

# Essential pain management at a rural district hospital in Burundi

G Sund,<sup>1</sup> W Morriss,<sup>2</sup> K Ikeda,<sup>3</sup> A Izere,<sup>4</sup> JC Kwizera<sup>4</sup>

<sup>1</sup>Department of Anaesthesia and Réanimation, Hope Africa University, Burundi

<sup>2</sup>Department of Anaesthesia, University of Otago, Christchurch Hospital, New Zealand and World Federation of Societies of Anaesthesiologists

<sup>3</sup>Department of Anaesthesiology, University of Virginia, United States of America

<sup>4</sup>Hope Africa University, Burundi

Corresponding author, email: [gsund@serge.org](mailto:gsund@serge.org)

**Background:** Pain management is a significant challenge in low- and middle-income countries (LMICs). In settings where resources are limited, interventions to improve pain management must be low-cost and context-appropriate.

**Methods:** At a rural district hospital in Burundi, East Africa we undertook the delivery of a simple educational workshop called Essential Pain Management (EPM) and introduction of regular acute pain rounds for post-surgical patients. At the same time, we carried out a pre- and post-intervention audit of pain management. We hypothesised that the use of the EPM educational workshop and introduction of regular acute pain rounds for post-surgical patients would lead to a reduction in patient pain scores, time to first ambulation, hospital length of stay, and changes to analgesic medication prescribing practices.

**Results:** We found improvements in modified visual analogue scale (VAS) scores on postoperative days one (mean VAS 42.3 vs 31.4,  $p < 0.001$ ) and two (mean VAS 33.7 vs 27,  $p = 0.001$ ), with no difference on day three. We also found a reduction in time to first ambulation after introduction of this service (median time of 38.8 hours vs 28 hours,  $p < 0.001$ ) with no change in length of stay (median four days in both groups). There was also a marked increase in administration of analgesic medications after the service was introduced.

**Conclusion:** Our audit demonstrates a positive impact following a simple low-cost intervention in a rural hospital where resources are severely limited. We believe that this intervention offers a feasible and context-appropriate approach for improving postoperative pain management in a low-resource setting.

**Keywords:** pain, Africa, rural, low-cost, essential pain management

## Introduction

Burundi is a small landlocked country in East Africa with a population of 11.8 million people.<sup>1</sup> It is one of the poorest countries in the world with a poverty rate of 74.7% and a human development index (HDI) score of 0.417, ranked 185 of 189 countries.<sup>2</sup> Burundi has a per capita gross domestic product (GDP) of US\$ 700 per year compared to US\$ 59 800 in the United States.<sup>1</sup> Annual healthcare expenditure per capita is \$ 58.02 (2014 data).<sup>3</sup> According to 2016 data, Burundi has the lowest surgeon to population ratio in East, Central and Southern Africa at 0.18 surgeons per 100 000 people.<sup>4</sup> There are currently six physician anaesthesia providers working in the country (all but one of whom work in the largest city, Bujumbura), with the majority of anaesthesia care being provided by 328 non-physician anaesthesia providers.<sup>5</sup>

Kibuye Hope Hospital (KHH) is a rural district hospital with 229 beds established by the Free Methodist Church in 1946 and currently staffed by a mix of Burundian and expatriate healthcare workers. The vast majority of patients are subsistence farmers. During recent years, staff at the hospital have become increasingly aware of inadequacies in pain management, especially after surgery. Most patients undergoing major surgery including laparotomy, caesarean section, or intramedullary fracture fixation received only intermittent paracetamol for postoperative analgesia. We therefore decided to search for a

low-cost, simple intervention to address this problem of poor postoperative pain management.

World Health Organization (WHO) data suggest that 5.5 billion people out of the world's 7 billion population do not have access to treatments for moderate to severe pain.<sup>6</sup> A disproportionately high number of these people live in low- and middle-income countries (LMICs) and the problem of postoperative pain management seen at KHH is likely to be repeated in many hospitals in LMICs, although there is a paucity of data with regards to pain management practices in LMICs. Resources are very limited and interventions to improve pain management must be low-cost and effective in these environments.<sup>7</sup>

There is evidence that pain management education and the introduction of an acute pain service improves patient pain scores, time to first ambulation, and hospital length of stay in well-resourced environments,<sup>8</sup> however, we wanted to investigate whether a simple, low-cost strategy would be effective in KHH with very limited resources. Our strategy comprised delivery of a simple educational workshop called Essential Pain Management (EPM) and introduction of regular acute pain rounds for post-surgical patients. At the same time, we carried out a pre- and post-intervention audit of pain management.

