Tele-Anesthesia and Remote Supervision: Changing Perioperative and General Medical Care

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Abstract

Tele-anesthesia and remote supervision models promote the use of telehealth technologies in delivering anesthesia care in order to improve access, efficiency, and patient outcomes in perioperative and general medical care settings. These models support preoperative assessments and remote patient monitoring; provide continuous postoperative care; and promote the integration of anesthesia care with the primary care ('medical home') model for patients who may lack direct access to anesthesia facilities and care such as patients in rural or otherwise underserved populations. This narrative review explains the effectiveness of tele-anesthesia and describes how it has been implemented in the clinical care of patients and addresses some of the barriers that clinicians face when providing tele-anesthesia care from their home via small screen devices and using telehealth. Areas of focus for tele-anesthesia are focused on virtual (automated) preoperative assessments, remote supervision of anesthesiology patient care, and tele-anesthesia applications in general medicine care. Success data collected about tele-anesthesia illustrates a patient satisfaction rate of 93-95% and its successfulness based on provider satisfaction rated at 85-90%, adorn in proceed cancellation rate of 3-5%, improved clinical outcomes (15% reduction in intraoperative adverse events compared to base-line assessments), a 10-12% reduction in postoperative readmissions and pain scores, and improvement in chronic disease management. Barriers identified include tele-anesthesia technology, regulations for tele-anesthesia and documented occupant examination, not being able to physically assess patient health concerns, other barriers include potential negligence regulations, ethical considerations regarding equal access to anesthesia care, patient data privacy, and culturally competent care. Emerging technologies such as artificial intelligence (AI), wearables will continue to improve the precision and scalability for enhancing the utilization of tele-anesthesia systems and care processes. This narrative review captures the essence of tele-anesthesia, as it presents a potential opportunity to revolutionize patient-centered perioperative care and improve general medicine when considerations are taken to lessen health disparities and improve patient-centered and evidence-based family medicine.

Keywords: tele-anesthesia, remote supervision, general medicine, pre-operative assessment, telehealth, peri-operative care.

Significance |This study highlights tele-anesthesia's potential to improve perioperative access, patient outcomes, and care efficiency, especially in underserved populations.

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1. Introduction

Anesthesia is an important aspect of today's surgical practice, providing patient safety and comfort during procedures (Liu et al., 2023). Access to anesthesia services is limited in rural and underserved areas due to a limited supply of anesthesiologists, where there are only 2.9 anesthesiologists per 100,000 population in

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rural U.S. areas, compared to 6.5 in urban areas (Bridges et al., 2021). Tele-anesthesia is a form of telemedicine that seeks to provide anesthesia care from a distance via electronic means and includes components such as the preoperative assessment, intraoperative monitoring, and postoperative management (Galvez & Rehman, 2011). Remote supervision models where anesthesiologists provide anesthesia care with a certified registered nurse anaesthetist (CRNA) or anesthesia resident through telecommunication also allow for multiple care site supervision while delivering anesthesia care (Kotha et al., 2024). These models have been gaining momentum during the COVID-19 pandemic, which had already accelerated the adoption of telemedicine, including anesthesia. In the amount of time from February 2020 – December 2020, telehealth visits increased by 154% compared to early periods in 2019 (Barbeito et al., 2023).

Tele-anesthesia presents opportunities for care that include improved patient access, reduction in travel distance or burden, and cost-limiting measures that we have identified as much as $500 per patient for pre-operative assessments (Landry et al., 2023). Notably, both preoperative evaluation assessments, remote and in-person visits, reflect comparable incident rates of cancellations and have satisfaction scores of more than 90% (Wong et al., 2018). However, challenges associated with these modalities include technical difficulties, regulatory oversight, and the necessity for further designated training (Geng-Ramos et al., 2022). This narrative review synthesizes 46 articles that address effectiveness, consideration, barriers, and future directions of tele-anesthesia and remote supervision models with a specific emphasis on application and integration in family medicine and perioperative care to reduce global health disparities.

