A study of the knowledge, perceptions, and practices of anaesthetists towards paediatric post-operative nausea and vomiting management.

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Declaration

I, Simon Gowans, declare that this research report is my own unaided work. It is being submitted for the Degree of Master of Medicine in Anaesthesia at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

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Abstract

Background

Postoperative nausea and vomiting (PONV) is a common adverse event after surgery and anaesthesia in European paediatric patients. Despite advances in PONV management, there remains inadequate adherence by anaesthetists to consensus guidelines. South Africa has a unique profile of paediatric PONV and limited literature on this topic could be identified. The aim of this study was to describe the knowledge, perceptions, and practices of anaesthetists in the University of Witwatersrand's Department of Anaesthesiology towards the management of paediatric PONV.

Methods

A cross-sectional, contextual, descriptive study was done in the form of a structured self-administered electronic questionnaire. Data was collected on respondents' practices, knowledge, and perceptions of paediatric PONV and its management.

Results

Data was collected from May 2022 to September 2022. A total of 149 questionnaires were analysed. 6% of respondents reported having patients who had experienced PONV in the last month. Less than half of anaesthetists reported assessing for risk factors (48%) or using clinical prediction tools (42%) for PONV. Despite this, 54% of respondents used prophylaxis for PONV in all patients. There was a 57% pass rate for the knowledge section of the questionnaire. Most anaesthetists (89%) appreciated the seriousness of PONV as a side effect, but just over half (50.3%) felt confident in managing it.

Conclusion

South African anaesthetists surveyed had limited experience of paediatric PONV. Respondents' knowledge of PONV guidelines and management was poor and there was limited preoperative screening for PONV. However, many anaesthetists had adopted a liberal antiemetic prophylaxis strategy. This approach may be beneficial as it simplifies the management of an unfamiliar problem. However, this may also represent over treatment of a comparatively rare complication of anaesthesia.

Integration of the global consensus on PONV management into the South African setting could be of great benefit to our paediatric population.

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Abbreviations

5-HT: 5-hydroxytryptamine.

AIMS: Anaesthesia Information Management System.

ANZCA: Australian and New Zealand College of Anaesthetists.

IQR: Interquartile range.

N: Number

PDNV: Postdischarge nausea and vomiting.

PONV: Postoperative nausea and vomiting.

POPI: Protection of Personal Information Act.

POVOC: Postoperative Vomiting in Children.

PV: Postoperative vomiting.

RCT: Randomised Control Trial.

REDCap®: Research Electronic Data Capture.

SAJAA: South African Journal of Anaesthesia and Analgesia.

SBA: Single best answer.

SOP: Standard operating procedure.

TCI: Target controlled infusion.

TIVA: Total intravenous anaesthetic.

VPOP: Vomiting in the Postoperative Period.

Statement

This research report consists of a literature review, draft article, study proposal and appendices. The study proposal is included for background reference and is not for examination.

The formatting of this research report complies with the University of the Witwatersrand's Style Guide for Theses, Dissertations and Research Reports.

The draft article has been prepared in accordance with the latest available authors' guidelines for submission to the South African Journal of Anaesthesia and Analgesia. However, the formatting and referencing of the draft article, in the interests of readability, has been kept consistent with the rest of the research report.

Review of the literature

1.1 Introduction.

Nausea and vomiting are common adverse events after surgery and anaesthesia in North American and European paediatric patient populations.[1-3] Postoperative nausea and vomiting (PONV) is defined as nausea and/or vomiting occurring within 24 to 48 hours after surgery and anaesthesia.[4, 5] Nausea is the subjective feeling of unpleasantness in the stomach and the urge to vomit.[4] The feeling of nausea is not easily expressed by children and, as a result, many studies[1-3, 5, 6] assess only postoperative vomiting (PV). Postdischarge nausea and vomiting (PDNV) is vomiting and/or nausea that occurs after discharge following a procedure which requires anaesthesia.[7] The specific time period in which PDNV occurs has not been defined in the current guidelines[7] but the latest literature that could be found[4, 5] suggests this includes nausea and/or vomiting occurring up to 7 days after anaesthesia. This review will use the encompassing term postoperative nausea and vomiting (PONV) to refer to both PV in children and PONV adults.

1.2 Incidence of PONV in paediatric patients.

Two large European studies[1, 2] found the incidence of PONV, within 24 hours of a surgical procedure, in children to range from 3.4% to as high as 70% (occurring in strabismus surgery without PONV prophylaxis being administered). A more recent study by Bourdaud et al.[3] estimated the overall incidence at just under 25%. Two smaller studies[8, 9] looking at children undergoing ambulatory surgery, reported an incidence of PDNV, also within 24 hours of the procedure, of 12.4 – 14%.

There are few published studies regarding the incidence of PONV in African paediatric populations. Kabre et al. [10] found an incidence of PONV of 7.8% in paediatric patients undergoing ambulatory surgery.

A study by Swart et al.[11] looking at complications after surgery in paediatric patients at an academic hospital in South Africa reported an overall incidence of PONV of 1.4%. These authors also compared the incidence of PONV between African patients (4.4%) and non-African patients (1.2%).[11] However, this study was limited by its small size and the failure to follow up for PONV for 24 hours after surgery.

A 2016 audit by Mogane et al.[12] of perioperative pain management in paediatric patients undergoing tonsillectomy at a tertiary hospital in South Africa, reported a 5% incidence of PONV in the recovery room. This audit shared similar limitations to the study published by Swart et al.[11], being a single centre study with a small sample size and not following up for PONV for 24 hours.

This incidence is lower than that reported in European studies[1-3] of paediatric PONV. This may be attributed to a hypothesised link[13] between race and reduced incidence of PONV that has been reported in adult studies[14, 15] of PONV in the black African population.

1.3 Complications of PONV in paediatric patients

PONV in paediatric patients is associated with complications such as wound dehiscence, bleeding, aspiration, and dehydration resulting in electrolyte derangements.[4-6]

PONV is also a cause of unplanned admission after day case surgery and the associated additional health care costs.[7] A large study by Awad et al.[16] of children undergoing day case surgery in Ireland found 2.2% of children had unplanned admissions. Furthermore, the study[16] showed that even with anti-emetic prophylaxis commonly given, PONV accounted for 8% of these admissions. Importantly this represented half of all the unplanned admissions classified as being “anaesthetic related”.

1.4 Risk factors and clinical predictive scores for PONV in paediatric patients

Risk factors for PONV in paediatric patients are different to those in adult patients.[4, 5, 17] Even risk factors common between the two groups (such as history of previous PONV or motion sickness), may not yet be known in younger paediatric patients.[18] This difference was emphasised in a 2004 study[18] that showed adult risk scores for PONV were not accurate enough to be clinically useful in paediatric patients. As a result of this, new risk scores[1-3] to predict PONV in paediatric patients have been developed and published.

The POstoperative VOmiting in Children (POVOC) Score, developed by Eberhart et al.[1] was published in 2004 after analysing data from 1401 children undergoing anaesthesia in German hospitals. It found four independent risk factors for

postoperative nausea and vomiting: surgery ≥ 30 minutes, age ≥ 3 years, strabismus surgery and previous PONV or previous PONV in first degree relatives. The incidence of PONV was 9%,10%, 30%, 55% and 70% for 0,1,2,3,4 risk factors, respectively.[1] The POVOC score (excluding strabismus surgery) was externally validated in a 2007 study.[2]

A more recent risk score, the Vomiting in the Postoperative Period (VPOP) score,[3] was developed in 2014. Risk factors for PONV in 2393 children undergoing anaesthesia in 11 hospitals in France were analysed. Five independent risk factors were found: duration of anaesthesia ≥ 45 minutes, age (≥ 3 years and ≤ 13 years being the highest risk group), multiple doses of opioids, predisposition to PONV and high-risk surgeries (tonsillectomy, tympanoplasty and strabismus surgery).[3] These scoring systems have not been validated in the South African paediatric population.[13]

1.5 Strategies to prevent and manage paediatric PONV.

Historically, the large incidence of PONV[19] but with relatively limited serious adverse events [20] meant it was regarded as a "big little problem".[20] However, with limited anti-emetic agents available at the time,[21] PONV was regarded as an "unavoidable consequence of the perioperative experience".[20]

However, there are now at least 6 classes of drugs[21] to prevent and treat PONV and good evidence[17] for other interventions to reduce the baseline risk of PONV. There are also regularly revised consensus guidelines[7, 17, 22] for the management of PONV. The latest version, The Fourth Consensus Guidelines for the Management of Postoperative Nausea and Vomiting[17] was published in 2020.

The current guidelines[17] use graded evidence and have recommendations for adult and paediatric PONV management. Whilst the guidelines are extensive and a full description of them is beyond the scope of this review it was worth noting the following recommendations[17] as they apply to the management of paediatric PONV:

1. Identify children at risk for PONV and use risk scores (such as the POVOC score) to quantify the risk of PONV.
2. Reduce baseline risk of PONV in all patients. The following interventions were recommended in paediatric patients:

    a. Use of propofol based total intravenous anaesthetic technique (TIVA) (Grade A1)
    b. Opioid sparing techniques, including caudal blocks (Grade A1).
    c. Liberal fluid therapy (Grade A3)
3. Administer antiemetic agents prophylactically to at risk patients. Importantly, the guidelines do not recommend routine prophylaxis for paediatric patients deemed to be at low risk for PONV and recommend dual prophylaxis for medium risk patients.
4. Treat established PONV with a different class of anti-emetic. Treatment with the same agent as given for prophylaxis does not appear to be effective if given within 6 hours of the original dose.[17]

These advances[17, 21] in the understanding of PONV and its management have resulted in some of the current debates[23, 24] about PONV management now focusing on how to translate these advances into clinically significant reductions in, or even the elimination of, PONV. One of the key points that has been consistently raised[21, 23, 25] is the problem of physician (anaesthetist) barriers to effective PONV management. Kranke, writing in his commentary [25] to one of these debates summarised the problem as this:

“The answers to the questions ‘postoperative nausea and vomiting – when will it stop?’ and whether ‘nausea and vomiting after anaesthesia will remain a ‘never ending story’ are largely dependent on you.”[25]

1.6 Doctors’ knowledge, perceptions and practices of PONV management in adult and paediatric patients

The majority of published literature on knowledge, perceptions, and practices of anaesthetists with regards to PONV does not differentiate between adult and paediatric population groups. Only one small study in Germany, reported in a letter[26] to the German journal “Der Anaesthesist”, could be found that described anaesthetists’ practices of paediatric PONV management.

A 1997 survey[27] of attitudes, perceptions and practices of anaesthesiologists and surgeons in Switzerland towards PONV in all patients (adult and paediatric) showed that almost all anaesthesiologists surveyed (90%) recognised that PONV was a problem in everyday practice. A majority of anaesthesiologists also agreed that

PONV practice needed to be improved. Their concerns were that current agents were not efficacious and too costly. Their understanding of PONV risk factors, prophylaxis, and treatment (a proxy for practice) was generally appropriate given the current published literature. However, respondents underestimated the incidence of PONV in both adults and paediatric patients [respondents estimated paediatric PONV incidence of 15% vs actual incidence of about 25%[3] with a range of between 3,4% and 70%.][1] This may be because the survey also revealed no standardisation for the documentation of the occurrence of PONV. PONV was recorded on the chart by 60% of anaesthesiologists. 20% of respondents documented the amount of vomiting and only 5% documented nausea scores. As a marker of institutional practices, only 17% of respondents formally evaluated PONV incidences at their hospital.[27]

Several studies done by Macario et al.[28, 29] at Stanford University Medical Centre looked at attitudes, perceptions, and practices of anaesthesiologists in California towards adverse outcomes including PONV.

In 1999, Macario et al. published a survey[28] looking at which adverse outcomes anaesthesiologists perceived patients to be most concerned about. In terms of perceived frequency of adverse events, nausea was ranked 2nd and vomiting 4th. In terms of "importance to avoid" vomiting was ranked 7th and nausea 10th. When frequency and "importance to avoid" were plotted together, nausea and vomiting were ranked second only behind incisional pain.[28]

A 2001 survey[29] of anaesthesiologists' practice of adult PONV management recorded 40 different prophylactic pharmacological regimens to be used for a hypothetical high-risk patient. The study also found a vast majority of respondents used older, more well-known drugs over newer, more efficacious agents. The authors hypothesised the following factors may explain such wide variation in PONV management: differences in training during residency, differences in the opinions of "thought leaders" in practice groups, differences in anaesthesiologist perceptions of the effectiveness of the drugs and differences in their perceptions of how PONV effects patients' quality of life. They also stated that "better mechanisms" were needed to assist with clinical decision making.[29]

Macario et al. revisited the prescribing practices of Californian anaesthesiologists in a 2006 study.[30] The prescribing practices for the treatment of established PONV in ambulatory surgery were assessed. Similar to the 2001 study[29], they found 18 different drug and 12 different non-pharmacological interventions for established PONV.[30] Despite this being against the published consensus guidelines, 26% of practitioners gave a repeat dose of the same drug for the treatment of PONV as given for prophylaxis; A quarter of respondents had no standardised protocol for PONV management in their post anaesthesia care unit.[30]

These were small studies that were not necessarily representative of the population of anaesthesiologists. The researchers also did not audit patient anaesthetic records so the data about anaesthesiologists' practice was self-reported with the risk of reporting bias.[28-30]

The only study that could be found that exclusively looked at PONV management practices in paediatric patients was reported in a 2010 letter[26] to the editor of Der Anaesthetist from Klotz and Philippi-Höhne. They reported on data collected from a cohort of 304 paediatric patients (aged 3 to 16), undergoing a variety of different surgical procedures over a 9-month period at Leipzig University Hospital. They found an incidence of PONV of 20.4%. Importantly, almost all the incidences of PONV (99%) occurred after discharge from the recovery room.[26] This highlights the possible underestimation of PONV incidence in the two South African studies[11, 12] that did not follow up PONV for the full 24 hours after the surgery.

In their analysis[26] of management to prevent PONV, Klotz and Philippi-Höhne stratified the patients' risk for PONV and then compared that to the management performed. They found that in 21.4% of cases, the correct PONV prophylaxis management was not performed. This resulted in a 40% rate of PONV in those patents. In contrast, in the other 78.6% of the patients where the correct PONV prophylaxis management was given, there was an incidence of PONV of 15%. Interestingly, a majority (79.6%) of the patients received a TIVA technique.[26]

Whilst this study[26] is relevant, because it was the only study solely describing PONV management in paediatric patients, it has some limitations. Most notably, the results of the study are reported as a letter to the editor [26] and therefore it is unclear if it has been peer reviewed. It was also a single centre study conducted over a short period

(9 months) and contained a small sample size (304 patients). Although the authors did follow up all patients for PONV, 33.9% of patients were outpatients and the follow up was done telephonically, as such, some episodes of PONV may not have been detected.[26]

Only one published study[31] outside of the United States and Europe on anaesthesiologists' knowledge, attitudes and perceptions was found. This 2014 electronic survey [31] of a selection of the fellows of the Australian and New Zealand College of Anaesthetists (ANZCA) looked at their prescribing practices for PONV in both adults and paediatrics. Although primarily focused on the use of dexamethasone as prophylaxis for PONV, it had relevant findings. The PONV practices generally followed the current best evidence and guidelines. Specifically, regarding dexamethasone, there was a good level of awareness of its potential adverse effects. However, given that it was widely prescribed, it was inferred that there was a balanced risk-benefit approach to prescribing.[31]

The study[31] of ANZCA fellows is limited by it being a self-reported survey with the potential for reporting bias. More importantly the authors admitted there may have been selection bias, in that the fellows who responded may have had an interest in PONV or involved in surgical cases with more emetic risk.[31]

Several studies[32-36] in Europe investigated anaesthesiologists' adherence to institutional protocols for PONV management.

Kooij et al. conducted two successive studies[32, 33] at a regional academic hospital in The Netherlands. In the first study[33] they assessed if a reminder added to an electronic Anaesthesia Information Management System (AIMS) at the preoperative clinic visit resulted in increased detection of patients at risk for PONV and improved prescription of PONV prophylaxis according to their pre-existing institution's protocol. In the second study[32] they assessed if a similar reminder on an AIMS, but delivered intraoperatively to the anaesthetist, resulted in improved administration of PONV prophylaxis to at risk patients. Both studies[32, 33] were divided into control-intervention-control periods.

Similar findings were made in both studies.[32, 33] In the initial control period, adherence to the protocol for PONV management was very poor. In the first study, 38% of patients identified at being at risk of PONV were correctly prescribed

prophylaxis. In the second study, 39% of patients eligible for PONV prophylaxis received the correct medication in the correct time frame. This improved in the automated reminder intervention period to 73% and 79% respectively. Notably, when the studies reverted to their control period the rates of adherence returned to near baseline (31% and 41% respectively).[32, 33]

These studies[32, 33] had several aspects that make it difficult to replicate. They were performed at an institution that used a pre-operative clinic to assess patients and enter their anaesthetic plan into an AIMS. The anaesthetic plan is then carried out by nurse anaesthetists under supervision. Nevertheless, the studies[32, 33] highlighted the poor adherence to the pre-existing protocols for PONV management.

