



# Expanding Perianesthesia Practice With Connected Care

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**A FITNESS ENTHUSIAST IS TRACKING** her heart rate using a sophisticated monitoring and Global Positioning System device during a fast-paced cycling race. She periodically glances at her watch and is surprised to see periods of sustained heart rates of more than 200 beats per minute. She pulls off to a medical tent in an abundance of caution despite feeling fine. Within 24 hours, she has received perianesthesia services after emergent cardiac intervention. Without the incredibly compact and sophisticated device on her wrist, arguably a type of medical device, her condition might have gone undiagnosed and untreated. These kinds of do-it-yourself medical monitoring and intervention devices may quickly become a data point within the perianesthesia care plan.

The cycling of a wheel is often measured in revolutions per minute or RPMs. In the world of health care technology, RPM is an acronym for remote patient monitoring, which happens to be the health care “revolution” of the moment. The growth in the number of Internet “connected” health care devices and associated mobile health applications has matched changes to telehealth service options. Smartphones, smartwatches, and fitness trackers, sometimes unbeknownst to their users, are constantly able to capture data points like heart rate, steps taken, quality of sleep, or flights of stairs walked as out-of-the box functionality. Advances in add-ons to these devices (peripherals) and creative uses of existing functionality are adding to the

ways in which patients can monitor and receive treatment aided by technology. The perianesthesia nurse will have to face greater patient demand for incorporation of device data into care. The growing numbers and types of devices for monitoring, communication, and delivery of nursing interventions will create unique ways for expanding the perianesthesia scope of practice in all phases of care.

## Regulatory and Guideline Drivers

The consumer demand for care that extends outside walls of clinics and hospitals has been a driver of remote patient monitoring, collection of connected device data, and the incorporation of more digital interventions into the nursing care plan. A key change in the regulatory space occurred with the Food and Drug Administration (FDA) approval of a prescription, mobile-application-based treatment for substance use disorder in 2017.<sup>1</sup> The Center for Medicare and Medicaid Services recently announced that in 2019 there would be an effort to modernize reimbursement to expand virtual care options.<sup>2</sup> The proposal would expand Medicare reimbursement for telehealth services beyond just rural care and would pay for technology-enabled remote visits using video or images. These changes will help health care providers and agencies to determine how best to incorporate these data and use these devices in a new paradigm of continuing care that may extend beyond the typical episodic care encounter.

The FDA’s new perspectives and the changes proposed by the Center for Medicare and Medicaid Services are critical to expanding access to care through digital interventions. Any new technology still requires the creation of an evidence base and guidelines supporting its use, safety, and efficacy. In response to more connected device and remote patient monitoring options, several regulatory and

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health care groups have been actively working to advocate and provide this guidance. In 2016, a large consortium of health care groups including the American Heart Association, the American Medical Association, and the Healthcare Information and Management Systems Society (HIMSS) formed a non-profit group called Xcertia. The group is working to promote best practices, boost consumer confidence, and reduce provider burden. Their finding that there has been a lack of guidance on mobile health (mHealth) applications validated their decision to focus their guidelines on privacy, security, data retention, and content that is both accurate and of high quality.<sup>3</sup>

The American Medical Association, in addition to their presence on the Xcertia group, also recently released their “Digital Health Implementation Playbook.”<sup>4</sup> The playbook is a practical guide intended to assist with the integration of remote patient monitoring into clinical practices. The FDA, a key gatekeeper and approver in the digital health space, also recently has added their voice to the digital health conversation. Their “Digital Health Action Innovation Plan” is a part of their recent effort to bring efficiency and modernization to how they handle review and regulation of digital health devices and applications.<sup>5</sup> For health care providers and consumers, the changes will mean that more mobile health applications will be released faster than ever before.

### **Boundaries of Perianesthesia Practice**

The switch to a greater number of ambulatory surgical procedures was one of the largest recent changes to perianesthesia practice. Arguably, the perianesthesia nurse had to shift their emphasis away from comfort and stability before handing off to an inpatient surgical care unit, toward ambulatory home discharge readiness. In many practices, there was a shift toward a more aggressive and proactive focus on complications that might delay or prevent discharge. The digital health revolution is on the verge of being equally disruptive to perianesthesia practice. When patients walk in the door with sophisticated monitoring, analytic, and interventional tools in their pockets, the perianesthesia nurse will need to promote safe and effective use of these tools as they adjust and incorporate them into care.

