A cross-sectional survey of anesthetic airway equipment and airway management practices in Uganda

Short title: Ugandan anesthetic airway equipment and management

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Authors contribution

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Abstract

Background

Anesthesia-related causes contribute to a significant proportion of perioperative deaths, especially in low and middle-income countries (LMICs). There is evidence that complications related to failed airway management are a significant contributor to perioperative morbidity and mortality. While existing data have highlighted the magnitude of airway management complications in LMICs, there is inadequate data to understand their root causes. This study aimed to pilot an airway management capacity tool that evaluates airway management resources, provider practices and experiences with difficult airways in an attempt to better understand potential contributing factors to airway management challenges.

Methods

We developed a novel airway management capacity assessment tool through a non-systematic review of existing literature on anesthesia and airway management in LMICs, internationally recognized difficult airway algorithms, minimum standards for equipment and the safe practice of anesthesia; and the essential medicines and health supplies list of Uganda. We distributed the survey tool during conferences and workshops, to anesthesia care providers from across the spectrum of surgical care facilities in Uganda. The data was analyzed using descriptive methods.

Results

Between May 2017 and May 2018, 89/93 surveys were returned (17% of anesthesia providers in the country) from all levels of health facilities that provide surgical services in Uganda. Equipment for routine airway management was available to all anesthesia providers surveyed, but with a limited range of sizes. Pediatric airway equipment was always available 54% of the time. There was limited availability of capnography (15%), video laryngoscopes (4%), cricothyroidotomy kits (6%), and fiberoptic bronchoscopes (7%). Twenty one percent (18/87) of respondents reported experiencing a “can’t intubate, can’t ventilate” (CICV) scenario in the 12 months preceding the survey, while 63% (54/86) reported experiencing at least one CICV during their career. Eighty five percent (74/87) of respondents reported witnessing a severe airway management complication during their career, with 21% (19/89) witnessing a death as a result of a CICV scenario.

Conclusion

We have developed and implemented an airway management capacity tool that describes airway management practices in Uganda. Using this tool, we have identified significant gaps in access to airway management resources. Gaps identified by the survey, along with advocacy by the Association of Anesthesiologists of Uganda, in partnership with the Ugandan Ministry of Health, have led to some progress in closing these gaps. Expanding this availability further, providing more airway management training and identifying opportunities to support skilled workforce expansion have the potential to improve perioperative safety in Uganda.

Key points summary

- *Question:* In Uganda, what are anesthesia provider experiences of airway management and what airway management resources do they have available?
- *Findings:* Most anesthesia providers in Uganda witness severe airway management complications and access to essential airway management equipment is inconsistent.
- *Meaning:* The lack of consistent availability of airway management equipment may be contributing towards anesthesia-related morbidity and mortality in Uganda and addressing these shortfalls could improve safety of perioperative care in the country.

Glossary of terms

LMIC	Low- and middle-income country
CICV	Can't intubate, can't ventilate
EMHSLU	Essential medicines and healthcare supplies list Uganda
PAP	Physician anesthesia provider
NPAP	Non-physician anesthesia provider
HCIV	Health Centre IV

Introduction

Surgically treatable conditions contribute significantly to the global burden of disease. We increasingly recognize that universal health coverage globally, driven by the sustainable development agenda (Sustainable Development Goal 3), will only be achieved if we improve access to safe surgery and anesthesia care.[1-3] Over the past 70 years, perioperative mortality has improved 10-fold, though most of these gains have been in high-income countries.[4] In low- and middle-income countries (LMICs), mortality after caesarean section, remains 50 times higher than in high-income countries (HICs).[5]

Anesthesia-related causes contribute to a significant proportion of perioperative deaths, and this is especially true in Africa. A study of emergency obstetric surgery in Zimbabwe found an avoidable mortality rate for anesthesia of 2.1 per 1000, with 72% of overall deaths contributed to by factors under the control of the anesthetist.[6] Aspiration of gastric contents, failure of airway management and lack of clinical supervision were significant factors in a report from Nigeria, with anesthesia related maternal mortality rates of 9%.[7] Data from South Africa suggest a significant proportion of anesthesia-related maternal deaths were avoidable and commonly related to unpreparedness to convert from spinal to general anesthesia or undertake airway management following a complication.[8] This data, and others, show that complications arising from failure of airway management are a major contributor to perioperative morbidity and anesthesia related deaths in LMICs, with up to half of all anesthesia-related deaths attributed to failed airway management.[7,9-11] Airway management is a critical skill for the anesthesia provider in the effort to make surgery safer. [12,13]

