

# Gradian Health Systems: Elevating the Role of Biomedics in Global Surgery

By Adam Lewis

**W**hen John Willy—a biomedical equipment technician (BMET) in Uganda—woke up one morning last September, he probably didn't expect to be a gatekeeper for lifesaving surgery. But after receiving an emergency call to repair an anesthesia machine at a nearby hospital, that's what he became.

Willy was summoned by the hospital to fix a broken knob that controls the machine's oxygen concentrator, without which the hospital's anesthetist wouldn't be able to manage the flow of oxygen into the patient. (In Uganda, it's common for hospitals to lack access to cylinder oxygen.) While Willy hadn't seen this issue before, his training, paired with some ingenuity, allowed him to facilitate the repair and ready the machine for the surgery—now able to be performed because he responded with timely, expert service.

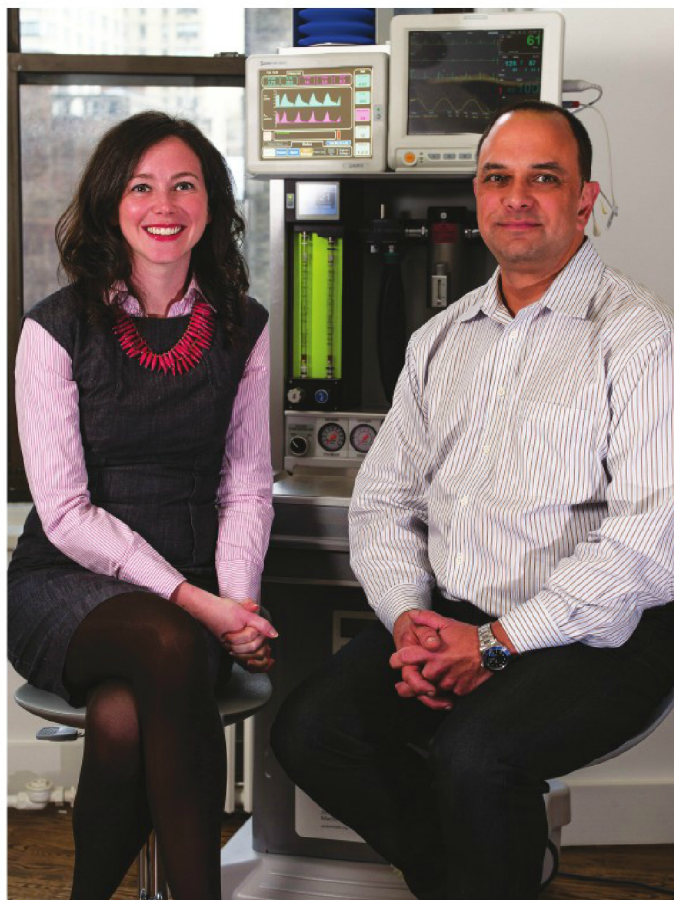
## Anesthesia for All

In the world of surgery and anesthesia, BMETs like Willy are crucial pieces to a complex, systemic puzzle—a puzzle that becomes even more complex in low-resource settings like Uganda, where medical equipment challenges are far more rampant, the surgical needs far greater, and the availability of trained BMETs far less common. With specialized knowledge and intricate skills, these technicians can be the difference between a successful surgical operation and one that puts the patient's life in jeopardy. After all, doctors and nurses are often only as effective as the devices they operate, so it's imperative for BMETs to play a role in ensuring that those devices run effectively and efficiently over time. The need for trained technicians is especially critical in parts of the world that have become accustomed to broken or otherwise inoperable equipment.

Gradian Health Systems is a nonprofit social enterprise that seeks to improve access to surgical and anesthesia care worldwide. We were founded in 2011 by the Nick Simons Foundation, a private philanthropy that supports programs to improve healthcare. We've built a model for equipping resource-constrained hospitals to deliver anesthesia safely by keeping technical support at the center of our mission—regarding equipment service as highly as the equipment itself.

Nearly 5 billion people around the world currently lack access to safe surgery.<sup>1</sup> Gradian works to fill this gap through technology, service, training, and advocacy. Based in New York with a global network stretching from the United Kingdom to Southeast Asia to sub-Saharan Africa, the Gradian team manufactures, sells, maintains, and trains users to operate the Universal Anaesthesia Machine (UAM). This CE-certified general anesthesia machine was designed in and for low-resourced hospitals where unreliable electricity and shortages of compressed medical gases often prevent conventional machines from functioning. To date, the UAM has been installed in more than 140 operating rooms across 23 countries, contributing to an estimated 100,000 safer surgeries worldwide.

The UAM uses both continuous-flow and draw-over anesthesia technologies to enable the system to function indefinitely without



*Sadie Healy and Ismael Cordero by the Universal Anaesthesia Machine.*

power or compressed oxygen. It features an integrated oxygen concentrator to generate its own oxygen and provides standard connectors for cylinder, pipeline, and portable oxygen. If no electricity or external source of oxygen is available, the machine automatically draws in room air as the carrier gas. Its optional ventilator provides electrically driven automatic ventilation in volume- and pressure-control modes. The UAM will operate without mains power for up to 6 hours on rechargeable battery power and comes with a manual ventilation option as a final safety measure.

## BMET: An Endangered Species

One reality we came to recognize early on was that it isn't enough to design and distribute new technology to low-resourced operating rooms; we need to invest in BMETs every step of the way to ensure that the UAM remains functional for the long term. This goal requires a business model in which equipment service and training play an integral role so our customers and the people they serve can feel confident in a reliable flow of anesthesia from the UAM.

