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Influencing factors of patient safety in anesthesia services in a low- and middle-income country

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ABSTRACT

Patient safety in anesthesia remains a concern in low- and middle-income countries due to workforce shortages, limited equipment, and inconsistent protocols. In Jakarta, where demand for anesthesia is rising, baseline data on these parameters are lacking. This study aimed to identify gaps in human resources, equipment availability, and safety protocol adherence. A cross-sectional survey of all actively practicing anesthesiologists in Jakarta was conducted in January 2024, yielding 115 responses. The questionnaire, developed and face-validated through a focus group with senior anesthesiologists, covered three domains: human resources, facilities and equipment, and protocols. Internal reliability was assessed using Cronbach's alpha. Participation was voluntary, responses were anonymous, and data were analyzed using descriptive statistics. Prolonged work hours were reported by a minority of respondents (6.1-7%), with 22.7% agreeing that anesthesiologists' workload is too high. Most rated human resource parameters positively (median 4/5), but access to basic monitoring devices for oxygenation, ventilation, circulation, and temperature was limited. Protocol adherence was generally high (median 4-5/5), though a small minority of institutions lacked incident reporting pathways, patient risk assessment, and post-surgical recovery rooms. Improving patient safety in Jakarta requires ensuring essential monitoring equipment, optimizing staffing to manage workload, and mandating full perioperative safety protocols across facilities.

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1. INTRODUCTION

Patient safety, the prevention of adverse events arising from healthcare processes [1], is a growing concern in Jakarta, where the demand for anesthetic care in both surgical and out-of-operating-room settings continues to rise. While specific data on anesthesiology are scarce, previous studies on physicians in Jakarta more broadly have highlighted persistent challenges, including suboptimal protocol compliance, high workload, poor teamwork, and ineffective communication [2]-[4]. These systemic issues may also affect anesthesia services, yet no comprehensive assessment of patient safety parameters has been conducted in this setting.

Globally, the World Health Organization (WHO) estimates the mortality risk from preventable medical accidents at 1 in 300, with low- and middle-income countries (LMICs) accounting for about 134 million adverse events and 2.6 million avoidable deaths each year [1]. Specifically in anesthesia, it is estimated that 5 billion people do not have access to safe, affordable anesthesia worldwide [5], [6]. Further, a discrepancy between high-income and lower-income countries has been noted. Anesthesia-related mortality rates have been declining in high-income countries but remaining stagnant in LMICs [7], where shortages in the workforce and infrastructure are compounded by inadequate safety systems [8], [9]. Indonesia exemplifies these challenges, with only 0.76 anesthesiologists per 100,000 population, well below the recommended four per 100,000 [5], [6], [10]. Beyond workforce scarcity, studies highlight other risks to patient safety, including ineffective communication and poor safety standards [11].

Anesthesia services comprise multiple stages, i.e., pre-anesthesia preparation, induction and airway management, maintenance, and post-surgical care, each of which carries distinct safety risks. International anesthesia guidelines [12], [13] emphasize patient safety measures at every stage. These guidelines underline the importance of human resource in patient safety, encompassing physician workload, clear job descriptions, and anesthesiologists' skills. Furthermore, equipment requirements, especially those for patient monitoring, are also outlined [12], [13]. Lastly, protocols and standard operational procedure (SOP) guidelines, such as proper patient identification, informed consent, and the use of medical records, are required in every hospital [12].

Despite these recommendations, studies evaluating patient safety in anesthesia remain limited. Available data are largely drawn from regional studies in other LMICs, with variable findings. Charuluxananan *et al.* [14] in Thailand found that issues related to patient safety include the inadequate number of anesthesiologists, lack of supervision during procedures, ineffective communication, and lack of adherence to protocols. Sinha *et al.* [15] in India revealed that there is still a lack of monitoring equipment availability, emergency equipment, and incident-reporting protocols. Data regarding the quality of anesthesia services and patient safety in Indonesia are scarce. One study by Ramlan *et al.* revealed the limited utilization of capnography for intraoperative monitoring in Indonesia, but other factors influencing patient safety were not addressed [16].