Prior surgical and anesthesia capacity surveys in Uganda have identified limitations in human resources, infrastructure, equipment and supplies; meaning many hospitals do not meet the WHO-WFSA International Standards for providing safe anesthesia.[14-17] Supply chain difficulties and limited funding contribute to a lack of resources at the point of care in almost all facilities, with public facilities most affected.[18] In Uganda, public facility resources are based on the Essential Medicines and Healthcare Supplies List in Uganda (EMHSLU, Appendix 1). However, this list lacks some essential airway management tools.[19]

There has been no recent, detailed survey of available resources and practices for airway management in Uganda despite the significant role this plays in the provision of safe anesthesia. This study aimed to develop and pilot an airway management capacity survey tool and provide an up-to-date evaluation of the resources available for and practices of airway management in Uganda. We hypothesized that the survey would identify gaps in the availability of airway management equipment in Uganda and variability in the confidence of providers across the range of airway management techniques.

Methods

Study type

We undertook a descriptive cross-sectional survey of anesthesia-related airway resources, airway management practices, and airway complications among anesthesia providers in Uganda between 2017 and 2018. This manuscript adheres to the applicable CONSORT guidelines. (See EQUATOR Checklist)

Ethical approval

The requirement for written informed consent was waived by the University of California, San Francisco Ethics Committee. In Uganda the study was approved by Mbale Regional Referral Hospital Research Ethics Committee (MRRH REC IN-COM 66/2017) and the Uganda National Council of Science and Technology (HS95ES).

Survey facilities and study population

We targeted physician anesthesia providers (PAPs), non-physician anesthesia providers (NPAPs) and anaesthesia trainees, working in private healthcare facilities, private-not-for-profit (PNFP) and public hospitals including Health Centre IVs (HCIV), District/General hospitals, and Regional and National referral hospitals. In this study, we aimed to survey providers from the single national referral hospital and a minimum of 10 different facilities in each of the following categories: HCIV, general hospitals, and regional referral hospitals. Further detail about the distribution of health facilities in Uganda is available in appendix 2.

Survey tool development

We developed an airway management capacity tool through a non-systematic review of existing literature on anesthesia and airway management in LMICs, internationally recognized difficult airway algorithms and minimum standards for equipment and the safe practices of anesthesia; and the essential medicines and health supplies list of Uganda.[17,19,20] Following discussions between the research team on the content, structure and language, the survey tool was initially piloted on five senior anesthesia trainees. A new iteration of the tool was then piloted on three NPAPs at Mbale Regional Referral Hospital to assess for clarity and usability, leading to the final study tool, comprising of the following categories: participant demographics, airway equipment availability, airway management techniques and difficult airway management experiences and complication rates. Most questions used

Likert scales. To assess confidence for example, we used four grades: very confident, moderately confident, slightly confident and not confident at all. (see supplemental figure 1 for full survey tool)

Data collection

Data was collected between May 2017 and May 2018 by convenience sampling at professional anesthesia meetings and education training courses held in Kampala, Mbale, and Masaka. We also employed snowball sampling using contact emails and physically visited select facilities or hospitals. When able, more than one anaesthesia provider was allowed to complete the survey from each facility. The physical visits were by convenience and depended on non-study travel by some research team members. We administered the survey on paper or electronic form using a custom REDCap database (Vanderbilt University, Nashville, USA). Respondents were asked to answer according to what they had at their place of work rather than what they know. During the physical visits, a member of the research team asked to physically see the items available. Paper surveys were manually entered into the REDCap database by study staff.

Data Analysis

We performed descriptive analyses for all quantifiable data on a question-by-question basis to manage non-response bias, analyzing each question using the total number of responses, which varied among questions. We describe the data using means, ranges and proportions, with figures made in Excel (Microsoft 2010, Seattle WA, USA). Both numerators and denominators have been included to make it clear when survey questions were not answered by all respondents. Where applicable, comparison was made between health facility types (availability of equipment and drugs) and the different cadres of anaesthesia provider (confidence in airway management techniques).

Results

Demographics

Ninety three surveys were distributed with 89 returned giving a completion rate of 96%. This represented 17% of anesthesia providers in the country at the time. Almost two thirds of respondents were non-physician anesthesia providers with the remainder being either physician specialists or trainees. Table 1 provides a breakdown of the survey respondents by facility type and anesthesia cadre. The respondents represented all levels of health facilities that provide surgical services in Uganda with the largest representation from regional referral hospitals (27%, 24/89) and the smallest from district/general hospitals (11%, 10/89). The average time in anesthesia practice was 8.9 (0-40) years. Ninety one percent (79/87) of respondents reported they had received some form of difficult airway management training, at least during anesthesia training. Electronic questionnaires required between 15-20 minutes to complete, while physical ones required 10-20 minutes.