In 2010, Franck et al. published an article[37] in “Der Anaesthetist” reporting on their audit of adherence to a departmental standard operating procedure (SOP) for PONV. The audit was performed over 15 months at the Charité – Universitätsmedizin Berlin. All patients over the age of 14 who had a general anaesthetic were included. The SOP divided patients into three risk categories for PONV (low, moderate, and high) based on the Apfel risk score. The audit [37] found that the majority of patients (92.1%) deemed to be low risk for PONV were managed correctly for PONV based on the SOP. However, only 18.5% of patients assessed to be high risk by the SOP were managed correctly. Overall, 54% of patients did not receive correct PONV management based on their PONV risk.[37]

Kappen et al. at the University Medical Centre Utrecht in The Netherlands, published a series of studies[34-36] between 2014 and 2016 looking at anaesthesiologists’ practice of PONV. It showed that anaesthesiologists’ practice was not universally improved by risk stratification tools and that practice was still influenced by personal perceptions of PONV.[34-36]

The initial study[36] was a randomised control trial (RCT) comparing the incidence of PONV between a group of adult patients managed by anaesthesiologists who had access to a PONV risk score calculator in their anaesthetic information management system and a group managed by anaesthesiologists who provided “care as usual”. The study showed no improvement in PONV rates between the two groups. Although there were several limitations to the study that might have explained the result, it is important to expand on one of them. Anaesthesiologists in the

intervention group (provided with the PONV risk score calculator) prescribed more PONV prophylaxis than the “care as usual group”. However, the anaesthesiologists in the intervention group rarely prescribed more than 2 anti-emetics to patients at high risk for PONV. This is despite good evidence[17] for the use of more than 2 agents in these high-risk patients. The authors of the study[36] could not explain this variation in practice.

To investigate these findings further, Kappen et al. carried out a quantitative and qualitative study[34] of perceptions of “barriers and facilitators” to using the PONV risk score calculator. They compared the results between the original intervention and “care as usual” group of anaesthesiologists. The discussion about the perceptions toward using a risk calculator tool is outside the scope of this review. However, there were 3 other important themes that were reported about PONV management:

a. PONV was not thought to be a concern by the study participants.

b. It was regarded as an expected adverse effect of anaesthesia with a low patient burden.

c. It should not be over treated because of the risks of adverse effects from the anti-emetic drugs.

Kappen et al.[34] also reported that anaesthesiologists’ knowledge of PONV management was incomplete; particularly regarding risk factors for PONV and the prediction of patients at risk of PONV. Anaesthesiologists interviewed said they used an implicit approach, and while they were aware of the literature, often relied on anecdotal risk factors for PONV. For example, it was found that there was hesitancy to prescribe dexamethasone and droperidol because of concern for adverse effects.[34]

1.7 Summary: the current state of adult and paediatric PONV management.

In a review article published this year, Schlesinger et al.[21] were critical of the rate of adult and paediatric PONV given the current management strategies available. The risk factors of PONV in paediatric patients are well established[1-3, 17, 18] and there is a validated clinical prediction tool to risk stratify patients at risk of PONV [1, 2]. There is good peer reviewed evidence[17] for effective pharmacological and non-pharmacological interventions to both prevent and treat PONV. Finally, there are

recently published consensus guidelines.[17] This has led Schlesinger et al.[21] to state that:

"Nowadays, no patient should unnecessarily suffer from PONV, since effective and tolerable pharmaceutical therapy options are available and can be applied in most cases".

Historically there was wide variation of practice and poor adherence[29, 30] to contemporaneous guidelines.[7, 22] The causes of this were probably multi-factorial.[29] More recent studies are divided as to whether the management is improving[31] or remaining the same[26, 32-37] as before.

One of the keys barriers to effective PONV management in adult and paediatric patients appears to inadequate adherence to guidelines and institutional protocols.[26, 32, 33, 37] Another barrier to effective PONV management may be incomplete knowledge regarding the risk factors and correct management.[34] It may be that there remains a perception that PONV is not a serious side effect.[34] However, even the earliest studies[27, 28] found that anaesthetists recognised that PONV was a serious side effect. Ineffective pharmacological management may be due to some anaesthetists being unwilling to use certain drugs which they perceive to have adverse side effects,[34] but, again, this finding was not replicated in another study.[31]

The ongoing high rate of PONV in both adult[17] and paediatric patients[26] in the face of such effective interventions has led to some commentators[21, 23, 25] to call for a move away from risk stratification and towards universal PONV prophylaxis. This is a significant shift from the traditional approach[6, 19] where risk stratification and selective prophylaxis were favoured. The proponents[21, 23, 25] of this liberal PONV prophylaxis strategy argue that the traditional concerns[6] about the cost and side effects of PONV prophylaxis are less relevant today. They hypothesise[23, 25] that simplifying the management of PONV, with less emphasis on risk stratification, and adopting a universal prophylaxis approach could result in less PONV.

1.8 Role of this study in the current body of research.

There is a low incidence of PONV, with a range of 1.2 – 5%, in South African paediatric patients.[11, 12] Notwithstanding the shortcomings of these studies,[11, 12] given the findings of lower rates of PONV in studies of adult South African

patients,[14, 15] it is plausible that those may be the true rates of PONV in South African paediatric patients.[13] Even in developed countries, with a far larger burden of paediatric PONV[1-3, 18, 26] and access to novel interventions[32, 33, 35] there are still significant barriers[21, 34] to effective PONV management. This has led to some commentators[21, 23, 25] to call for universal PONV prophylaxis for all patients undergoing surgery. As perioperative medicine begins to navigate towards achieving the ideal of a "PONV-free hospital" [21] with potentially far more liberal anti-emetic prophylaxis[21, 23, 25] being prescribed, it is important to recognise that the PONV situation in South Africa may be unique.[13] Therefore, it is meaningful to understand what South African anaesthetists' knowledge, perceptions and practices are towards paediatric PONV and attempt to integrate the global research consensus with the South African patient population.

1.9 References

1.Eberhart LH, Geldner G, Kranke P, Morin AM, Schäuffelen A, Treiber H, et al. The development and validation of a risk score to predict the probability of postoperative vomiting in pediatric patients. Anesth Analg. 2004;99(6):1630-7. DOI:10.1213/01.Ane.0000135639.57715.6c.
2.Kranke P, Eberhart LH, Toker H, Roewer N, Wulf H, Kiefer P. A prospective evaluation of the POVOC score for the prediction of postoperative vomiting in children. Anesth Analg. 2007;105(6):1592-7. DOI:10.1213/01.ane.0000287816.44124.03.
3.Bourdaud N, Devys JM, Bientz J, Lejus C, Hebrard A, Tirel O, et al. Development and validation of a risk score to predict the probability of postoperative vomiting in pediatric patients: the VPOP score. Paediatr Anaesth. 2014;24(9):945-52. DOI:10.1111/pan.12428.
4.Kovac AL. Postoperative Nausea and Vomiting in Pediatric Patients. Paediatr Drugs. 2021;23(1):11-37. DOI:10.1007/s40272-020-00424-0.
5.Ames WA, Machovec K. An Update on the Management of PONV in the Pediatric Patient. Best Pract Res Clin Anaesthesiol. 2020;34(4):749-58. DOI:10.1016/j.bpa.2020.05.007.
6.Rose JB, Watcha MF. Postoperative nausea and vomiting in paediatric patients. Br J Anaesth. 1999;83(1):104-17. DOI:10.1093/bja/83.1.104.
7.Gan TJ, Meyer TA, Apfel CC, Chung F, Davis PJ, Habib AS, et al. Society for Ambulatory Anesthesia Guidelines for the Management of Postoperative Nausea and Vomiting. Anesth Analg. 2007;105(6):1615-28. DOI:10.1213/01.ane.0000295230.55439.f4.
8.Efune PN, Minhajuddin A, Szmuk P. Incidence and factors contributing to postdischarge nausea and vomiting in pediatric ambulatory surgical cases. Paediatr Anaesth. 2018;28(3):257-63. DOI:10.1111/pan.13333.
9.de Orange FA, Marques J, Flores M, Borges PS. Dexamethasone versus ondansetron in combination with dexamethasone for the prophylaxis of postoperative vomiting in pediatric outpatients: a double-blind, randomized, placebo-controlled clinical trial. Paediatr Anaesth. 2012;22(9):890-6. DOI:10.1111/j.1460-9592.2012.03900.x.
10.Kabré YB, Traoré ISS, Kaboré FAR, Ki B, Traoré AI, Ouédraogo I, et al. Anesthesia for ambulatory pediatric surgery in sub-Saharan Africa: a pilot study in Burkina Faso. Anesth Analg. 2017;124(2):623-6. DOI:10.1213/ANE.0000000000001780.
11.Swart ED, Rajah C, Rodseth RN. Induction behaviour and race and its association with postoperative agitation in paediatric elective surgery. South Afr J Anaesth Analg. 2017;23(2):20-3. DOI:10.1080/22201181.2017.1293385
12.Mogane PN, Mashinini M, Lundgren C. Audit of perioperative pain management in paediatric patients following tonsillectomy at a tertiary hospital in Johannesburg. South Afr J Anaesth Analg. 2019;25(2):30-6. Available from: https://journals.co.za/doi/abs/10.10520/EJC-19cc3efedd
13.Rodseth RN. Guest Editorial: Postoperative nausea and vomiting in South Africa–the next step. South Afr J Anaesth Analg. 2016;22(5):130. Available from: https://www.ajol.info/index.php/sajaa/article/view/166605/156038.
14.Alli A, Omar S, Tsang S, Naik BI. The effect of ethnicity on the incidence of postoperative nausea and vomiting in moderate to high risk patients undergoing general anesthesia in South Africa: a controlled observational study. Middle East J Anaesthesiol. 2017;24(2):119. Available from: https://pubmed.ncbi.nlm.nih.gov/30140116/
15.Rodseth RN, Gopalan PD, Cassimjee HM, Goga S. Reduced incidence of postoperative nausea and vomiting in black South Africans and its utility for a modified risk scoring system. Anesth Analg. 2010;110(6):1591-4. DOI:10.1213/ANE.0b013e3181da9005.
16.Awad IT, Moore M, Rushe C, Elburki A, O'Brien K, Warde D. Unplanned hospital admission in children undergoing day-case surgery. Eur J Anaesthesiol. 2004;21(5):379-83. DOI:10.1017/s0265021504005058.

17.Gan TJ, Belani KG, Bergese S, Chung F, Diemunsch P, Habib AS, et al. Fourth Consensus Guidelines for the Management of Postoperative Nausea and Vomiting. Anesth Analg. 2020;131(2):411-48. DOI:10.1213/ANE.0000000000004833
18.Eberhart LH, Morin AM, Guber D, Kretz FJ, Schäuffelen A, Treiber H, et al. Applicability of risk scores for postoperative nausea and vomiting in adults to paediatric patients. Br J Anaesth. 2004;93(3):386-92. DOI:10.1093/bja/aeh221.
19.Kovac A. L. Prevention and treatment of postoperative nausea and vomiting. Drugs. 2000;59(2):213-43.10.2165/00003495-200059020-00005
20.Kapur PA. The big "little problem". Anesth Analg. 1991;73(3):243-5. DOI:10.1213/00000539-199109000-00001
21.Schlesinger T, Weibel S, Kranke P. Postoperative/postdischarge nausea and vomiting: evidence-based prevention and treatment. Curr Opin Anaesthesiol 2023;36(1):109-16. DOI: 10.1097/ACO.0000000000001200
22.Gan TJ, Meyer T, Apfel CC, Chung F, Davis PJ, Eubanks S, et al. Consensus guidelines for managing postoperative nausea and vomiting. Anesth Analg. 2003;97(1):62-71. DOI: 10.1213/01.ane.0000068580.00245.95
23.Eberhart LH, Morin AM. Risk scores for predicting postoperative nausea and vomiting are clinically useful tools and should be used in every patient: Con–'life is really simple, but we insist on making it complicated'. Eur J Anaesthesiol. 2011;28(3):155-9. DOI: 10.1097/EJA.0b013e3283427f4f
24.Pierre S. Risk scores for predicting postoperative nausea and vomiting are clinically useful tools and should be used in every patient: Pro–'Don't throw the baby out with the bathwater'. Eur J Anaesthesiol. 2011;28(3):160-3. DOI: 10.1097/EJA.0b013e328342fd86
25.Kranke P. Effective management of postoperative nausea and vomiting: let us practise what we preach! Eur J Anaesthesiol. 2011;28(3):152-4. DOI: 10.1097/EJA.0b013e3283435e51
26.Klotz C, Philippi-Höhne C. Prophylaxe von Übelkeit und Erbrechen in der Kinderanästhesie [Prophylaxis of postoperative nausea and vomiting in pediatric anesthesia: recommendations and implementation in clinical routine]. Der Anaesthesist. 2010;59(5):477-8. German. DOI: 10.1007/s00101-010-1716-8
27.Wilder-Smith OHG, Martin NC, Morabia A. Postoperative nausea and vomiting: a comparative survey of the attitudes, perceptions, and practice of Swiss anesthesiologists and surgeons. Anesth Analg. 1997;84(4):826-31. DOI:10.1097/00000539-199704000-00024.
28.Macario A, Weinger M, Truong P, Lee M. Which clinical anesthesia outcomes are both common and important to avoid? The perspective of a panel of expert anesthesiologists. Anesth Analg. 1999;88(5):1085-91. DOI:10.1097/00000539-199905000-00023.
29.Macario A, Chung A, Weinger MB. Variation in practice patterns of anesthesiologists in California for prophylaxis of postoperative nausea and vomiting. J Clin Anesth. 2001;13(5):353-60. DOI:10.1016/s0952-8180(01)00283-5.
30.Macario A, Claybon L, Pergolizzi JV. Anesthesiologists' practice patterns for treatment of postoperative nausea and vomiting in the ambulatory Post Anesthesia Care Unit. BMC Anesthesiology. 2006;6(1):1-7. DOI:10.1186/1471-2253-6-6.
31.Corcoran TB, Edwards T. A survey of antiemetic dexamethasone administration—frequency of use and perceptions of benefits and risks. Anaesth and Intensive Care. 2015;43(2):167-74. DOI:10.1177/0310057X1504300205.
32.Kooij FO, Klok T, Hollmann MW, Kal JE. Automated reminders increase adherence to guidelines for administration of prophylaxis for postoperative nausea and vomiting. Eur J Anaesthesiol 2010;27(2):187-91. DOI: 10.1097/EJA.0b013e32832d6a76
33.Kooij FO, Klok T, Hollmann MW, Kal JE. Decision support increases guideline adherence for prescribing postoperative nausea and vomiting prophylaxis. Anesth Analg. 2008;106(3):893-8. DOI: 10.1213/ane.0b013e31816194fb

34.Kappen TH, Van Loon K, Kappen MAM, Van Wolfswinkel L, Vergouwe Y, Van Klei WA, et al. Barriers and facilitators perceived by physicians when using prediction models in practice. J Clin Epidemiol. 2016;70:136-45. DOI:10.1016/j.jclinepi.2015.09.008.
35.Kappen TH, Vergouwe Y, Van Wolfswinkel L, Kalkman CJ, Moons KGM, Van Klei WA. Impact of adding therapeutic recommendations to risk assessments from a prediction model for postoperative nausea and vomiting. Br J Anaesth. 2015;114(2):252-60. DOI:10.1093/bja/aeu321.
36.Kappen TH, Moons KGM, Van Wolfswinkel L, Kalkman CJ, Vergouwe Y, Van Klei WA. Impact of risk assessments on prophylactic antiemetic prescription and the incidence of postoperative nausea and vomiting: a cluster-randomized trial. Anesthesiology. 2014;120(2):343-54. DOI:10.1097/ALN.0000000000000009.
37.Franck M, Radtke FM, Baumeyer A, Kranke P, Wernecke KD, Spies CD. Einhaltung der Behandlungsrichtlinien für postoperative Übelkeit und Erbrechen: Wie gut gelingt der Wissenstransfer hin zu einer besseren klinischen Versorgung? [Adherence to treatment guidelines for postoperative nausea and vomiting: How well does knowledge transfer result in improved clinical care?]. Der Anaesthesist. 2010;59:524-8. German. Available from: https://link.springer.com/article/10.1007/s00101-010-1712-z

Draft article

A study of the knowledge, perceptions, and practices of anaesthetists towards paediatric post-operative nausea and vomiting management.

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Ethics

The author/s declare that this submission is in accordance with the principles laid down by the Responsible Research Publication Position Statements as developed at the 2nd World Conference on Research Integrity in Singapore, 2010. Prior to commencement of the study ethical approval was obtained from the University of Witwatersrand's Human Research Ethics Committee (Medical) (M220377). All procedures were in accordance with the ethical standards of the responsible

committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008. Informed consent was obtained from all patients for being included in the study.

Authorship

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

- The conception and design of the study, or acquisition of data, or analysis and interpretation of data.
- Drafting the article or revising it critically for important intellectual content.
- Final approval of the version to be submitted.

The authors further confirm that:

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

Plagiarism

The authors confirm that the work submitted is original and does not transgress the plagiarism policy of the journal. No data, text, or theories by others are presented as if they were the author’s own. Proper acknowledgements of other’s work has been given (this includes material that is closely copied, summarized and/or paraphrased), quotation marks are used for verbatim copying of material. Permissions have been secured for material that is copyrighted.

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PONV, paediatric PONV, perioperative medicine.

Abstract

Background

Postoperative nausea and vomiting (PONV) is a common adverse event after surgery and anaesthesia in European paediatric patients. Despite advances in PONV management, there remains inadequate adherence by anaesthetists to consensus guidelines. South Africa has a unique profile of paediatric PONV and limited literature on this topic could be identified. The aim of this study was to describe the knowledge, perceptions, and practices of anaesthetists in the University of Witwatersrand's Department of Anaesthesiology towards the management of paediatric PONV.