The Indonesian Society of Anaesthesiology and Intensive Care in Jakarta (PERDATIN JAYA) has initiated programs to improve awareness of patient safety among its members. Yet, the status of anesthesia service safety in Jakarta remains unknown. This study addresses this knowledge gap by assessing human resources, equipment availability, and protocol adherence, to inform targeted strategies to enhance patient safety in Indonesia's capital.

2. METHOD

2.1. Questionnaire development

Questions designed to evaluate the parameters of service quality and patient safety in anesthesia were developed through a focus group discussion [17] with a panel of anesthesiologists who had practiced for at least ten years. This expert panel review also served to establish face validity [18], ensuring that the questionnaire items were comprehensive in addressing the intended domains. The questionnaire was developed in Indonesian. The first draft of questions was then distributed to ten initial respondents. Feedback regarding question clarity, length, and other comments was collected, and revisions were made accordingly.

The final draft of the questionnaire comprises 50 questions. The first question enquires about participants' agreement to participate in the study, and the rest of the survey is divided into three main parts: 13 questions about human resources, 25 questions about available equipment (18 questions for monitoring equipment and 7 questions for operating room equipment), and 11 questions about available hospital protocols. Participants are also allowed to add comments or notes that they deem relevant to their answers.

2.2. Study design, sampling, and bias control

This study is a cross-sectional study aiming to evaluate the parameters of anesthesia-related service quality and patient safety in Jakarta. The study includes all anesthesiologists actively practicing in the capital city during 2023. The list of anesthesiologists was obtained from the database of the Indonesian Society of Anaesthesiology and Intensive Care in Jakarta (PERDATIN JAYA). Anesthesiologists who declined to fill out the survey and those who failed to complete the survey were excluded from the study. Several measures were implemented to minimize bias in this survey-based study. To prevent selection bias, [19] the survey link was distributed to all anesthesiologists listed in the aforementioned database. Further, the survey allowed anonymous responses to minimize social desirability bias [20].

2.3. Survey distribution

The survey was developed using the web-based software platform Research Electronic Data Capture (REDCap; accessed from redcap.fk.ui.ac.id) hosted at the Faculty of Medicine, Universitas Indonesia [21].

An electronic link containing the survey was then distributed to anesthesiologists via WhatsApp (WhatsApp Inc.; Menlo Park, California, United States), a commonly used communication platform [22], to maximize reach and participation on January 13th, 2024, with a reminder sent on January 15th, 2024. No financial or material incentives were provided.

2.4. Statistical analysis

The responses obtained were directly exported from REDCap as a Microsoft Excel file. Grossly incomplete responses were excluded. Statistical analysis is performed using the software Statistical Package for Social Scientist (SPSS). Nominal variables are presented as proportions, ordinal data as medians, and numerical data as means along with their standard deviations. Descriptive statistics were chosen given the study's exploratory design.

Internal reliability of the questionnaire items was assessed separately for two domains: human resource-related and protocol-related patient safety parameters. For each domain, Cronbach's alpha [23] was calculated to determine the degree of internal consistency among items. Cronbach's alpha values ≥0.70 were considered acceptable, values between 0.60–0.69 were considered borderline, and values <0.60 were interpreted as indicating low internal consistency. The "Cronbach's alpha if item deleted" statistic was also reviewed to assess whether the removal of any item would improve the overall reliability.

3. RESULTS AND DISCUSSION

3.1. Baseline characteristics

The survey was distributed to 422 anesthesiologists, and 159 responses (39.75%) were obtained. Forty-four responses (27.67%) were excluded due to grossly incomplete data, and a total of 115 responses (72.33%) were analysed as shown in Table 1. Overall, 65.2% of respondents are male and 34.8% are female. The respondents' average age is 48.42 ± 10.93 years old. Professional experience as an anesthesiologist varies, with 17.4% having worked for 1 to 5 years, 30.4% for 6 to 10 years, 20.9% for 11 to 15 years, 9.6% for 16 to 20 years, and 21.7% for more than 20 years.