Access to airway management resources

Equipment

The results on availability of airway management equipment are shown as averages across all respondents in figure 1 and broken down by health facility type in supplementary table 1. Equipment including facemasks, self-inflating bags, pulse oximeters, Macintosh blade laryngoscopes, endotracheal tubes and suction systems, were "always" available to respondents >80% of the time. Video laryngoscopes, cricothyroidotomy kits, capnography and fiberoptic bronchoscopes were "always" available less than 20% of the time. Rescue devices, including stylets, laryngeal mask airways (LMA), and bougies, had variable availability, being "always" available 69% (61/88), 50% (44/88) and 38% (33/88) of the time, respectively (Figure 1). Equipment including optical stylet, light wand, Aintree catheter, Enk flow modulator, retrograde wire and Combitube were either "never" available, or providers were "unsure" of their availability and therefore they were not included in figure 1.

Cylinder oxygen was "always" available 74% (66/89) of the time, while piped oxygen was only available 25% (22/89) of the time. Respondents reported access to a limited range of sizes for most equipment, with adult sizes the most common. Pediatric airway management equipment was reliably available 54% (45/84) of the time but rarely or never available 15% (13/84) of the time. Private, PNFP, and referral hospitals tended to have higher access to airway management equipment. However, 71% (59/83) of facilities did not have a dedicated difficult airway trolley or equivalent for the preparedness to manage a difficult airway. Similarly, assistance from another person skilled in airway management was “always” available 25% (22/88) of the time and “rarely or never” available 32% (28/88) of the time.

Availability of drugs

The most commonly available muscle relaxant was suxamethonium which was “always available” 94% (83/88) of the time. Rocuronium, an intermediate-acting non-depolarizing muscle relaxant was “always” available 5% (4/87) of the time while others in the same class were “always” available 36% (31/87) of the time, the most common being atracurium. The neuromuscular blocker reversal agent, neostigmine, was “always” available 36% (31/87) of the time. Private hospitals were more likely to have access to more neuromuscular blocking agents as well as reliable access to neostigmine. HCIVs, district and regional referral hospitals had inconsistent access to these drugs.

Airway Management Practices

Rapid Sequence Induction

When asked what they would do during rapid sequence induction (RSI) of a patient with a full stomach, 90% (77/86) of respondents reported they would “always” perform preoxygenation, 80% (68/85) would “always” apply cricoid pressure and 81% (70/86) would “rarely’ or “never” provide manual breaths prior to intubation. On the other hand, only 67% (58/86) of respondents would “always” paralyze the patient.

Confidence in airway management techniques

Ninety three percent (82/88) of respondents were “very confident” in the technique of direct laryngoscopy with a Macintosh blade while 72% (62/86) were “very confident’ in laryngeal mask airway placement. There were fewer respondents who were “very confident” in using video laryngoscopy, fiberoptic intubation, intubation through LMA and cricothyroidotomy. There were even fewer respondents confident in the use of blind digital intubation, blind nasal intubation, awake direct laryngoscopy, awake video laryngoscopy and retrograde wire intubation (Figure 2).

There were differences in confidence between cadres of anesthesia providers, with PAPs more than twice as likely to report, on average, high confidence across all techniques compared to NPAPs (37%, 7/19 vs 15%, 8/53). PAPs were more likely to be confident in alternative intubation techniques such as intubating through an LMA, video laryngoscopy and fiberoptic intubation. Regarding cricothyroidotomy, a last resort rescue technique, the overall confidence was low, with only 11% (2/19) of PAPs and only 2% (1/53) of NPAPs reporting "very confident". (See supplementary table 2)

Difficult Airway management

Difficult airway experience and complications

In the year preceding the survey, 21% (18/87) of respondents reported experiencing a “can’t intubate, can’t ventilate” (CICV) scenario, while 63% (54/86) reported experiencing at least one such event during their career, with an average of 1.6 (0-10) events per respondent.

Complications of airway management

Eighty three percent (74/89) respondents reported witnessing a severe complication of airway management during their career. Airway trauma (58%, 52/89) and cardiac arrest (54%, 48/89) were the most reported complications, while patient recall was the least reported (10%, 9/89). In this cohort, 21% (19/89) of anesthesia providers had witnessed death from a CICV situation (Figure 3).

Approach to difficult airways

In a difficult airway situation, 80% (71/89) of respondents reported using a difficult airway algorithm. In a “can't intubate, can ventilate” scenario, 56% (48/85) would perform three attempts at direct laryngoscopy before trying an alternative technique, and 4% (3/85) would attempt five times or more. When faced with a “can’t intubate, can’t ventilate” (CICV) scenario, 67% (38/57) had awakened a patient, and 26% (15/58) had performed a cricothyroidotomy.

