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Perceived knowledge and practices of nurses regarding immediate post-operative pain management in surgical wards in Rwanda. A descriptive cross-sectional study

Odile Umuhoza[a], Geldine Chironda[b,*], Godfrey Katende[b], Madeleine Mukeshimana[a]

[a] School of Nursing and Midwifery, College of Medicine and Health Sciences, University of Rwanda, Kigali, Rwanda
[b] Human Resources for Health Rwanda, New York university, University of Rwanda, College of Medicine and Health Sciences, School of Nursing and Midwifery, Kigali, Rwanda

A B S T R A C T

Background: The World Health Organisation (WHO) states that pain is still an issue that needs a multi-disciplinary approach, even though it does not appear on the list of disease burdens. Worldwide, knowledge and practice deficiencies regarding immediate post-operative pain management among nurses remain a pervasive problem.

Purpose of the study: The purpose of this study was to assess the perceived knowledge and practice of immediate post-operative pain management among nurses working in surgical wards in Rwanda.

Methodology: This study used a descriptive cross-sectional design involving a convenience sample of 131 nurses working in surgical wards. Data was collected using a self-administered questionnaire. Descriptive statistics, Pearson's correlation coefficient and linear regression were used to analyse the data.

Results: The majority of the nurses 97 (74%) had high levels of knowledge on immediate post-operative pain management. While 115 (88%) of the nurses had moderate levels of practice with regards to immediate post-operative pain management. Age (21.8 95% CI (21.1–22.5), p = 0.000), gender (20.7 95% CI (20.4–21, p = 0.000), marital status (20.3 95% CI (18.1–22.5), p = 0.000), educational level (22.2 95% CI (21.5–22.5), p = 0.008) and working experience (21 95% CI (20.1–21.9), p = 0.000) were significantly associated with the perceived knowledge of nurses. Yet, only age (33.2 95% CI (32.9–33.6), p = 0.032), educational level (32.2 95% CI (30.8–33.6), p = 0.006) and working experience (32.5 95% CI (32–33), p = 0.031) were significantly associated with the practice of nurses. Simple linear regression analysis showed a weak positive correlation (0.379, p < 0.000) in which the knowledge contributed to the observed practice by 14.4%.

Conclusion: Periodic continuance of professional development (CPD) with an emphasis on the skills needs to be conducted, monitored and evaluated by the hospital administration to enhance nurses' skills in pain management for better patient outcomes.

1. Introduction

The incidence of post-operative pain is estimated to vary between 47 and 100%, posing a big challenge in all ages, races, sexes, different economic status and geographical locations (Woldehaimanot, Eshetie, & Kerie, 2014; Goldberg & McGee, 2011). Globally, and according to the World Health Organisation (WHO), pain is an issue that needs a multi-disciplinary approach, although it does not appear on the list of disease burdens (Size, Soyannwo, & Justins, 2007). For the first three days, post-operative pain is severe, unpleasant and uncomfortable hence it needs timely management (Kolobe, 2015; Mwaka, Thikra, & Mung'ayi, 2013). Therefore, equipping nurses with accurate, updated knowledge and skills about immediate post-operative pain management to give compassionate care, especially for patients hospitalised in surgical wards, is paramount (Madenski, 2014).

Globally, the knowledge and practice of nurses regarding immediate pain management has been highlighted in few studies. A study conducted in South Africa revealed knowledge deficits, inconsistent clinical practices as well as limited training in post-operative pain management among nurses (Wulff, 2012). In Kenya, only 41% of the nurses reported that they had sufficient knowledge to assess and manage post-operative pain (Kituyi, Imbaya, Wambani, Sisenda, & Kuremu, 2011). A study conducted in Rwanda revealed an altered knowledge base and pain evaluation techniques as challenges for post-operative pain management among anesthesia residents (Johnson, Mahaffey, Egan, Twagirumugabe, & Parlow, 2015). However, most of the studies conducted highlight general pain management rather than immediate post-surgical pain management (Manwere, Chipfuwa, Mukwamba, & Chironda, 2015; El-Rahman, Al Kalaldeh, & Muhbes, 2013).