Table 1. Sociodemographic and professional history of respondents

Questionnaire item	Result
Sociodemographic data	
Age, mean ± SD, years	48.42 ± 10.93
Male, n (%)	75 (65.2)
Experience as an anesthesiologist, n (%)	
1 to 5 years	20 (17.4)
6 to 10 years	35 (30.4)
11 to 15 years	24 (20.9)
16 to 20 years	11 (9.6)
> 20 years	25 (21.7)

3.2. Human resources

Figure 1(a) reveals the duration of active work for anesthesiologists every week. Most (47.8%) of respondent's report working 20-40 hours per week, followed by those working 40-60 hours per week at 37.4%. A minority of anesthesiologists (7.8%) work for less than 20 hours per week, and, similarly, on the other end of the spectrum, 7.0% work for more than 60 hours per week. Figure 1(b) illustrates the duration of weekly standby work, with most anesthesiologists (41.7%) working for 20-40 hours per week, followed by those working for less than 20 hours/week, 40-60 hours/week, and more than 60 hours/week at 31.3%, 20.9%, and 6.1%, respectively.

Table 2 summarizes respondents' opinions regarding human resource-related patient safety parameters. Most respondents tended to agree that the number of anesthesiologists available in their hospital was adequate, with a median score of 4 on a 5-point scale (IQR 3-5). Similarly, respondents generally agreed that job division between healthcare professionals was clear (median 4, IQR 3-4), adequate supervision was provided during anesthesia procedures (median 4, IQR 3-5), anesthesia-related knowledge was continuously updated in accordance with evidence-based medicine (median 4, IQR 4-5), and effective communication occurred between healthcare professionals during anesthesia procedures (median 4, IQR 4-5). In contrast, perceptions of workload were less favorable, with a median score of 3 (IQR 2–3), and 22.7% of respondents strongly agreed that workload was too high.

Internal consistency of the six-item work satisfaction questionnaire was assessed using Cronbach's alpha. The initial analysis yielded a Cronbach's alpha of 0.535, indicating low internal consistency.

Examination of the corrected item–total correlations revealed that five items had positive correlations ranging from 0.188 to 0.516, while the workload item ("Anesthesiologists' workload is too high") had a negative corrected item–total correlation (–0.125). The "Cronbach's alpha if item deleted" analysis indicated that removal of this item would increase the overall Cronbach's alpha to 0.668.

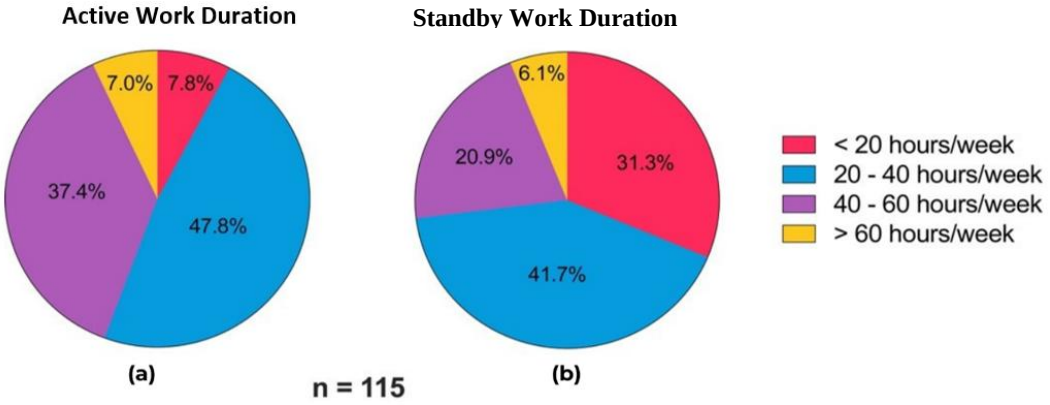

Figure 1. Work duration for anesthesiologists on a weekly basis: (a) active work duration, including operating room procedures, ICU visits, and outpatient clinics, and (b) standby work duration, including on-call work that does not necessitate the respondent to be present at the hospital

Table 2. Opinion of respondents regarding human resource-related patient safety parameters