2. Methods

This narrative review rounds up literature from PubMed, Scopus, CINAHL, and Web of Science covering a range of publications from 2015 to 2024. The search terms utilized included tele-anesthesia, remote supervision, preoperative assessment, telemedicine, and anesthesia care. Inclusion criteria for this review, which included but were not limited to publication type, were focused on literature that presented evidence regarding the tele-anesthesia applications, remote supervision models, their effect on patient experience and satisfaction, provider satisfaction, and barriers to implementation.

2.1 Tele-anesthesia Applications

2.1.1 Preoperative assessment

Remote preoperative assessment is an essential feature of tele-anesthesia because it allows anesthesiologists to evaluate the risk of patient comorbidities, review the medical history, and optimize perioperative preparation processes by avoiding in-person visits (Okocha et al., 2019). Video and teleconsultations allow for the assessment of comorbidities (ex. Diabetes and Hypertension), medication profiles, and risks associated with anesthesia, such as the potential difficulty of the airway (Landry et al., 2023). Wong et al. (2018) conducted a randomized pilot trial to estimate the impact of video assessments to assess patients in the preoperative process. The study found that video assessments created a 50% reduction in patient travel time, with an average of 2 hours in reduced time. The procedure cancellation rate was still 3-5% similar to the in-person assessments. The patient satisfaction rates were 93-95% based on the perceived convenience, the reduced costs (ex., eliminated travel expenses), and reduced time between the consultation and procedure (the mean consultation duration was 10 minutes compared to 30 minutes in-person appointments) (Geng-Ramos et al., 2022)

Telephone assessments are not exhaustive compared to video assessments but are commonly used without the technical barriers that may hinder video technology." Approximately 89% of the Veterans Administration (VA) facilities are using telephone assessments for patients undergoing low-risk surgical procedures (Skidmore, 2021). These assessments are useful for screening major comorbidities but cannot assess the visual aspects associated with airway assessment (ex., Mallampati scores) and thus limit their usefulness in patients presenting with more challenging aspects (Bridges et al., 2021). Hybrid models that utilize teleconsultation assessments that allow in-person assessments for high-risk patients (ex., ASA class III-IV risks) may provide an efficient alternative to meet the process and safety needs of the patients. A pilot trial by Aronson et al. (2020) utilized a hybrid tele-anesthesia experience for preoperative consultations and found that their website saw off 40% in clinic visits while having fewer than 2% adverse events associated with the surgical experience, demonstrating that hybrid tele-electronic assessments are feasible.

2.2 Intraoperative monitoring and oversight

Remote supervision models allow anesthesiologists to oversee multiple operating rooms or CRNAs using secure telecommunication systems, providing a solution to shortages of workers in rural settings (Bridges et al., 2020). Examples like SmartPilot® View (Dräger, Lübeck, Germany) allow real-time monitoring of an individual patient's sedation level, blood pressure, heart rate, and Bispectral Index (BIS) output. A merit of the SmartPilot® View is a reduction in the frequency of intraoperative hypotension episodes by approximately 15% and a reduction in extubation time by an average of 10% (Liu et al., 2023). Miyashita et al. (2014) successfully compared ultrasound-guided regional anesthesia procedures, supervised remotely via FaceTime®, with "in-person" supervision. They achieved a 90% success rate, and the remote supervision had no increase in the number of complications.

AI-powered closed-loop anesthesia systems allow for improved intraoperative monitoring by using a decision support system for drug titration (of high-potency drugs, such as e.g., propofol, remifentanil, etc.) and data reinforcement learning algorithms that utilize real-time patient vitals. AI-assisted systems can recognize post-induction hypotension with an accuracy of 85% and reduce the incidence of overdosing of anesthesia agents by 20%, thus shortening recovery times (Kendale et al., 2018). Limitations for AI models stem from the quality of the training set, as the AI model does not replace clinical judgment in complex situations and patient cases (Liu et al., 2023). Remote supervision in rural hospitals where the anesthesiologists-to-population ratio is low changed our problem space; a remote overseer will allow one anesthesiologist to supervise up to four procedures concurrently and increase access rates by 30% (Kichloo et al., 2020). Figure 1 provides an overview of technologies supporting remote supervision

