

## Traumatic Brain Injury Neurosurgical Care Continuum Delays in Mulago Hospital in Kampala Uganda

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**Abstract :** Background: Patients with traumatic brain injury (TBI) can develop rapid neurological deterioration from swelling and intracranial hematomas, which can result in focal tissue ischemia, brain compression, and herniation. Moreover, delays in management increase the risk of secondary brain injury from hypoxemia and hypotension. Therefore, in TBI patients with subdural hematomas (SDHs) and epidural hematomas (EDHs), surgical intervention is both necessary and time sensitive. Significant delays are seen along the care continuum in low- and middle-income countries (LMICs) largely due to limited healthcare capacity to address the disproportional rates of TBI in Sub Saharan Africa (SSA). While many LMICs have subsidized systems to offset surgical costs, the burden of securing funds by the patients for medications, supplies, and CT diagnostics poses a significant challenge to timely surgical interventions. In Kampala Uganda, the challenge of obtaining timely CT scans is twofold: logistical and financial barriers. These bottlenecks contribute significantly to the care continuum delays and are associated with poor TBI outcomes. Objective: The objectives of this study are to 1) describe the temporal delays through a modified three delays model that fits the context of neurosurgical interventions for TBI patients in Kampala and 2) investigate the association between delays and mortality. Methods: Prospective data were collected for 563 TBI patients presenting to a tertiary hospital in Kampala from 1 June - 30 November 2016. Four time intervals were constructed along five time points: injury, hospital arrival, neurosurgical evaluation, CT results, and definitive surgery. Time interval differences among mild, moderate and severe TBI and their association with mortality were analyzed. Results: The mortality rate of all TBI patients presenting to MNRH was 9.6%, which ranged from 4.7% for mild and moderate TBI patients receiving surgery to 81.8% for severe TBI patients who failed to receive surgery. The duration from injury to surgery varied considerably across TBI severity with the largest gap seen between mild TBI (174 hours) and severe TBI (69 hours) patients. Further analysis revealed care continuum differences for interval 3 (neurosurgical evaluation to CT result) and 4 (CT result to surgery) between severe TBI patients (7 hours for interval 3 and 24 hours for interval 4) and mild TBI patients (19 hours for interval 3, and 96 hours for interval 4). These post-arrival delays were associated with mortality for mild ( $p=0.05$ ) and moderate TBI ( $p=0.03$ ) patients. Conclusions: To our knowledge, this is the first analysis using a modified 'three delays' framework to analyze the care continuum of TBI patients in Uganda from injury to surgery. We found significant associations between delays and mortality for mild and moderate TBI patients. As it currently stands, poorer outcomes were observed for these mild and moderate TBI patients who were managed non-operatively or failed to receive surgery while surgical services were shunted to more severely ill patients. While well intentioned, high mortality rates were still observed for the severe TBI patients managed surgically. These results suggest the need for future research to optimize triage practices, understand delay contributors, and improve pre-hospital logistical referral systems.

**Keywords :** care continuum, global neurosurgery, Kampala Uganda, LMIC, Mulago, traumatic brain injury

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