Questionnaire Item	Response*, Median (IQR)
Number of anesthesiologists in my hospital is adequate	4 (3-5)
Anesthesiologists' workload is too high	3 (2-3)
Job division between healthcare professionals is clear	4 (3-4)
Adequate supervision is performed during anesthesia procedure(s)	4 (-5)
My anesthesia-related knowledge is continuously updated in accordance to evidence-based medicine	4 (4-5)
Effective communication is performed between healthcare professionals during anesthesia procedure(s)	4 (4-5)

*Questionnaires are answered on a 5-point Likert Scale, a score of 1 indicates the respondent's absolute disagreement with the statement, whereas 5 indicates the respondent's absolute agreement.
Abbreviations: IQR = interquartile range

3.3. Facilities and equipment

As shown in Table 3, almost all respondents (≥95%) reported consistent availability of basic monitoring devices such as peripheral oxyhemoglobin saturation devices and electrocardiograms. However, end-tidal CO_2 and skin temperature monitors were always available in only half of the respondents' settings, with core temperature monitoring in less than one-fifth. Non-invasive blood pressure monitors were widely available (91.9%), while invasive pressure monitoring and continuous central venous pressure were consistently available in only 27% of settings. Access to video laryngoscopes and echocardiography was also limited (55% and 36%, respectively). Moreover, devices such as the bi-spectral index, neuromuscular blockade testing, TCI pumps, fiberoptic bronchoscope, and most POC tests are never available in most of the respondents' work settings.

For operating room equipment, defibrillators and laryngeal mask airways were almost universally available (> 90%), and ultrasound guidance for central venous access and nerve blocks was reported as always available by 67.7% and 64.6% of respondents, respectively. However, emergency cricothyroidotomy kits, peripheral nerve stimulators, and lipid emulsions were available in less than one-third of settings.

3.4. Protocols and standard operational procedures

Table 4 shows that most key safety protocols and SOPs were reported as consistently performed, with median ratings ranging from 4 to 5 on a 5-point Likert scale. Informed consent documentation, patient identity verification, and post-operative recovery room admission were reported as "always performed" by more than 79% of respondents. Pre-anesthetic evaluation was documented by 65.6%, while equipment readiness checks were reported by 75.3%. However, only 60.2% had a clear SOP for incident reporting,

Table 3. Availability of facilities and equipment in hospitals

Questionnaire item	Number of responses	Always available, n (%)	Sometimes available, n (%)	Never available, n (%)
Availability of monitoring equipment				
Peripheral oxyhemoglobin saturation	100	99 (99)	1 (1)	0 (0)
End-tidal carbon dioxide	100	51 (51)	41 (41)	8 (8)
Non-invasive blood pressure	99	91 (91.9)	2 (2.0)	6 (6.1)
Skin temperature	100	45 (45)	39 (39)	16 (16)
Core temperature	100	17 (17)	31 (31)	52 (52)
Electrocardiogram	100	95 (95)	5 (5)	0 (0)
MAC/End-tidal volatile anesthetic concentration	100	52 (52)	32 (32)	16 (16)
Neuromuscular blockade monitor	100	7 (7)	29 (29)	64 (64)
Bi-spectral index	99	12 (12.1)	25 (25.3)	62 (62.6)
Continuous CVP/Continuous invasive arterial BP	100	27 (27)	39 (39)	34 (34)
Video laryngoscope	100	55 (55)	25 (25)	20 (20)
TCI Pump	100	32 (32)	27 (27)	41 (41)
Fiberoptic Bronchoscope	99	25 (25.3)	20 (20.2)	54 (54.5)
Echocardiography	100	36 (36)	33 (33)	31 (31)
POC testing: blood glucose	100	50 (50)	36 (36)	14 (14)
POC testing: hemoglobin	100	18 (18)	34 (34)	48 (48)
POC testing: lactate	100	12 (12)	22 (22)	66 (66)
POC testing: ABG and electrolytes	100	21 (21)	27 (27)	52 (52)
Availability of operating room equipment				
Defibrillator	96	94 (97.9)	1 (1)	1 (1)
LMA	96	95 (99)	1 (1)	0 (0)
Emergency cricothyrotomy kit	96	15 (15.6)	30 (31.3)	51 (53.1)
USG for central venous access	96	65 (67.7)	21 (21.9)	10 (10.4)
USG for nerve blocks	96	62 (64.6)	21 (21.9)	13 (13.5)
Peripheral nerve stimulator for nerve blocks	96	27 (28.1)	18 (18.8)	51 (53.1)
Lipid emulsion	96	27 (28.1)	34 (35.4)	35 (36.5)