High levels of education and an additional course on pain management were among the factors associated with a good knowledge and practice of pain management (D'emeh, Yacoub, Darawad, Al-Badawi, & Shahwan, 2016). Under-management of immediate post-operative pain

* Corresponding author.
E-mail addresses: gerrychironda@yahoo.co.uk, gc88@nyu.edu (G. Chironda).

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is associated with inadequate knowledge of the staff, poor pain assessment and fear of analgesics-related complications (Gupta, Kaur, Sharma, & Goyal, 2010). Again, another study revealed that the knowledge of pain management had a strong correlation with pain management practices (Alzghoul & Abdullah, 2016). The significance of nurses' role in pain management, ranging from advocacy to administration of analgesics and evaluation of outcomes, cannot be overstated.

Improper management of post-operative acute pain can contribute to medical complications including pneumonia, deep vein thrombosis, infection and delayed healing (Meissner et al., 2015). Furthermore, inadequately controlled post-operative pain is life-threatening, causes prolonged hospitalisation, chronic post-surgery pain and can even be fatal (Masigati & Chilonga, 2014; Rodríguez-Betancourt, Marzán-Esquivel, Oliva-Martínez, & Carmona-Meza, 2014; Woldehaimanot et al., 2014; Olufunke, 2018). However, little is documented about the knowledge and practices of the nurses regarding immediate post-operative pain management in surgical wards in Rwanda. Therefore, this study seeks to document the perceived knowledge and practices of nurses working in surgical units with regard to immediate post-operative pain management in Rwanda.

2. Purpose of the study

The purpose of this study is to assess the perceived knowledge and practice of immediate post-operative pain management among nurses working in surgical wards in Rwanda.

3. Specific objectives

To assess the perceived knowledge of nurses working in surgical wards with regards to immediate post-surgery pain management in Rwanda.

To evaluate the perceived practice of nurses working in surgical wards with regards to immediate post-surgery pain management in Rwanda.

To establish factors associated with perceived knowledge and practice of nurses working in surgical wards concerning immediate post-surgery pain management in Rwanda.

To examine the relationship between perceived knowledge and the practice of nurses with regards immediate post-operative pain management in Rwanda.

4. Materials and methods

4.1. Study design

The study used a descriptive cross-sectional design. This study was conducted from February to April 2017.

4.2. Study setting area

The study was conducted in the Rwanda Military Hospital (RMH) and the Kigali University Teaching Hospital (CHUK), which are two referral hospitals in Rwanda. The two hospitals were chosen because they are similar in that both are public referral hospitals with the same level of practice. They all located in Kigali City though in different districts, one in Kicukiro, and the other in Nyarugenge District.

4.3. Study population

A convenience sample of all the nurses working in surgical units, licensed by Rwanda Nursing and Midwifery Council were selected to participate in the study. Participants who were easily accessible, ready and available on duty at the time of data collection were selected to participate in the study. The nurses who had not been working at the surgical units for the past six months were excluded from the study.

4.4. Sample size

The sample was estimated using the formula of Kish (1965) of cross-sectional studies.

$$N = \frac{Z\alpha^2 . P . (1-P)}{\delta^2}$$

N = the sample estimate of nurses.
P = Assumed true population prevalence which was estimated at 50% since no similar study has been done in Rwanda.
Zα = standard normal deviation at 95% confidence interval which corresponds to 1.96
δ^2–Absolute error between the estimated and true population of 5%

$$\text{The calculated Sample Size } N = \frac{1.96 * 1.96 * 0.5 * (1 - 0.5)}{0.05 * 0.05} = 384$$

However, using the modified Kish Leslie formula for available adjusted sample size, K is the actual number of registered nurses working in surgical units from the two selected study sites, which is 225.

$$N/[1 + (N-1)/K] = 384/[1 + (384 - 1)/225] = 142$$

Therefore, the calculated sample size of 142 was used for the study, meaning 142 questionnaires were distributed. However, 131 questionnaires were returned which translate to response rate of 92.3%. Hence, the sample size for the study was 131.