When asked about how they would manage a hypothetical clinical scenario of CICV, 62% (48/78) of respondents would perform a scalpel cricothyroidotomy while 19% (15/78) would not attempt any emergency front of neck access technique in the absence of a surgeon. In the same situation, 9% (8/85) of respondents would “always” paralyze the patient (if not paralyzed already), and 47% (40/86) would “always” place an LMA.

Discussion

We successfully implemented a novel survey tool to provide a snapshot of airway management equipment and practices in Uganda. It is the first of its kind undertaken in sub-Saharan Africa and was easy to implement with a high completion rate. We found that equipment for routine adult airway management is usually available in most surgical facilities, while pediatric equipment is available only half of the time. We also identified several other critical gaps that stem from lack of incorporation into national facility supply procurement options, including the lack of access to capnography, with two in every three anesthesia providers lacking access to this essential and standard safety tool. We found that difficult airway scenarios were commonly encountered in clinical practice with a fifth of respondents experiencing a CICV scenario within the 12 months prior to the survey.

Implications of our findings

In Uganda, there have been improvements in the availability of many of the items considered mandatory for safe anesthesia care, including pulse oximetry, suxamethonium, non-depolarizing neuromuscular blockers and reversal agents since 2007.[15] In 2018, the World Health Organization and the World Federation of Societies of Anaesthesiologists (WFSA) published updated standards for the safe practice of anesthesia.[17] "Highly recommended" standards include some commonly unavailable in Uganda, such as bougies, appropriately sized pediatric airway equipment, and a consistent supply of oxygen, which was lacking for 8% of respondents. While continuous waveform capnography is "recommended" rather than "highly recommended", there is a growing movement to reduce the global capnography gap similar to the global effort on pulse oximetry.[21-25]

A recent study by van de Merwe et al has highlighted that procedural sedation across Africa, conducted by non-physician anesthesia providers, saw an 8-fold increase in the odds of severe complications or death compared to physician anesthesia providers.[26] The paper hypothesizes that an inability to recognize and manage complications of procedural sedation may be one of the contributing factors to this postoperative morbidity. Our survey has revealed lower confidence from NPAPs across all airway management techniques. These findings collectively stress the potential value of a physician specialist-led anesthesia team as well as increased investment to improve current training programs for all anesthesia providers.

The incidence of a CICV scenario experienced by Ugandan anesthesia providers is much higher than the incidence quoted in HIC studies of 1 in 10,000 anesthetics, with more than 21% experiencing such an event in the last 12 months.[27] Reflecting on the current management of a difficult airway in Uganda, the relatively low percentage of providers (9%) that would routinely paralyze their patient while managing a CICV scenario correlates with the proportion of providers that have awakened a patient from anesthesia following an airway difficulty. Perhaps, anesthesia providers in this cohort perceive the approach of waking up the patient rather than paralyzing as a safer course of action in a setting with fewer alternatives for complex airway management. It also provides an opportunity for improvement in guidelines and practice. In many LMICs, including Uganda, difficult airway management guidelines are routinely adopted from HICs, for example, the United Kingdom.[20] However, given the differences in access to the resources routinely used in HICs, it would be appropriate for individual countries to adapt and implement guidelines for their setting. Alternatively, context appropriate algorithms could be developed. An example of how they might differ could be emphasis on waking a patient up in a CICV scenario rather than paralyzing them. Setting-specific practice guidelines might also provide the impetus for a countrywide capacity building project focused on guideline implementation and in-service training, both of which would be likely to contribute to improvements in airway management and enhanced patient safety.

Strengths and limitations of our study

Our survey collected more than ten responses per type of healthcare facility, representing 17% of anesthesia providers in the country at the time. However, we acknowledge that our results may not apply to all anesthesia providers in the country. Data collection was completed primarily at regional and national meetings for convenience. This may have introduced bias as respondents at these meetings arguably may have more access to professional development activities or come from relatively better resourced facilities. Another study limitation could be that we did not reach providers who work alone at their facilities and hence have no opportunity to attend continuing medical education events and conferences. It is common in rural facilities for an anesthesia provider to be the only one employed and hence expected to be available all the time. Therefore, the results might not be generalizable to this group of providers.