Abbreviations: MAC = minimum alveolar concentration; CVP = central venous pressure; BP = blood pressure; TCI = target-controlled infusion; POC = point of care; LMA = laryngeal mask airway; USG: ultrasonography

Table 4. Availability of protocols and standard operational procedure guidelines

Questionnaire item	Response*	
	Always performed (%)	Median (IQR)
Pre-anesthetic evaluation is performed before patients enter the operating room and is recorded in patients' medical records	65.6	5 (4-5)
There is a process to assess patients' risk profiles along with appropriate risk management steps	41.9	4 (3-5)
Equipment readiness is checked pre-operatively	75.3	5 (4.5-5)
Patients' pre-operative fasting duration is adequate	50.0	4.5 (4-5)
Informed consent is performed and recorded in patients' medical records	88.2	5 (5-5)
Patients know their choice of anesthesia and its alternatives	59.8	5 (4-5)
Patients choose the type of anesthesia performed	18.3	4 (3-4)
Patients are educated regarding anesthesia complications	52.7	5 (4-5)
Patients' identity and type of surgery is checked before anesthesia	83.9	5 (5-5)
All patients are admitted and monitored in the recovery room post-surgery	79.6	5 (5-5)
There is a clear standard operational procedure for incident reporting	60.2	5 (4-5)

*Data sourced from a 5-point Likert Scale, a score of 1 indicates that the statement is never performed for any cases, whereas 5 indicates the statement is always performed for all cases.
Abbreviations: IQR = interquartile range

The 11 items demonstrated good internal consistency, with a Cronbach's alpha coefficient of 0.807, indicating that the scale was reliable. The "Cronbach's Alpha if Item Deleted" analysis showed that removing any individual item would not result in a substantial improvement in the alpha value, suggesting that all items contributed meaningfully to the overall reliability.

3.5. Discussion

Studies evaluating patient safety parameters in anesthesia are limited, and, specifically in Jakarta, such data is not yet available. This study collected and analysed 115 survey responses from currently practicing anesthesiologists in Indonesia's capital. The results revealed that, overall, some aspects of patient safety in anesthesiology and intensive care within this region require improvement, including factors related to human resources, facilities and equipment, and protocol availability.

This study found that the number of anesthesiologists varies between institutions, with most hospitals having 2 to 5 anesthesiologists. Respondents tend to agree that the number of practicing anesthesiologists is adequate. This result differs from a Thai survey where most respondents perceive a lack of anesthesia personnel [14]. According to a previous study, a minimum of four anesthesiologists is required per 100,000 population to reach a reasonable standard of healthcare [10]. However, Indonesia only has 0.76 anesthesiologists per 100,000 population [5]. The apparent adequacy in Jakarta likely reflects an urban concentration of specialists approximately 4 per 100,000 in the capital [24] masking disparities across other provinces. This suggests inequitable distribution rather than true sufficiency, which has implications for national healthcare planning.

This study found that most anesthesiologists in Jakarta work 20-60 hours weekly (85%), which is in line with other studies from several countries [25], [26]. However, some respondents worryingly reported exceeding 60 working hours per week (7%). Prolonged hours and fatigue are known concerns for patient safety, as they lead to ineffective communication, impaired memory, and decreased attention [27]. Although no specific work duration guideline is available for anesthesiologists, many European countries have adopted the European Working Time Directive that imposes a 48-hour limit on the maximum weekly working time [27]. This indicates that although Jakarta anesthesiologists may not face extreme workloads on average, high-risk subgroups remain vulnerable. Policy efforts should consider not only staffing ratios but also workload regulation.

Moreover, respondents reported clear job divisions, adequate supervision, and effective communication between personnel. They also report continuously updating their knowledge, reflecting the success of continuing medical education (CME) programmes in Indonesia [28], including those organized by PERDATIN JAYA. Overall, these findings indicate a more positive outlook, as previous studies show that these factors improve the quality of healthcare and patient safety [29].

