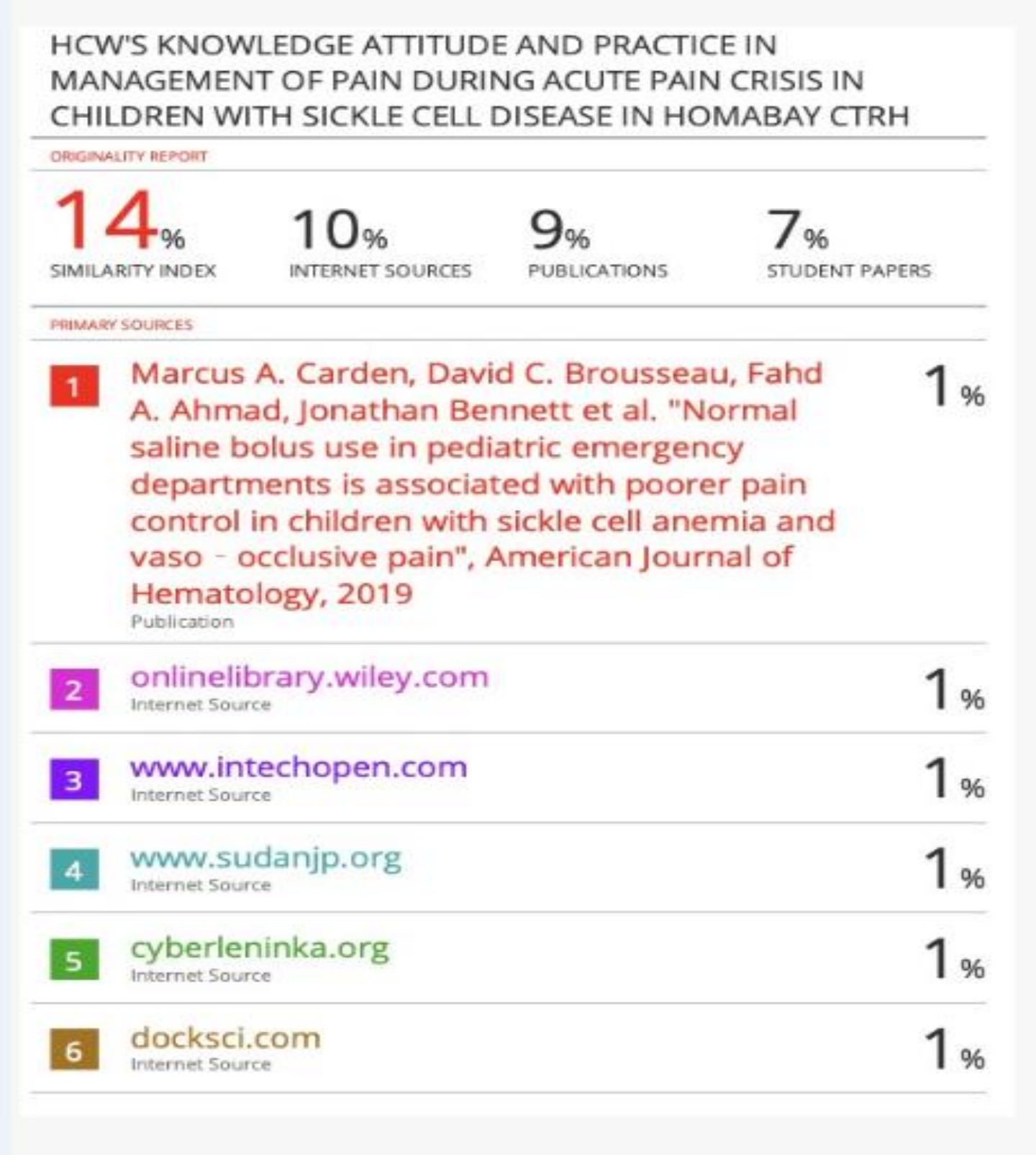
		Timelines February 2021 to April 2022											
		Feb	March	April	May	Oct	Nov	Dec	Jan	Feb	March	April	April
	Proposal development												
	Regulatory/Ethical approvals												
Activity	Piloting and Data collection												
	Data analysis												
	Dissertation write up												

APPENDIX VII: BUDGET

The study cost will be footed by the principal investigator.

