

phones, LCD screens, Macs and PCs. These video laryngoscopes were used to teach laryngoscopy during a first-year anesthesia orientation training course in Uganda with good reception.

Findings: Creation of functional video laryngoscopes for less than \$20 per unit is feasible and may be able to increase access to this technology for educational and clinical purposes in LMICs. More formal testing and development of these low-cost video laryngoscopes is planned.

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A Novel, low-cost intraoperative fluorescent imaging system for surgical use: Opportunities for research capacity in low- and middle-income countries

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Background: Capacity-building efforts to train surgeons in low- and middle-income countries (LMICs) have increased the population of surgeons in these countries. Some of these surgeons may be interested in pursuing research but face prohibitive resource obstacles. For example, intraoperative fluorescent molecular imaging has emerged recently as a promising surgical adjuvant to better identify tumors, metastatic disease and diseased lymph nodes. The technology involves using a light source, filters and camera during surgery to view cancer-selective fluorophores that absorb and emit specific wavelengths of light. This growing area of research would welcome contributions from LMICs, but imaging systems remain expensive and not readily available. Our objective was to design a low-cost, easy-to-use fluorescent imaging system compatible with any traditional endoscope. Demonstrated efficacy of such system indicates that surgeons in LMICs can be not just recipients of training and resources but also drivers of research and innovation.

Methods: The imaging system was constructed solely from readily available commercial materials. We performed verification testing of three design iterations to incorporate an LED light source, minimize loss of light output, and develop an effective filtering system for fluorescence detection. The device was tested *in vitro* and in an animal model (chicken) using fluorophores known as quantum dots of different concentrations.

Findings: Criteria for an effective imaging system were satisfied. First, the system's "white light" intensity was comparable to that of standard clinical xenon light sources. Second, the viewing lens provided the magnification and resolution required for intraoperative imaging. Third, the system distinguished fluorescent tissue from non-fluorescent tissue with appropriate sensitivity and specificity, both *in vitro* and *in vivo*. Finally, the entire system was constructed for under 500 U.S. dollars.

Interpretation: Prohibitive cost remains an obstacle to surgeons in LMICs who pursue basic science and translational research. In the field of intraoperative fluorescent molecular imaging, we demonstrate that an imaging system can be designed at low cost and with applicability to preclinical testing. The system is compatible with standard clinical endoscopes and accommodates various fluorescent molecular contrast agents. This study represents a successful effort to potentially broaden the surgical research capacity in LMICs.

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Community education program developed with community members for emergency referral in northern Ghana: Lessons about active community participation for innovation and ownership of interventions

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Project Purpose: Ghana has a maternal mortality ratio of 380/100,000 live births and a neonatal mortality rate of 28/1,000 live births. Although most of these deaths could be prevented by timely access to quality care during medical emergencies, the country lacks a functional emergency referral care system. The most common options for emergency transportation in Ghana's Upper East Region (UER) are foot, bicycles, donkey carts and motorbikes. In 2012, Sustainable Emergency Referral Care (SERC) Initiative—a comprehensive system of transportation and communication for emergency referral—was launched in UER to address this need. However, the absence of an educational component to enhance utilization of SERC's transportation services was an identified implementation gap. This project focused on developing context-specific and culturally-tailored community education materials required to facilitate community members' capacity to recognize signs of obstetric and neonatal emergencies, and consequently utilize SERC's transportation services to access medical care, promptly.

Methods: The project was in three parts. The first was a qualitative study to describe community members' ability to recognize and respond to signs of obstetric and neonatal emergencies, and to elicit recommendations for effective community education. Seven focus group discussions conducted among community members in three districts were audiotaped, transcribed verbatim, coded in NVivo 10.2 software and analyzed using framework analysis. Findings guided the second part, which comprised production of educational videos in the local dialects; conceptualizing, developing and compiling educational illustrations; and organizing local groups to compose educational songs. Training of trainers and developing a curriculum to guide educational activities formed the last part.

Outcome: Qualitative study revealed mistaken beliefs and detrimental practices that merit specific focus in an educational program. Educational materials produced include two educational videos, a 40-page flip chart and jingles. Two implementation assistants