Traumatic Brain Injury in Kenya: A Preliminary Review of the Literature

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Abstract
Kenya has a disproportionately high rate of road traffic accidents each year, many of them resulting in traumatic brain injuries (TBIs). A review of articles written on issues pertaining to the medical treatment of people with TBI in the past 15 years in Kenya indicates a significantly high incidence of TBIs and a high mortality rate. This article reviews the available literature as a first step in exploring the status of rehabilitation of Kenyans with cognitive impairments and other disabilities resulting from TBIs. From this preliminary review, it is apparent that despite TBI being a pervasive public health problem in Kenya, it has not received due attention in the public and private sectors as evidenced by a serious lack of post-acute rehabilitation services for people with TBIs. Implications for this lack of services are discussed and recommendations are made for potential approaches to this problem.

Keywords
Kenya, traumatic brain injury, head injury, brain injury, brain injury rehabilitation

Introduction
Traumatic brain injury (TBI) continues to be a significant public health problem in the world, manifested by high levels of mortality and disability, and exerting undue financial burden on governments and individuals in terms of treatment costs and lost manpower. This burden is felt most acutely by developing countries, which in addition to having the least resources have a disproportionately high prevalence of TBIs primarily due to the substantially higher incidence of road traffic accidents in those countries. As one of the rapidly developing nations in Africa, Kenya has a significantly high rate of traffic-related deaths and disabilities most of which result from brain injuries. Although there are no accurate numbers available on the prevalence of TBIs in Kenya, the high frequency of motor vehicle–related injuries and fatalities, and the numbers mentioned in the articles reviewed for this article, point to a high occurrence of brain injuries in the country.

Broadly defined, TBI is an insult to the brain caused by an external physical force or penetration of the skull by a foreign object. A TBI is not congenital or degenerative in nature and is not the result of a disease (Falvo, 2009) or acute illness. TBI is typically classified as mild, moderate, or severe. Between 10% and 30% of TBIs are considered moderate and between 5% and 25% are in the severe category. Severity of injury is generally determined by Glasgow Coma Scale (GCS) ratings immediately following the injury, usually upon arrival at a treatment facility.

The World Health Organization (WHO; 2011) estimates that each year more than 10 million people in the world sustain TBIs resulting in death or extensive hospitalization (Hyder, Wunderlich, Puvanachandra, Gururaj, & Kobusingye, 2007; WHO, 2011) with the survivors often acquiring a permanent disability (Roozenbeek, Maas, & Menon, 2013). Most recent data indicate that TBI is responsible for more than 4.5 million deaths a year which translates to approximately one in every 10 deaths in the world. This number is expected to increase, especially due to the rapidly increasing rates of TBI in developing countries. The WHO predicts that by the year 2020, TBI will be the leading cause of mortality and disability in the world, surpassing chronic diseases and other current leading causes of death (WHO, 2002). That increase is expected to be even more pronounced in developing countries where that trend is already evident. Between 1970 and 2000, the number of road traffic accident deaths in Africa increased by 35% (El-Gindi, Mahdy, & Abdel Azeem, 2001).

It is for this reason that TBI has often been referred to as “the silent epidemic” (Langlois, Rutland-Brown, & Ward, 2011).
2006) especially due to the fact that most of its consequences, especially cognitive impairments, are not obvious. Unlike physical or sensory disabilities, many people with TBI do not appear to have a disability. Visible or not, TBI continues to be a significant public health problem accounting for billions of dollars in medical expenses and lost manpower every year. That financial and human capital burden is felt by all countries, but most profoundly by developing and underdeveloped countries that have disproportionately higher prevalence of TBI.

While there are many causes of TBI, road traffic accidents are responsible for about 60% of brain injuries in the world (Hyder et al., 2007). Globally, road traffic accidents are responsible for more than 50 million injuries every year, with about 1.2 million ending in death (Jacobs & Aeron-Thomas, 2012; WHO, 2011). Other causes are falls, which account for about 25%, and other non-motor-vehicle-related accidents and acts of violence which collectively account for about 15% of TBIs (Hyder et al., 2007).

Although developing countries have the lowest number of motor vehicles, they have the highest road traffic accident mortality rates (Saidi, Mutiso, & Ogengo, 2014). As a continent, Africa has about 4% of the world’s motor vehicles. However, the number of road traffic accident fatalities on the continent account for 11% of all motor vehicle related deaths in the world (Jacobs & Aeron-Thomas, 2012). In contrast, developed countries, who own 60% of the world’s motor vehicles, account for only 14% of global road traffic accident fatalities (Saidi et al., 2014).