Equipment availability presented greater challenges. While pulse oximetry, ECGs, and non-invasive blood pressure monitors were nearly universal, $ETCO_2$ (51%) and temperature monitoring (45%) remained inconsistent. The American Society of Anesthesiologists (ASA) and other guidelines recommend that oxygenation, ventilation, circulation, and body temperature should always be readily monitored [13], [29], [30]. These gaps reflect underinvestment in basic monitoring infrastructure, which has been linked to avoidable perioperative morbidity and mortality in LMICs. Prioritizing universal provision of capnography and temperature monitoring should be considered a baseline patient safety intervention in Indonesia [31], [32].

More advanced monitors are sometimes needed to give more information and increased safety in high-risk situations. End-tidal anesthetic agent concentration monitoring is suggested when volatile agents are used [13], [29]. Invasive blood pressure offers beat-to-beat monitoring in unstable patients. These monitors are always available in only 52% and 27%, respectively. More than 60% of respondents reported that neuromuscular blockade and depth of anesthesia monitors are never available to them. Core temperature monitors, required for cases at risk of becoming hypothermic [33], are only always available in 17% of responses. The lack of such monitors may limit anesthesiologists' ability to safely manage high-risk patients, contributing to outcome disparities compared with high-income countries [34].

Other than monitoring devices, certain equipment is also important to ensuring safety in emergent cases. Airway devices, such as videolaryngoscopy, have been shown to improve intubation success [35]. In more specific cases, intubation can only be achieved by using a fiberoptic bronchoscope (FOB). It is worrying that 20% of respondents reported not having a videolaryngoscope in their practice, and even more so on FOB (54%). Although the incidence is not high, unpredicted difficult intubation can cause catastrophic consequences. Every hospital needs to have a system to deal with this situation, and the availability of alternative airway devices is critical. Although supraglottic airway devices are available in almost all respondents' daily practice, more than 50% reported not having emergency cricothyroidotomy kits. By contrast, defibrillators were nearly universal (97.9%), demonstrating that provision is possible when systems prioritize certain equipment. These findings highlight the urgent need for national minimum equipment standards, coupled with institutional mechanisms to ensure compliance.

Regional anesthesia safety was mixed: ultrasound, used in performing nerve blocks [36], was available in 67.7% of hospitals, reflecting positive adoption trends, but peripheral nerve stimulators were available in only less than 30% of respondents. This discrepancy can be explained by the ultrasound's versatility: it can guide nerve blocks, assist in central venous access, and, with probe modification, even serve as an echocardiogram. Evidence shows that ultrasonography improves success rates and reduces complications compared to peripheral nerve stimulators, which ASRA now recommends as adjuncts rather than primary tools. Similarly, lipid emulsions were always available in less than a third of respondents [36], [37]. Without lipid emulsions, local anesthetic systemic toxicity remains a potentially fatal complication [38]. Ensuring its availability is a low-cost, high-impact intervention that professional societies should urgently advocate. Further, data regarding other agents, such as naloxone and flumazenil for opioid and benzodiazepine toxicity, respectively, were not collected and should be included in future studies.

Gaps in diagnostic tool availability were also noted. Echocardiography is only always available in 36% of responses. Point-of-care (POC) tests, such as intraoperative blood glucose monitoring for diabetic

patients [13], are only always available for 50% of respondents. Other POC tests, i.e., hemoglobin, lactate, and ABG, offer quicker results than traditional tests, potentially improving clinical outcomes, though reliability requires further research [39]-[42]. However, only a minority of respondents (12-21%) consistently have these POC tests available.

Protocol adherence was generally high, with pre-anesthetic evaluation, informed consent, perioperative safety checks, and postoperative monitoring consistently reported. Almost all anesthesiologists uphold patient autonomy. Respondents report that, in most cases, patients know the choice of anesthesia and its alternatives; can choose the type of anesthesia; and are educated regarding its risks. These align with international accreditation standards [12], [43]. However, the lack of universal adoption in a minority of hospitals remains concerning, as lapses in identity checks or informed consent can result in serious harm [44]. This suggests that while policies exist, enforcement and monitoring remain inconsistent.