In brief, EPM is a 1-day multidisciplinary workshop which aims to teach healthcare workers to better recognise, assess and treat pain.<sup>9</sup> It was originally designed for low-resource settings and,

since the pilot workshop in 2010, has been taught at over 60 countries worldwide.<sup>10,11</sup> The EPM programme provides a simple system for managing pain patients, emphasises early handover to local instructors and development of context-appropriate solutions for local problems.

The workshop comprises short interactive lectures, brainstorming sessions and small group case discussions. A typical programme is shown in Appendix 1. EPM uses the "RAT system" (standing for Recognise, Assess and Treat) as a simple framework for managing pain of all types. Key components of the workshop include a simple classification of pain, assessment of severity, and pharmacological and non-pharmacological treatment of pain, including a discussion of the basic pharmacology, dosing and side-effects of commonly used analgesics, and the importance of explanation, reassurance and basic nursing care. The workshop participants discuss a range of clinical cases in small groups and this allows integration of knowledge and development of context-appropriate management plans. Participants also discuss the factors that prevent pain being managed as well as it could be where they work (pain management "barriers") and explore possible solutions.

We hypothesised that the use of the EPM educational workshop and introduction of regular acute pain rounds for post-surgical patients would lead to a reduction in patient pain scores, time to first ambulation, hospital length of stay, and changes in analgesic medication administration practices.

## Methods

Our audit was approved by the Kibuye Hope Hospital Ethics Committee and also the Institutional Review Board for Human Research of the University of Virginia, United States (IRB number 21958). We used a pre- and post-intervention observational design.

The audit population comprised all patients between 18 and 65 years of age presenting for surgical procedures under anaesthesia between November 2018 and January 2019 (pre-intervention) and between January 2019 and March 2019 (post-intervention). We excluded patients undergoing ophthalmological procedures, patients undergoing ambulatory surgery, patients undergoing endoscopies, and patients requiring repeated surgery during the first three days after the primary surgery.

The audit intervention consisted of introduction of regular acute pain rounds (APR) on 7 January, reinforced by delivery of a one-day EPM educational workshop on 12 January 2019. The APRs were held daily between 11 am and 1 pm, and conducted by a physician anaesthesiologist at least six days per week accompanied by one to three medical students rotating on an anaesthesia and critical care attachment. Analgesic prescribing was at the discretion of the physician anaesthesiologist but was based on a tiered approach outlined in the EPM workshop.

The EPM workshop emphasises use of the WHO analgesic ladder for progressive cancer pain, and use of the "reverse WHO ladder" for acute, severe, nociceptive pain as is commonly experienced after surgery (Appendix 2). Both ladders suggest a tiered approach to pain management, based on whether the patient's pain is mild, moderate or severe. Given the limitation of available analgesics in our hospital pharmacy, the majority of patients reporting mild pain (VAS 0–3) were prescribed oral paracetamol, patients with moderate pain (VAS 3–6) were prescribed oral paracetamol and tramadol, and patients with severe pain (VAS 7–10) were given boluses of intravenous morphine in addition to oral paracetamol and tramadol. Although nonsteroidal anti-inflammatory medications (NSAIDs) are used in many institutions worldwide, and are suggested for treatment for post-surgical pain in the EPM workshop, we chose not to prescribe them for post-surgical pain at our hospital. NSAID use has historically been low at KHH because of a high prevalence of gastric ulcer disease in patients, and concern from our surgical colleagues about impaired fracture union in patients receiving NSAIDs.

The EPM workshop was delivered by one physician anaesthesiologist and two non-physician anaesthetists who had received instructor training during workshops in Bujumbura (Burundi's largest city) in December 2018. The workshop at KHH was attended by 15 participants, including three medical students involved in this project, one general surgeon, one pharmacy technician, several generalist physicians and the nursing chiefs from the departments of surgery, maternity and emergency medicine.

Three medical students were responsible for data collection for both the pre-intervention and post-intervention patient groups. Data were collected in a register and later transferred to a REDCap database with deletion of patient identifiers. The following demographic data were collected for all patients at the time of surgery: name, medical record number, age, gender, date of surgery, type of surgery, type of anaesthesia and surgical incision time. After surgery, VAS scores were recorded for three consecutive days or duration of hospital stay if less than three days. The data collectors also noted time of first ambulation (TOFA) and hospital length of stay (LOS), and determined the administration of analgesic medications by asking the patient directly and also by review of nursing records.