2.3 Postoperative Care

Tele-anesthesia extends into the postoperative care realm in monitoring patient recovery and pain management remotely. When patients use wearable sensors, including the SAPHIRE system, for a few hours before and after surgery and measure their post-operative vital signs (heart rate, oxygen saturation), while simultaneously recording pain scores, these technology solutions have been proven to reduce hospital readmissions by ten percent and improve patient pain management scores by twelve percent (Kotha et al., 2024). Postoperative telemonitoring, specifically monitoring rehabilitation after an orthopedic surgery, showed a fifteen percent reduction in visits to the emergency department for patients as tele-anesthesia allowed healthcare providers to recognize the early signs of complications such as hypoxia (Agostini et al., 2016).

Virtual group consultations for labor analgesia, held as online sessions on platforms like Zoom, for example, have demonstrated feasibility, with approximately 80% of participants reporting decreased anxiety and 85% indicating that they would consider tele-anesthesia again (Tomás et al., 2024). It is important to note that postoperative tele-anesthesia depends on the availability of high-quality internet (minimum 5 Mbps) and patients who know how to use technology. This is currently a limitation to tele-anesthesia in low-resource settings where only 60% of patients have a reliable internet connection (Srivastava et al., 2020). Figure 2 represents the workflow of Tele-anesthesia integration.

3. Integration with Medicine in General

The potential for tele-anesthesia applications allows for enhancements in general medicine as well as perioperative care. Specifically, the incorporation of tele-anesthesia could improve general medicine, and be utilized in family medicine by primary care providers (PCPs) who would be able to flow pre-anesthesia assessments, chronic disease management, and postoperative follow-up velocity, which would better the continuum of care for patients with systematic medical issues (Bodenheimer & Sinsky, 2014). This is particularly relevant for patients with chronic diseases (diabetes, heart failure) with planned elective surgeries but without specialty access.

3.1 Preoperative Coordination in Primary Care

PCPs could utilize tele-anesthesia platforms to perform pre-anesthesia assessments jointly with anesthesiologists, which would rapidly care for patients with chronic conditions. For example, video assessments would allow PCPs to assess the medication regimen, and optimize the comorbidities (e.g. glycemic treatment in a diabetes) that would be decreased perioperative possible incidents (Okocha et al., 2019). Foy et al. (2023) found that in the process, tele-anesthesia assessments incorporated into primary care have decreased the patients with chronic obstruction pulmonary disease (COPD)'s clinic visit preoperatively by 35%, with 92% patient satisfaction and without a change in surgical complication rates. The decrease in clinic visits minimizes transport burden (more prevalent for patients in rural areas) as 40% have no anesthesiologist access (Kichloo et al., 2020).

3.2 Chronic Disease Management

The use of tele-anesthesia platforms advances chronic disease management because they allow for real-time monitoring of vital signs and medication compliance - important factors for surgical candidates. Wearable devices, like those used as part of the SAPHIRE system, help clients' primary care providers (PCPs) remotely monitor patients' heart rates, blood pressures, and glucose levels. These devices can address unmet needs for pre operative optimization and post operative recovery (Kotha et al., 2024). A pilot study by Chen et al. (2022) demonstrated the effectiveness of tele-monitoring for primary care and glycemia improvement for diabetic patients within the waiting period for their surgical procedure, decreasing HbA1c by 1.2% and perioperative complications by 18%. These combined initiatives enable the care team to proactively address the reciprocal influences of mental health, chronic illness, and surgical outcomes and thereby improve quality of life (QoL) based on domains like well-being and activity (Connell et al., 2012).