Incident reporting pathways are also available in most anesthesiologists' work settings, yet not universally. Such systems are critical for learning from errors and preventing recurrence, especially in anesthesia [45]. Further, hospital accreditation manuals also necessitate its adoption in every hospital [12]. The absence of incident reporting pathways in some institutions suggests cultural or administrative barriers, possibly linked to punitive approaches or underdeveloped governance structures [46].

The internal reliability of the questionnaire varied: the protocol domain showed strong consistency (Cronbach's $\alpha = 0.807$), while the human resource domain was weaker ($\alpha = 0.535$). This limitation should be considered when interpreting the findings, as it reduces the confidence with which conclusions about human resource adequacy can be generalized. Nevertheless, the results highlight the need for more precise measurement tools in this domain. Future studies may benefit from refining survey instruments through qualitative interviews or Delphi consensus methods [47] to ensure items capture the full spectrum of human resource issues in anesthesiology. Additionally, survey constructs should be culturally and contextually relevant, reflecting not only international standards but also the realities of Indonesia's healthcare system, such as the uneven distribution of anesthesiologists across provinces. By addressing these methodological gaps, future research could produce more reliable data that better inform workforce planning and policy development.

This study has completed its objective of obtaining data regarding the parameters of patient safety in Jakarta, which were previously lacking. However, some limitations of this study include its relatively low response rate (39.75%) and, consequently, its small sample size. The low response rate may be attributed to the lack of follow-up and methods of contacting, the relatively long survey, and respondents' perception of the survey's importance [48]. These factors introduce risk of nonresponse bias [49], as anesthesiologists most engaged with patient safety may have been more likely to participate, potentially inflating positive findings. Moreover, Jakarta, as a capital city, has one of the highest numbers of healthcare workers and facilities in Indonesia, which suggests that it may not represent all Indonesian provinces. Further, the study's survey-based design increases the risk of recall biases. Future studies can incorporate a larger sample size, such as a nationwide survey; use face-to-face interviews to gain more accurate data; perform an on-site evaluation regarding the availability of human resources, equipment, and protocols to prevent recall bias; and carry out an analytical study that compares patient safety parameters between subgroups, such as hospital types and areas. These strategies should provide more comprehensive data, allowing a clearer understanding regarding the state of patient safety and how to improve it.

4. CONCLUSION

To conclude, this study sheds light on the parameters of patient safety in anesthesia care within Indonesia's capital, highlighting several areas for improvement. Anesthesiologists reported working prolonged hours, and possible issues regarding excessive workload were raised. However, respondents tend to agree that other aspects of human resources were adequate. Gaps in equipment availability are also reported, including limited access to essential monitors and airway devices, which may compromise safe practice. Further, protocol and SOP adherence were generally strong, yet variability among institutions suggests that standardization can still be improved. These findings carry important implications for health policy and practice. Ensuring equitable distribution of anesthesiologists, investing in essential monitoring and airway equipment, and mandating minimum patient safety standards across all hospitals should be prioritized. Professional societies such as PERDATIN JAYA and policymakers should collaborate to strengthen continuing education, implement regular audits of equipment availability, and establish systems for workload monitoring and incident reporting. Addressing these gaps will not only enhance patient safety in Jakarta but can also serve as a model for broader improvements in anesthesia care across Indonesia. Future research should expand beyond the capital to provide nationally representative data and guide sustainable policy interventions.

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AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

The authors state no conflict of interest.

INFORMED CONSENT

We have obtained informed consent from all individuals included in this study.

ETHICAL APPROVAL

The research related to human use has been complied with all the relevant national regulations and institutional policies in accordance with the tenets of the Helsinki Declaration and this study has been approved by the Ethics Committee of the Faculty of Medicine, University of Indonesia - Cipto Mangunkusumo Hospital (approval number: KET-1011/UN2.F1/ETIK/PPM.00.02/2023).

DATA AVAILABILITY

The data that support the findings of this study are available from the corresponding author, [AAWR], upon reasonable request.

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