This survey did not examine potential confounding factors such as the type of surgery undertaken, nor the influence of infrastructure issues such as the lack of an anesthetic machine or reliability of electricity supply. We also did not ask about preoperative airway assessment to assess risk or use of the WHO surgical safety checklist that includes components related to planning for management of a potential difficult airway. These may have influenced choice of the anesthetic technique, which could impact the need for certain types of airway equipment. In addition, some components of the survey may have been affected by recall bias. For example, while it may be easier to remember some of the major complications that occur immediately, like cardiac arrest and front of neck access, many anesthesia providers are not routinely involved in the postoperative care of their patients and so they may not have the opportunity to recognize, and therefore recall, complications such as hypoxic brain injury, airway injury, and patient recall. Also, questions on complications lacked severity scales and could therefore have a degree of bias. Lastly, this survey is a snapshot before the COVID pandemic. A lot has since changed in terms of airway equipment availability. Although this is outside the scope of this study, we acknowledge the progress that has been made by the Ugandan Ministry of Health and the Association of Anesthesiologists of Uganda (AAU) in improving access to anesthesia supplies since this survey.

Future work

As access to surgical services is scaled up in the country, attention must also be given to ensure access to safe anesthesia, including airway management. Our survey identified critical gaps in access to airway management equipment recommended for the safe practice of anesthesia. The Association of Anesthesiologists of Uganda should submit proposals for amendment for drugs and airway equipment to be included in the next update of the EMHSLU. These should include capnography, pediatric size airway equipment and video laryngoscopes among others.

While we have identified gaps in provider confidence across a range of airway management techniques, we did not explore the underlying reasons for these gaps. Further work should explore these, review and identify gaps in anesthesia training curricula currently used in Uganda. We should periodically collect snapshot data using this tool to monitor for adverse airway events, to inform training, to update national equipment guidelines and to assess the impact of these changes on perioperative patient safety. In addition, we encourage other resource-constrained countries to similarly evaluate resources and skills for airway management, especially as they increase access to perioperative care.

Conclusions

Airway management challenges are common in Uganda and may contribute to significant perioperative morbidity and mortality. We have developed and used an airway management capacity tool that has identified significant gaps in access to airway management resources and provider practices. Our findings suggest that expanding availability of airway management equipment (especially oxygen, capnography, video laryngoscopy and pediatric airway equipment) should be feasible by working with local government and hospital leadership to update facility supply options. In addition to improving access to equipment, improving access to training opportunities is another gap that must be filled to support skilled workforce expansion and improve patient safety.

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Table 1: Distribution of survey respondents across health facility types and cadres of anesthesia provider.

Health facility or provider cadre	Number of respondents, n (%)
Total	89 (100)
Health facilities	
Government facility	
National Referral Hospital	13 (15)
Regional Referral Hospital	24 (27)
District/General Hospital	10 (11)
Health Centre IV	11 (12)
Non-government facility	
Private-not-for-profit Hospital	17 (19)
Private Hospital	14 (16)
Anesthesia provider cadre	
Physician Specialist	20 (22)
Physician Trainee	9 (10)
Non-physician Anesthetist	55 (62)
Non-physician Trainee	5 (6)

Figure 1: Availability of airway management equipment in health facilities in Uganda