Over the past 40 years, there has been a significant decrease in road traffic accident deaths in developed countries, while in developing countries like Kenya, the opposite has been true as road traffic accident mortality rates have increased exponentially (Mwang’ombe & Shitsama, 2013; Pratte, 1998). Factors attributable to the decline in road traffic accident fatalities in industrialized countries include implementation of preventive measures (Jennett, 1996), including mandatory helmet and seat belt laws, rigorous enforcement of alcohol limits, and enforcement of speed limits by traffic police. In developing countries, the rapid increase in road traffic accidents and associated deaths is primarily due to driving in excess of the speed limit (Bachani et al., 2012); lack of, or inadequate enforcement, of traffic laws (El-Gindi et al., 2001; Pukose, 2007); lack of helmet laws or of enforcement thereof; driving while intoxicated (Hassan, Macharia, & Atinga, 2005; Odero, Garner, & Zwi, 1997); operation of unroadworthy vehicles (El-Gindi et al., 2001); and poor road conditions.

**TBI in Kenya**

In Kenya, the mortality rate from road traffic accidents has been increasing every year since independence in 1963 (Bachani et al., 2012). Currently, it is estimated that 3,000 Kenyans die as a result of road traffic accidents every year, and thousands more are incapacitated, causing huge financial burdens on their families and on the public health system (Odero, Khayesi, & Heda, 2003; Saidi et al., 2014). In their 2003 study of road traffic injuries, Odero and his colleagues found that the mortality rate in Kenya was 68 for every 10,000 registered motor vehicles (Odero et al., 2003), a rate that is about 40 times greater than in developed countries. According to a study by Bachani and others in 2012, road traffic accident–related fatalities in Kenya increased at a rate of 7% between 2004 and 2009. During that period, the number of motorcycle-related injuries increased by 29%. Like others before it, this study revealed that speeding, failure to use seat belts, and failure to wear helmets and/or reflective clothing were among the primary contributors to the high mortality.

As with most developing countries, determining the prevalence of TBI in Kenya is, to an extent, a matter of estimation due to the large number of factors and variables involved (Hyder et al., 2007). First, there is the epidemiological issue of the universal tendency to confuse TBI and head injury. Head injury typically refers to any visible lacerations, abrasions, or contusions to the face or skull (Bruns & Hauser, 2003) which may not necessarily result in an injury to the brain. On the contrary, some brain injuries such as concussions can occur without any visible external injuries. It is perceivable that many cases of TBI go unreported because they are recorded as head injury. It also is perceivable that many cases of mild brain injury, which constitute the majority of TBIs, go unreported (Hyder et al., 2007) and that some head injuries are reported as TBIs. In the case of Kenya, language could be an additional factor as those who transport accident victims to the hospital may not be fluent in English and may report the circumstances of the accident in Kiswahili or any of the other 41 languages, potentially confusing the words for “brain” and “head” in reference to the victim’s injuries.

In serious accidents in which the victims sustain many injuries, triage and emergency room treatment typically focuses on the visible injuries such as fractures or open wounds; and brain injuries may not be detected until many days or weeks later. In that case, those TBIs may never make it into the TBI statistics as they were not reported as a direct result of the accident. Furthermore, in cases in which the individual dies at the accident scene, in transit to the hospital, or upon admission, the death may be attributed to other injuries. Compounding the problem in developing countries such as Kenya is the lack of evaluative skills among lower level medical staff, the lack of knowledge regarding assessment tools such as GCS and Injury Severity Score (ISS), and the lack of an adequate data documentation and recording system (Saidi et al., 2014) especially in rural areas. Therefore, although some records exist on the prevalence of TBI in Kenya in particular, and the developing world in general, they are in most likelihood a gross underestimation of the true numbers of TBIs that actually occur there.
In Kenya, the above factors in combination with the sharp increase in the number of motor vehicles, and in particular motor cycles (Khanbhai & Lutonia, 2012; Saidi & Mutisto, 2013), have resulted in a significant rise in the number of road traffic accidents (Osoro, Nganga, Oundo, Omolo, & Luman, 2011) and consequently in the number of people who sustain TBI as a result. As stated before, accurate numbers on the incidence of TBI are difficult to determine due to a lack of a centralized national reporting and record keeping system.