Discharge readiness, particularly in an era of patients living longer with chronic illness, has become challenging in light of assuring continuity of existing care alongside the postsurgical care requirements. Remote patient monitoring will continue to be a means for bridging a patient’s pre-anesthetic care regimen to their postsurgical treatment course. The perianesthesia nurse will need to expand their comfort with a broadening set of technical competencies such as communication tools, remote monitoring through connected devices, and an expanded focus on technology-enabled health and wellness programs. A look at industry trends offers some current and future state insights as to the potential preoperative and postoperative impacts to nursing care.

### ***Preadmission and Preoperative Considerations***

The preadmission and preoperative practice environments typically entail the evaluation of current health, identification of sources for intraoperative and postoperative risk, and the provision of education about the upcoming surgical experience. The perianesthesia nurse collaborates with anesthesia colleagues to gather and prioritize data to help derive the anesthesia plan and ensure a safe perianesthesia course. Expanded innovations for mobile health applications and remote patient monitoring could potentially provide new assessment data points for nurses practicing in these settings. Emerging and maturing innovations for cardiorespiratory evaluation provide excellent examples of how these technologies may become a key part of evaluation procedures and planning practices.

Sleep apnea, particularly undiagnosed sleep apnea, is always a postanesthesia concern that requires diligent evaluation and observation. Sleep evaluation applications are one of the most popular mobile health and wellness tools for smartphone and wearable device users. These devices attempt to monitor quantity and quality of sleep as well as provide services that support good sleep hygiene. There is a constant stream of new digital tools for sleep evaluation including sleep apnea identification, many of which use audio analysis of sleep sounds and additional sensor data to identify disruptions in sleep.<sup>6</sup> Using telehealth and remote monitoring for detecting sleep

abnormalities, although, is not new. The change has been in the explosion of low cost, do-it-yourself sleep evaluation tools, which may come to compete with more invasive, expensive, and clinic-based sleep evaluation options.

In addition to more sleep evaluation offerings, there has also been a growth in peripheral medical devices that can be used in conjunction with connected devices to create even more powerful remote patient monitoring options. For example, there are several spirometry devices that can attach to a mobile device. These types of respiratory peripherals can provide insights into a patient's respiratory health and lung functioning from the comfort of their own home. These at-home monitoring devices have also been shown in some cases to favorably compete with commercial respiratory evaluation diagnostic tools.<sup>7</sup>

There are several additional preoperative data points that the nurse and anesthesia team might want to consider when determining overall readiness and risk for surgery. Mobile devices and wearables, as mentioned previously, can generate enormous amounts of data about general levels of exercise and activity. Sleep and spirometry tools like the ones mentioned previously can allow for further inferences such as adherence to inhaled medication regimens or exercise tolerance. Consider also the importance of creating new and powerful indicators of how surgical interventions can impact quality of life. For example, many patients seek surgical intervention for conditions causing them pain. Preoperatively, a nurse may be able to use connected device data to determine how pain is affecting the patient's sleep, activity, or exercise. This baseline preoperative data can then be used as an additional measure of how well the surgery has improved the patient's pain and quality of life through comparisons to the baseline data.

### ***Postanesthesia Considerations***

Patient demand that their device data be incorporated into their care and evaluation could spill over into the monitoring of postoperative progress and complications as well. Perianesthesia practice could also shift as devices become more reliable and sensitive and as reimbursement and practice models catch up to this patient demand and

emerging research. The future state of perianesthesia practice could include an expanded perianesthesia period where the nurse may be remotely monitoring a patient for a period of time to facilitate a safer or more comfortable home discharge experience. Teledermatology and electrocardiography applications are great models for understanding how emerging applications and devices might change care.

Many surgical procedures entail external surgical incisions and the potential for implanted drainage devices. Existing teledermatology applications created to monitor moles and other skin abnormalities could be expanded for use in wound and incision monitoring. These kinds of skin imaging applications use augmented reality to measure changes to skin over time.<sup>8</sup> Using technology to measure and record observations removes the opportunity for human error and bias. Even well intentioned and experienced practitioners may have difficulty discerning color, sizing, or memory of baseline states and may be influenced by cultural, behavioral, or environmental factors.<sup>9,10</sup> Imagine a time lapse application that could monitor the color of drainage on a dressing or in a drainage collection device. Alert creation from simple algorithms could notify a central perianesthesia monitoring center when particular quantities or shades of drainage appear. Simple image-based algorithms integrated with remote monitoring devices could alert a nurse as needed rather than requiring intensive, eyes-on inpatient, or even telehealth presence. In the short term, simpler applications already in use could be repurposed to monitor the progress of incision healing or give indicators of infection.