	Description	**Unit Cost (Ksh)**	**Number**	**Cost estimate (Ksh)**
1	Stationery	5,000	1	5,000
2	Research assistant	20,000	1	20,000
3	Data entry	15,000	1	15,000
4	Transport and accommodation	30,000	1	30,000
5	Didactic Training	70000	1	70000
6	Data Analysis	30,000	1	30,000
7	Reports printing and binding	15,000	1	15,000
8	Dissemination and publishing results	20,000	1	20,000
9	Contingency	25,000	1	25,000
	TOTAL	**230,000**		**230,000**

APPENDIX VIII: TURNITIN REPORT



HCW'S KNOWLEDGE ATTITUDE AND PRACTICE IN MANAGEMENT OF PAIN DURING ACUTE PAIN CRISIS IN CHILDREN WITH SICKLE CELL DISEASE IN HOMABAY CTRH

ORIGINALITY REPORT

14%	10%	9%	7%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Marcus A. Carden, David C. Brousseau, Fahd A. Ahmad, Jonathan Bennett et al. "Normal saline bolus use in pediatric emergency departments is associated with poorer pain control in children with sickle cell anemia and vaso - occlusive pain", American Journal of Hematology, 2019 Publication	1%
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HCW'S KNOWLEDGE ATTITUDE AND PRACTICE IN MANAGEMENT OF PAIN DURING ACUTE PAIN CRISIS IN CHILDREN WITH SICKLE CELL DISEASE IN HOMABAY CTRH

by Edith Ogada

Submission date: 02-May-2022 06:36AM (UTC+0300)
Submission ID: 1825822456
File name: EDITH_OGADA_DISSERTATION_APRIL_2022_1.docx (437.07K)
Word count: 17982
Character count: 94677

APPENDIX VII.KNH-UON ERC APPROVAL.

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Ref: KNH-ERC/A/428

11th November 2021

Dr. Edith Juma Ogada
Reg. No.H58/33988/2019
Dept. of Paediatrics and Child Health
Faculty of Health Sciences
University of Nairobi

APPROVED
11 NOV 2021
KNH/UoN-ERC

Dear Dr. Ogada

RESEARCH PROPOSAL: HEALTHCARE WORKERS' KNOWLEDGE, ATTITUDE AND PRACTICES IN MANAGEMENT OF PAIN DURING PAINFUL CRISIS IN CHILDREN WITH SICKLE CELL DISEASE IN HOMABAY COUNTY TEACHING AND REFERRAL HOSPITAL (P419/05/2021)

This is to inform you that KNH-UoN ERC has reviewed and approved your above research proposal. Your application approval number is **P419/05/2021.** The approval period is 11th November 2021 – 10th November 2022.

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by KNH-UoN ERC.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to KNH-UoN ERC 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH-UoN ERC within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to KNH-UoN ERC.

This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

For more details consult the KNH- UoN ERC website **http://www.erc.uonbi.ac.ke**

Yours sincerely

PROF. M.L CHINDIA
SECRETARY, KNH- UoN ERC

c.c. The Principal, College of Health Sciences, UoN
The Senior Director, CS, KNH
The Chair, KNH- UoN ERC
The Assistant Director, Health Information, KNH
The Dean, School of Medicine.UoN
The Chair, Dept.of Paediatrics and Child Health, UoN
Supervisors: Dr. Florence Munla, Dept. of Paediatrics and Child Health, UoN
Dr. Diana Marangu, Dept.of Paediatrics and Child Health, UoN