

# Skull Base Neurosurgery in Low-Resource Settings: An International Survey to Define Current Capacities and Challenges

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## Introduction

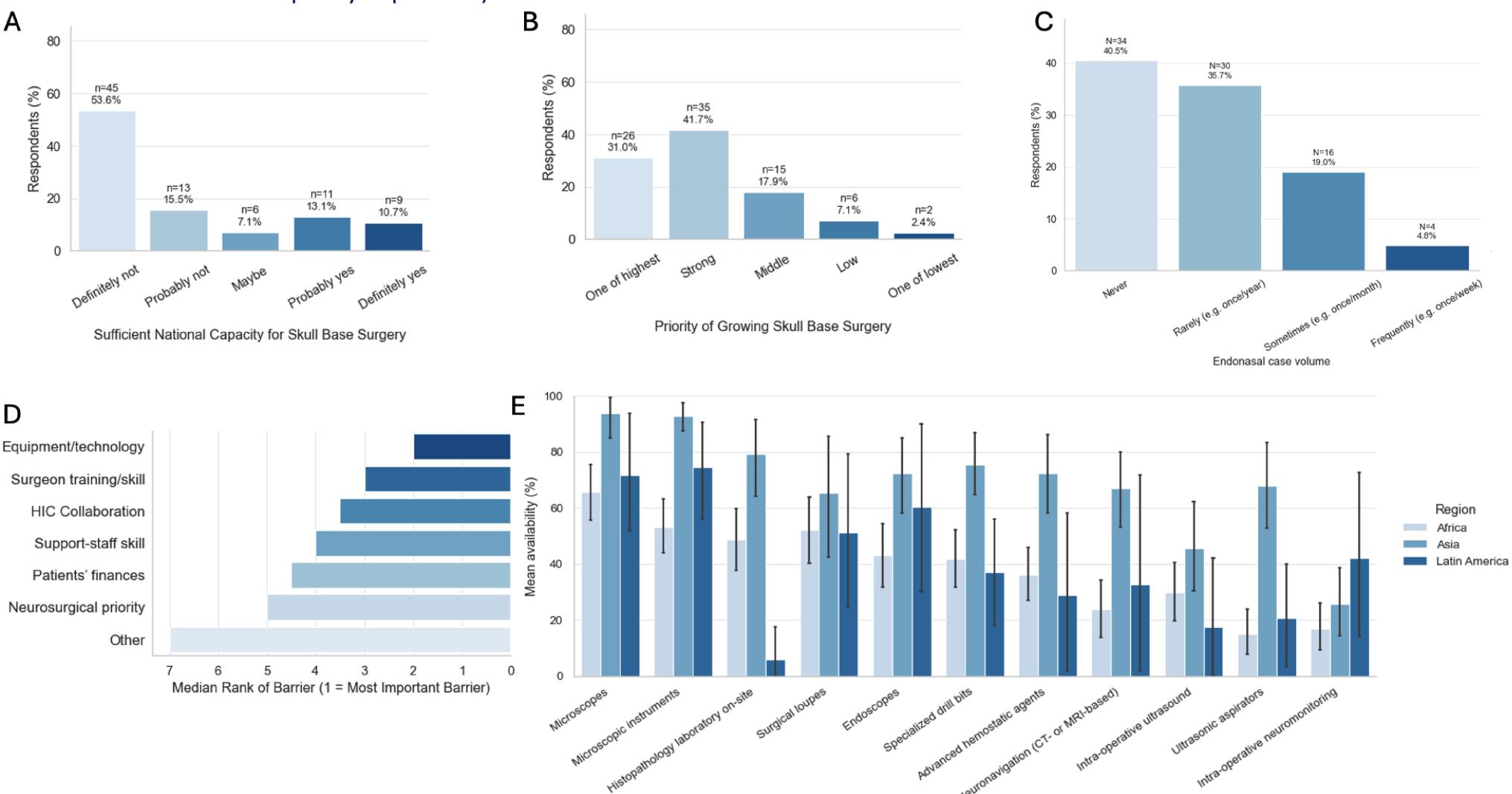
Skull base pathologies pose a major unmet burden in low- and low-middle-income countries (LLMICs) due to the required specialized training, heavy operating room resources, and intense perioperative care—all of which are scarce. Nonetheless, some LLMIC neurosurgeons are expanding skull base practices, with limited data describing this experience. We aim to evaluate the current state of skull base neurosurgery in LLMICs to provide a foundational understanding of the challenges and opportunities.