4.5. Data collection instrument

A self-administered questionnaire was used which was developed from a standardised tool developed by Ferrell and McCaffery (2008) and attributes of some studies in literature (Manwere et al., 2015; Alhassan, Ahmed, & Bannaga, 2017). The original standardised tool was developed to assess the knowledge and attitude with regards to pain. This tool is available for use in the public domain. The original tool has a test-retest reliability of $r > 0.8$ and an internal consistence reliability of $r > 0.7$. The instrument has been used by several studies as indicated by the original developers. Since attitudes influence the choice of actions, the authors evaluated the attitudes questions and changed them into practice questions. The researchers selected knowledge and practice questions which were only applicable to immediate post-operative pain management based on their applicability in the Rwandan context. The instrument was administered in English since all nurses can read, comprehend and understand the language.

The self-administered instrument was divided into three sections, namely socio-demographic, knowledge and practice sections. Section A described the personal characteristics of study participants. Section B were questions related to perceived knowledge with regards to post-operative pain management among nurses. The researchers agreed that since these were not novice nurses (pass mark at 50%), the pass mark was set at 80% percentile level for all aspects of knowledge and practice. The overall scale for knowledge and practice was adopted from Basak, Petpichetchian, and Kitrungrote (2014). The responses to knowledge questions were rated on a Likert scale where a favourable response was given a higher score and the least favourable response was given a lower mark. The highest attainable score for the knowledge section on post-operative pain management was 17 while the lowest score was 4. High levels of knowledge were from 14 to 17 points which translates to 80 to 100 per cent. Moderate and low levels of knowledge with regards to post-operative pain management were from 12 to 13 points (79–70%) and below mark 13 (70%) respectively. Section C measured the level of practice towards immediate post-operative pain management among nurses. The practice section consisted of 12 questions in the format of True or False. A true practice answer was given a value mark of 2, while the wrong answer (false) was given a value of 1. The highest attainable score was 24 and the lowest was 12. Scores of

20–24 (80–100%) signified good practices. Total scores of 17 to 19 (70–79%) signified moderate practice while total scores below 17 (70%) was a low level of practice.

4.6. Validity and reliability of the instrument

Content validity was ensured by using the adopted and modified instrument to suit the context of Rwanda. Again, inclusion of items obtained from literature ensured that the research tool had content validity. Moreover, the instrument was submitted to three independent reviewers and experts in pain management. Regarding reliability, the questionnaire was pilot tested before data collection with the use of 10 nurses from one of the surgical units different from the study setting. The results of the pilot study and feedback from experts were then used to modify the instrument to suite the Rwandan context. A reliability analysis was performed on the modified instrument and the Cronbach's alpha of 0.71 was obtained, meaning that the instrument was a very good measure of perceived knowledge and practice of immediate post-operative pain management in Rwanda.

4.7. Data collection process

After getting permission of Institutional review Board (IRB) and hospital authorities, the researcher proceeded to surgical units of the selected sites to start data collection. On arrival to the surgical ward, the in charge of the unit was informed. The purpose of the study was explained to study participants and those who were willing to participate signed the consent form before filling the questionnaire. The participants were informed of returning the completed questionnaires in an enclosed or sealed envelop and deposit them at the ward in-charge office for collection by the researchers.

4.8. Data analysis

Data was coded, entered in a computer and was analysed using SPSS (Version 21). Descriptive statistics were used to describe the demographic characteristics, level of perceived knowledge and practice of nurses with regards to immediate post-operative pain management. Continuous data were shown in terms of mean plus/minus standard deviation while categorical data was expressed in the form of numbers and percentages. Inferential statistics of chi-square was used to identify factors associated with perceived knowledge and practice. Multiple regression analysis was performed on the factors associated with knowledge and practice of nurses for the purposes of controlling confounding factors. Further, simple linear regression analysis was implemented to explain the contribution of knowledge to practice. The level of significance was set at 0.05.

4.9. Ethical considerations

The permission to collect data was guaranteed by the Institutional Review Board (IRB) of the College of Medicine and Health Sciences (CMHS/IRB/110/2017), University of Rwanda after reviewing the study protocol. Also, the institutional review boards of Rwanda Military Hospital (EC/RMH/113/2017) and the Kigali University Teaching Hospital (EC/CHUK/343/2017) offered permission to collect data. The participants signed the consent forms before data collection. No participant names appeared on the questionnaires in order to respect the principle of anonymity, and data was kept confidential.