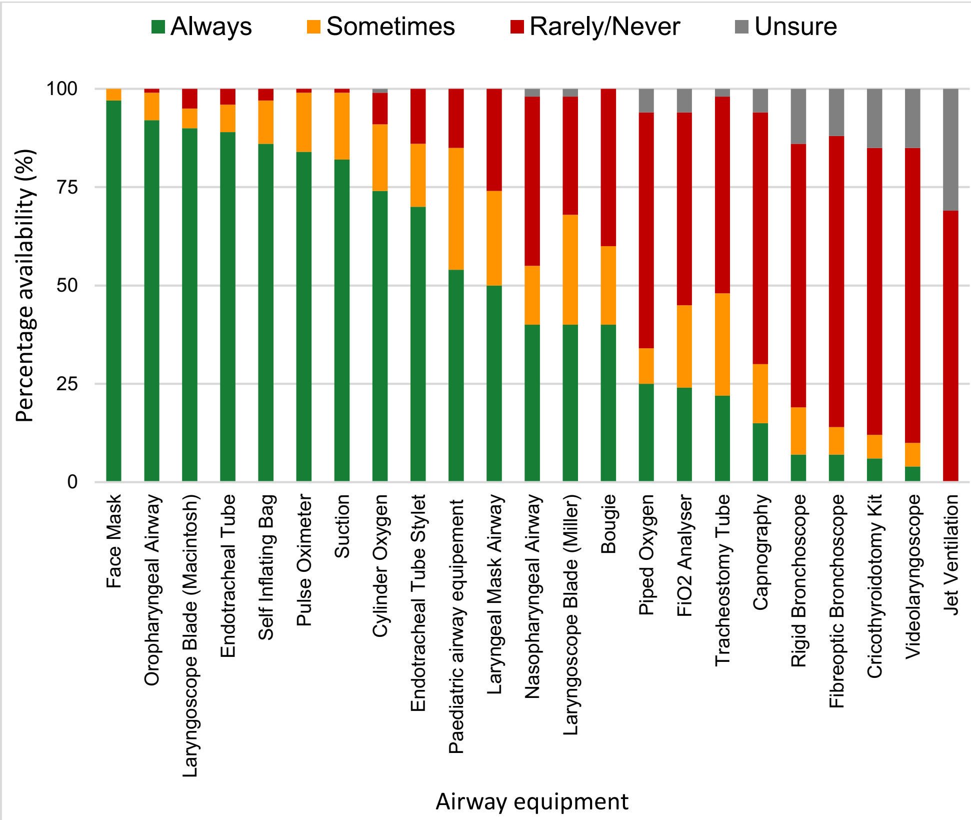


Figure 2: Confidence of Ugandan anesthesia providers in airway