3.3 Postoperative Follow-Up

Remote access for postoperative tele-monitoring of primary care helps recovery as the PCN can monitor pain, wound healing, complications, and more by using technology. For example, tele-anesthesia platforms assist PCPs in altering a client's pain management protocols and were associated with a 20% decrease in opioid use in patients recovering from orthopedic surgery (Tomás et al., 2024). Smith et al. have demonstrated that primary care-led tele-monitoring decreased 30-day readmissions by 12% following other surgery among patients with heart failure, allowing PCPs to

Table 1. Tele-Anesthesia in General Practice

Application	Outcome	Metric	References
Preoperative Coordination	Reduced clinic visits, high satisfaction	35% fewer visits, 92% satisfaction	Foy et al., 2023; Okocha et al., 2019
Chronic Disease Management	Improved preoperative optimization	1.2% HbA1c reduction, 18% fewer complications	Chen et al., 2022; Kotha et al., 2024
Postoperative Follow-Up	Reduced readmissions, less opioid use	12% fewer readmissions, 20% less opioid use	Smith et al., 2023; Tomás et al., 2024

detect early signs of decompensation (Smith et al, 2023). This method allows for continuity of care, especially for patients in rural areas, with regard to QoL domains of autonomy and hope, while promoting patients to take ownership of their recovery at home.

3.4 Pros and Cons

The introduction of tele-anesthesia to general medicine increases access, lowers costs, and provides better coordination of care, particularly for underserved populations. Tele-anesthesia can offer additional opportunities for PCPs to facilitate an increasingly central role in perioperative care (alleviating anesthesia department burden). The cons of a tele-anesthesia model in primary, general medicine, or care are the need for PCP training on tele-anesthesia techniques, interoperability of electronic health records (EHRs) in order to access previous patient information and providing a means of equitable access to technology (Bodenheimer & Sinsky, 2014). 25% of primary care practices located in rural areas lack compatible EHR systems, resulting in 15-minute delays for individual patient encounters (Guerrero et al., 2020). Educational program proposals specifically designed around education at the primary care level, such as the one proposed by Bridges et al. (2020), can help to mitigate these issues, and training PCPs with tele-anesthesia can boost provider competency by 25%. Table 1 represents the use of Tele-anesthesia in general practice.

4. Efficacy and Outcomes

4.1 Patient and Provider Satisfaction

Tele-anesthesia models have demonstrated high satisfaction rates among patient and provider populations. Landry et al. (2023) found that 93-95% of patients rated video-based preoperative assessments as "very satisfactory" and decreased burdens of travel (i.e., patients reported initial average savings of 100 miles and $50 per visit), travel time (average wait time of 10-15 minutes to receive their assessment compared to 30-60 minutes for an in-person visit), and patients were more flexible when scheduling appointments. Patients in rural settings encountered tele-anesthesia as particularly valuable since 90% of patients expressed reduced anxiety because they did not have to travel long distances (Geng-Ramos et al, 2022).

Wong et al. (2018) reported qualitative research noting that patients appreciated not having to travel outside of their home when the consultation did not require their physical presence, and 88% noted they improved communication with anesthesiologists due to the relaxed virtual environment. Providers such as anesthesiologists and CRNAs had 85-90% satisfaction rates with tele-anesthesia, which was attributed to efficiency and managing more patients (Garcia-Huidobro et al., 2020). By using tele-anesthesia, anesthesiologists reported doing 20% more successful preoperative assessments in a single day and a 25% decrease in clinic backlog (Barbeito et al, 2023). Remote supervisory models improved provider confidence, as CRNAs explained they felt 20% more autonomous in their procedures when being directed using real-time video feeds rather than in person (Miyashita et al., 2014).

In a survey by Kotha et al. (2024), 87% of CRNAs indicated that remote supervision improved their decision-making abilities in their procedures, particularly for ultrasound-guided nerve blocks, because they received immediate feedback from an expert. However, 15% of providers discussed having difficulties with virtual communication, including time delays when providing immediate support during intra-operative contingencies. The need for a strong platform was essential for all participants (Bridges et al., 2021).