Methods

A cross-sectional, contextual, descriptive study was done in the form of a structured self-administered electronic questionnaire. Data was collected on respondents' practices, knowledge, and perceptions of paediatric PONV and its management.

Results

Data was collected from May 2022 to September 2022. A total of 149 questionnaires were analysed. 6% of respondents reported having patients who had experienced PONV in the last month. Less than half of anaesthetists reported assessing for risk factors (48%) or using clinical prediction tools (42%) for PONV. Despite this, 54% of respondents used prophylaxis for PONV in all patients. There was a 57% pass rate for the knowledge section of the questionnaire. Most anaesthetists (89%) appreciated the seriousness of PONV as a side effect, but just over half (50.3%) felt confident in managing it.

Conclusion

South African anaesthetists surveyed had limited experience of paediatric PONV. Respondents' knowledge of PONV guidelines and management was poor and there was limited pre-operative screening for PONV. Despite this, many anaesthetists have adopted a liberal anti-emetic prophylaxis strategy. This approach may be beneficial as it simplifies the management of an unfamiliar problem. However, this may also represent over treatment of a comparatively rare complication of anaesthesia. Integration of the global consensus on PONV management into the South African setting could be of great benefit to our paediatric population.

Introduction

Postoperative nausea and vomiting (PONV), defined as nausea and/or vomiting occurring within 24 to 48 hours after surgery and anaesthesia[1, 2], is a common adverse event after surgery and anaesthesia in European paediatric patient populations.[3-5] The incidence of PONV in these populations ranges from 3.4% to as high as 70%[3, 4] depending on the presence of risk factors. Overall, PONV is estimated to occur in about 1 in 4 children.[5]

South Africa appears to have a unique profile of PONV.[6] Several studies[7, 8] have found a significantly decreased incidence of PONV in adult Black South African patients. Whilst the reasons for this still need further investigation it appears to be a true finding.[6] Small, single-centre audits[9, 10] of immediate postoperative complications in paediatric patients in South Africa reported an incidence of PONV of 1.2 – 5 %. While these studies limited follow up for PONV to the recovery room only – this is still significantly lower than the rates reported in European studies[3-5] of paediatric patients.

Historically, PONV was regarded as a 'little big problem'[11]: one with a large incidence [12] but with relatively few adverse events. However, a lack of effective prophylaxis and treatment meant it was regarded as a 'unavoidable consequence of the perioperative experience'.[11]

There have been significant advances in the field of PONV management in the last 20 years.[13] The risk factors for PONV in paediatric patients are well established[3-5, 14, 15]. The POVOC score, a validated clinical prediction tool, has been developed to risk stratify paediatric patients at risk of PONV[3, 4]. There is peer reviewed evidence [15] for effective pharmacological and non-pharmacological interventions to both prevent and treat PONV. Finally, there are regularly updated consensus guidelines on PONV management.[15-17] However there remains, in some commentators' opinions[13], an unacceptably high rate of both adult[15] and paediatric[18] PONV.

One of the keys barriers to effective PONV management in adult and paediatric patients appears to be inadequate adherence by anaesthetists to guidelines and institutional protocols.[18-21] The causes of this are probably multifactorial[22], but some of the investigated reasons include anaesthetic perceptions that PONV is not a serious side effect and concerns about the side effects of anti-emetic drugs.[23]

The ongoing high rate of PONV in both adult and paediatric patients in the face of such effective interventions has led to some commentators[13, 24, 25] to call for a move away from risk stratification and towards universal PONV prophylaxis. The proponents[13, 24, 25] of this liberal PONV prophylaxis strategy argue that the traditional concerns[26] about the cost and side effects of PONV prophylaxis are less relevant today. They hypothesise[24, 25] that simplifying the management of PONV, with less emphasis on risk stratification, and adopting a universal prophylaxis approach, could result in less PONV.

As perioperative medicine begins to navigate towards achieving the ideal of a 'PONV-free hospital'[13] with potentially far more liberal anti-emetic prophylaxis being prescribed, it is important to recognise that the PONV situation in South Africa may be unique.[6] Therefore, it is essential to understand South African anaesthetists' knowledge, perceptions and practices with regards to paediatric PONV as we attempt to integrate changes in the global research consensus[13, 24, 25] with the South African patient population.

The aim of this study was to describe the knowledge, perceptions, and practices of anaesthetists in the University of Witwatersrand's Department of Anaesthesiology towards the management of paediatric postoperative nausea and vomiting.

Method

A cross-sectional, contextual, descriptive study was conducted in the form of a structured self-administered electronic questionnaire. The study population consisted of all medical officers, registrars and consultants working full- or part-time in the University of Witwatersrand's Department of Anaesthesiology. The study population at the time of data collection was 228. A sample size of 143 was calculated to have a margin of error of 5% and a 95% confidence interval.

Approval to conduct the study was obtained from the Academic Head of the Department as well as from the University of Witwatersrand's Human Research Ethics Committee (Medical) (M220377).

The questionnaire was developed from the latest consensus guidelines on PONV management [15], and adapted, with permission, from a published questionnaire of doctor's practices by Corcoran and Edwards.[27] The questionnaire was reviewed by a

panel of experts in the field of paediatric anaesthesia. The questionnaire collected data on respondents' demographics; practices of paediatric PONV management; knowledge of paediatric PONV and perceptions of paediatric PONV. The knowledge section was assessed in the form of 10 single best answer (SBA) questions. These questions were adapted from the latest consensus guidelines [15] on paediatric PONV. Additionally, the Angoff Method was used to determine a pass mark of 60% for this section. Questions assessing respondents' perceptions of PONV were answered using a five-part Likert Scale.[28]

Study data was collected and managed using REDCap® electronic data capture tools hosted at the University of the Witwatersrand. REDCap® (Research Electronic Data Capture) is a secure, web-based software platform designed to support data capture for research studies.[29, 30] It allowed for anonymous collection of responses.

Data was analysed, using R v4.2.0., with the assistance of a biostatistician. All categorical data was summarised as counts and percentages. Continuous data was summarised as medians and interquartile ranges. For the knowledge section, a score out of 10 was calculated and a pass or fail outcome was assigned based on the pass mark of 6/10 (60%). For the perceptions section, Likert items were scored (strongly disagree = 1 to strongly agree = 5) and the average score, rounded to the nearest integer was calculated across the five Likert items. Comparisons between professional rank and knowledge, perceptions, and practices of paediatric PONV, were made using Fisher's exact tests / Pearson's chi-squared tests for categorical data, and Kruskal-Wallis tests for continuous data. When categorical variables were ordinal, or where contingency tables were stratified by professional rank, generalised Cochran-Mantel-Haenszel tests were performed. Statistical significance was taken at the 5% level. For the secondary objectives, no family-wide correction was made for multiple comparisons.

Results

Data was collected from May 2022 to September 2022. A total of 158 anaesthetists responded to the survey, representing a response rate of 69%. After discarding incomplete responses, 149 questionnaires were analysed. The demographic data of the respondents is shown in Table 1.

Table 1: Demographic data of respondents	
Characteristic	**n (%) ***
Age range	
< 30 years old	18 (12%)
30 - 39 years old	104 (70%)
≥ 40 years old	27 (18%)
Current position in the Department	
Medical Officer	34 (23%)
Registrar	81 (54%)
Consultant	34 (23%)
Number of years of worked doing full time anaesthesia	
≤ 5 years	78 (52%)
6 - 9 years	44 (30%)
≥ 10 years	27 (18%)
Highest level of examination completed	
Diploma in Anaesthesia	23 (15%)
Part 1 of Fellow of College of Anaesthetists	89 (60%)
Part 2 of Fellow of College of Anaesthetists	37 (25%)
*** (N = 149)**	

Practice of paediatric PONV management

Table 2 shows the data of respondents' practices of PONV management.

Overall, very few respondents reported having patients who had experienced PONV. When asked to recall all cases over the last month, only 9 respondents (6%) had patients who had experienced PONV.

Other notable findings are that a minority of anaesthetists reported assessing for risk factors (48%) or using clinical prediction tools (42%) for PONV. However, a majority (54%) reported giving PONV prophylaxis to all patients and 44% gave prophylaxis after clinical assessment.

Of the anaesthetists who gave prophylactic medication, the most used first line drug was dexamethasone (90%). 5-HT_3 receptor antagonists were the most common second-line drug, used in 79% of cases. Most (87%) anaesthetists had never given a paediatric total intravenous anaesthetic (TIVA) for the sole purpose of PONV prophylaxis.

On further analysis the only statistically significant relationship was between professional rank and the most used second-line drugs for prophylaxis. In this case, consultants used less 5-HT_3 receptor antagonists compared to the other ranks.

Table 2: Respondents' practices of PONV management in paediatric patients.	
Characteristic	**N = 149 ***
Patient experience PONV in the last month.	
Yes	9 (6%)
No	140 (94%)
Proportion of patients seen to have experienced PONV.	
0%	56 (38%)
< 10%	88 (59%)
10%	0 (0%)
25%	5 (3.4%)
> 25%	0 (0%)
Routine preoperative assessment for risk factors for PONV in patients.	
Yes	71 (48%)
No	78 (52%)
Use clinical prediction models or risk scores to predict PONV in patients.	
Yes	62 (42%)
No	87 (58%)
Routine counselling of parents or care givers of children presenting for day case surgery about PONV.	
Yes	60 (40%)
No	89 (60%)
Routine counselling of parents or care givers of children presenting for day case surgery about PONV occurrence after discharge.	
Yes	34 (23%)
No	115 (77%)

Description of PONV prophylaxis strategy for patients.	
All patients get PONV pharmacological prophylaxis.	80 (54%)

No patients get pharmacological PONV prophylaxis.	3 (2.0%)
Selective based on clinical assessment.	66 (44%)
Approximate percentage of patients receiving pharmacological PONV prophylaxis.	
80 (50,100) †	
Most used first line drug for PONV prophylaxis in at risk patients.	
Dexamethasone	135 (91%)
5-HT_3 receptor antagonist	13 (8.7%)
None	1 (0.7%)
Most used second line drug for PONV prophylaxis in at risk patients.	
5-HT_3 receptor antagonist	117 (79%)
Dexamethasone	14 (9.4%)
Metoclopramide	11 (7.4%)
Cyclizine	2 (1.3%)
Droperidol	1 (0.7%)
Promethazine	1 (0.7%)
Other	3 (2.0%)
Number of paediatric total intravenous anaesthetics (TIVAs) including target-controlled infusion (TCI) anaesthetics given for the sole purpose of PONV prophylaxis.	
0	129 (87%)
1 – 10	18 (12%)
> 10	2 (1.3%)
* N (%) † Median (IQR)	

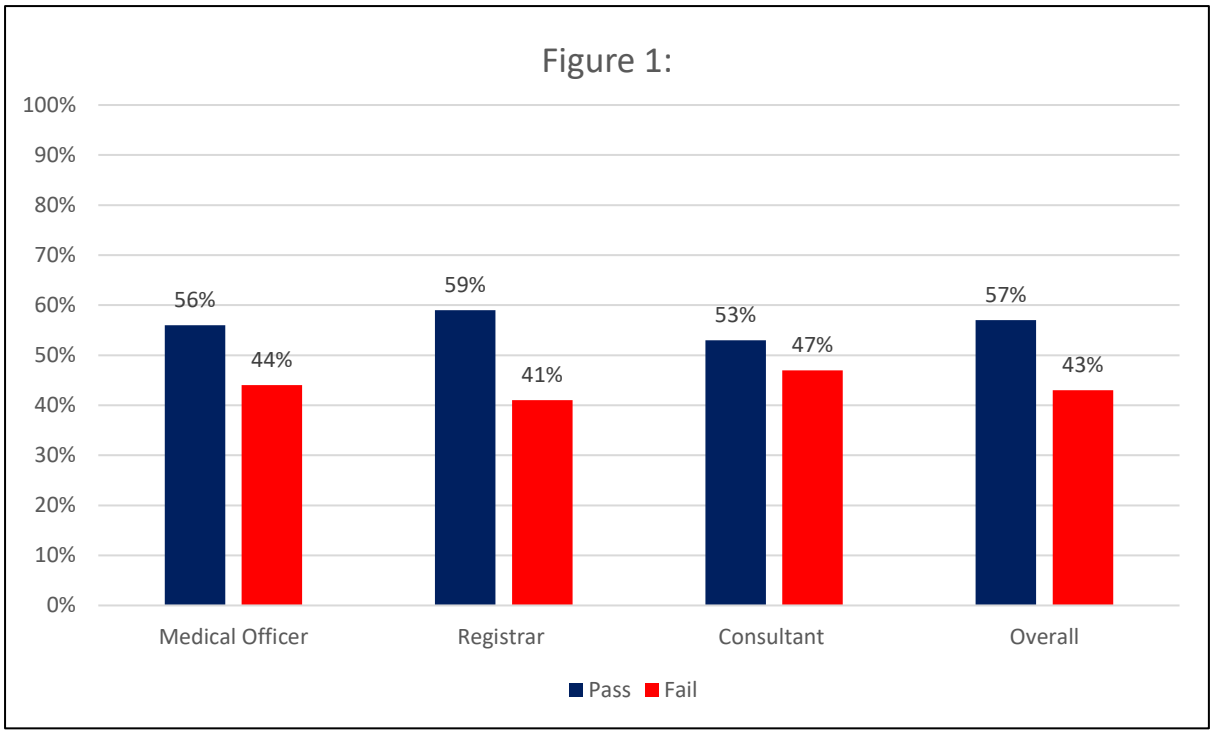
Knowledge of paediatric PONV management

Using the pass mark of 60%, set by the Angoff Method, there was a 57% pass rate. The median mark was 6/10. There were no statistically significant differences in knowledge scores or pass rates between the professional ranks. This data is presented in Figure 1.

Questions that assessed respondents' knowledge of PONV theory were poorly answered. Thirty seven percent (n = 55) correctly identified the POVOC score as the most appropriate score to predict PONV in paediatric patients. A plurality (48%) selected the Apfel score – which is used for adult PONV prediction. Less than half of participants (47%), knew the correct dose for dexamethasone (150 mcg/kg).

The questions that assessed prevention and management of PONV, with hypothetical clinical scenarios, were better answered. The exception was the scenario of a patient at high risk for PONV, where only 21% of anaesthetists selected the correct option of dual prophylaxis and to consider a TIVA. The two questions assessing management of established PONV in the recovery room were correctly answered by 50% and 96% of the respondents respectively.

There was no statistically significant difference between the professional ranks in terms of performance on the individual questions.



Pass/fail percentage for knowledge section of questionnaire.

Perceptions of paediatric PONV

Figure 2 shows the perceptions of paediatric PONV for the full cohort as percent responses per Likert scale category. Notable findings are the following. Almost 90% (n = 134) of respondents agreed or strongly agreed with the statement that paediatric PONV is a serious adverse effect of anaesthesia. However, respondents selected either neutral (35%), disagree (21%) or strongly disagree (2.7%) to the statement that their understanding of paediatric PONV and its management was acceptable for their level of training in anaesthesia. Just over half (50.3%) of respondents felt confident in managing paediatric PONV.

Figure 3 shows the breakdown of responses based on department rank. The only statistically significant difference in perceptions between different ranks in the department was whether PONV was a serious adverse effect of anaesthesia. More consultants disagreed with or were neutral to the statement than medical officers and registrars.

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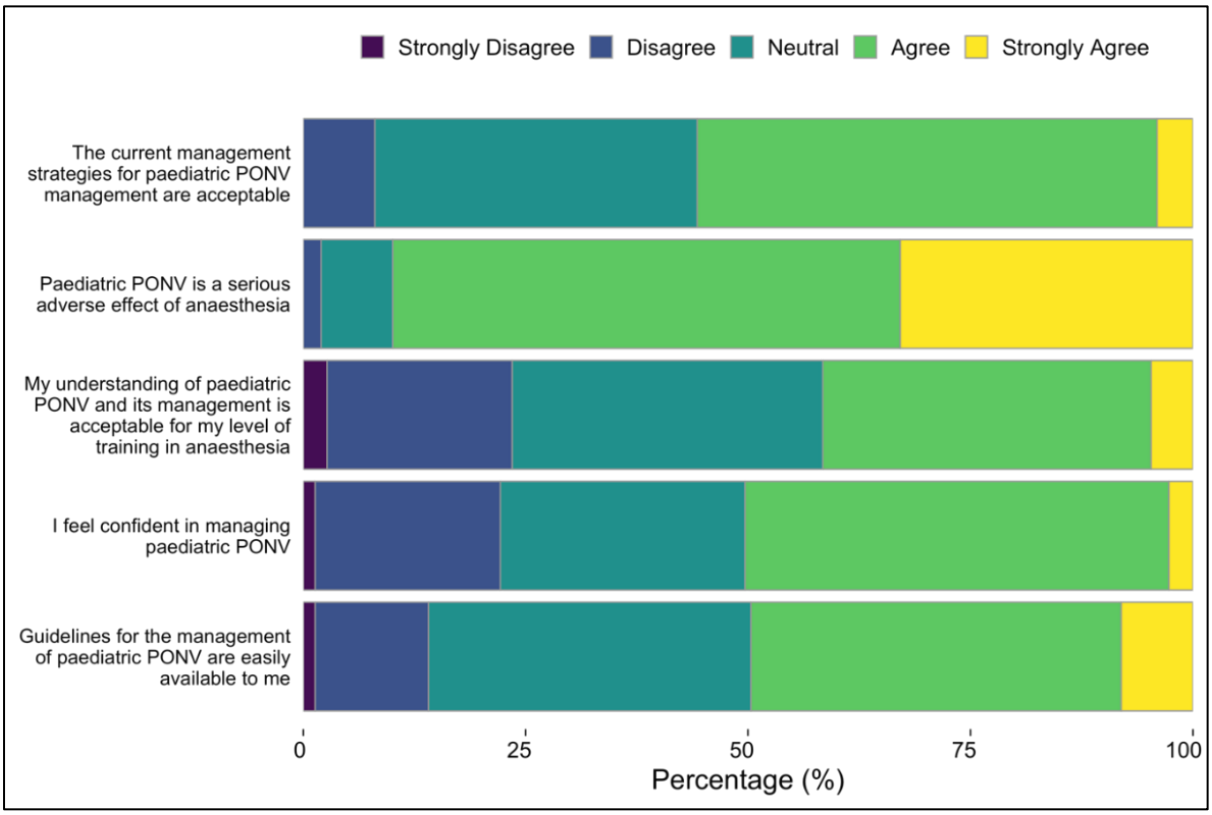


Figure 2. Perceptions of paediatric PONV for the full cohort. Data shown as percent respondents answering each category for each Likert-scale item.