5. Results

5.1. Demographic data

A total of 131 (100%) nurses working in the surgical ward participated in the study. Of these, 91 (70%) of the nurses' ages were greater than 31 years. One hundred and eight (82%) of the nurses were females, of whom, the majority were married (114 (87%). With respect to educational level, 101 (77%) of the nurses had attained an advanced diploma in nursing (A1) and 96 (73%) having working experience of more than five years (Table 1).

Table 1
Demographic data of study participants (n = 131).

Demographic variables	Frequency (%)
Age	
26–30 years	40 (30)
Greater than 31	91 (70)
Gender	
Male	23 (18)
Female	108 (82)
Marital status	
Single	10 (8)
Married	114 (87)
Widow	7 (5)
Educational level	
Certificate in nursing (A2)	25 (19)
Advanced diploma in nursing (A1)	101 (77)
Bachelor's degree in nursing (A0)	5 (4)
Working experience	
< 2 years	13 (10)
2–5 years	22 (17)
More than 5 years	96 (73)

5.2. Perceived knowledge of nurses with regards to immediate post-operative pain management

More than half of the nurses (86 (66%)) said their source of information was from hospital setting. Slightly above average (67 (51%)) number of the nurses perceived the level of pain management in surgical ward to be effective. Seventy-five (57%) of the nurses reported that they had an adequate knowledge on the tools used in pain management. The majority of the nurses (104 (79%)) reported that they had an adequate knowledge of immediate post-surgery pain management. All the nurses (131 (100%)) reported that they had used international or national tools in assessing pain. The majority of the nurses (109 (83%)) reported receiving no support to improve their knowledge on post-operative management. Seventy-five (57%) of the nurses reported negatively on the changes in post-surgery pain management. Eighty-five (65%) of the nurses reported that post-surgery pain management was at a good level. Slightly more than half (68 (52%)) of the nurses said that the duration of analgesia of 1–2 mg was 4-5hrs after administration. One hundred and one (77%) nurses correctly highlighted that older patients cannot tolerate opioids for pain relief. Seventy-seven (59%) nurses indicated incorrectly that giving a patient water for injection was not a useful test for pain reality. While 111 (85%) nurses correctly reported that hydrocodone/acetaminophen 7.5 mg/325 mg per oral as being approximately equal to 5–10 mg of morphine (Table 2).

5.3. Perceived practice of nurses of immediate post-operative pain management in a surgical ward

Table 3 shows that a slightly more than half (69 (53%) number of the nurses reported wrongly that vital signs were not always indicators of pain intensity. While 75 (58%) of the nurses highlighted falsely that patients distracted from pain did not have severe pain. The majority (86 (66%)) of the nurses correctly reported that patients sleep in severe pain. Slightly more than half of the nurses (68 (52%)) falsely reported that respiratory depression rarely occurs in a stable dose of opioids. The majority (115 (88%) of the nurses correctly reported that combining

Table 2
Perceived knowledge of nurses on immediate post-operative pain management (n = 131).

Items on the questionnaire	Frequency (%)
Perceived Knowledge about immediate post-surgery pain management	4 (3)
Inadequate	23 (18)
Moderate	104 (79)
Adequate	
Source of knowledge about immediate post-surgery pain management	20 (15)
Radio	25 (19)
Peer	86 (66)
Hospital	
Rating of the level of managing pain of immediate postoperative patients in surgical ward	64 (49)
Moderate	67 (51)
Effective	
Knowledge on tools used in pain assessment	
Moderate	56 (43)
Adequate	75 (57)
Use internationally or nationally recognized tools in assessing pain	131 (100)
Yes	
Support of nurses on improving knowledge on immediate post-operative pain management from the hospital administration	22 (17)
Yes	109 (83)
No	
Duration Of Analgesia 1–2 mg Is 4–5 h	
True	68 (52)
False	63 (48)
Narcotic/opioid addiction is defined as impaired control over drug, use compulsive use, continued use despite harm, and craving	80 (61)
False	51 (39)
True	
Equianalgesia means approximately equal analgesia is used	
True	118 (90)
False	13 (10)

analgesics and opioid controls pain better than using only analgesics. While 97 (74%) nurses correctly reported that opioids should not be given to patients with a history of substance abuse. Most of the nurses (75 (57%)) correctly indicated that patients are encouraged to endure much pain before using opioids. While 113 (86%) nurses reported incorrectly that children who are 11 years old can report pain, so clinicians do not rely on the parents during pain assessment. The majority (83 (63%)) of the nurses reported incorrectly that after an initial dose of opioid analgesics, subsequent doses should be adjusted as per the individual patient's response. Majority of nurses (99 (76%)) incorrectly highlighted sedation assessment as not being needed during opioid pain management (Table 3)