## Methods

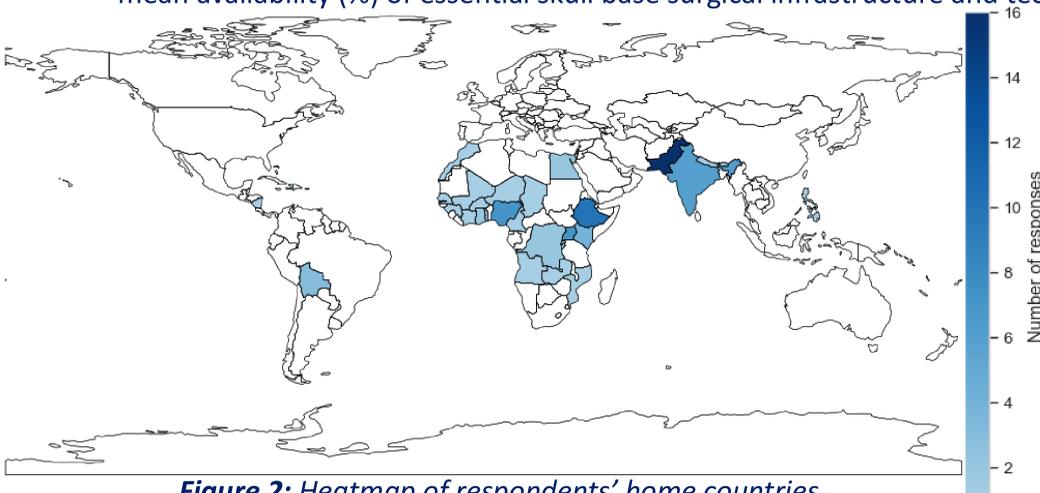
Through various avenues, we distributed a structured digital survey to LLMIC skull base neurosurgeons across four domains: pre-operative factors (disease severity, surgical capacity, patient access), intra-operative/surgeon factors (training, case volumes, tool availability, collaborating subspecialists), post-operative factors (ICU/radiation access, follow-up, outcomes), and systemic factors (reasons surgery was not performed, barriers to capacity expansion).

## Results

**Eighty-four neurosurgeons from 31 LLMICs responded**; most were from Africa (64.3%) and Asia (29.8%). At least **69.1% perceived national skull base surgery capacity as inadequate**. Patients often presented with advanced disease (median severity 70.0/100). On average, **52.5% of patients received indicated surgery**. The most common reasons for lack of surgery were inability to pay and patient declining intervention, followed by inadequate resources/technology. Operative volume was modest (mean 3.7 cases/month), with sporadic exposure to higher-complexity disease and minimal endonasal approaches. Key technologies were inconsistently available, particularly neuromonitoring, ultrasonic aspiration, and neuronavigation. Postoperative resources were similarly variable (when needed, ICU availability 61.4% and radiotherapy 46.5%). Respondents reported a mean goal achievement of 68.8% with a moderate-to-severe long-term complication rate of 27.1%. In multivariable analysis, greater equipment availability and higher monthly case volume were independently associated with higher goal achievement, though effect sizes were small.



**Figure 1:** (A) Perceived sufficiency of national capacity for skull base surgery. (B) Reported priority of growing skull base surgery within national neurosurgical agendas. (C) Self-reported endonasal case volume. (D) Median-ranked barriers to expanding skull base surgery (1 = most important). (E) Regional comparison of mean availability (%) of essential skull base surgical infrastructure and technologies with error bars representing variability across respondents.



**Figure 2:** Heatmap of respondents' home countries.

## Conclusions

Although skull base neurosurgery is resource-intensive, it is growing in LLMICs. By not only extending survival but also improving quality of life and reducing disability, it may serve as a high-cost, high-reward investment. Insights from this work will inform targeted interventions to improve access to effective surgical care for people in these resource-constrained parts of the world.