The most recent reliable study on road traffic injuries rates in Kenya (Bachani et al., 2012) puts the rate at about 60 per 100,000 population. Based on the fact that TBIs are the single most common consequence of road traffic accidents, and that TBI accounts for about 50% of all road traffic accident deaths (Saidi, Macharia, & Atinga, 2005), it is easy to see, even without exact numbers, that Kenya has a high incidence of TBI. The global prevalence of TBI is estimated at 200 per 100,000 population. However, the rates vary between countries and regions, ranging from 67 in some developed countries to 317 in some developing countries. The prevalence rate in Kenya remains unknown. However, based on global rates, prevalence in comparable countries in Africa, and on the high incidence of road traffic injuries and its high correlation with TBI, the prevalence is likely to be on the higher end of the global TBI prevalence.

Literature Review

A review of literature on this participant resulted in very few articles written on TBI in Kenya. To be precise, only four articles were published in peer reviewed journals between 2001 and 2013. The literature search also identified six articles in the form of unpublished dissertations and manuscripts almost exclusively written by students and faculty of the University of Nairobi in the same period. Although none of the 10 articles include TBI incidence or prevalence rates, they all allude to a high incidence of TBI in Kenya. Incidentally, all of the articles are based on studies or research carried out at Kenyatta National Hospital (KNH), the teaching hospital for the University of Nairobi, which is also the largest referral hospital in Kenya. A search of articles on TBI based on treatment at other medical facilities in Kenya yielded no results.

The most recent is a 2013 article by Wekesa, Ogongo, Siongei, Elbusaidy, and Iwaret published in the East and Central African Journal of Surgery, in which the authors discuss the demographics of participants with traumatic head injuries at KNH. Wekesa et al. (2013) reiterated the challenges of determining the epidemiology of TBI in developing countries such as Kenya due to the scarcity of CT scans, the main diagnostic tool for TBI, and the issue of polytrauma injuries and fatalities in which brain injury is often not factored. They proceeded to present findings of the cross-sectional study whose specific focus was on patients with intracranial bleeding resulting from brain trauma. The study included 51 patients between 4 and 81 years of age, the majority of whom were male (96%). Other relevant demographics included that 55% of the participants were married, 57% had elementary (primary) education, 47% were employed, 35% were alcohol consumers, and 21% were cigarette smokers. These demographics are typical of a cross section of Kenyans and are comparable with the patient demographics in all other studies reviewed.

Citing other studies, including one done in the United States in 1994, the authors pointed out the association between TBI and low social economic status in Kenya. In addition, they inferred that the level of education is negatively correlated to TBI incidence in that less than 4% of the TBI patients in their study had tertiary education, as opposed to 68% who had little or no education. They added that although 47% of the participants reported being employed, they were engaged in low paying jobs consistent with their low academic level (Wekesa et al., 2013). The authors concluded their article by calling for more population-based studies on TBI to present a clearer picture of the incidence and impact of TBI in Kenya.

In 2011, Kiboi, Kitunguu, Angwenyi, Mbuthia, and Sagina conducted a study on the predictors of functional recovery following TBI involving intracranial hematomas. In their study, which was published in World Neurosurgery, the authors started by highlighting the significance of intracranial hematomas which they describe as the most common clinical problem encountered by neurosurgeons, and which is associated with high mortality rates and very poor prognosis among TBI patients (Kiboi, Kitunguu, Angwenyi, Mbuthia, & Sagina, 2011). For their study, which was the first to address that particular medical participant among Kenyan patients, the authors reviewed records of 608 patients diagnosed with TBI and admitted at KNH neurosurgical unit between January and December, 2009. Their review specifically looked for treatment variables predictive of favorable functional outcomes. As expected, the majority of the patients were male (89%), with about 50% of the patients between the ages of 26 and 45. Surprisingly, 48% of the patients had sustained TBI as a result of assault, with road traffic accident and falls contributing to the other 51% of the patients.

According to their findings, 46% of the patients achieved “good functional recovery” (Kiboi et al., 2011) whereas 34% ended up with moderate or severe disability, which translates to approximately 231 people. The report did not account for the remaining 20% of the patients, but based on other studies, that could be the number that died during treatment. A significant finding from that study was that patients who sustained TBI from motor vehicle accidents were less likely to achieve functional recovery than those whose TBI resulted from falling. From the data, the authors concluded that long periods between injury and treatment, poor GCS scores, pupillary abnormalities, and being older than 61 years were predictive of poor functional recovery.
In an article published in the *Annals of African Surgery*, Opondo and Mwangombe (2007) reported that their research was conducted on 87 patients with TBI admitted at KNH Intensive Care Unit (ICU) between April and September, 2005. Fifty-eight percent of the patients were involved in road traffic accidents. The purpose of the research was “to determine the outcome of severe traumatic brain injury and to document the factors influencing mortality” (Opondo & Mwangombe, 2007, p. 1). Precisely, they wanted to look at the differences in treatment between TBI patients who had survived and those who had died, to determine what could be done differently to increase the survival rate. Mortality among the 87 patients admitted during that 6-month period was 54%. Among those who survived, 29% were severely disabled or remained in a persistent vegetative state. From the study, the authors determined that GCS score of less than 5, diffuse axonal injury, intracerebral lesions, and high blood sugar were the primary factors influencing poor outcomes.