management techniques

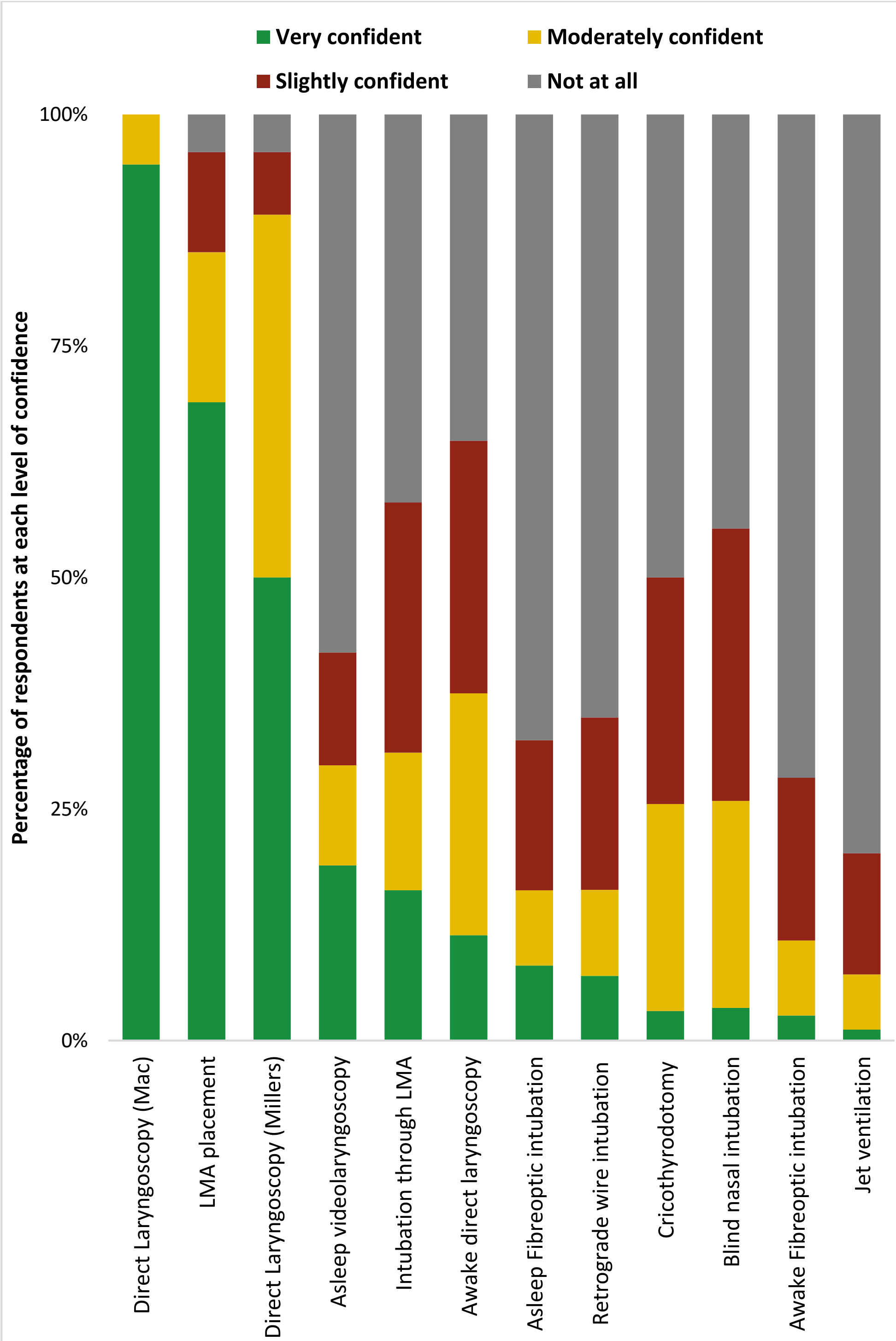
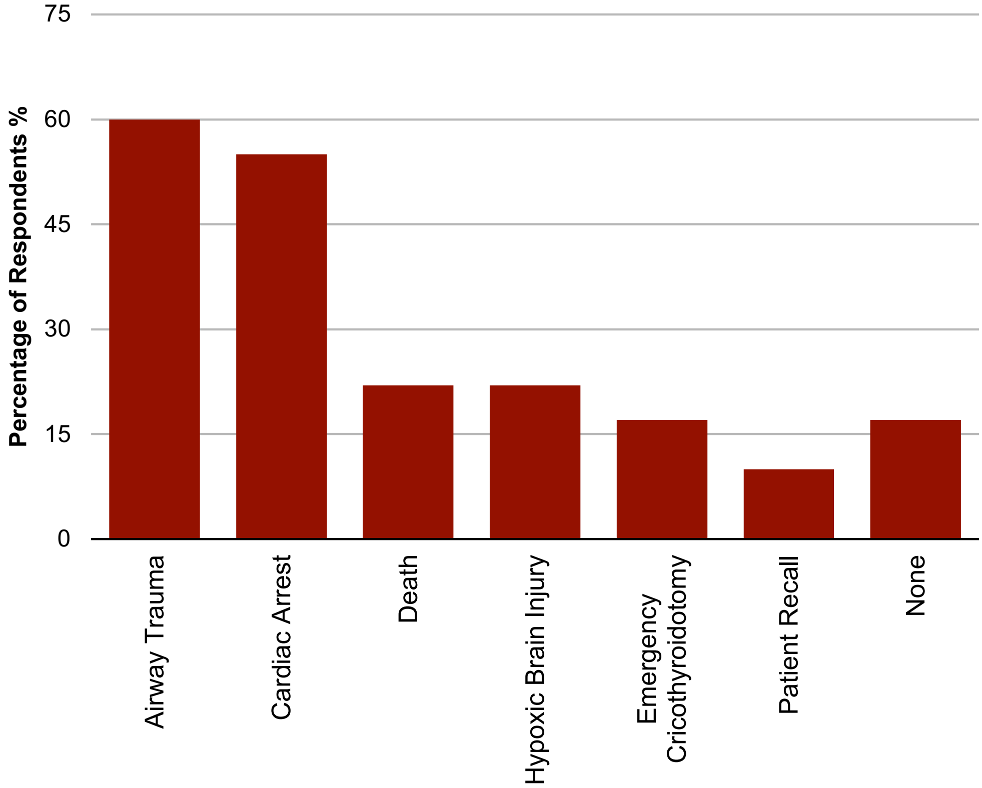