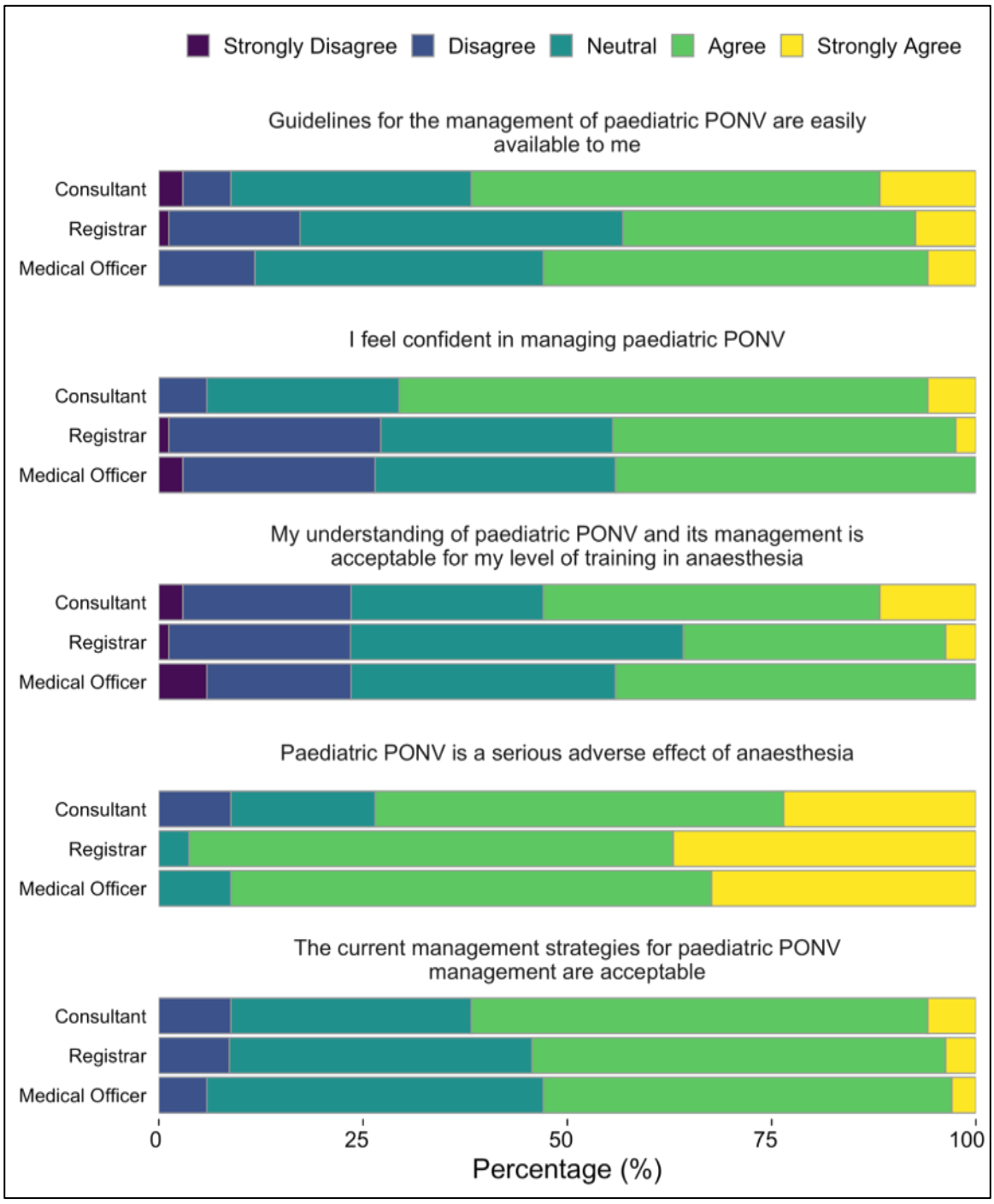


Figure 3. Perceptions of paediatric PONV by professional rank. Data shown as percent respondents answering each category for each Likert-scale item.

Further analysis of responses

Further analysis was done comparing respondents' answers to questions about practice and knowledge. Of the anaesthetists who used dexamethasone as a first-line agent (n = 135), only 44% knew the recommended intravenous dose. There was also no statistically significant association between the use of a scoring system to predict PONV risk and knowledge of the name of the score (chi-squared analysis c^2 = 0.675, df = 1, p-value = 0.411).

Associations between the outcomes of the knowledge and perception sections were also analysed. The knowledge outcome was analysed as whether individuals passed or failed. Perception outcomes were analysed as 'agree' (agree, and strongly agree ratings) vs 'neutral/disagree' (neutral, disagree, strongly disagree ratings).

There was no statistically significant correlation between passing the knowledge section and respondents having agreed with the perception statement that PONV is a serious adverse effect of anaesthesia (c^2 = 2.827, df = 1, p-value = 0.092). The absence of any statistically significant association was maintained when controlling for professional rank (generalised Cochran-Mantel-Haenszel Test, c^2 = 3.343, df = 1, p-value = 0.067).

Despite this, further analyses of the relationship between knowledge outcome and perception of the seriousness of PONV were performed within each level of professional rank. These analyses detected a statistically significant association between knowledge outcome and perception within consultants: consultants failing the knowledge assessment were more likely to be neutral to, or disagree, that PONV was a serious adverse effect; c^2 = 4.5, df = 1, p-value = 0.034).

There was also a statistically significant correlation between passing the knowledge section and whether participants agreed with the perception statement that they felt confident in managing PONV (c^2 = 8.321, df = 1, p-value = 0.004). This association was maintained when controlling for professional rank (generalised Cochran-Mantel-Haenszel Test, c^2 = 10.39, df = 1, p-value = 0.001). Further analyses of the relationship between the outcome of the knowledge section and perceived competency were performed within each level of professional rank. These analyses detected a statistically significant association between knowledge test outcome and confidence in managing PONV amongst registrars (registrars agreeing that they felt

confident managing paediatric PONV also passed the knowledge assessment; c^2 = 9.091, df = 1, p-value = 0.003). For consultants and medical officers, no statistically significant association was found (consultants: c^2 = 0.924, df = 1, p-value = 0.336; medical officers: c^2 = 1.229, df = 1, p-value = 0.268).

Discussion

Anaesthetists surveyed by this questionnaire had very limited experience of paediatric PONV. The reported 6% of observed PONV in the last month is comparable to the 5% incidence of recovery room PONV reported by Mogane et al.[10] In contrast, Bourdaud et al, in a study[5] of European patients reported an overall incidence of PONV of just under 25%. In this survey, only 3.4% (n = 5) of respondents reported seeing PONV in 25% of their patients in the past year, and no respondent saw higher PONV rates. However, it is unclear for what duration of time respondents in this study followed up for PONV in their patients.

It is interesting to note the liberal PONV prophylaxis strategy reported by many of the respondents – with 54% giving PONV prophylaxis to all patients. Contrast this to the findings of Corcoran and Edwards[27], who found just over 30% of surveyed Australian and New Zealand anaesthetists gave between 90 and 100% of their patients PONV prophylaxis. Even that proportion was noted to be high by the authors[27] and not in line with contemporary guidelines.

Similarly to Corcoran and Edwards' study[27], dexamethasone and $5HT_3$ receptor antagonists were the main drugs used for PONV prophylaxis reported in this study. However, respondents in this study used dexamethasone more than $5HT_3$ antagonists as the first line agent for PONV prophylaxis. This could reflect easier access to dexamethasone in South African academic hospitals.

The low numbers of anaesthetists who reported screening for risk factors for PONV (48%), using a clinical prediction model or risk score (42%) and counselling parents about PONV after day case surgery (40%) are in keeping with working in an environment with a low PONV incidence. However, it should be noted that several European studies[19-21] have also found poor adherence to guidelines for assessing for risk factors for PONV in adult and paediatric patients.

Respondents' knowledge of PONV and its management was poor. Only 57% of respondents achieved the pass mark in the knowledge section of the questionnaire.

Knowledge of specific PONV theory, as it appears in the Fourth Consensus Guidelines for the Management of Postoperative Nausea and Vomiting, was also poor. Results improved somewhat when respondents were asked to select management options based on clinical scenarios. The contrast in these two findings may be a limitation of the questionnaire: that the clinical scenarios were too easy. However, the use of the Angoff Method to develop the pass mark should have mitigated the risk of this. Alternatively, it could indicate that respondents are more comfortable applying knowledge to clinical scenarios rather than recalling facts. However, it is worth noting the inconsistencies detected between clinical practice and knowledge. The practice of using a PONV risk assessment tool was not associated with knowing the name of the correct risk assessment tool. Of the respondents who used dexamethasone first-line, only 44% knew the recommended intravenous dose.

Most respondents were aware that PONV is a serious side effect of anaesthesia. However, more consultants disagreed with or were neutral to the statement than medical officers and registrars. Amongst consultants who disagreed with this, there was a significant association with not passing the knowledge section. A similar finding was reported in a 2016 study by Kappen et al.[23], who found that anaesthetists were both less concerned about the seriousness of PONV and had poor knowledge of interventions to prevent PONV. The reasons for this finding in this study may be similar to those elicited by Kappen et al[23]: that PONV was regarded as a known side effect of anaesthesia, with a low morbidity, and should not be overtreated. It would be unfortunate if this viewpoint of PONV as an “unavoidable consequence of the perioperative experience”, first highlighted by Kapur in her 1991 editorial[11], is still prevalent amongst South African anaesthetists today.

The large number of neutral responses to questions about respondents’ perceptions of PONV could reflect the respondents’ limited experience of seeing patients with PONV. This is best illustrated by over a third (36%) having a neutral response to whether current PONV management strategies are acceptable. This is in contrast to some experts’ opinion[13] that the current PONV prevention and treatment techniques are excellent.

The majority of respondents were either neutral to (35%) or disagreed with (21%) and strongly disagreed with (2.7%) the statement that their understanding of paediatric PONV and its management was acceptable for their level of training in anaesthesia. It is unsurprising then that just over half (50.7%) of respondents felt confident in managing paediatric PONV. One of the reasons for this lack of confidence in PONV management may be respondents' poor knowledge of PONV management. This is evidenced by there being a statistically significant correlation between respondents passing the knowledge section and whether they agreed with the perception statement that they felt confident in managing PONV. Therefore, improving anaesthetists' knowledge of PONV management may help in improving their confidence in treating it.

This study is limited by the population being drawn from a single academic department and may not be reproducible in other population groups. This is particularly relevant when one considers that Macario et al[22] hypothesised that 'thought leaders' in a group, and in resident training, may influence PONV practice. As a self-reported survey there is a risk of response bias. Conducting the survey electronically and anonymously may have helped to reduce some of that bias.

Conclusion

South African anaesthetists surveyed had limited experience of paediatric PONV. In keeping with this limited experience, their knowledge of PONV guidelines and management is poor and there is inadequate pre-operative screening for PONV. Whilst most anaesthetists appreciated the seriousness of PONV as a side effect, just over half felt confident in managing it.

Interestingly, many anaesthetists surveyed had adopted a liberal anti-emetic prophylaxis strategy. This approach may be beneficial as it simplifies the management of a problem that is not commonly seen and makes recalling seldom used scoring systems and risk factors less important. However, this may also represent over treatment of a comparatively rare complication of anaesthesia and exposes patients to potential side effects. It also increases health care costs.

Further studies could investigate the incidence of paediatric PONV in the South African population, audit PONV prophylaxis administration and analyse the cost-benefit relationship of routine prescribing of PONV prophylaxis. We need to determine how best to integrate the shifting global consensus on PONV management with the South African paediatric patient population.

References

1.Kovac AL. Postoperative Nausea and Vomiting in Pediatric Patients. Paediatr Drugs. 2021;23(1):11-37. DOI:10.1007/s40272-020-00424-0.
2.Ames WA, Machovec K. An Update on the Management of PONV in the Pediatric Patient. Best Pract Res Clin Anaesthesiol. 2020;34(4):749-58. DOI:10.1016/j.bpa.2020.05.007.
3.Eberhart LH, Geldner G, Kranke P, Morin AM, Schäuffelen A, Treiber H, et al. The development and validation of a risk score to predict the probability of postoperative vomiting in pediatric patients. Anesth Analg. 2004;99(6):1630-7. DOI:10.1213/01.Ane.0000135639.57715.6c.
4.Kranke P, Eberhart LH, Toker H, Roewer N, Wulf H, Kiefer P. A prospective evaluation of the POVOC score for the prediction of postoperative vomiting in children. Anesth Analg. 2007;105(6):1592-7. DOI:10.1213/01.ane.0000287816.44124.03.
5.Bourdaud N, Devys JM, Bientz J, Lejus C, Hebrard A, Tirel O, et al. Development and validation of a risk score to predict the probability of postoperative vomiting in pediatric patients: the VPOP score. Paediatr Anaesth. 2014;24(9):945-52. DOI:10.1111/pan.12428.
6.Rodseth RN. Guest Editorial: Postoperative nausea and vomiting in South Africa–the next step. South Afr J Anaesth Analg. 2016;22(5):130. Available from: https://www.ajol.info/index.php/sajaa/article/view/166605/156038.
7.Rodseth RN, Gopalan PD, Cassimjee HM, Goga S. Reduced incidence of postoperative nausea and vomiting in black South Africans and its utility for a modified risk scoring system. Anesth Analg. 2010;110(6):1591-4. DOI:10.1213/ANE.0b013e3181da9005.
8.Alli A, Omar S, Tsang S, Naik BI. The effect of ethnicity on the incidence of postoperative nausea and vomiting in moderate to high risk patients undergoing general anesthesia in South Africa: a controlled observational study. Middle East J Anaesthesiol. 2017;24(2):119. Available from: https://pubmed.ncbi.nlm.nih.gov/30140116/
9.Swart ED, Rajah C, Rodseth RN. Induction behaviour and race and its association with postoperative agitation in paediatric elective surgery. South Afr J Anaesth Analg. 2017;23(2):20-3. DOI:10.1080/22201181.2017.1293385
10.Mogane PN, Mashinini M, Lundgren C. Audit of perioperative pain management in paediatric patients following tonsillectomy at a tertiary hospital in Johannesburg. South Afr J Anaesth Analg. 2019;25(2):30-6. Available from: https://journals.co.za/doi/abs/10.10520/EJC-19cc3efedd
11.Kapur PA. The big "little problem". Anesth Analg. 1991;73(3):243-5. DOI:10.1213/00000539-199109000-00001
12.Kovac A. L. Prevention and treatment of postoperative nausea and vomiting. Drugs. 2000;59(2):213-43.10.2165/00003495-200059020-00005
13.Schlesinger T, Weibel S, Kranke P. Postoperative/postdischarge nausea and vomiting: evidence-based prevention and treatment. Curr Opin Anaesthesiol 2023;36(1):109-16. DOI: 10.1097/ACO.0000000000001200
14.Eberhart LH, Morin AM, Guber D, Kretz FJ, Schäuffelen A, Treiber H, et al. Applicability of risk scores for postoperative nausea and vomiting in adults to paediatric patients. Br J Anaesth. 2004;93(3):386-92. DOI:10.1093/bja/aeh221.
15.Gan TJ, Belani KG, Bergese S, Chung F, Diemunsch P, Habib AS, et al. Fourth Consensus Guidelines for the Management of Postoperative Nausea and Vomiting. Anesth Analg. 2020;131(2):411-48. DOI:10.1213/ANE.0000000000004833
16.Gan TJ, Meyer T, Apfel CC, Chung F, Davis PJ, Eubanks S, et al. Consensus guidelines for managing postoperative nausea and vomiting. Anesth Analg. 2003;97(1):62-71. DOI: 10.1213/01.ane.0000068580.00245.95
17.Gan TJ, Meyer TA, Apfel CC, Chung F, Davis PJ, Habib AS, et al. Society for Ambulatory Anesthesia Guidelines for the Management of Postoperative Nausea and Vomiting. Anesth Analg. 2007;105(6):1615-28. DOI:10.1213/01.ane.0000295230.55439.f4.