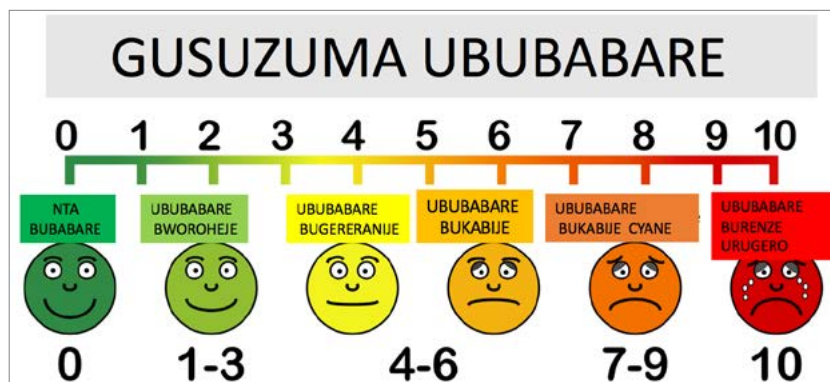


Figure 1: Modified VAS translated into Kinyarwanda

We used a modified VAS scale developed in Rwanda by Dr Olulofabi and colleagues (Figure 1). The medical students explained the modified VAS scale to the patients in the local Kirundi language using pre-determined wording in order to maintain consistency between pre- and post-intervention observations. The students initially asked patients if their pain was mild, moderate or severe. Patients then chose a modified VAS score from the 0–3 (mild), 4–6 (moderate) or 7–10 (severe) part of the VAS scale.

VAS scores and TOFA were analysed using Wilcoxon rank-sum tests. LOS was analysed using Kaplan-Meier curves and log-rank tests. Several patients stayed in hospital for more than 14 days because of non-pain-related complications. For the purpose of this audit, these patients were considered to have a LOS of 14 days.

## Results

We enrolled and collected data for a total of 240 patients in the pre-intervention group and another 251 in the post-intervention group. Table I summarises study patient demographics, type of surgery, and type of anaesthesia for the two groups. Caesarean section is the most common surgical procedure at KHH and the high ratio of females to males (65% to 35%) and high percentage of spinal anaesthesia (68%) is consistent with this. There was a notable difference between the percentage of caesarean sections in the pre-intervention group (48%) and post-intervention group (28%).

Table II summarises modified VAS scores for patients in both groups for days 1, 2 and 3. Data are incomplete because of early discharge of some patients. The results show an improvement in modified VAS scores between the pre-intervention group and post-intervention group on days one and two, but no difference on day three.

Table III shows data on TOFA and LOS. There was a modest reduction in TOFA between the pre-intervention and post-intervention groups but no difference in LOS. We were unable to capture all patients in our TOFA analysis because some patients were discharged before the acute pain round on the first postoperative day. Two patients in each group died as a result of surgical complications, unrelated to analgesic administration. One patient in the pre-intervention group was transferred to an isolation unit for suspected diagnosis of tuberculosis and was lost to follow-up.

Figure 2 summarises changes in administration of analgesic medications in the two groups. There was a marked increase in the use of oral paracetamol and oral tramadol, with some use of intravenous morphine in the post-intervention group.

**Table II:** Pre- and post-intervention modified VAS scores for days 1, 2, and 3. Values are mean (SD)

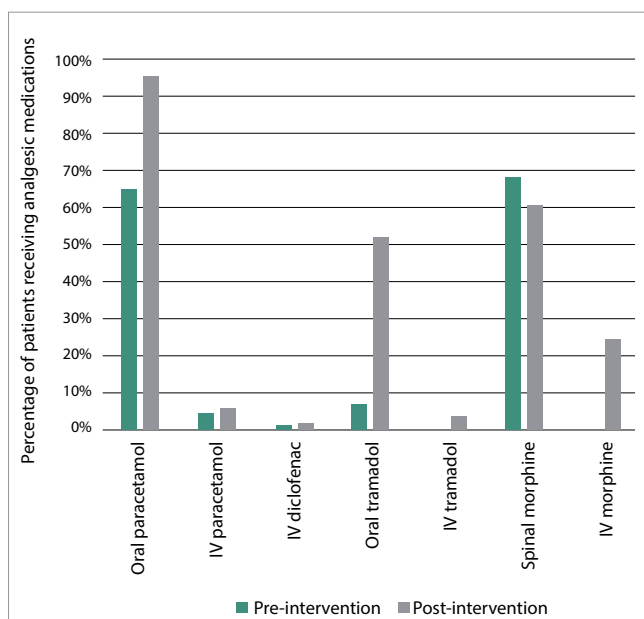
	Pre-intervention VAS Mean (SD)	Post-intervention VAS Mean (SD)	P-value
Day 1	42.3 (22.8) mm (n = 217)	31.4 (18.9) mm (n = 243)	< 0.001
Day 2	33.7 (19) mm (n = 185)	27.0 (16.8) mm (n = 188)	0.001
Day 3	25.8 (18.5) mm (n = 160)	23.0 (16.6) mm (n = 168)	0.34