Figure 3: Witnessed complications of airway management amongst anesthesia providers in Uganda



Supplementary Table 1: Comparison of survey responses for airway equipment and drug availability between different levels of health facilities. Availability is expressed as the number (percentage) of facilities where the item is always available.

Airway equipment and drugs	Private-not-for-profit Hospital	Private Hospital	National Referral Hospital	Regional Referral Hospital	District/General Hospital	Health Centre IV
Number of respondents, n (%)	17 (19)	14 (16)	13 (15)	24 (27)	10 (11)	11 (12)
Facemask	17/17 (100)	14/14 (100)	12/13 (92)	23/23 (100)	8/10 (80)	11/11 (100)
Oropharyngeal airway	17/17 (100)	13/14 93)	10/13 (77)	21/23 (91)	9/10 (90)	11/11 (100)
Laryngoscope blade (Macintosh)	16/16 (100)	14/14 (100)	13/13 (100)	18/23 (78)	8/10 (80)	9/11 (82)
Endotracheal tube	17/17 (100)	14/14 (100)	12/13 (92)	22/23 (96)	7/10 (70)	6/11 (55)
Self inflating bag	16/17 (94)	14/14 (100)	5/13 (38)	21/23 (91)	9/10 (90)	11/11 (100)
Pulse oximeter	15/17 (88)	14/14 (100)	8/13 (62)	22/24 (92)	6/10 (60)	10/11 (91)
Suction	16/17 (94)	14/14 (100)	4/13 (31)	21/24 (88)	8/10 (80)	10/11 (91)
Cylinder oxygen	15/17 (88)	14/14 (100)	10/13 (77)	20/24 (83)	2/10 (20)	5/11 (45)
Paediatric airway equipment	13/15 (87)	11/14 (79)	6/13 (46)	15/22 (68)	0/10 (0)	0/11 (0)
Laryngeal mask airway	11/17 (65)	11/14 (79)	4/13 (31)	16/23 (70)	1/10 (10)	1/11 (9)
Nasopharyngeal airway	11/17 (65)	8/14 (57)	4/13 (31)	9/23 (39)	2/10 (20)	1/11 (9)
Laryngoscope blade (Miller)	11/16 (69)	10/14 (71)	4/13 (31)	6/23 (26)	0/10 (0)	2/11 (18)
Bougie	10/16 (63)	9/14 (64)	2/13 (15)	12/23 (52)	0/10 (0)	0/11 (0)
Stylet	14/16 (88)	14/14 (100)	5/13 (38)	19/23 (83)	4/10 (40)	5/11 (45)
Piped oxygen	6/17 (35)	5/14 (36)	5/13 (38)	6/22 (27)	0/10 (0)	0/11 (0)
FiO_2 analyzer	5/17 (29)	4/14 (29)	1/13 (8)	5/24 (21)	3/10 (30)	0/11 (0)
Tracheostomy tube	6/16 (38)	5/14 (36)	3/13 (23)	4/23 (17)	1/10 (10)	0/11 (0)
Video laryngoscopes	1/16 (6)	1/14 (7)	1/13 (8)	1/23 (4)	0/10 (0)	0/11 (0)
Cricothyroidotomy kits	2/15 (13)	3/14 (21)	0/13 (0)	0/23 (0)	0/10 (0)	0/11 (0)
Capnography	3/16 (19)	2/14 (14)	2/13 (15)	5/24 (21)	0/9 (0)	1/11 (9)
Fibreoptic bronchoscope	2/16 (13)	3/14 (21)	0/13 (0)	1/23 (4)	0/10 (0)	0/11 (0)
Suxamethonium	16/16 (100)	14/14 (100)	12/13 (92)	24/24 (100)	9/10 (90)	8/11 (73)
Rocuronium	3/15 (20)	0/14 (0)	1/13 (8)	0/24 (0)	0/10 (0)	0/11 (0)
Other neuromuscular blocker	9/15 (60)	12/14 (86)	4/13 (31)	3/24 (13)	0/10 (0)	3/11 (27)
Neostigmine	9/16 (56)	11/14 (79)	4/13 (31)	3/24 (13)	0/10 (0)	0/11 (0)

Supplementary Table 2. Comparison of confidence levels between different cadres of anaesthesia providers when considering airway management practices. Expressed as the number (percentage) of respondents who felt ‘very confident’.

Airway management technique	Physician Specialist	Physician Trainee	Non-physician Anaesthetist	Non-physician Trainee
Number of respondents, n (%)	20 (22)	9 (10)	55 (62)	5 (6)
Direct laryngoscopy with Macintosh (curved) blade?	20/20 (100)	8/9 (89)	50/54 (93)	4/5 (80)
Direct laryngoscopy with Miller (straight) blade?	17/20 (85)	5/9 (56)	19/54 (35)	2/5 (20)
Awake direct laryngoscopy with local anesthetic topicalization	5/20 (25)	1/9 (11)	3/54 (6)	0/5 (0)
Asleep videolaryngoscopy	11/19 (58)	1/9 (11)	3/52 (6)	0/5 (0)
Awake videolaryngoscopy with local anesthetic topicalization	5/19 (26)	1/9 (11)	0/54 (0)	0/5 (0)
Asleep fiberoptic intubation	5/19 (26)	1/9 (11)	1/50 (2)	0/5 (0)
Awake fiberoptic intubation with local anesthetic topicalization	2/19 (11)	0/9 (0)	0/51 (0)	0/5 (0)
Blind digital intubation (using your fingers)	1/19 (5)	0/9 (0)	0/51 (0)	0/5 (0)
Blind nasal intubation	2/19 (11)	0/9 (0)	0/52 (0)	1/5 (20)
LMA placement	18/19 (95)	8/9 (89)	33/53 (62)	3/5 (60)
Intubating through an LMA	10/19 (53)	1/9 (11)	2/53 (4)	0/5 (0)
Retrograde wire intubation	2/19 (11)	1/9 (11)	3/53 (6)	0/5 (0)
Jet ventilation	1/19 (5)	0/9 (0)	0/51 (0)	0/5 (0)
Cricothyroidotomy (any technique)	2/19 (11)	2/9 (22)	1/53 (2)	0/5 (0)