18.Klotz C, Philippi-Höhne C. Prophylaxe von Übelkeit und Erbrechen in der Kinderanästhesie [Prophylaxis of postoperative nausea and vomiting in pediatric anesthesia: recommendations and implementation in clinical routine]. Der Anaesthesist. 2010;59(5):477-8. German. DOI: 10.1007/s00101-010-1716-8
19.Kooij FO, Klok T, Hollmann MW, Kal JE. Automated reminders increase adherence to guidelines for administration of prophylaxis for postoperative nausea and vomiting. Eur J Anaesthesiol 2010;27(2):187-91. DOI: 10.1097/EJA.0b013e32832d6a76
20.Kooij FO, Klok T, Hollmann MW, Kal JE. Decision support increases guideline adherence for prescribing postoperative nausea and vomiting prophylaxis. Anesth Analg. 2008;106(3):893-8. DOI: 10.1213/ane.0b013e31816194fb
21.Franck M, Radtke FM, Baumeyer A, Kranke P, Wernecke KD, Spies CD. Einhaltung der Behandlungsrichtlinien für postoperative Übelkeit und Erbrechen: Wie gut gelingt der Wissenstransfer hin zu einer besseren klinischen Versorgung? [Adherence to treatment guidelines for postoperative nausea and vomiting: How well does knowledge transfer result in improved clinical care?]. Der Anaesthesist. 2010;59:524-8. German. Available from: https://link.springer.com/article/10.1007/s00101-010-1712-z
22.Macario A, Chung A, Weinger MB. Variation in practice patterns of anesthesiologists in California for prophylaxis of postoperative nausea and vomiting. J Clin Anesth. 2001;13(5):353-60. DOI:10.1016/s0952-8180(01)00283-5.
23.Kappen TH, Van Loon K, Kappen MAM, Van Wolfswinkel L, Vergouwe Y, Van Klei WA, et al. Barriers and facilitators perceived by physicians when using prediction models in practice. J Clin Epidemiol. 2016;70:136-45. DOI:10.1016/j.jclinepi.2015.09.008.
24.Kranke P. Effective management of postoperative nausea and vomiting: let us practise what we preach! Eur J Anaesthesiol. 2011;28(3):152-4. DOI: 10.1097/EJA.0b013e3283435e51
25.Eberhart LH, Morin AM. Risk scores for predicting postoperative nausea and vomiting are clinically useful tools and should be used in every patient: Con–'life is really simple, but we insist on making it complicated'. Eur J Anaesthesiol. 2011;28(3):155-9. DOI: 10.1097/EJA.0b013e3283427f4f
26.Rose JB, Watcha MF. Postoperative nausea and vomiting in paediatric patients. Br J Anaesth. 1999;83(1):104-17. DOI:10.1093/bja/83.1.104.
27.Corcoran TB, Edwards T. A survey of antiemetic dexamethasone administration—frequency of use and perceptions of benefits and risks. Anaesth and Intensive Care. 2015;43(2):167-74. DOI:10.1177/0310057X1504300205.
28.Likert R. A technique for the measurement of attitudes. Archives of psychology. 1932. Available from: https://psycnet.apa.org/record/1933-01885-001
29.Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: Building an international community of software platform partners. J Biomed Inform. 2019;95:103208. DOI:10.1016/j.jbi.2019.103208.
30.Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42(2):377-81. DOI:10.1016/j.jbi.2008.08.010.

Appendices

Appendix 1: Approval by the Human Research Ethics Committee (Medical)

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

R14/49 Dr Simon Gowans

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M220377 MED22-01-076

NAME: (Principal Investigator)	Dr Simon Gowans
DEPARTMENT:	Anaesthesiology
PROJECT TITLE:	A study of the knowledge, perceptions, and practices of anaesthetists towards paediatric post-operative nausea and vomiting management
DATE CONSIDERED:	25/03/2022
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Megan Wellbeloved and Dr Sheena Smith
APPROVED BY:	Dr C Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	20/04/2022

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary in Room 301, Third floor, Faculty of Health Sciences, Phillip Tobias Building, 29 Princess of Wales Terrace, Parktown, 2193, University of the Witwatersrand. I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**. The date for annual re-certification will be one year after the date of convened meeting where the study was initially reviewed. In this case, the study was initially reviewed March and will therefore be due in the month of March each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature _____ Date _____

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 2: Approval by the Graduate Studies Committee

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Private Bag 3 Wits, 2050
Fax: 027117172119
Tel: 02711 7172076

Reference: Mrs Sandra Benn
E-mail: sandra.benn@wits.ac.za

01 March 2022
Person No: 2526337
PAG

Dr SJ Gowans
10 6th Avenue
Parktown North
2193
South Africa

Dear Dr Simon Gowans

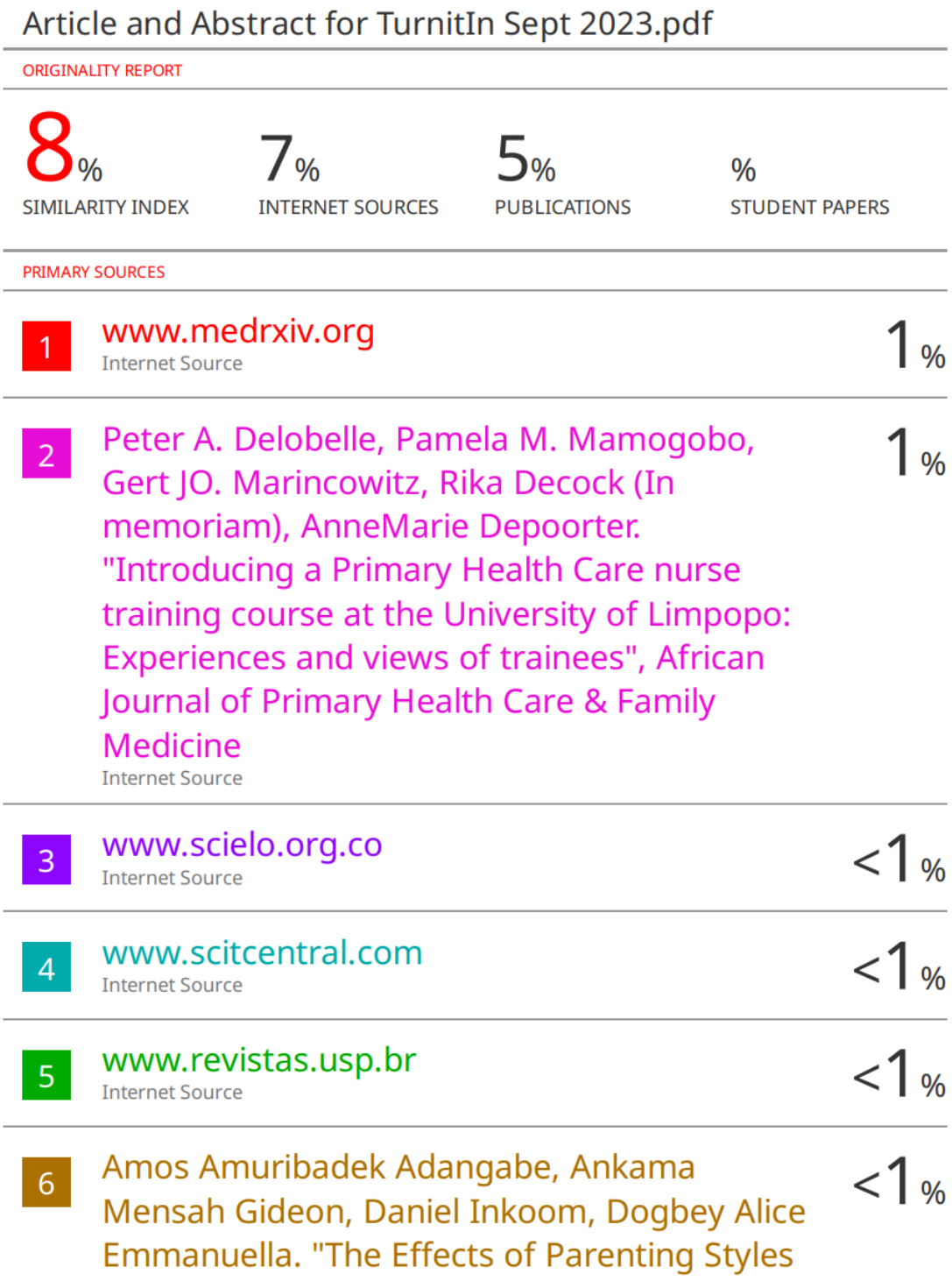
Master of Medicine in Anaesthesia: Approval of Title

We have pleasure in advising that your proposal entitled *A study of the knowledge, perceptions, and practices of anaesthetists towards paediatric post-operative nausea and vomiting management* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

Appendix 3: TurnitIn Report



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3. approval of the version to be published. These conditions must all be met (uniform requirements for manuscripts submitted to biomedical journals; refer to icmje.org); and
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Acknowledgements

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1. Jun BC, Song SW, Park CS, Lee DH. The analysis of maxillary sinus aeration according to aging process: volume assessment by 3-dimensional reconstruction by high-resolutional CT scanning. Otolaryngol Head Neck Surg. 2005 Mar;132(3):429-34.
2. Polgreen PM, Diekema DJ, Vandeberg J, Wiblin RT, et al. Risk factors for groin wound infection after femoral artery catheterization: a case-control study. Infect Control Hosp Epidemiol [Internet]. 2006 Jan [cited 2007 Jan 5];27(1):34-7. Available

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Book references: Jeffcoate N. Principles of Gynaecology. 4th ed. London: Butterworth, 1975:96-101. *Chapter/section in a book:* Weinstein L, Swartz MN. Pathogenic Properties of Invading Microorganisms. In: Sodeman WA jun, Sodeman WA, eds. Pathologic Physiology: Mechanisms of Disease. Philadelphia: WB Saunders, 1974:457-472.

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Appendix 5: Proposal

A study of the knowledge, perceptions, and practices of anaesthetists towards paediatric post-operative nausea and vomiting management.

Simon John Gowans

2526337

Supervisor:	Dr Megan Wellbeloved Department of Anaesthesiology, Nelson Mandela Children's Hospital.
Co-supervisor:	Dr Sheena Smith Department of Anaesthesiology, University of the Witwatersrand.

4.1 Introduction and Problem Statement

Nausea and vomiting are common adverse events after surgery and anaesthesia in North American and European paediatric patient populations [1-3]. Post-operative nausea and vomiting (PONV) is defined as nausea and/or vomiting occurring within 24 to 48 hours after surgery and anaesthesia [4, 5]. Nausea is the subjective feeling of unpleasantness in the stomach and the urge to vomit [4]. The feeling of nausea is not easily expressed by children and, as a result, many studies [1-3, 5, 6] assess only post-operative vomiting (PV). Post discharge nausea and vomiting (PDNV) is vomiting and/or nausea that occurs after discharge following a procedure which requires anaesthesia [7]. The specific time period in which PDNV occurs has not been defined in the current guidelines [7] but the latest literature that could be found [4, 5] suggests this includes nausea and/or vomiting occurring up to 7 days after anaesthesia. This review will use the encompassing term post-operative nausea and vomiting (PONV) to refer to both PV in children and PONV adults.

Two large European studies [1, 2] found the incidence of PONV, within 24 hours of a surgical procedure, in children to range from 3.4% to as high as 70% (occurring in strabismus surgery without PONV prophylaxis being administered). A more recent study by Bourdaud et al. [3] estimate the overall incidence at just under 25%. Two smaller studies [8, 9] looking at children undergoing ambulatory surgery, reported an incidence of PDNV, also within 24 hours of the procedure, of 12.4 – 14%.

There are few published studies regarding the incidence of PONV in African paediatric populations. Kabre et al. [10] found an incidence of PONV of 7.8% in paediatric patients undergoing ambulatory surgery.

A study by Swart et al. [11] looking at complications after surgery in paediatric patients at an academic hospital in South Africa reported an overall incidence of PONV of 1.4%. They also compared the incidence of PONV between African patients (4.4%) and non-African patients (1.2%) [11]. However, this study was limited by its small size and the failure to follow up for PONV for 24 hours after surgery.

This incidence is lower than that reported in European studies [1-3] of paediatric PONV. This may be attributed to a hypothesised link [12] between race and reduced

incidence of PONV that has been reported in adult studies [13, 14] of PONV in the black African population.

PONV in paediatric patients is associated with complications such as wound dehiscence, bleeding, aspiration, and dehydration resulting in electrolyte derangements [4-6].

PONV is also a cause of unplanned admission after day case surgery and the associated additional health care costs [7]. A large study [15] of children undergoing day case surgery in Ireland found 2.2% of children had unplanned admissions. Furthermore Awad et al. [15] showed that even with anti-emetic prophylaxis commonly given, PONV accounted for 8% of these admissions. Importantly this represented half of all the unplanned admissions classified as being “anaesthetic related”.

Risk factors for PONV in paediatric patients are different to those in adult patients [4, 5, 16]. Even risk factors common between the two groups (such as history of previous PONV or motion sickness), may not yet be known in younger paediatric patients [17]. This difference was emphasised in a 2004 study [17] that showed adult risk scores for PONV were not accurate enough to be clinically useful in paediatric patients. As a result of this, new risk scores [1-3] to predict PONV in paediatric patients have been developed and published.

The POVOC (POst-operative VOmiting in Children) Score, developed by Eberhart et al. [1] was published in 2004 after analysing data from 1401 children undergoing anaesthesia in German hospitals. It found four independent risk factors for post-operative nausea and vomiting: surgery ≥ 30 minutes, age ≥ 3 years, strabismus surgery and previous PONV or previous PONV in first degree relatives. The incidence of PONV was 9%,10%, 30%, 55% and 70% for 0,1,2,3,4 risk factors, respectively [1]. The POVOC score (excluding strabismus surgery) was externally validated in a 2007 study [2].

A more recent risk score, the VPOP (Vomiting in the Post Operative Period) score [3], was developed in 2014. It analysed risk factors for PONV in 2393 children undergoing anaesthesia in 11 hospitals in France. It found five independent risk factors: duration of anaesthesia ≥ 45 minutes, age (≥ 3 years and ≤ 13 years being the highest risk group), multiple doses of opioids, predisposition to PONV and high-risk surgeries (tonsillectomy, tympanoplasty and strabismus surgery) [3]. These

scoring systems have not been validated in the South African paediatric population [12].

The Fourth Consensus Guidelines for the Management of Post-Operative Nausea and Vomiting [16] were published in 2020. Using graded evidence, they risk stratify PONV into low, medium, and high risk depending on the number of risk factors present. Prophylactic anti-emetics are then given based on risk stratification. Importantly they do not recommend anti-emetic prophylaxis for low-risk patients (no risk factors present). These guidelines also advise the use of clinical prediction models/risk scores (such as the POVOC score) to assist in identifying children at risk for PONV [16].

The majority of published literature on knowledge, perceptions, and practices of anaesthetists with regards to PONV does not differentiate between adult and paediatric population groups. Other studies only look at anaesthetists' management of PONV in adult patients. No studies that described anaesthetists' knowledge, perceptions and practices of paediatric PONV management could be found.

A 1997 survey [18] of attitudes, perceptions and practices of anaesthesiologists and surgeons in Switzerland towards PONV in all patients (adult and paediatric) showed that almost all anaesthesiologists surveyed (90%) recognised that PONV was a problem in everyday practice. A majority of anaesthesiologists also agreed that PONV practice needed to be improved. Their concerns were that current agents were not efficacious and too costly. Their understanding of PONV risk factors, prophylaxis, and treatment (a proxy for practice) was generally appropriate given the current published literature. However, respondents underestimated the incidence of PONV in both adults and paediatric patients [respondents estimated paediatric PONV incidence of 15% vs actual incidence of about 25% [3] with a range of between 3,4% and 70%[1]]. This may be because the survey also revealed no standardisation for the documentation of the occurrence of PONV. PONV was recorded on the chart by 60% of anaesthesiologists. 20% of respondents documented the amount of vomiting and only 5% documented nausea scores. As a marker of institutional practices, only 17% of respondents formally evaluated PONV incidences at their hospital [18].

Several studies done by Macario and others [19, 20] at Stanford University Medical Centre looked at attitudes, perceptions, and practices of anaesthesiologists in California towards adverse outcomes including PONV.

In 1999, Macario et al. published a survey [19] looking at which adverse outcomes anaesthesiologists perceived patients to be most concerned about. In terms of perceived frequency of adverse events, nausea was ranked 2nd and vomiting 4th. In terms of "importance to avoid" vomiting was ranked 7th and nausea 10th. When frequency and "importance to avoid" were plotted together, nausea and vomiting were ranked second only behind incisional pain [19].

A 2001 survey [20] of anaesthesiologists' practice of adult PONV management recorded 40 different prophylactic pharmacological regimens to be used for a hypothetical high-risk patient. The study also found a vast majority of respondents used older, more well-known drugs over newer, more efficacious agents. The authors hypothesised the following factors may explain such wide variation in PONV management: differences in training during residency, differences in the opinions of "thought leaders" in practice groups, differences in anaesthesiologist perceptions of the effectiveness of the drugs and differences in their perceptions of how PONV effects patients' quality of life. They also stated that "better mechanisms" were needed to assist with clinical decision making [20].

Macario revisited the prescribing practices of Californian anaesthesiologists in a 2006 study [21]. The prescribing practices for the treatment of established PONV in ambulatory surgery were assessed. Similar to the 2001 study [20], they found 18 different drug and 12 different non-pharmacological interventions for established PONV [21]. 26% of practitioners gave a repeat dose of the same drug for the treatment of PONV as given for prophylaxis; despite this being against the published consensus guidelines. 25% of respondents had no standardised order for PONV in their post anaesthesia care unit [21].

These studies [19-21] all had similar limitations. They were small studies that were not necessarily representative of the population of anaesthesiologists. The researchers also did not audit patient anaesthetic records so the data about anaesthesiologists' practice was self-reported with the risk of reporting bias.