5.4. Participants' level of knowledge and practice of immediate post-operative pain management in a surgical ward

The minimum and maximum total scores on the knowledge sub-section was 11 and 16 respectively with the mean score of 14.2 (SD = 1.2). The majority of the nurses [(97 (74%)] had high a level of perceived knowledge of immediate post-operative pain management (Table 4).

With regards to practice, the minimum and maximum total scores on the practice sub-section was 16 and 20 respectively with the mean score of 18.1 (SD = 1.02). 115(88%) of the nurses had moderate levels of practice with regards to immediate post-operative pain management (Table 4).

Table 3
Assessment of practice on immediate post-operative pain management (n = 131).

Items on the questionnaire	Frequency (%)
Nurses frequently do vital signs as they are always indicators of the intensity	
True	62 (47)
False	69 (53)
Patients distracted from pain do not have severe pain	
True	55 (42)
False	75 (58)
Patients sleep in severe pain during immediate post-operation	
True	86 (66)
False	45 (34)
When a stable dose of opioid is given, respiratory depression rarely occur	
True	63 (48)
False	68 (52)
Combining analgesics and opioid control pain than using analgesics agent	
True	115 (88)
False	16 (12)
Opioids are not used in patients with history of substance abuse	
True	97 (74)
False	34 (26)
Elderly patient cannot tolerate opioids for immediate pain relief	
True	101 (77)
False	30 (23)
Patients are encouraged to endure much pain before using opioid	
True	75 (57)
False	56 (43)
Eleven years children cannot report pain so nurses rely on the parent's assessment of the child's pain intensity	
True	18 (14)
False	113 (86)
After initial dose of opioid analgesic subsequent doses should be adjusted in accordance with individual patient's response	
True	48 (37)
False	83 (63)
Anticonvulsant drug such as gabapentin produce optimal pain relief after a single dose	
True	44 (34)
False	87 (66)
Sedation assessment is recommended during opioid pain management	
True	32 (24)
False	99 (76)

Table 4
Participants level of knowledge and practice regarding immediate post-operative pain management (n = 131).

Perceived knowledge Score out of 17	Knowledge score in percentage	Level of knowledge/ Frequency	Mean (SD)
11	65	Low – 1 (1%)	14.2 (1.2)
12	71	Moderate – 33	
13	76	(25%)	
14	82	High – 97 (74%)	
15	88		
16	94		
Perceived practice score out of 24	Practice score in percentage	Level of practice/ Frequency	Mean (SD)
16	67	Low – 14 (10%)	18.1
17	71	Moderate – 115	(1.02)
18	75	(88%)	
19	79	High – 2 (2%)	
20	83		

5.5. Factors associated with perceived knowledge and practice of nurses with regards to immediate post-operative pain management

The factors associated with perceived knowledge of nurses with

Table 5
Factors associated with knowledge and practice of Nurses regarding immediate post-operative pain Management in surgical ward (n = 131).

Variables	Factors associated with knowledge		Factors associated with Practice	
	Mean (95% CI)	p-value	Mean (95% CI)	P value
Age				
26–30 years	21.8 (21.1–22.5)	0.000	33.2 (32.9–33.6)	0.032
Greater than 31	20.6 (20.4–20.8)		33.4 (33.1–33.8)	
Gender				
Male	20.7 (20.4–21.0)	0.000	33.5 (33.2–33.8)	0.051
Female	22.1 (21.6–22.6)		32.7 (32.2–33.2)	
Marital status				
Single	20.3 (18.1–22.5)	0.000	33 (32–33.8)	0.463
Married	21.0 (20.8–21.2)		33.5 (33.2–33.7)	
Widow	22.0 (20.4–23.6)		33.1 (32.5–33.8)	
Educational level				
Certificate in nursing	20.7 (20.4–21.0)		33.3 (33.1–33.6)	
Advanced diploma	22.2 (21.5–22.5)	0.008	32.2 (30.8–33.6)	0.006
Bachelor's degree	22.0 (21.5–22.5)		33.9 (33.3–34.5)	
Working experience				
< 2 years	21.5 (19.9–23.2)		33.4 (32.9–33.8)	
2–5 years	21 (20.1–21.9)	0.000	32.5 (32–33)	0.031
More than 5 years	20.9 (20.7–21.4)		33.6 (33.3–33.9)	