**Table III:** Pre- and post-intervention TOFA and LOS. Values are median (range)

	Pre-intervention Median (range)	Post-intervention Median (range)	P-value
Time of first ambulation	38.8 (2–313) hours (n = 202)	28.0 (1–195) hours (n = 223)	< 0.001
Length of stay	4 (1–14) days (n = 237)	4 (1–14) days (n = 249)	> 0.48

**Table I:** Summary of gender, age, type of surgery, and type of anaesthesia for the pre- and post-intervention groups. Values are number (proportion)

	Pre-intervention Number of patients (%)	Post-intervention Number of patients (%)	Total Number of patients (%)
<b>Gender</b>			
Female	167 (70%)	154 (61%)	321 (65%)
Male	73 (30%)	97 (39%)	170 (35%)
<b>Age</b>			
18–30 years	131 (55%)	107 (43%)	238 (49%)
31–50 years	79 (33%)	104 (41%)	183 (37%)
51–65 years	30 (12%)	40 (16%)	70 (14%)
<b>Type of surgery</b>			
Caesarean section	116 (48%)	71 (28%)	187 (38%)
Orthopaedic	41 (17%)	44 (17%)	85 (17%)
General surgery (intra-abdominal)	16 (7%)	29 (12%)	45 (9%)
Other	67 (28%)	107 (43%)	174 (36%)
<b>Type of anaesthesia</b>			
General	52 (22%)	75 (30%)	127 (26%)
Local/peripheral nerve block/sedation	13 (5%)	18 (7%)	31 (6%)
Spinal	175 (73%)	158 (63%)	333 (68%)
<b>Total</b>	<b>240 (100%)</b>	<b>251 (100%)</b>	<b>491 (100%)</b>



**Figure 2:** Administration of analgesic medications in pre- (green) and post- (grey) intervention groups. Data are proportion of patients who received each analgesic

While we did not screen for all side-effects related to analgesic administration, the medical students charged with data collection were instructed how to screen for and record serious complications, including respiratory depression. There were no reported cases of respiratory depression or other serious complications thought to be related to analgesic administration in either group of patients.

## Conclusion

Our audit has demonstrated a small but measurable improvement in post-surgical pain management in a small rural hospital in Burundi following a simple low-cost intervention – the use of Essential Pain Management teaching and the introduction of regular acute pain rounds. We found a small reduction in modified VAS scores, reduced TOFA, and changes in the administration of analgesic medications after the intervention.

There are multiple reasons why pain management may be suboptimal in LMICs. Barriers include a lack of knowledge, low prioritisation by staff and patients, low staff numbers, lack of medicines especially opioids, concerns about opioid side-effects, and cultural factors.<sup>7</sup> Patients in resource-poor environments may become fatalistic about the lack of adequate pain treatment and also may not seek it because of limited financial means to pay for medications.

Pain management usually requires a multidisciplinary approach and communication between cadres can be problematic. The EPM programme aims to provide basic pain management education for pain of all types, and encourage interaction between cadres, identification of local barriers and development of appropriate local solutions. The introduction of an acute pain management service at KHH could be seen as an example of this process and benefits may extend beyond improvements in simple measures like VAS and TOFA. For example, hospital staff from other services

requested our assistance with pain management after becoming aware of the work we were doing with postoperative patients. These patients included several children hospitalised in the paediatric ward with acute sickle cell crisis.

Instituting change can be difficult in any healthcare environment but particularly so when resources are short and there are not enough hospital staff. We believe that the use of an audit helped the introduction of the acute pain management service. The collection of data before the intervention raised awareness and stimulated interest, and collection of data during the APRs helped to reinforce the need for an acute pain service and provided specific local evidence of its value. We suspect that the use of this type of audit in resource-poor environments is often seen as a luxury extra during introduction of a new service rather than an essential part of change management.

We are aware of some of the limitations of our audit. First, we only looked at a short period immediately after the introduction of APRs and EPM education. We do not know whether the improvements in pain management will be maintained in the longer term and therefore we plan to repeat the audit approximately one year after introduction of the service. In order to have a sustained impact there will need to be continuing education and support for those involved in pain management. Second, by necessity, data collection was unblinded and therefore subject to observer bias. This may have affected recording of the modified VAS scores although we attempted to minimise this by using standardised predetermined wording. Third, there was a larger proportion of caesarean section patients in the pre-intervention group compared to the post-intervention group and this may have affected the observations.