The oldest journal article identified on this participant was one written by Mwang’ombe and Kiboi (2001) and published in *the East African Medical Journal* in 2001. This article describes a study which, like the one by Wankesa and his colleagues, focused on identifying factors that influence the outcome of severe TBI at KNH. This was a retrospective study on the 677 patients who were treated for severe head injury at KNH between January 1992 and December 1996. The demographics of the patients in this study were comparable with those in the other two studies, that is, males outnumbered females, with the majority of the patients being between 26 and 45 years of age. The study indicated that 56% of the patients died while undergoing treatment. About 38% had moderate to good recovery which in this context was defined as “resumption of normal life with moderate or minor neurological or psychological deficits” (Mwang’ombe & Kiboi, 2001, p. 238). From this study, the authors concluded that age, GCS score, systolic blood pressure, and pupillary reaction to light were the leading predictors of outcomes following TBI.

Two of the dissertations found on the participant of TBI in Kenya focused on institutional structure and practitioner skills and performance, and how they affect the outcomes of TBI patients at KNH. The first one, written by Bhoyyo (2010), was based on a study of the management of patients with severe TBI at KNH, in particular, the practices of anesthesia and neurology practitioners and their adherence to guidelines established by the Brain Trauma Foundation (BTF). The study was carried out via a self-administered questionnaire given to 53 practitioners who worked directly with head injured patients. According to Bhoyyo, the study revealed that many of the practitioners did not follow the protocol of care on a regular basis. For example, only 20% of the practitioners managed hypotension in TBI patients as required by BTF. Among the reasons given for failure to meet the set guidelines were limited staff and resources, including hospital beds.

The other dissertation, authored by L. W. Macharia (2013), aimed to “determine the structure and processes that support quality nursing care for TBI patients” (L. W. Macharia, 2013). For the study, the author recruited 133 participants working in the Critical Care Unit (CCU) and Accident Emergency (AE) departments at KNH, the majority of whom had at least 5 years experience. From the study, Macharia found that there was a significant correlation between nurses’ knowledge (skills) and the quality of their management of TBI patients, especially the prevention of secondary TBI in the two departments. As in Bhoyyo’s study, the challenges reported by the participants included inadequate staff, lack of or shortage of equipment, and lack of guidelines.

A comprehensive study on cognitive dysfunction among TBI patients at KNH was conducted by Gachanja (2013) and reported in an unpublished manuscript. The goal of the study was to determine the prevalence and extent of cognitive dysfunction using some standard assessment tools including the Mini Mental Status Exam (MMSE), the Trails Making Test (TMT), and the Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) Part A and B. Participants in the study were 74 (58 male and 16 female) brain injured patients with a mean age of 34 years. All participants were patients in the surgical clinic, neurology department, and treatment wards at KNH. According to the author’s report, 24 patients (32%) indicated moderate to severe cognitive impairment according to their MMSE results. Part A of the TMT revealed moderate or severe cognitive impairment in 27 (36%) of the patients, while Part B indicated moderate or severe cognitive impairment in 37 of the patients (50%). Fifty-eight percent of the patients were ranked as moderately or severely cognitively impaired by the RBANS. That study reported significant association between cognitive impairment and age, education level, and socioeconomic status. In her conclusion, based on the study, the author recommended clinical screening and cognitive rehabilitation of TBI patients to improve their quality of life.

An unpublished manuscript by Wafula (2010) addressed the age factor in the early outcomes of TBI. Based on a study on 67 patients (67% adults and 33% children) with severe head injury at KNH, the study found that children ages 3 to 5 were the majority in the pediatric group. Poor outcomes (mortality) were associated with patients at the extremes of the age spectrum, that is, the youngest and the oldest. One of the important findings in Wafula’s study was that children had significantly fewer poor outcomes than adults with similar GCS scores, suggesting a higher rate of survival among severely head injured children than adults. However, in an overall, study-wide comparison between outcomes of children and those of adults, no statistically significant difference was noted.