regards to immediate post-operative pain management in surgical wards were; age (21.8 95% CI (21.1–22.5), p = 0.000), gender (20.7 95% CI (20.4–21, p = 0.000), marital status (20.3 95% CI (18.1–22.5), p = 0.000), educational level (22.2 95% CI (21.5–22.5), p = 0.008) and working experience (21 95% CI (20.1–21.9), p = 0.000) (Table 5).

The factors associated with perceived practices of nurses with regard to immediate post-operative pain management were; age (33.2 95% CI (32.9–33.6), p = 0.032), educational level (32.2 95% CI (30.8–33.6), p = 0.006) and working experience (32.5 95% CI (32–33), p = 0.031) (Table 5).

Table 6 highlights the multiple regression analysis. There was an overall significant moderate positive correlation (r 0.624, p < 0.05) between age, gender, marital status, educational level and working experience and perceived knowledge of nurses with regards to immediate post-operative management in surgical units. The aforementioned covariates are contributing nearly 39% variance on the perceived knowledge of nurses. Similarly, a significant positive moderate relationship (r 0.590, p < 0.05) between the covariates and perceived practice of nurses was revealed with a variance of 35% on the outcome. Simple linear regression analysis was conducted and showed a weak positive correlation (0.379, p < 0.05) between perceived knowledge and practice of nurses with regards to immediate post-operative pain management in surgical wards in which the knowledge contributed to the observed practice at 14.4%.

Table 6
Multiple regression analysis for demographic variables, knowledge and practice of nurses (n = 131).

Multiple regression analysis for factors associated with knowledge of nurses				
R = 0.624	R^2 = 0.389	Sig F change 0.0000	P value for the correlation = 0.05'	
Variables	Coefficient (B)	95%CI(B)	Standard error	Significance level
Age in years	−2.094	−2.739 to −1.450	0.326	0.000
Gender	0.946	0.254–1.638	0.350	0.008
Marital status	0.677	0.092–1.262	0.295	0.024
Educational level	0.348	0.143–0.553	0.104	0.001
Working Experience	1.177	0.680–1.674	0.251	0.000
Multiple regression analysis for factors associated with practice nurses				
R = 0.590	R^2 = 0.348	Sig F change 0.000	p value for the correlation = 0.05	
Age	0.565	−0.130 to −1.260	0.351	0.110
Gender	−1.750	−2.416 to −1.085	0.336	0.000
Educational level	0.251	0.051–0.451	0.101	0.014
Working experience	−0.147	−0.651 to −0.356	0.254	0.564
Simple linear regression analysis for knowledge and practice of nurses				
R = 0.379	R^2 = 0.144	Sig F change 0.00	p value for the correlation = 0.05	
Knowledge of nurses	0.493	0.327–0.658	0.084	0.000

6. Discussion

6.1. Perceived knowledge of immediate post-operative pain management

The study's findings show that the nurses, through self-report, have an adequate knowledge about the immediate post-operative surgery and this confirms the findings of D'emeh et al. (2016) where nurses in surgical units had knowledge in pain assessment and management issues. Contrary to other studies (Wulff, 2012; Basak et al., 2014), nurses reveal low level of knowledge regarding post-operative pain management. This finding may not be surprising as the majority of the nurses in the current study had more than 5 years of experience and were at the level of advanced diploma, therefore their knowledge of pain management is naturally more in comparison to their counterparts at certificate level. In fact, the nurses reported that their knowledge was acquired in the hospital setting, although the majority further clarified that they had not received any support from the hospital with regards to improving their knowledge of immediate post-operative pain management. This may be interpreted that the nurses had not had any further training on post-operative pain management in the form of continuing professional development. Adequate knowledge provided to the nurses is important in order to enhance the nurses' role in the management of patients' pain from advocacy to administration of analgesics and evaluation of the outcome in surgical wards (Madenski, 2014). Providing this knowledge through health professional education is imperative (Katende & Mugabi, 2015).