Although we have made significant progress, pain management at KHH continues to be challenging because it is seen as relatively unimportant by many healthcare workers. This is not surprising when nurse to patient ratios can be as low as one to 25 in some wards and there are many longstanding barriers. Administration of fluids and antibiotics are often seen as being much more important. Treatment of severe pain is particularly problematic because of the time taken to administer intravenous analgesics (including morphine) and concerns about opioid side-effects. EPM emphasises cheap, simple treatments and addresses opioid concerns and we hope that, in time, ongoing education will result in increased prioritisation of pain management.

Some hospital staff also expressed concern that patients would not be prepared to pay for increased analgesic medications but, interestingly, this does not seem to have been the case. A retrospective analysis of the cost of analgesic medications before the intervention showed a mean cost per patient of 1 428 Burundian francs (US\$ 0.76) before the introduction of acute pain rounds and 2 492 Burundian francs (US\$ 1.31) after the introduction. While this cost may not be insignificant for a farmer living in rural Burundi, these data illustrate that increased analgesic medications can be provided cheaply and patients are prepared to pay more for improved analgesia. Of note, in our



institution, intravenous analgesics cost significantly more than oral analgesics, which likely explains much of the increased cost per patient. As an example, the cost of one gram of intravenous paracetamol costs 10 000 Burundian francs (US\$ 5.25) while the cost of one gram of oral paracetamol costs 60 Burundian francs (3 cents). The EPM workshop also emphasises prioritising oral administration of analgesics whenever possible, which is especially relevant in a setting like ours where there is such a wide discrepancy in cost between injectable and oral analgesics. Unfortunately, our hospital pharmacy does not stock oral morphine or another equivalent oral analgesic, and so our only option for the treatment of patients with severe pain is injectable morphine. We continue to investigate the possibility of adding oral morphine to our hospital's formulary. While injectable ketamine is also available at our institution, and has occasionally been used for postoperative pain, given our limited nursing staff, monitoring for ketamine-related side-effects has proven difficult.

While we originally hypothesised that improved pain management would translate into decreased LOS after surgery, we did not find this in our audit. This suggests that LOS at our hospital is not determined by adequacy of pain management, or earlier ambulation, but is instead determined by other factors which our study did not identify. In other settings, where adequacy of pain control is a determining factor in length of hospital stay, it is possible that shortened hospitalisation times could decrease patient cost and shift the financial impact of this intervention from one of increased cost to one of cost savings.

Pain management has been described as a basic human right<sup>12</sup> but there are many barriers to adequate pain management in Burundi and other resource-poor countries. The EPM educational programme emphasises simple multimodal treatment strategies, a team approach, and local solutions to local problems. The introduction of acute pain rounds at KHH, underpinned by audit and EPM, has resulted in significant gains and may provide a simple, low-cost strategy for improving pain management in other low-resource environments.

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### Conflict of interest

The authors (GS, WM, KI, AI, JCK) declare that they have no conflict of interest.

### Funding source

There was no external funding for this project.

### Ethical approval

Our audit was approved by the Kibuye Hope Hospital Ethics Committee and also the Institutional Review Board for Human Research of the University of Virginia, United States (IRB number 21958). As the information collected in the study did not exceed what would be reasonably expected to be documented in the patients' notes and this was a quality improvement audit, no additional consenting process was considered necessary by the Kibuye Hope Hospital ethics committee.


### ORCID

G Sund  <https://orcid.org/0000-0003-3449-3838>

W Morriss  <https://orcid.org/0000-0001-8174-9723>

K Ikeda  <https://orcid.org/0000-0003-0038-0587>

A Izere  <https://orcid.org/0000-0002-1353-5675>

JC Kwizera  <https://orcid.org/0000-0001-8939-2327>

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### Appendix 1: EPM 1-Day Workshop Programme

Time	Duration (mins)	Lecture/Discussion
0830–0915	45	Welcome, introductions Local perspective Pre-workshop test
0915–0925	10	Introduction
0925–0940	15	What is pain?
0940–0955	15	Why should we treat pain?
0955–1005	10	Assessment of severity
1005–1020	15	Classification of pain
1020–1050	30	Break
1050–1110	20	Pain physiology and pathology
1110–1130	20	Pain treatment overview
1130–1200	30	Pain medications
1200–1230	30	Pain management barriers
1230–1315	45	Lunch
1315–1340	25	Using the RAT system
1340–1500	80	Case discussions
1500–1530	30	Break
1530–1615	45	Overcoming barriers
1615–1700	45	Post-workshop test and answers Feedback Certificates and photos

### Appendix 2: Reverse WHO ladder