Kappen and others at the University Medical Centre Utrecht in The Netherlands, published a series of studies [22-24] between 2014 and 2016 looking at anaesthesiologists' practice of PONV. It showed that anaesthesiologists' practice was not universally improved by risk stratification tools and that practice was still influenced by personal perceptions of PONV [22-24].

The initial study [22] was a randomised control trial (RCT) comparing the incidence of PONV between a group of adult patients managed by anaesthesiologists who had access to a PONV risk score calculator in their anaesthetic information management system and a group managed by anaesthesiologists who provided "care as usual". The study showed no improvement in PONV rates between the two groups. Although there were several limitations to the study that might have explained the result, it is important to expand on one of them. Anaesthesiologists in the intervention group (provided with the PONV risk score calculator) prescribed more PONV prophylaxis than the "care as usual group". However, the anaesthesiologists in the intervention group rarely prescribed more than 2 anti-emetics to patients at high risk for PONV. This is despite good evidence [16] for the use of more than 2 agents in these high-risk patients. The authors of the study [22] could not explain this variation in practice.

To investigate these findings further, Kappen et al. carried out a quantitative and qualitative study [24] of perceptions of "barriers and facilitators" to using the PONV risk score calculator. They compared the results between the original intervention and "care as usual" group of anaesthesiologists. The discussion about the perceptions toward using a risk calculator tool is outside the scope of this review. However, there were 3 other important themes that were reported about PONV management:

a. PONV was not thought to be a concern by the study participants.

b. It was regarded as an expected adverse effect of anaesthesia with a low patient burden.

c. It should not be over treated because of the risks of adverse effects from the anti-emetic drugs.

Knowledge of PONV management was incomplete; particularly regarding risk factors for and the prediction of patients at risk of PONV. Anaesthesiologists interviewed

said they used an implicit approach, and while they were aware of the literature, often relied on anecdotal risk factors for PONV. For example, Kappen et al. [24] found that there was hesitancy to prescribe dexamethasone and droperidol because of concern for adverse effects.

Only one published study [25] outside of the United States and Europe on anaesthesiologists' knowledge, attitudes and perceptions was found. This 2014 electronic survey [25] of a selection of the fellows of the Australian and New Zealand College of Anaesthetists (ANZCA) looked at their prescribing practices for PONV in both adults and paediatrics. Although primarily focused on the use of dexamethasone as prophylaxis for PONV it had relevant findings. The PONV practices generally followed the current best evidence and guidelines. Specifically, regarding dexamethasone, there was a good level of awareness of its potential adverse effects. However, given that it was widely prescribed, it was inferred that there was a balanced risk-benefit approach to prescribing [25]. This contrasted with the strong concerns about side effects of dexamethasone voiced in the study by Kappen et al. [24] of perceptions of "barriers and facilitators" to using a PONV risk score calculator.

The study of ANZCA fellows is limited by it being a self-reported survey with the potential for reporting bias. More importantly the authors admitted there may have been selection bias, in that the fellows who responded may have had an interest in PONV or involved in surgical cases with more emetic risk [25].

PONV is a frequent and unpleasant adverse effect of anaesthesia in children. It can result in serious morbidity as well as increased hospital stay and associated costs. The importance of managing it effectively is increasingly being recognised by anaesthetists. Published studies and consensus guidelines have attempted to reduce the incidence of PONV by providing evidence-based management. However, even in countries with high incidences of PONV, there remain anaesthetist-associated barriers to effective PONV management. In many cases, there is an anecdotal approach to PONV management that may be borne out of an ongoing perception that PONV is not a serious adverse event. This may be the reason for the wide variation in practices.

No published studies describing the knowledge, perceptions and practices of anaesthetists towards paediatric PONV in South Africa could be found.

4.2 Aim and Objectives.

4.2.1 Aim

The aim of this study is to describe the knowledge, perceptions, and practices of anaesthetists in the University of Witwatersrand's Department of Anaesthesiology towards the management of paediatric post-operative nausea and vomiting.

4.2.2 Primary Objectives

The primary objectives of this study are to describe:

a. Anaesthetists' knowledge of the risk factors, prevention, and treatment of paediatric post-operative nausea and vomiting.

b. Anaesthetists' perceptions of the significance of paediatric post-operative nausea and vomiting prevention.

c. Anaesthetists' self-reported practices of management of paediatric post-operative nausea and vomiting.

4.2.3 Secondary Objectives

a. To compare between anaesthetic medical officers, registrars and consultants:

i. The knowledge of paediatric post-operative nausea and vomiting and its management.

ii. The practices of paediatric post-operative nausea and vomiting management.

iii. The perceptions of paediatric post-operative nausea and vomiting and its management.

b. To describe the relationship between:

i. Anaesthetists' knowledge and practices of paediatric post-operative nausea and vomiting and its management.

ii. Anaesthetists' knowledge and perceptions of paediatric post-operative nausea and vomiting and its management.

iii. Anaesthetists' practices and perceptions of paediatric post-operative nausea and vomiting and its management.

c. To compare the knowledge, practices and perceptions of paediatric post-operative nausea and vomiting and its management between anaesthetists performing occasional, frequent, and mainly paediatric anaesthesia cases.

4.3 Research Assumptions

The following definitions will be used in this study:

Anaesthetic: A technique allowing performance of surgical and other interventional procedures by rapidly, safely, and pleasantly producing analgesia (pain control), absence of anxiety (or absence of awareness with general anaesthesia), and adequate muscle relaxation.

Surgery or procedure: An intervention that requires an anaesthetic to be performed on the patient for the purposes of completing the intervention.

Anaesthetist: A medical doctor that performs anaesthesia.

Anaesthesiologist or specialist anaesthetist: A medical doctor that has completed specialist training in anaesthesia and is registered with a professional body as such.

Intern: A medical doctor undergoing a two-year internship programme at a designated public training hospitals in South Africa. This includes a two-month rotation in anaesthesia.

Medical Officer: A medical doctor who has completed their two-year internship programme and is registered for independent practice.

Registrar: Medical doctors in a four-year trainee programme to specialise through an accredited University programme.

Consultant: A doctor, with many years of experience working in their specialist field, employed in a senior supervisory role in a department in public hospitals in South Africa. In the University of Witwatersrand's Department of Anaesthesiology not all consultants are specialist anaesthetists.

Paediatric patient: Any child under the age of 12 years.

Post-operative nausea and vomiting (PONV): An incidence of vomiting or subjective experience of nausea occurring within 24 hours after the administration of an anaesthetic.

Post-operative vomiting (PV): Any incidence of vomiting occurring within 24 hours after the administration of an anaesthetic.

Post-discharge nausea and vomiting (PDNV): Nausea and vomiting that occurs up to 7 days after discharge from a hospital or ambulatory surgery center following anaesthesia.

4.4 Demarcation of study field

The study will be conducted in the Department of Anaesthesiology, in the Faculty of Health Sciences of the University of the Witwatersrand. The total staff complement of the department is 74 Consultants, 114 Registrars and 40 Medical Officers working at several hospitals.

Paediatric surgeries occur at the following hospitals that are serviced by anaesthetists from the Department of Anaesthesiology:

a. Charlotte Maxeke Johannesburg Academic Hospital. It is a tertiary level hospital.

b. Chris Hani Baragwanath Academic Hospital. It is a tertiary level hospital.

c. Rahima Moosa Mother and Child Hospital. It is a regional level hospital.

4.5 Ethical Considerations

This proposal will be submitted to the Human Research Ethics Committee (Medical) and the Graduate Studies Committee of the University of the Witwatersrand. Approval to perform this study has been obtained from the Academic Head of the University of Witwatersrand's Department of Anaesthesiology (Appendix A).

The study will use a self-administered electronic questionnaire. Study data will be collected and managed using REDCap® (Research Electronic Data Capture) electronic data capture tools hosted at the University of the Witwatersrand. REDCap® is a secure, web-based software platform designed to support data capture for research studies [26, 27].

The questionnaire will be distributed to potential participant's using email address that have been supplied by the potential participants to the Department of Anaesthesia. Participants will not be required to enter unique identifying data when answering the questionnaire.

REDCap® allows for the delivery and tracking of responses to questionnaires using participant's email addresses. Email tracking is required to ensure that the same participant does not complete the survey multiple times. However, participant's responses to the questionnaire will be automatically coded by REDCap® as they are collected, and unidentifiable to the principal investigator, the supervisors, and a biostatistician. This is because REDCap ® manages questionnaire delivery and data collection in two separate modules. Participant's email addresses cannot be linked to the survey responses as there will be no "Participant Identifiers" in the data set. It would not be reasonably possible on the REDCap® platform for the Principal Investigator, the supervisors, and a biostatistician to be able to identify participant's responses using their email addresses.

The questionnaire will be prefaced by an information sheet (Appendix B). A consent form will be placed at the beginning the questionnaire and consent will be inferred by choosing to continue and complete the questionnaire. Participants will be informed that this study will be voluntary, and they shall be able to withdraw at any time without prejudice.

All participants and their responses shall remain confidential. Only the principal investigator, supervisors and a biostatistician will have access to the raw data.

Data will be stored securely stored for two years, if a scientific publication arises from the study and six years if there is no publication. The study will be conducted according to the principles of the Declaration of Helsinki [28] and the South African Good Clinical Practice: Clinical Trial Guidelines [29].

The study will be compliant with the Protection of Personal Information (POPI) Act [30] regarding the collection and preservation of confidential information and third-party access to the information.

4.6 Research Methodology

4.6.1 Research design

This study will have a cross-sectional, contextual, descriptive design. It will be a survey in the form of a structured self-administered electronic questionnaire.

A survey is a research tool that collects information from a population group [31]. This survey will be cross-sectional as it will collect information on exposure status and outcome status of the participants at a single point in time [31]. This study will be a factual survey (assessing anaesthetists' knowledge and practices) and attitudinal survey (assessing anaesthetists' perceptions).

A contextual study is one that is conducted within a specific population group [32]. This study is contextual as it is a study of anaesthetists in the University of Witwatersrand's Department of Anaesthesiology.

A descriptive study aims to describe the characteristics of the participants in the sample. It does not define any relationships between these characteristics [31]. This study will describe the following characteristics of anaesthetists: knowledge of, perceptions of, and practices of, paediatric PONV management.

4.6.2 Study population

All anaesthetists working in the Department of Anaesthesiology at the University of the Witwatersrand.

4.6.2.1 Sample method

A convenience sampling method will be used. Convenience sampling uses the most readily available individuals to form the study sample [33]. In this study, this will be the anaesthetists in the department that complete the questionnaire until the sample size is reached.

4.6.2.2 Sample size

The Department of Anaesthesiology consists of 40 medical officers, 114 registrars and 74 consultants for a total staff complement of 228. StatCalc from Epi Info ™ (a public domain statistical software suite from the Centers for Disease Control and

Prevention) was used to determine the sample size. For the study to have a margin of error of 5% and a 95% confidence interval a sample size of 143 is required.

4.6.2.3 Inclusion and exclusion criteria

Inclusion Criteria

All medical officers, registrars and consultants working full or part time in the University of Witwatersrand's Department of Anesthesiology.

Exclusion Criteria

a. Medical interns rotating through the Department of Anesthesiology.

b. Participants who do not consent to take part in the survey.

c. Department members involved in the development of the questionnaire. 1 consultant is co-supervising this study, 4 consultants formed the expert panel, and 9 consultants were involved in the Angoff Method.

d. Blank questionnaires will be excluded from the data analysis but used to calculate the response rate.

4.6.3 Data Collection

4.6.3.1 Questionnaire Development

The questionnaire was developed from the current consensus guidelines [16] on PONV management, a peer reviewed article [4] and adapted from a questionnaire of doctor's practices of PONV [25] selected after a comprehensive literature review. The questionnaire was reviewed by a panel of experts in the field of paediatric anaesthesia. The study will use a self-administered electronic questionnaire composed of four parts (Appendix C).

The first part (Section A) will collect basic demographic data from participants relating to their medical experience and position in the department.

The second part of the questionnaire (Section B) will ask questions to describe the participants' practice of paediatric PONV. Some of these questions are adapted from the questionnaire [25] developed by Corcoran and Edwards. Permission has been granted by the lead author to adapt this questionnaire (Appendix D).

The third part of the questionnaire (Section C) will ask questions to describe the participants knowledge of paediatric PONV. These will be asked as single best answer questions. These questions are adapted from the latest consensus guidelines [16] and a review article [4] on paediatric PONV.

The fourth part of the questionnaire (Section D) will ask questions to describe the participants perceptions of paediatric PONV. These will be subjective questions, which will be answered using a five-part Likert Scale. The answers options will range from the sentiments “strongly agree” to “strongly disagree”. All questions will be phrased so that “strongly agree” represents a positive perception of the importance of PONV management.

4.6.3.2 Data Collection

Data will be collected using a quantitative method in the form a structured electronic self-administered questionnaire. A link to the questionnaire will be sent out via email and/or other electronic messaging to the study population using contact details available from the Department of Anaesthesiology.

Study data will be collected and managed using REDCap® (Research Electronic Data Capture) electronic data capture tools hosted at the University of the Witwatersrand. REDCap® is a secure, web-based software platform designed to support data capture for research studies, providing an intuitive interface for validated data capture; audit trails for tracking data manipulation and export procedures; automated export procedures for seamless data downloads to common statistical packages; and procedures for data integration and interoperability with external sources [26, 27].

The estimated data collection period will be two months from the date of ethical approval. To improve response rates, non- and incomplete responders will be contacted again.

4.6.3.3 Data Analysis

The data collected will be exported from REDCap® into Microsoft® Excel® for Microsoft® Office 365™. The answers of each section will be coded numerically to allow for quantitative assessment in a suitable statistical programme.

4.6.3.3.1 Analysis of Primary Objectives

The primary objectives will have a descriptive analysis.

a. Anaesthetists' knowledge of paediatric PONV (measured as a percentage score) will be continuous variables and will be described using the mean and standard deviation if normally distributed or medians and interquartile ranges if non-normally distributed. Additionally, the Angoff Method [34], was used to determine a pass mark of 60% for this section (Appendix E).

The Angoff Method is a step wise process to develop a pass mark for a new assessment [34]. It uses a panel of raters (individuals familiar with the field being assessed) to review each question in an assessment and determine the probability that the "minimally qualified candidate" [34] would answer correctly. These determinations are then averaged and the average of the determinations for all the questions forms the pass mark [34]. To improve validity, determinations with a standard deviation between raters of greater than 10 are discussed by the panel of raters in a facilitated meeting [34]. Raters can then adjust their determinations after the panel discussion [34].

A panel of 9 raters was formed from consultant anaesthetists in the Department. The raters received an email explaining the Angoff Method and a copy of the knowledge section of the questionnaire. They submitted their Round 1 determinations electronically. An online rater panel discussion was held, facilitated by the lead researcher, and after a further 2 rounds of rating an average score of 60% was determined. After the 3 rounds the highest standard deviation between rater's determinations was 11.73 (Appendix D).

Thus, anaesthetists' knowledge will also be categorical variables (i.e., achieved Angoff Method derived pass mark or not) and will be described using frequencies and percentages.

b. Anaesthetists' practices of paediatric PONV management) will contain both categorical and continuous variables. Categorial variables will be described using

frequencies and percentages. Continuous variables will be described using the mean and standard deviation if normally distributed or medians and interquartile ranges if non-normally distributed.

c. Anaesthetists' perceptions of paediatric PONV measured on a Likert Scale) will be ordinal and analysed as categorical variables. Categorical variables will be described using frequencies and percentages.

In addition to the item analysis, a Likert scale score will be generated by summing the responses for each Likert item. A Likert Scale score is determined as follows:

i. For each question the responses to the questions are coded so that the sentiment "strongly disagree" is 1 point and the sentiment "strongly agree" is 5 points.

ii. The number of participants responses for each sentiment option is recorded. The number of responses per sentiment are then multiplied by the sentiment code (i.e., 5 for "strongly agree" multiplied by number of responses for "strongly agree").

iii. Those totals per sentiment response are summed for each question and divided by the total number of responses for that question. That final number (between 1 and 5) is the Likert Scale Score for that question and represents all participants overall perception to that question.

The Likert Scale Score will be analysed as a categorical variable.

4.6.3.3.2 Secondary Objectives Data Analysis

The secondary objectives will have a comparative and descriptive analysis.

Participants' demographic information will be categorical variables and will be described using frequencies and percentages. This will include data on participants position in the Department (anaesthetic medical officer, registrar, or consultant) and for specialist anaesthetists whether they perform occasional, frequent or mainly paediatric anaesthesia cases.

a. Comparisons of continuous knowledge score results between medical officer, registrar and consultant groups will be done using the unpaired T-test when normally distributed and Wilcoxon rank sum test (Mann-Whitney) if not normally distributed.

Categorical variables (Angoff Method derived pass mark achieved or not) will be compared using Chi Squared or Fisher's exact test for categorical variables. A p value of <0.05 will be considered statistically significant.

b. Comparisons of practices of paediatric PONV management between medical officer, registrar and consultant groups will be done using Chi Squared or Fisher's exact test for categorical variables. A p value of <0.05 will be considered statistically significant. Continuous variables will be compared using unpaired T-test when normally distributed and Wilcoxon rank sum test (Mann-Whitney) if not normally distributed. Responses to individual questions about practice of paediatric PONV will also be compared with responses to similar questions of PONV practice found in the literature review.

c. Comparisons of perceptions of paediatric PONV between medical officer, registrar and consultant groups will be done using Chi Squared or Fisher's exact test for categorical variables. A p value of <0.05 will be considered statistically significant. The responses to individual questions on perceptions of paediatric PONV and the derived Likert Scale Score will be compared between groups.