The repurposing of teledermatology applications for advanced postsurgical monitoring may be a future enhancement, but functionality approaching medical grade use is already available in existing products, most notably current generation smartwatches and smartphones. Out-of-box functionality includes electrical sensing that allows for a single lead electrocardiography reading and heart rate capture. The accelerometers that measure device movement within these devices can also detect when the user may have taken a fall and offer to contact emergency services. Fall detection research,<sup>11</sup> along with a growing body of evidence for the use of connected devices as a

successful home intervention,<sup>12</sup> continues to expand and will be a critical adjunct to assuring that if perianesthesia complications arise in the home, existing connected devices may be useful for ensuring timely intervention.

### ***Maturing the Revolution by the Minute***

Technology is alluring as a means of reducing health care costs, adding data to inform care and potentially allowing more patients to recover from their home. There are several challenges to the broader use of connected devices for monitoring patients remotely and for their use in evaluating progress toward surgical recovery goals. The maturation of these innovations will require ongoing research and consideration of several factors including access, data quality, cost, reimbursement models, security, liability, and integration into practice.

The presumption of access can be dangerous and discriminatory in any discussion about patient use of technology. There continues to be challenges in finding affordable and reliable high-speed Internet connections that would be critical to ensuring that sophisticated monitoring or communication tools could be used as intended. Even in cases of consistent high-speed Internet, digital literacy on the part of patients and care providers also could create a barrier to the proper use of the technologies discussed previously. Despite extensive testing by device and application vendors, these devices ultimately rely on proper use by patients in their prescribed contexts. Data quality and fidelity can easily be threatened by variables such as user error, digital literacy challenges, and any manner of device speed or connectivity issues. Greater dependence on these tools could expose greater risk to patients and providers who may come to rely on them to monitor for complications or to be accurate on detection of urgent patient issues.

Regulatory and accreditation agencies such as the FDA are important safety gatekeepers in this space, despite historical accusations that they hinder innovation. Regulatory complexity is further confounded by the crowded health care application and device marketplace. Nurses need to quickly figure out how new technologies can be incorporated into their daily workflows to keep

up with revisions to reimbursement models and patient demand for integration of device data into care. The electronic health care revolution was the first data tsunami nurses faced. Connected device data are already creating a pent-up secondary data wave requiring that nurses quickly determine if these data can be incorporated in an efficient and efficacious way. Integration into practice also requires both a working understanding of the technologies themselves and a recognition of their value in improving the quality of care and support of existing care standards.

### ***Examining Risk and Ethical Obligations***

An ethical profession like nursing has both a social imperative to do the greatest good but also a legal obligation to intervene within the scope of practice including serving as a mandated reporter. The potential to expand perianesthesia practice may allow nurses to practice at the top of their licenses but may also expose them to new liability risk and ethical challenges. The authors of a recent review of sleep evaluation technologies<sup>6</sup> questioned at what point these technologies cross over from wellness and lifestyle management into truly serving as medical diagnostic tools. Devices that are able to detect dysrhythmias have also been a source of medical ethical and legal concern, with one medical-legal expert calling them “a potential liability nightmare.”<sup>13</sup> How much trust can be placed in these devices in terms of the quality of data, fidelity of findings, and usefulness to care providers who may have to go to great lengths to get the data in the first place? Do potential Health Insurance Portability and Accountability Act (HIPPA) security issues and blurring of privacy lines among vendors, patients, and health care providers create more risk than benefit? There is no question that the perianesthesia nurse will need to be an explorer of this new technology so they can advocate, troubleshoot, safeguard, and be flexible all while continuing to put the patient first by prioritizing interventions even in the face of expanding data sources and complexity.

### **Conclusions**

Health care is a business that must be responsive not just to regulatory and reimbursement demands but also to individual health care

consumer trends and interests. Surgical units and centers will inevitably adopt some remote patient monitoring and integrate patient connected device data into care. They may unfortunately do this largely to remain competitive without carefully considering the impact on nurses and other providers who are already overburdened with mountains of health care data and increasingly complex patients. Although smartphone adoption is extremely high, there are still many who may not have access to reliable or affordable

high-speed data. Varying digital literacy on the part of both patients and nurses may further exacerbate safe use and high fidelity data capture. Nurses will need to be aware of emerging technologies and ready to determine how best to effectively sort good data and technologies from bad. There is little question that these technologies can either create frustration and increase risk or can be harnessed as tools for promoting safer surgical experiences and for potentially expanding perianesthesia practice.

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