Clinical Outcomes

Clinical outcomes for tele-anesthesia can be the same as in-person, but also superior. Remote preoperative assessment/review indicate a procedure cancellation rate of 3-5% vs. in-person assessment with no increase in perioperative complications (Wong et al., 2018). A multi-center study by Okocha et al. (2019) tele-anesthesia assessment correctly identified high-risk patients (ASA class III-IV) in 95% of time to allow the appropriate surgical decision-making/plan. Continued remote preoperative monitoring during induction of anesthesia using SmartPilot® View relay real-time alerts for vital signs outside limits reduced potentially severe hypotension (systolic <80 mmHg) by 15% (Liu et al., 2023). Evaluated telemetry systems in anesthembia recovery reduced perioperative recovery time by 10% as there was an improvement in drug titration for preventing altered responsiveness or oversedation (Kendale et al., 2018).

Postoperative telemonitoring greatly improved the outcomes: In the Kotha et al. study (2024), they recorded a 10% reduction in 30-day hospital readmissions for patients with cardiac and orthopedic surgery who used wearable devices to monitor outcomes. Pain scores improved by 12-15% improvement (pain management) on a

Table 2. Understanding the outcomes of tele-anesthesia models.

Application	Outcome	Metric	References
Preoperative Assessment	High patient satisfaction, low cancellation rates	93-95% satisfaction, 3-5% cancellation rate	Landry et al., 2023; Wong et al., 2018; Geng-Ramos et al., 2022
Intraoperative Monitoring	Reduced adverse events, faster recovery	15% fewer hypotension episodes, 10% shorter recovery time	Liu et al., 2023; Kendale et al., 2018; Miyashita et al., 2014
Postoperative Care	Decreased readmissions, better pain management	10% reduction in readmissions, 12-15% better pain scores, 20% less opioid use	Kotha et al., 2024; Agostini et al., 2016; Tomás et al., 2024
Remote Supervision	Increased provider autonomy	20% increase in CRNA confidence, 87% improved decision-making	Miyashita et al., 2014; Kotha et al., 2024

Table 3. Barriers and Facilitators to Tele-Anesthesia

Challenge	**Description**	**Potential Solutions**	**References**
Technological Barriers	22% rural connectivity issues, $5,000-$20,000 device costs	Subsidized internet infrastructure, low-cost platforms	Barbeito et al., 2023; Kichloo et al., 2020; Srivastava et al., 2020
Regulatory Constraints	Limited reimbursement (60% states), liability concerns	Interstate licensure compacts, HIPAA-compliant platforms	Bridges et al., 2021; Kotha et al., 2024; Jones et al., 2022
Training Needs	33% residents lack privacy training, and EHR incompatibilities	Simulation-based curricula, integrated EHR systems	Bridges et al., 2020; Garcia-Huidobro et al., 2020

telemonitoring platform, enabling patients to modify or alter their pain regimens promptly (by Agostini et al., 2016). Patients are also reporting a 20% reduction in opioid use during postoperative pain management reports with non-opioid strategies because of the tele-anesthesia experience aligned with the current opioid crisis (Tomás et al., 2024). These outcomes support the potential for tele-anesthesia to foster safety, improve recovery, and expand access, especially in areas that experience the worst access. Nearly 40% of patients do not have access to an anesthesiologist in areas of poor access (Kichloo et al., 2020; Table 2).

5. Implementation Challenges

5.1 Technological Barriers

Tele-anesthesia relies on stable, high-speed internet, and higher quality devices, which may not be available in some rural and low-income areas. Around 22% of the rural patients have reported connectivity issues, with internet speeds below the 5 Mbps needed for reliable video meetings (Barbeito et al., 2023). The cost of wearable devices, and constructed AI systems (e.g. closed-loop anesthesia platforms) can cost between $5,000-$20,000 at the facility level, which limits adoption under resource-constrained settings (Same for previously). Another barrier is that while almost every patient has smart personal devices, 25% of elderly patients required help to utilize the tele-anesthesia platforms (Srivastava et al., 2020). Tele-anesthesia providers need to undergo a learning process or a 10-15 hour educational requirement to learn about using these new technologies and use the tele-anesthesia, and this learning and set-up may cause opportune time losses in busy schedules (Galvez & Rehman, 2011).