Correlation analysis, will be performed to describe a relationship between:

a. Anaesthetists' knowledge score (derived from the Angoff Method) and individual questions on practices of paediatric PONV.

b. Anaesthetists' knowledge score (derived from the Angoff Method) and perceptions of paediatric PONV (based on the Likert Scale Score).

c. Anaesthetists' practices of paediatric PONV (based on individual questions) and perceptions (based on the Likert Scale Score).

If the data is normally distributed the Pearson correlation coefficient will be used. If that data is not normally distributed the Spearman rank correlation method will be used.

If sufficient data is available, comparisons between the knowledge scores, individual questions on practices of paediatric PONV and perceptions of paediatric PONV (based on the Likert Scale Score) between specialist anaesthetists performing occasional, frequent, and mainly paediatric anaesthesia cases will be described.

4.7 Significance of Study

PONV is a frequent and unpleasant adverse effect of anaesthesia in children. The importance of managing it effectively is increasingly being recognised by anaesthetists. Published studies and consensus guidelines have attempted to reduce the incidence of PONV by providing evidence-based management. However, even in countries with high incidences of PONV, there remain anaesthetist-associated barriers to effective PONV management. In many cases, there is an anecdotal approach to PONV management that may be borne out of an ongoing perception that PONV is not a serious adverse event. This may be the reason for the wide variation in practices.

No published studies looking at anaesthetists' knowledge, perceptions, and practices of paediatric PONV could be found. In the short term this study could be used to educate anaesthetists in the Department about the importance of paediatric PONV and its correct management. The results of this study could also be published and presented at meetings and forums to improve wider awareness of paediatric PONV management. In the long term, this study could encourage further research into paediatric PONV in South Africa and these could guide future interventions in the management of paediatric PONV.

4.8 Validity and reliability of the study

Validity refers to how accurately a data collection tool measures what it was designed to measure [35]. Content validity is an assessment of the accuracy of the data collection tool to measure the different components that contribute to the overall objective that is being measured [36]. In this study content validity has been improved by the following:

a. A panel of experts in paediatric anaesthesia has reviewed the questionnaire. This will also improve the reliability of the study [37].

b. Questions about knowledge of PONV have been taken from consensus guidelines and a peer reviewed article selected after an extensive literature review.

c. Questions about the perceptions of PONV management have been developed by the researcher after an extensive literature review of studies of doctors' perceptions of PONV.

d. Questions about practices of PONV management have been adapted, with permission, from a published article with a validated questionnaire.

Reliability is a measure of the reproducibility of a test [38]. Reliability has been improved in this study by the following:

a. Questions assessing participants' knowledge of PONV have been formulated as single best answer (SBA) questions. SBA questions are the recommended format for medical education multiple choice questions [39] and have been found to improve reliability in medical education examinations [40].

b. Having sufficient number of questions testing participants knowledge of PONV and its management [37].

c. The questions assessing participants knowledge of PONV have been assessed by a panel of consultants using the Angoff Method [34] to develop an acceptable pass mark. This also ensures that overall the questions are of an acceptable difficulty – preventing participants either getting all the questions correct or incorrect [37].

d. The questions have been phrased to be unambiguous and easy to understand [37].

e. The questionnaire will be delivered to all respondents as an identical electronic version. Therefore, trying to standardize the conditions in which the questionnaire is answered.

f. The questionnaire is short and easy to access electronically to avoid respondent fatigue.

g. The questions about self-reported practice of PONV management are placed first in the questionnaire. This is to reduce question order bias where the single best answers to the knowledge section may influence participants responses.

4.9 Potential limitations of the study

There are several potential limitations to this study.

The study tool will be a self-reported questionnaire with the risk of several limitations. Participants may not understand the questions; they may fatigue, and not answer the questions accurately or not complete the questionnaire; they may complete the questionnaire under different settings (e.g., using resources to find for the answers to

questions). These limitations could decrease the validity and reliability of the study. Efforts to minimise these risks have already been discussed above.

This study only includes anaesthetists in the Department of Anaesthesiology at the University of the Witwatersrand and so may not be generalisable to anaesthetists outside this department.

This study may also be affected by several different biases. Bias in research means a systematic error in the conduct of the study [41]. .

There is a risk of recall bias [31] as the participants will be required to complete the questionnaire based on their previous anaesthetic practice.

The sample method may create a risk of selection bias [31]. Convenience sampling is a type of non-probability sampling. That means that there the probability of an individual being sampled is unknown and therefore may reflect bias on behalf of the researcher [42]. This risk is mitigated by having the questionnaire delivered via REDCap® which will automatically collect the data without the researcher knowing which participants data has been collected.

4.10 Project Outline

4.10.1 Project Timeline

Activity	May 21	June 21	July 21	Aug 21	Sept 21	Oct 21	Nov 21	Dec 21
Proposal Preparation	X	X	X	X	X	X		
Literature Review	X	X	X	X	X	X	X	X
Proposal Submission						X		
Ethics Approval						X	X	X
Postgraduate Approval						X	X	X

Activity	Jan 22	Feb 22	Mar 22	April 22	May 22	June 22	July 22	Aug 22
Data Collection	X	X						
Data Analysis			X	X				
Draft Article					X	X	X	
Submission								X

4.10.2 Project Budget

The primary researcher, as a registered student at the University of the Witwatersrand, has access to REDCap® software, without additional charge, under the University's license for up to 1000 messages.

Costs associated with the printing and submission of the protocol to the post graduate committee and any relevant ethics committees, and the submission of the final dissertation will be borne by the Department of Anaesthesiology.

Currently an electronic submission is accepted, and printing and binding is not anticipated to be required.

Miscellaneous costs associated with data collection (computer usage, internet access) will be incurred by the principal researcher. This should not exceed R2000.

4.11. References

1.Eberhart LH, Geldner G, Kranke P, Morin AM, Schäuffelen A, Treiber H, et al. The development and validation of a risk score to predict the probability of postoperative vomiting in pediatric patients. Anesth Analg. 2004;99(6):1630-7. DOI:10.1213/01.Ane.0000135639.57715.6c.
2.Kranke P, Eberhart LH, Toker H, Roewer N, Wulf H, Kiefer P. A prospective evaluation of the POVOC score for the prediction of postoperative vomiting in children. Anesth Analg. 2007;105(6):1592-7. DOI:10.1213/01.ane.0000287816.44124.03.
3.Bourdaud N, Devys JM, Bientz J, Lejus C, Hebrard A, Tirel O, et al. Development and validation of a risk score to predict the probability of postoperative vomiting in pediatric patients: the VPOP score. Paediatr Anaesth. 2014;24(9):945-52. DOI:10.1111/pan.12428.
4.Kovac AL. Postoperative Nausea and Vomiting in Pediatric Patients. Paediatr Drugs. 2021;23(1):11-37. DOI:10.1007/s40272-020-00424-0.
5.Ames WA, Machovec K. An Update on the Management of PONV in the Pediatric Patient. Best Pract Res Clin Anaesthesiol. 2020;34(4):749-58. DOI:10.1016/j.bpa.2020.05.007.
6.Rose JB, Watcha MF. Postoperative nausea and vomiting in paediatric patients. Br J Anaesth. 1999;83(1):104-17. DOI:10.1093/bja/83.1.104.
7.Gan TJ, Meyer TA, Apfel CC, Chung F, Davis PJ, Habib AS, et al. Society for Ambulatory Anesthesia Guidelines for the Management of Postoperative Nausea and Vomiting. Anesth Analg. 2007;105(6):1615-28. DOI:10.1213/01.ane.0000295230.55439.f4.
8.Efune PN, Minhajuddin A, Szmuk P. Incidence and factors contributing to postdischarge nausea and vomiting in pediatric ambulatory surgical cases. Paediatr Anaesth. 2018;28(3):257-63. DOI:10.1111/pan.13333.
9.de Orange FA, Marques J, Flores M, Borges PS. Dexamethasone versus ondansetron in combination with dexamethasone for the prophylaxis of postoperative vomiting in pediatric outpatients: a double-blind, randomized, placebo-controlled clinical trial. Paediatr Anaesth. 2012;22(9):890-6. DOI:10.1111/j.1460-9592.2012.03900.x.
10.Kabré YB, Traoré ISS, Kaboré FAR, Ki B, Traoré AI, Ouédraogo I, et al. Anesthesia for ambulatory pediatric surgery in sub-Saharan Africa: a pilot study in Burkina Faso. Anesth Analg. 2017;124(2):623-6. DOI:10.1213/ANE.0000000000001780.
11.Swart ED, Rajah C, Rodseth RN. Induction behaviour and race and its association with postoperative agitation in paediatric elective surgery. South Afr J Anaesth Analg. 2017;23(2):20-3. DOI:10.1080/22201181.2017.1293385
12.Rodseth RN. Guest Editorial: Postoperative nausea and vomiting in South Africa–the next step. South Afr J Anaesth Analg. 2016;22(5):130. Available from: https://www.ajol.info/index.php/sajaa/article/view/166605/156038.
13.Alli A, Omar S, Tsang S, Naik BI. The effect of ethnicity on the incidence of postoperative nausea and vomiting in moderate to high risk patients undergoing general anesthesia in South Africa: a controlled observational study. Middle East J Anaesthesiol. 2017;24(2):119. Available from: https://pubmed.ncbi.nlm.nih.gov/30140116/
14.Rodseth RN, Gopalan PD, Cassimjee HM, Goga S. Reduced incidence of postoperative nausea and vomiting in black South Africans and its utility for a modified risk scoring system. Anesth Analg. 2010;110(6):1591-4. DOI:10.1213/ANE.0b013e3181da9005.
15.Awad IT, Moore M, Rushe C, Elburki A, O'Brien K, Warde D. Unplanned hospital admission in children undergoing day-case surgery. Eur J Anaesthesiol. 2004;21(5):379-83. DOI:10.1017/s0265021504005058.

16.Gan TJ, Belani KG, Bergese S, Chung F, Diemunsch P, Habib AS, et al. Fourth Consensus Guidelines for the Management of Postoperative Nausea and Vomiting. Anesth Analg. 2020;131(2):411-48. DOI:10.1213/ANE.0000000000004833
17.Eberhart LH, Morin AM, Guber D, Kretz FJ, Schäuffelen A, Treiber H, et al. Applicability of risk scores for postoperative nausea and vomiting in adults to paediatric patients. Br J Anaesth. 2004;93(3):386-92. DOI:10.1093/bja/aeh221.
18.Wilder-Smith OHG, Martin NC, Morabia A. Postoperative nausea and vomiting: a comparative survey of the attitudes, perceptions, and practice of Swiss anesthesiologists and surgeons. Anesth Analg. 1997;84(4):826-31. DOI:10.1097/00000539-199704000-00024.
19.Macario A, Weinger M, Truong P, Lee M. Which clinical anesthesia outcomes are both common and important to avoid? The perspective of a panel of expert anesthesiologists. Anesth Analg. 1999;88(5):1085-91. DOI:10.1097/00000539-199905000-00023.
20.Macario A, Chung A, Weinger MB. Variation in practice patterns of anesthesiologists in California for prophylaxis of postoperative nausea and vomiting. J Clin Anesth. 2001;13(5):353-60. DOI:10.1016/s0952-8180(01)00283-5.
21.Macario A, Claybon L, Pergolizzi JV. Anesthesiologists' practice patterns for treatment of postoperative nausea and vomiting in the ambulatory Post Anesthesia Care Unit. BMC Anesthesiology. 2006;6(1):1-7. DOI:10.1186/1471-2253-6-6.
22.Kappen TH, Moons KGM, Van Wolfswinkel L, Kalkman CJ, Vergouwe Y, Van Klei WA. Impact of risk assessments on prophylactic antiemetic prescription and the incidence of postoperative nausea and vomiting: a cluster-randomized trial. Anesthesiology. 2014;120(2):343-54. DOI:10.1097/ALN.0000000000000009.
23.Kappen TH, Vergouwe Y, Van Wolfswinkel L, Kalkman CJ, Moons KGM, Van Klei WA. Impact of adding therapeutic recommendations to risk assessments from a prediction model for postoperative nausea and vomiting. Br J Anaesth. 2015;114(2):252-60. DOI:10.1093/bja/aeu321.
24.Kappen TH, Van Loon K, Kappen MAM, Van Wolfswinkel L, Vergouwe Y, Van Klei WA, et al. Barriers and facilitators perceived by physicians when using prediction models in practice. J Clin Epidemiol. 2016;70:136-45. DOI:10.1016/j.jclinepi.2015.09.008.
25.Corcoran TB, Edwards T. A survey of antiemetic dexamethasone administration—frequency of use and perceptions of benefits and risks. Anaesth and Intensive Care. 2015;43(2):167-74. DOI:10.1177/0310057X1504300205.
26.Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: Building an international community of software platform partners. J Biomed Inform. 2019;95:103208. DOI:10.1016/j.jbi.2019.103208.
27.Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42(2):377-81. DOI:10.1016/j.jbi.2008.08.010.
28.World Medical Association. Declaration of Helsinki - Ethical principles for Medical Research Involving Human Subjects. Brazil: World Medical Assoication; 2013. Available from: https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/. Accessed July 2021
29.Department of Health. South African Good Clinical Practice: Clinical Trial Guidelines. Pretoria, South Africa: Department of Health 2020. Available from: https://www.sahpra.org.za/wp-content/uploads/2021/06/SA-GCP-2020_Final.pdf. Accessed July 2021.
30.South Africa. Protection of Personal Information Act 4 of 2013. Pretoria, South Africa: Information Regulator 2013. Available from https://www.gov.za/documents/protection-personal-information-act. Accesssed July 2021
31.Gropper MA, editor. Miller's Anesthesia. 9th ed. Philadelphia: Elsevier; 2020. 2795-812 p.
32.Strydom H, Fouché C, Poggenpoel M, Schurink E, W. Schurink. Research at grass roots. Pretoria: Van Schaik Publishers; 1998.

33.Endacott R, Botti M. Clinical research 3: Sample selection. Accid Emerg Nurs. 2007;15(4):234-8. DOI:10.1016/j.aaen.2006.12.006.
34.Wheaton A, Parry J, editors. Using The Angoff Method to Set Cut Scores. Question Mark Users Conference; 2012; New Orleans: Question Mark. Available from: https://www.pmcommunity.ro/download/examen_pmp/Metoda%20Angoff%20scoring%20examen%20PMP%20-%20detalii.pdf.
35.Endacott R. Clinical research 1: Research questions and design. Accid Emerg Nurs. 2007;15(2):106-9. DOI:10.1016/j.aaen.2006.12.003.
36.Kimberlin CL, Winterstein AG. Validity and reliability of measurement instruments used in research. Am J Health Syst Pharm. 2008;65(23):2276-84. DOI:10.2146/ajhp070364.
37.Downing SM. Reliability: on the reproducibility of assessment data. Med Educ. 2004;38(9):1006-12. DOI: 10.1111/j.1365-2929.2004.01932.x.
38.Wass V, Van der Vleuten C, Shatzer J, Jones R. Assessment of Clinical Competence. Lancet. 2001;357(9260):945-9. DOI: 10.1016/S0140-6736(00)04221-5.
39.Paniagua MA, Swygert KA, editors. Constructing Written Test Questions For the Basic and Clinical Sciences. Paniagua MS, KA, editor. Philadelphia: National Board of Medical Examiners; 2016.
40.Tan LT, McAleer JJA. The introduction of single best answer questions as a test of knowledge in the final examination for the fellowship of the Royal College of Radiologists in Clinical Oncology. Clin Oncol. 2008;20(8):571-6. DOI: 10.1016/j.clon.2008.05.010.
41.Schulz KF, Grimes DA. Essential Concepts in Clinical Research. 2nd ed. Edinburgh: Elsevier; 2019.
42.White SE. Basic and Clinical Biostatistics. 5th ed. New York: McGraw-Hill Education; 2020.

Appendix A: Correspondence for permission from the Head of Department of Anaesthesiology at the University of the Witwatersrand.

Simon Gowans
10 6th Avenue. Parktown North.
1 October 2021

To: Dr P. Motshabi, PhD. Academic Head: Department of Anaesthesia, University of the Witwatersrand.

Dear Dr Motshabi,

RE: Request for provisional permission to perform research in the Department of Anaesthesia.

I am a first-year anaesthetic registrar in the Department of Anaesthesia. I would like to request provisional permission to undertake a survey of anaesthetists in the Department as part of my study entitled: "A study of the knowledge, perceptions and practices of anaesthetists towards paediatric post-operative nausea and vomiting management". The aim of the study is to describe the knowledge, perceptions, and practices of anaesthetists in the Department towards the management of paediatric PONV. This study will form part of the dissertation for my Master of Medicine (Anesthesia) at the University of the Witwatersrand.

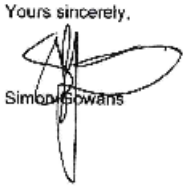
Data will be collected using a secure electronic self-administered questionnaire hosted by REDCap® (Research Electronic Data Capture). REDCap® is a secure, web-based software platform designed to support data capture for research studies. The questionnaire can be completed by participants after working hours. There are no anticipated costs to the Department.

I will be submitting my research proposal to the Human Research Ethics Committee (Medical) and the Graduate Studies Committee of the University of the Witwatersrand. Once final approval to conduct research from these committees has been received, I can forward them to you for your final permission to undertake research in the Department.

A copy of the final dissertation will be made available to the Department.