While it sounds both intuitive and straightforward, complementing equipment with local service and training is not a stan-

standard practice for medical device manufacturers in the developing world. Nearly 80% of devices in many low and/or middle-income countries (LMICs) are donated or second-hand,<sup>2</sup> meaning they are susceptible to breaking down. When they do, it can be difficult to find the spare parts and BMETs needed to repair them—especially if they come without a service warranty, maintenance manuals, and professional training, which is often the case. Even products developed specifically for LMICs might fail to account for local need, environments, and expertise. With these factors at play, it's not surprising that anywhere from half to three quarters of all medical equipment in developing countries lies inoperable.<sup>3</sup>

Despite these issues, neither the global health community nor national governments have invested adequately in the biomedical engineering vocation in LMICs. As a World Health Organization survey reveals, BMETs face limited in-country opportunities for education, job training, and career advancement, and countries rarely have professional societies and regulatory bodies in place to advance the field.<sup>4</sup> Another survey found that the vast majority of hospitals in LMICs—particularly those in sub-Saharan Africa—had trouble finding qualified local BMETs to service their medical devices, a challenge no doubt exacerbated by disproportionately small hospital budgets devoted to equipment maintenance.<sup>5</sup> In Malawi, for instance, there are only nine BMETs for a population of more than 16 million.<sup>6</sup>

“Because of their small number and limited availability, the role of BMETs is often not understood or appreciated,” says Coco Kanda, a Congolese BMET who repairs, maintains, and trains both

users and other BMETs on medical equipment in the Democratic Republic of the Congo. “If developing countries are to move forward, they must develop the capacity to invest in technology and to maintain the equipment they acquire.”

### Training the Trainer

With this challenge in mind, Gradian offers a warranty for the UAM that guarantees strong in-country service support implemented through partnerships with local distributors that have BMETs on staff. We thoroughly vet our partners based on their ability and commitment to provide fast, accurate, and comprehensive support to UAM users wherever they are. After identifying local distributors, our biomedical service manager trains them on the specifics of the UAM so they can become trainers themselves.

We've found this “train the trainer” approach provides long-term benefits both for us and the distributors—typically, independent entrepreneurs or small enterprises eager to expand their technical skills and grow their business. For BMETs with specific expertise and limited opportunities to make a living, these partnerships can be valuable sources of employment, skill-refinement, and networking. The contributions they bring to Gradian, however, are even more valuable.

Once we make a sale, we turn to these local UAM experts to install the machine and train the hospital's technical staff on its maintenance needs. During installation, our BMETs demonstrate how the machine is assembled, how to manage common repairs, and how to conduct preventive maintenance checks. As part of this

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training, they also supply technicians with tools, manuals, training guides, instructional videos, and other materials to aid future service needs. Afterwards, trainees receive certificates validating their expertise, as well as ongoing training and certification opportunities down the road. These trainings are vital for equipping hospitals with the knowledge and skills needed to operate and maintain the UAM and for emphasizing the importance of BMETs in this work.

"The BMETs are usually very appreciative and surprised that this kind of attention and support is being given to them by a manufacturer," says Ismael Cordero, Gradian's biomedical service manager. "During these trainings, the BMETs take center stage in the presence of the hospital's administrators, who often do not fully recognize their contribution."

## The Day After Tomorrow

When it comes to maintenance and repairs beyond day-to-day service needs, Gradian-certified BMETs become our eyes and hands on the ground. Since so much medical equipment comes without after-sales support—thereby compromising the lifetime usability of a machine—we've prioritized customer service throughout our business operations.

Each UAM comes with a complimentary warranty that covers preventive maintenance and repairs for up to 2 years, with affordable options to extend it. Using a combination of e-mail, phone, and SMS platforms, our customer experience manager maintains close contact with our distribution partners and each hospital. Our biomedical service manager is always available to troubleshoot any

operational challenges that arise, extending knowledge and service from our headquarters to each of our markets.

"We believe that high-quality customer service should be given to all customers, regardless of the country they live in," says Sadie Healy, Gradian's customer experience manager. "To ensure that, we depend on our BMETs to provide swift repairs and maintenance, and they depend on us for spare parts and additional support and training. We recognize and respect our need for one another in order to provide quality customer service."

Whenever a UAM user reports an issue with the machine, a BMET from one of our distribution partners manages the request in a timely, appropriate manner. Having established spare parts depots throughout our markets, we offer BMETs convenient access to the parts they need to service the UAM. These repairs can often be handled with basic tools. From our customers' perspective, this approach empowers BMETs to become links between the UAM and Gradian, positioning them as valued specialists integral to the long-term upkeep of a core component of the surgical suite.

## The Hands of BMETs

Over the last 5 years, Gradian has learned a number of crucial lessons about the human resources and expertise needed to maintain medical equipment in LMICs. But perhaps the most important insight is one that the medical equipment field has been grappling with for years: the downside of donating or selling devices without an eye toward the future. From our perspective, that future quite literally lies in the hands of BMETs.

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As the global surgery field aspires to close the unacceptable gap in access to safe surgical and anesthesia care, we feel it's time we gave equipment maintenance the attention it deserves. For medical device manufacturers, that means ensuring after-sales support, complete with links to BMETs trained on the equipment and local spare parts to enable repairs. For governments, that means devoting more resources to those charged with keeping their country's healthcare infrastructure functional, including professional engagement opportunities. For hospitals, that means regarding its technical staff as a critical part of the team, because providers can't deliver care without those who make healthcare delivery possible. And finally, for the global surgery community, that means acknowledging the role of BMETs in enabling such a lifesaving intervention—and how inextricably linked their services are to the long-term impact of a medical device.

After all, if we can't preserve the life of medical technology, how can we expect it to preserve our own? **24x7**

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