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Why do people die after surgery? A call for research action

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Death after surgery is largely under-recognized and poorly understood. While the intent of surgery is for benefit, a risk of death is always present. This risk is dependent upon many factors, including the type and severity of surgery, the disease requiring surgery, and patients' physiological reserve. However, most are unaware that an estimated 4.2 million people die within 30 days of surgery each year1. If surgery were categorised as a 'cause of death', it would be the third leading cause of death worldwide1. In fact, postoperative death contributes more years of healthy life lost than tuberculosis, malaria and HIV combined, and this may increase further as global access to surgery expands[1,2]. As well as the staggering human cost, this is a huge burden on families, communities, and health systems[3].

Postoperative death is a global issue that affects patients across all contexts. However, patients undergoing surgery in low- and middle-income countries (LMICs) are disproportionately at risk[4,5,6]. The mechanisms are uncertain and likely to be multifactorial. Challenges in accessing safe, timely, and affordable surgery increase disease severity and urgency at presentation, and therefore increase 'failure to cure'. Equally, for hospitals and health systems in resource limited settings, human resource and infrastructural constraints reduce the ability to recognise and respond to postoperative deterioration, thereby increasing 'failure to rescue'. Failure to rescue was quantified in the GlobalSurg-3 Study of 15,958 patients undergoing cancer surgery, where absence of consistently available postoperative care facilities was associated with 7 to 10 more deaths per 100 major complications in LMICs compared with high-income settings[7].

The need to increase global capacity for surgery, anaesthesia and obstetric care was highlighted in the 2015 Lancet Commission on Global Surgery and the recent resolution at the World Health Assembly for 'Integrated Emergency, Critical and Operative Care (ECO)' as a universal component of primary healthcare[2,8]. However, as surgical capacity increases, so must the evidence base and resourcing for safe, high-quality, and effective surgical interventions to prevent an increase in postoperative deaths.

Several initiatives have attempted to address this, through randomised trials, complex interventional studies, implementation of health technologies and consensus guidelines[9,10,11,12,13]. For example, ASOS-2 was a cluster-randomised trial of enhanced postoperative surveillance versus standard care to reduce mortality among high-risk adult surgical patients across Africa. Patients randomised to the intervention group were admitted to a higher-care ward area in closer proximity to the nursing station, with increased frequency of nursing observations, increased family interaction, and a physiological surveillance guide[9]. Overall, the intervention package did not decrease 30-day in-hospital mortality. They concluded that in-depth mixed-methods research would be required to prioritise and co-design perioperative interventions that can work effectively in resource-limited hospitals.

Progress is likely to come from understanding the causes, mechanisms, and mediators of postoperative deaths across diverse contexts. Whilst causal pathways are often hard to delineate, identifying potentially modifiable events throughout perioperative care pathways will allow the global community to develop contextually relevant interventions. For example, a secondary analysis of postoperative deaths within the reducing surgical site infections in low-income and middle-income countries (FALCON) trial highlighted four important findings. First, three-quarters of deaths occurred due to circulatory failure, the majority of which was sepsis-related. Second, most deaths happened within 7-days of surgery. Third,

1 in 7 deaths occurred without a clear cause identified, highlighting a lack of capacity for diagnostic imaging. Finally, 1 in 5 deaths occurred out-of-hospital. This provides critical insight into how patients die after surgery, with critical importance to intervention co-development.

Establishing why patients die after surgery is rather more complex. The sequence of events and interventions are often sadly only evident after a critical event has occurred. Whilst local processes for 'morbidity and mortality' reviews may be in place, limited opportunities exist for shared learning across hospitals and across borders. Furthermore, few countries have established routine reporting for perioperative mortality rates, despite calls for nationally representative annual reporting by the Lancet Commission on Global Surgery[2], and the Utstein Consensus on Global Surgery and Anaesthesia Indicators[15].

We invite a call to action for a major cross-sectional study of one thousand postoperative deaths around the world (POMR1000). This global study will require a novel approach, gleaning from multiple methodologies and requiring multidisciplinary input. This is likely to require adaptation of verbal autopsy methods such as those used in the Million Death Study in India[16], combined with understanding of processes from the National Confidential Enquiry into Patient Outcome and Death (NCEPOD)[17] and Royal College of Anaesthetists NAP7 audit study[18]. Evaluation of deaths will be anonymised, confidential, and focus on common themes in human factors, infrastructure, and systems. These can be compared between different patient groups, hospital types and modes of presentation to identify the highest-yield opportunities to reduce the global burden of postoperative death.

LLM Usage Statement: No artificial intelligence Large Language Model (LLM) was used in the production of this manuscript.

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