Additional information can be obtained from my supervisors Dr Megan Wellbeloved on drmeganwellbeloved@gmail.com and Dr Sheena Smith on sheenzsmith1@hotmail.com.

Yours sincerely,



Simon Gowans

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG
FACULTY OF HEALTH SCIENCES
WITS SCHOOL OF CLINICAL MEDICINE
DEPARTMENT OF ANAESTHESIOLOGY
Tel.(011)488 4344

05 October 2021

To Whom It May Concern

Re: Permission to conduct research in the Department of Anaesthesiology

This letter stands to affirm that I, Dr PMV Motshabi, grant permission to Dr Simon Gowans, to conduct a study in the Department of Anaesthesiology at University of Witwatersrand titled: "A study of the knowledge, perceptions and practice of anaesthetists towards paediatric post-operative nausea and vomiting management"

The information obtained from the data will be used for the Department to advance the training.

Yours sincerely

Dr P Motshabi

Appendix B: Study Information Sheet

"A study of the knowledge, perceptions, and practices of anaesthetists towards paediatric post-operative nausea and vomiting management."

Dear Colleague,

My name is Simon Gowans. I am a registrar in Anaesthesia at the University of the Witwatersrand. For my Master of Medicine (Anaesthesia) I am the Principal Investigator of the above entitled study that aims to describe anaesthetists' knowledge, perceptions and practices of paediatric post-operative nausea and vomiting (PONV) management.

I am inviting all anaesthetists in the Department (medical officers, registrars, and consultants) to complete a short self-administered electronic questionnaire in the form of a REDCap ® survey. The link to this survey appears below.

The questionnaire consists of 31 questions. It is adapted from consensus guidelines, a review article, and a published survey. Additionally, a panel of experts in paediatric anaesthesiology have reviewed this questionnaire. This questionnaire should not take more than 10 minutes to complete. Part of the questionnaire is an assessment of knowledge of PONV management. The answers to these questions (and references) are available on request and may serve to improve participants knowledge of paediatric PONV. There is minimal risk from completing this questionnaire.

This is a voluntary study. You may also choose to withdraw from it at any point without any prejudice to yourself. No reason is required to withdraw, and all data collected from you will be destroyed unless you specifically consent to its retention.

You will not be required to enter any unique identifying data in the questionnaire. Personal email addresses will be required to be entered into REDCap ® to deliver questionnaires to potential participants. However, your responses to the questionnaire will be automatically coded by REDCap® as they are collected, and unidentifiable to the principal investigator, the supervisors, and a biostatistician. This is because REDCap ® manages questionnaire delivery and data collection in two separate modules. Participant's Email addresses cannot be linked to the survey responses as there will be no "Participant Identifiers" in the data set. It would not be reasonably possible on the REDCap® platform for the Principal Investigator, the supervisors, and a biostatistician to be able to identify participant's responses using their email addresses.

This is a confidential questionnaire. Collected data will be treated in the strictest confidence and will only be available to the Principal Investigator, Co-Supervisors, and a biostatistician. The only exceptions would normally be:

1. Personal information may be disclosed if required by law.

2. The Human Research Ethics Committees of the University may exceptionally require personal data to respond to a formal complaint, or for a compliance audit

All data collected in the course of the study will be securely retained for two (2) years, if a scientific publication arises from the study and six (6) years if there is no publication. Thereafter it will be destroyed accordingly. All data will be handled and digitally secured to comply with the Protection of Personal Information Act, Act 4 of 2013.

A summarized version of this study may be presented to relevant stakeholders, to conferences and submitted to peer reviewed journals for publication. The results will be made available to all participants on request.

This study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg ("Committee"). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research. If you have any concern over the way the study is being conducted, please contact the Chairperson of this Committee who is Professor Clement Penny, who may be contacted on telephone number 011 717 2301, or by e-mail on Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za.

This study has also been reviewed and approved by the Graduate Studies Committee of the University of the Witwatersrand and the Academic Head of the Department of Anaesthesiology, University of the Witwatersrand.

Thank you for reading this Study Information Sheet. A copy of this sheet can be made available to you for your records.

Sincerely,

Dr Simon Gowans March 2022

Further information regarding this project and to report any adverse events you may contact the Principal Investigator, Dr Simon Gowans via telephone on 083 511 3647 or email at drsimongowans@outlook.com. You may also contact the project Supervisors Dr Megan

Wellbeloved via email on drmeganwellbeloved@gmail.com and Dr Sheena Smith on sheenzsmith1@hotmail.com.

Appendix C: Questionnaire

The questionnaire will be transcribed into REDCap® for dissemination electronically to the study participants. The following is a version of the questionnaire formatted for Microsoft® Word®.

Declaration of Consent

By completing this questionnaire electronically, I acknowledge that I have read and understand the Study Information Sheet for the study entitled “A study of the knowledge, perceptions, and practices of anaesthetists towards paediatric post-operative nausea and vomiting (PONV) management.” by Dr Simon Gowans. Furthermore, that in completing this questionnaire I consent to taking part in the study.

I understand this study shall consist of completing a short, self-administered electronic questionnaire. I understand the purpose of, and procedures involved in taking part in this study: this includes the benefits, risks and costs to me; outcomes of research; and details pertaining to data collection (including that questionnaire responses will be unidentifiable and confidential). Furthermore, I understand that all data collected in the course of the study will be securely retained for two (2) years, if a scientific publication arises from the study and six (6) years if there is no publication. Thereafter it will be destroyed accordingly.

I declare that my participation in this study is entirely voluntary and that I may withdraw at any time without affecting any of the benefits that I am entitled to. I acknowledge that no reason is required to withdraw, and all data collected from me will be destroyed unless I specifically consent to its retention.

I understand this study has been approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg (“Committee”). A principal function of this Committee is to safeguard the rights and dignity of all human subjects who agree to participate in a research project and the integrity of the research.

I understand that if I have any concern over the way the study is being conducted, I may contact the Chairperson of this Committee who is Professor Clement Penny, whom may be contacted on telephone number 011 717 2301, or by e-mail on

Clement.Penny@wits.ac.za. The telephone numbers for the Committee secretariat are 011 717 2700/1234 and the e-mail addresses are Zanele.Ndlovu@wits.ac.za and Rhulani.Mukansi@wits.ac.za

If I have any queries or concerns related to the study, I understand that I may contact the Principal Investigator, Dr Simon Gowans at:

Email: drsimongowans@outlook.com Phone: 083 511 364

Alternatively, I can contact the study Supervisors:

Dr Megan Wellbeloved on drmeganwellbeloved@gmail.com

Dr Sheena Smith on sheenzsmith1@hotmail.com.

Section A: Demographic Information

Please select the box that best describes you:

1. Age range:

< 30 years old	
30 - 39 years old	
≥ 40 years old	

2. Current position in the department:

Medical officer	
Registrar	
Consultant	

3. Number of years of worked doing full time anaesthesia

< 5 years	
6 – 10 years	
> 10 years	

4. Examinations completed:

Diploma in Anaesthesia	
Part 1 of Fellow of College of Anaesthetists	
Part 2 of Fellow of College of Anaesthetists	

5. Volume of paediatric anaesthesia cases performed on a regular basis:

Specialist anaesthetist in training	

Specialist anaesthetist with occasional (<50%) paediatric cases.	
Specialist anaesthetist with frequent (50 - 79%) paediatric cases.	
Specialist anaesthetist with mainly (≥80%) paediatric cases.	

Section B: Practice of paediatric PONV

The following questions are about your **actual anaesthetic experiences of paediatric PONV.** You are required to either input an answer or choose the option that best describes your practice. **There are no correct answers.**

1. In the last month have you had a paediatric patient experience PONV?

Yes	
No	

2. In the last year, approximately what proportion of paediatric patients have you seen experience PONV?

0%	
Less than 10%	
10%	
25%	
More than 25%	

3. Do you, preoperatively, routinely look for and ask about risk factors for PONV in paediatric patients?

Yes	
No	

4. Do you use clinical prediction models or risk scores to predict PONV in paediatric patients?

Yes	
No	

5. Do you routinely counsel parents/care givers of children presenting for day case surgery about PONV?

Yes	
No	

6. Do you routinely counsel parents/care givers of children presenting for day case surgery about what to do if PONV occurs after discharge home?

Yes	
No	

7. What option best describes your PONV prophylaxis strategy for paediatric patients?

No patients get pharmacological PONV prophylaxis.	
All patients get PONV pharmacological prophylaxis.	
Selective based on clinical assessment.	
Other – please state	

8. Approximately what percentage of your paediatric patients receive pharmacological PONV prophylaxis?

9. What is your most commonly used **first line drug** for PONV prophylaxis in at risk paediatric patients?

Dexamethasone	
$5HT_3$ receptor antagonist	
Metoclopramide	
Droperidol	
Cyclizine	
Promethazine	
Other (please state)	

10. What is your most commonly used **second line drug** for PONV prophylaxis in at risk paediatric patients?

Dexamethasone	
$5HT_3$ receptor antagonist	
Metoclopramide	
Droperidol	
Cyclizine	
Promethazine	
Other (please state)	

11. How many paediatric TIVAs (including TCI) anaesthetics have you given for the sole purpose of PONV prophylaxis?

0	
1 – 10	
More than 10	

Section C: Knowledge of paediatric PONV

For the purposes of the protocol submission the correct answer is marked with an X.

1. The following is a clinical prediction score to predict PONV in paediatric patients:

APFEL Score	
BARF Scale	X
PARA Score	
POVOC Score	
PRAm Score	

2. The following surgery is associated with the most increased risk of PONV:

Tympanoplasty	
Strabismus surgery	X
Otoplasty	
Adenotonsillectomy	
Laparotomy	

3. Which of the following is associated with increased risk of PONV?

Prepubertal female	
Age greater than 3 years	X
Surgery under 30 minutes	
Caudal anaesthesia	
Family history of smoking	

4. The following is the recommended dose for intravenous dexamethasone for the prevention of PONV:

15mcg/kg IV	
10mcg/kg IV	
150mcg/kg IV	X
4mg IV	
100mcg/kg IV	

5. Which of the following non-pharmacological interventions is consistently associated with a decreased incidence of PONV in paediatric patients?

Parental presence at induction	
Prolonged fasting period	
Liberal intravenous fluid therapy	X
Acupuncture	
Restrictive fluid therapy	

For the following clinical scenarios please select the most appropriate answer

6. An 18-month-old child is coming for a bilateral hernia repair that is estimated to last about an hour. He receives an inhalational induction, and a caudal block is done. He is intubated after a dose of propofol is given and anaesthesia is maintained with sevoflurane. What is the most appropriate PONV prophylaxis?

No pharmacological prophylaxis given.	
IV Droperidol	
IV Metoclopramide	
IV Dexamethasone and IV Ondansetron.	X
IV Dexamethasone and IV ondansetron and consider a TIVA.	

7. An 11-year-old girl is coming for an exploratory laparotomy for a pelvic cyst. She receives an intravenous induction, and an endotracheal tube is placed after a muscle relaxant is given. She receives fentanyl and morphine for analgesia. What is the most appropriate PONV prophylaxis?

No pharmacological prophylaxis given.	
IV Droperidol	
IV Metoclopramide	
IV Dexamethasone and IV Ondansetron.	
IV Dexamethasone and IV ondansetron and consider a TIVA.	X

8. A 2-year-old girl with no history of PONV or motion sickness comes for a 10-minute procedure to remove a K wire in her arm. Your anaesthetic plan is mask ventilation with IV propofol TIVA. What is the appropriate PONV prophylaxis?

No pharmacological prophylaxis given.	X
IV Droperidol	
IV Metoclopramide	
IV Dexamethasone and IV Ondansetron.	
IV Dexamethasone and IV ondansetron and consider a TIVA.	

9. A child coming for elective hernia surgery develops PONV after 30 minutes in recovery. She received IV dexamethasone and ondansetron intraoperatively. What is the most appropriate management?

Observation and keep NPO.	
Immediately repeat dose of IV ondansetron	
Repeat dose of IV ondansetron in 6 hours.	
Immediately give IV droperidol.	X
Immediately repeat dose of IV dexamethasone.	

10. A child coming for elective lower limb surgery develops PONV after 1 hour in recovery. He received IV dexamethasone intraoperatively. What is the most appropriate management?

Observation and keep NPO.	
Immediately dose of IV ondansetron	X
Repeat dose of IV dexamethasone in 6 hours.	
Immediately dose of IV droperidol.	
Immediately repeat dose of IV dexamethasone.	

Section D: Perceptions of paediatric PONV

The following questions are about your **personal perceptions of paediatric PONV**. Please select an answer from least agree to most agree. **There are no correct answers**.

1. Paediatric PONV is a serious adverse effect of anaesthesia:

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

2. My understanding of paediatric PONV and its management is acceptable for my level of training in anaesthesia:

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

3. The current management strategies for paediatric PONV management are acceptable:

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

4. I feel confident in managing paediatric PONV:

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

5. Guidelines for the management of paediatric PONV are easily available to me:

Strongly Agree	
Agree	
Neutral	
Disagree	
Strongly Disagree	

Thank you for taking the time to complete this survey.

Ends.

Appendix D: Correspondence for Permission to Adapt Questionnaire

From: Simon Gowans <simon.gowans1@wits.ac.za>
Sent: Tuesday, 13 July 2021 16:25
To: Corcoran, Tomas <Tomas.Corcoran@health.wa.gov.au>
Subject: Permission to use questionnaire for paediatric PONV study

Dear Prof Corcoran,
My name is Simon Gowans. I am a registrar (resident) in anaesthesiology at the University of the Witwatersrand in Johannesburg, South Africa. As part of my Masters in Medicine in Anaesthesiology I am conducting a study of the knowledge, perceptions and practices of anaesthesiologists in the Department of Anaesthesiology towards the management of post-operative nausea and vomiting in paediatric patients.

I have included the study "A survey of antiemetic dexamethasone administration—frequency of use and perceptions of benefits and risks", of which you are the lead author, in my literature review and would please like permission to adapt part of your survey for use in my study. This will be referenced in my protocol and acknowledged in the final dissertation and in any subsequent publications or presentations.

Please don't hesitate to contact me if you have any further queries.

Yours sincerely,

Dr. Simon Gowans

MBChB (UCT), DA (SA).

From: Corcoran, Tomas <Tomas.Corcoran@health.wa.gov.au>
Sent: Tuesday, 13 July 2021 19:00
To: Simon Gowans <simon.gowans1@wits.ac.za>
Subject: Re: Permission to use questionnaire for paediatric PONV study

Dear Simon

Yes, of course, I would be delighted if you find the question-set useful for the purposes of your masters degree. Please feel free to adapt it in whatever way you need, you have my full permission to do so.

Best wishes and good luck with your work

Tomás

Kind regards

Tomás Corcoran

Appendix E: Angoff Method Results

Angoff Method Rating Form

Round 1 Scores

Item	Average	R1	R2	R3	R4	R5	R6	R7	R8	R9	Std. Dev.
1	61,11	40	65	85	75	35	60	60	45	85	18,50
2	72,22	60	70	95	75	75	45	65	90	75	15,02
3	68,33	65	65	95	70	75	50	65	70	60	12,25
4	63,89	60	80	80	70	80	30	70	50	55	16,91
5	62,78	55	50	80	70	75	60	55	55	65	10,34
6	55,00	40	65	70	55	65	40	60	45	55	11,18
7	58,33	40	70	60	65	70	55	55	40	70	11,99
8	60,56	55	70	65	50	60	60	60	55	70	6,82
9	57,78	55	75	65	55	65	40	50	50	65	10,64
10	59,44	55	65	70	50	85	45	50	55	60	12,36

Total	61,94

Round 2 Scores

Item	Average	R1	R2	R3	R4	R5	R6	R7	R8	R9	Std. Dev.
1	56,67	40	65	55	75	50	60	60	45	60	10,61
2	73,89	60	70	95	75	75	60	65	90	75	12,19
3	67,22	65	65	75	70	75	60	65	70	60	5,65
4	64,44	60	70	80	70	80	45	70	50	55	12,61
5	63,33	55	55	80	70	75	60	55	55	65	9,68
6	49,44	40	50	45	55	55	40	60	45	55	7,26
7	52,78	40	60	50	65	55	55	55	40	55	8,33
8	60,56	55	70	65	50	60	60	60	55	70	6,82
9	56,67	55	65	65	55	65	40	50	50	65	9,01
10	61,11	55	65	70	50	85	55	55	55	60	10,83

Total	60,61

Round 3 Scores

Item	Average	R1	R2	R3	R4	R5	R6	R7	R8	R9	Std. Dev.
1	56,67	40	65	55	75	50	60	60	45	60	10,61
2	72,22	60	70	80	75	75	60	65	90	75	9,72
3	67,22	65	65	75	70	75	60	65	70	60	5,65
4	65,00	60	70	80	70	80	50	70	50	55	11,73
5	63,33	55	55	80	70	75	60	55	55	65	9,68
6	49,44	40	50	45	55	55	40	60	45	55	7,26
7	52,78	40	60	50	65	55	55	55	40	55	8,33
8	60,56	55	70	65	50	60	60	60	55	70	6,82
9	56,67	55	65	65	55	65	40	50	50	65	9,01
10	60,56	55	65	70	50	80	55	55	55	60	9,50

Total	60,44

Key:

Item: Questions 1 to 10 in Section C of the questionnaire.

R1 – R9: Rater 1 – Rater 9.

Std. Dev: Standard Deviation between Raters responses per question.

Average: Average of all Raters response to each question.

Total: The average of all the Rater’s averages per question.