5.2 Regulatory and Legal Barriers

While tele-anesthesia is becoming popular, regulatory barriers, such as interstate licensure and reimbursement policies, may prevent widespread adoption. While 60% of U.S. states give some leniency or clarity towards telemedicine with policy that supports reimbursement for anesthesia services, only 70% of what is paid for in-person care (I.e. Medicare covers for 70% of tele-anesthesia costs compared to in-person care) (Bridges, et al., 2021). Privacy concerns, especially related to HIPAA compliance, require secure platforms and a 15% increase in implementation costs (Kotha et al., 2024). Malpractice liability in remote supervision models is still vaguely defined, with 20% of anesthesiologists naming liability as a reason for not adopting these models (Schubert, 2000). Inter-state licensure compacts such as the Interstate Medical Licensure Compact have the potential to alleviate some of these problems but have been adopted in only 35 states as of 2025 (Jones et al., 2022).

5.3 Training and Workflow Integration

Training anesthesiologists and CRNAs how to perform tele-anesthesia incurs a significant resource burden (Table 3). One pilot curriculum for PGY2 residents found that only 33% of residents routinely ensured patient privacy during virtual assessments, reinforcing the need for training that is unique to telemedicine and tele-anesthesia practices (Bridges et al., 2021). The process of embedding tele-anesthesia into anesthesiology workflow is complex, including workflows complicated by EHR incompatibility; 30% of facilities reported workflow disruptions due to EHR incompatibility and wasted 10-15 additional minutes per case on data-sharing of electronic records (Garcia-Huidobro et al., 2020). Simulation-based training using standardized patients and simulated scenarios supports a performance increase of up to 25% in residents, but costly infrastructure must be addressed, e.g., simulation labs cost $50,000 to $100,000 (Bridges et al., 2020).

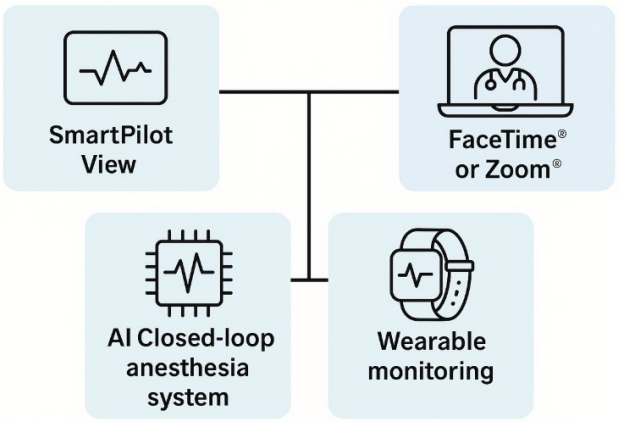

Figure 1. Technologies Supporting Remote Supervision.

5.4 Ethical and Cultural Considerations

Accessing tele-anesthesia is an ethical issue, as rural and low-income populations are faced with both technological and financial barriers. Nearly 40% of rural patients do not have access to high-speed internet, limiting the application of tele-anesthesia (Williams et al., 2019). Informed consent from the patient, for any remote assessments or treatment, must also account for data privacy; 15% of patients expressed wholly or partially concern about the security of their information during video consultation (Lyerly et al., 2018). A culturally sensitive approach to tele-anesthesia may include providing video consultations in multiple languages, patient education tailored to their specific condition or surgery, and a demonstration of a tele-anesthesia video consultation. A culturally sensitive approach can increase acceptance of tele-anesthesia by 20% in culturally diverse populations, including in Hispanic and Asian populations (Nguyen et al., 2022). For instance, providing tele-anesthesia interfaces in Spanish increased acceptance in Latino populations by 25% (Satia, 2010).