A surprising result was reported about nurses' use of internationally and nationally recognised tools in assessing pain in which all of them reported to use these tools which was in contrast with the results a study where few nurses affirmed the use of the aforementioned tools (Olufunke, 2018). However, slightly more than half of the nurses reported an adequate knowledge on the use of these tools. This may be interpreted that the nurses in this study could be aware of the international and national tools but lack a proper introduction and education on the use of these tools. Although nurses are aware of these tools, a study done revealed that nurses in clinical areas are not using pain assessment tools and this becomes a barrier to the management of immediate post-operative pain in surgical wards (Al-Khawaldeh, Al-Hussami, & Darawad, 2013). It is important to note that evidence-based tools, if inappropriately introduced to the end users, and without advocating for their use (Katende, Groves, & Becker, 2014), will have a significant impact on the patient outcomes. This problem can be mitigated with the support from hospitals through continuing professional development (Katende et al., 2014), but the hospitals' support lacked in this study. No wonder, the same proportion of nurses reported negatively about coping with the changes in post-surgery pain management due to inadequate knowledge on the use of the tools.

6.2. Perceived practices of nurses about immediate pain management

The results of the study showed that the majority of the nurses exhibited a moderate level of practices with regards to immediate post-operative pain management, and this is similar to the results of Wulff (2012), Basak et al. (2014), Alzghoul and Abdullah (2016) and Alhassan et al. (2017). These results may not be surprising as it is not necessary that a high level of knowledge will translate into better practices. Importantly, less than half of the nurses were convinced that vital signs were always indicators of pain intensity. The fact that nurses perform vital signs as their routine roles, interpreting the results has implications for quality care and patients' outcomes. In view of post-operative pain management, nurses must take correct and accurate records of the vital signs as these may help the healthcare team to evaluate the prognosis of surgery.

Furthermore, a large proportion of participating nurses reported that patients distracted from pain did not have severe pain. Whereas there is evidence that distraction may actually decrease pain (Katende & Mugabi, 2015), while post-surgery pain may not be easily distracted as it involves breaking through the skin and other sensory organs to pain. Moreover, the patients' vital signs are not yet stable, including the return of consciousness. About pain medication, the majority of the nurses falsely reported that elderly patients cannot tolerate opioids for pain relief. This means that the nurses would not give opioid medication to elderly patients thus leaving them in pain. It is important for nurses to understand that pain management is an important aspect that promotes healing and if pain is not well managed, patients may get complications such as respiratory distress causing morbidity and mortality. Moreover, a large proportion of the nurses reported that they would encourage patients to endure a lot of pain before using opioid medication, signifying inadequate practices with regards to post-operative pain management among the participating nurses. This therefore calls for the need to educate nurses on pain management for better outcomes. Additionally, the majority of the nurses said that there was no need to adjust subsequent opioid doses after the initial dose of opioid administration. Moreover, quite a large proportion of nurses said that they would give water for injection to determine if the pain was real, which is unethical. Again, this translates into knowledge deficiency among nurses on the use of pain assessment tools in relation to drugs.

6.3. Factors associated with the knowledge and practice of nurses with regards to immediate post-operative pain management in surgical wards

Among these, the majority were female nurses older than 31 years of age and having more than five years of experience. Additionally, most of the nurses who participated in the study had attained an advanced diploma in nursing. The study's findings are consistent with findings of Kizza (2012) and Kizza and Muliira (2015) who reported the same age group and gender in their studies. Although all the demographic variables were significantly associated with knowledge of nurses, age group of 26–30 years, females, widowed, nurses with advanced diploma as a qualification and those with less than 2 years' experience exhibited better knowledge regarding immediate post-operative pain management. In another study, only age and years of experience were associated with the knowledge of nurses on pain management (Manwere et al., 2015). However, another study revealed age and duration of employment not being associated with knowledge of nurses (D'emeh et al., 2016). These are expected results, considering the fact that the participating nurses fell within the age group that has nearly come from school, have a higher education level with vast experience in the surgical units.