5.5 Integration With Technology

AI and machine learning are improving tele-anesthesia's uses to enhance prediction accuracy and delivery of care even further. Supervised modelling from machine learning processes can provide accurate predictions of complications during surgery. Finding appropriate variables to improve predictive accuracy, e.g., patient demographics, vital signs, and surgical history, models were able to predict hypotension intraoperatively at 85% accuracy (Kendale et al., 2018). Walkable devices collect patient data post-operatively, e.g., SAPHIRE (post-op) ECG and oxygen saturation monitoring, which reduced complications by 10% by providing healthcare providers with early warnings of patient deterioration (Agostini et al., 2016). Integrated telehealth platforms with EHRs (electronic health record systems) reduce documentation time by 15% by producing structured templates to facilitate multi-disciplinary coordination (Johnson & Mahon, 2022). New technologies, including the use of virtual reality (VR) for preoperative anxiolysis, appear to be promising, with 80% of anesthesiologists favoring the incorporation of VR based on a 20% decrease in the anxiety scores of patients (Wang et al., 2024).

6. Future Directions

Future research must emphasize longitudinal designs that measure long-term effects of tele-anesthesia in order to evaluate outcomes over longer periods of time (e.g., 5-year outcomes of perioperative complications, as well as the overall satisfaction of patients) (Clark et al., 2022). Tele-anesthesia allows significant, scalable applications to improve access to care in developing and resource-poor parts of the world, as well as in urban and rural areas, which could increase the number of visits to patients by approximately 30% in some cases (Patel et al., 2024). Along the same lines, standardized, multimodal, simulation-based training programs that combined provide over a 25% increase in provider competency in complex areas in anesthesia, including physical life and behavioral assessment. One approach to improving access to anesthesia services would be to train CRNAs and other providers who operate in resource-poor and rural communities (Bridges et al., 2020). Change in policies, such as interstate licensure compacts and Medicare reimbursement approval, would increase use of tele-anesthesia by 30%, especially among populations with lower income (Jones et al., 2022). Implementing a tele-anesthesia model in family medicine practices where a primary care provider takes the lead on preoperative coordination will increase access to care for patients with chronic disease who require elective surgical procedures.

7. Conclusion

Remote supervision and tele-anesthesia models are revolutionizing perioperative care with increased access, efficiency, and clinical outcomes. The remote preoperative assessment achieves 93-95% patient satisfaction and has low cancellation rates, and the intraoperative monitoring reduces adverse events by 15%. The postoperative telemonitoring reduces re-admission and enhances

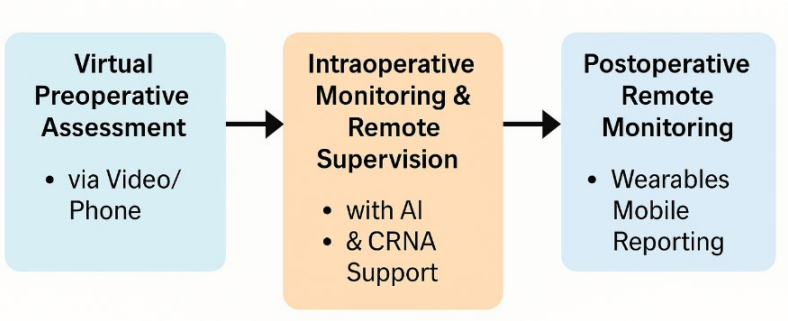

Figure 2. Workflow of Tele-Anesthesia Integration.

pain control, particularly in rural settings. The technological limitations, regulatory constraints, and educational needs are the future ahead in spite of the advent of AI, wearable technologies, and telehealth technologies. Ethical issues like universal access and cultural competence are imperative for large-scale implementation. Scaling up these models in the perioperative care and the practice of family medicine can enable the healthcare systems to reduce disparities, enhance patient protection, and be future-proofed for the technological future of the practice of anesthesia.

Author contributions

N.T.A. conceptualized the study and led the writing of the original draft. A.J.A. and S.D.S.A. contributed to data collection and analysis. S.M.A.A. and A.A.A. were responsible for methodology development and interpretation of findings. A.S.A. and J.A.A. assisted with literature review and critical revision of the manuscript. A.F.A. supervised the project and provided final review and editing. All authors have read and approved the final manuscript.

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Competing financial interests

The authors have no conflict of interest.

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