Participants whose ages was greater than 31 ($p = 0.000$), having a bachelor degree ($p = 0.008$) and experience more than 5 years ($p = 0.000$) statistically proved to have better practices on immediate post-operative pain management. In the context of Rwanda, most nurses will advance to bachelor degree level after they have acquired their advanced diploma in nursing in addition to certain years of practice. Therefore, advanced nursing education will significantly help them improve their practice/clinical skills. Again, the longer the clinical experience acquired, the more one will acquire and perfect his or her practice/clinical skills. Therefore, it can be inferred from the results that the nurses' knowledge and practice with regards to immediate post-operative pain management is influenced by the demographic characteristics. There are no studies to confirm or to contrast a moderate positive significant relationship ($r = 0.624$, $p = 0.000$) among demographic characteristics and knowledge of nurses. Additionally, the results showed that an increase in age resulted in a decrease in the knowledge of nurses on immediate post-operative pain management. This is not peculiar, the fact that as one increases in age, his or her ability to opt for continuous professional development tends to decrease hence the observed decrease in knowledge. The rest of the demographic variables influenced the knowledge of participating nurses positively.

Although gender was not associated with the practice of nurses, regression analysis revealed a significant negative influence on the practice of nurses. It can be inferred from the results that although there were more female nurses than males, the male nurses performed better on the practice test than the females meaning that the males had better practices than the females. On the contrary, a weak positive relationship between knowledge and practice was revealed and this confirms the findings whereby the knowledge of pain management has a strong association with pain management practices (D'emeh et al., 2016; Alzghoul & Abdullah, 2016). The results are in contrast to a study done by Al Hassan et al. (2017) where there was no relationship between knowledge and practice. Furthermore, the contribution of demographic characteristics on knowledge and practice of nurses was 38.9% and no study in literature could affirm or contrast the findings. However, the impact of knowledge on practice of nurses was only 14.4% and in other study, it was found to be 69% (Alzghoul & Abdullah, 2016). This infers that increasing the knowledge of the nurses on the immediate post-operative pain management will impact on their practice levels.

7. Limitations of the study

It should be noted that the results of this study were obtained through self-report. This may have information and recall bias and therefore 'perceived' knowledge and practices. Actual knowledge and practice could have been measured using a knowledge test and an observational test with a checklist for practice.

The study's sample size was limited to two public referral hospitals in Rwanda, therefore, the results cannot be generalizable. Therefore, a

bigger sample involving all nurses from the referral hospitals is necessary.

The original standardized tool measured knowledge and attitude. However, some attitude question were translated into practice questions. Other practice questions were derived from the studies in literature. Although it was tested for reliability and validity, the tool might not have given a true measure of practice with regards to immediate post-operative pain management.

8. Conclusion

The study results revealed that the majority of nurses had a high level of knowledge and a moderate level of practice towards immediate post-operative pain management in surgical wards. Age, gender, marital status, educational level and working experience were significantly associated with the knowledge of nurses with regards to immediate post-operative pain management in surgical wards. Meanwhile, the factors associated with practice were age, educational level and experience. There was a moderate positive significant relationship between demographic characteristics, knowledge and the practice of nurses with regards to immediate post-operative pain management. A weak positive and significant relationship existed between knowledge and practice. The impact of knowledge only on the practice of nurses was only 14.4%. Therefore, periodic continuous professional development with an emphasis on the skills required needs to be conducted, monitored and evaluated by the hospital administration to enhance nurses' knowledge and skills for better patient outcomes. Further research is needed to evaluate the implementation of the CPD on staff and patient outcomes.

Conflict of interest

The authors declare no other possible conflict of interest concerning the publication of the paper.

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Ethical approval details

The protocol for research have been approved by Institutional review board (IRB) of the College of Medicine and Health Sciences (CMHS/IRB/110/2017), University of Rwanda after reviewing the study protocol. Also the institutional review board of Rwanda military hospital (EC/RMH/113/2017) and Kigali university teaching hospital (EC/CHUK/343/2017) offered permission to collect data. Informed consent and participant authorisation were sought from the study participants.

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Appendix A. Supplementary data

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