A retrospective study by Amukoa (2007) used 132 patients with severe head injury admitted to the ICU at KNH between January and April, 2007. Similar to other studies discussed
earlier in this review, there was a significant male preponderance (88%) among the participants. Road traffic accidents as a primary mechanism of injury accounted for 82% of the participants. This study reported that “only 25% of the patients had surgery while the rest had conservative management” (Amukoa, 2007). According to the study, 91% of the 132 patients died while in the ICU and only 9% were discharged. Significantly, this study brings to view the picture of an overwhelmed emergency and intensive care system in Kenya where mortality is unnecessarily high due to a shortage of medical personnel and resources.

The last of the unpublished manuscripts reviewed on this participant was one by Mwang’ombe and Shitsama (2013). This article, which the authors presented at an international scientific conference, summarizes several studies conducted by the lead author between 1979 and 2009, separating the findings of the studies conducted before CT scan came into operation at KNH (1979-1985) from those conducted in the CT scan era (1999-2009). The most significant facts that came out of this article are that although the male to female ratio among the participants (7:1 and 8:1) and other demographics were comparable in the two periods, the mortality during the pre-CT period was 16%, a sharp contrast with the overall mortality rate of 57% during the CT period, with 60% of the patients dying within 48 hours of admission (Mwang’ombe & Shitsama, 2013). By itself, this article presents an empirical picture of the tremendous increase in TBI deaths in Kenya over the past 30 years (W. M. Macharia, Njeru, Muli-Musiime, & Nantulya, 2009).

Discussion and Recommendations

Overall, this literature review paints a grim picture of TBI in Kenya, in terms of epidemiology and the quality of services available for people with TBIs. At the very least, the review confirms a high and continually increasing prevalence of TBI in Kenya, based on the numbers mentioned in all the studies reviewed. More importantly, the literature points to a significantly high mortality rate among TBI patients who make it to the hospital; validates the notion that in Kenya, road traffic accidents are a primary cause for TBIs in particular, and mortality in general; and raises significant concern that little is being done to curb this epidemic, or to improve the treatment of its victims to increase the survival rates.

What is glaringly absent from all the articles written on TBI in Kenya, with the possible exception of the study by Gachanja, is what happens to those TBI patients who survive and are discharged from hospital. In other words, all scholarly literature available on TBI in Kenya pertains to the (hospital) treatment of people with brain injuries with no mention of any post-hospital rehabilitation services for TBI survivors, most of whom have moderate to severe limitations (Gachanja, 2013; Kiboi et al., 2011; Opondo & Mwangombe, 2007). As there are no outpatient brain rehabilitation programs affiliated with the hospitals such as KNH, and none in the private sector, TBI survivors in Kenya currently have nowhere to go for brain injury rehabilitation services such as cognitive rehabilitation that can enable them to gain an amount of independence and improve their quality of life, including obtaining employment when possible. These patients are typically discharged to their families where they continue to present as a financial burden directly to those families and indirectly to society (Saidi et al., 2014). Alternatively, they are left to fend for themselves, consequently, increasing their chances of sustaining additional brain injuries. This contrasts sharply with the attention given to other types of disabling conditions in Kenya such as visual impairment, deafness, and developmental disabilities for which there exists rehabilitation services including vocational training programs.

TBI is a worldwide problem exerting tremendous economic burden on public and private health systems in the affected countries. Although actual figures are currently unknown (Humphreys, Wood, Phillips, & Macey, 2013), it is clearly in the billions of dollars lost each year in terms of treatment costs and lost productivity. Nowhere is that impact felt more than in the developing countries such as Kenya where there is not enough money (Bryan-Hancock & Harrison, 2010) to cover more critical health care needs. As studies have shown, the majority of TBI victims are people between the ages of 20 and 50 (Bruns & Hauser, 2003; Humphreys et al., 2013; Mwang’ombe & Kiboi, 2001; Saidi et al., 2014), which represents a period in life when they are at the peak of their productive potential (W. M. Macharia et al., 2009). In addition, the majority of TBI victims are males, who in most cases are the primary or sole breadwinners in their families. Death or disability among this population represents an irreparable and permanent loss of income and livelihood to dependents, resulting in a cycle of poverty (Eide & Ingstad, 2013) and dependence on society. Moreover, in countries such as Kenya where there is no social welfare system, the repercussions are far reaching as dependents of TBI victims may discontinue their education prematurely due to lack of financial support, often resorting to under-age employment or engaging in criminal behavior.

It is therefore of crucial importance that steps be taken not only toward the prevention of TBI related deaths in Kenya but also in the rehabilitation of those who acquire cognitive impairments as a result of TBI, to help them return to independent and productive lifestyles. To accomplish that, there is a need for a comprehensive cross-sectional study of Kenyans with TBI who have been discharged from KNH and other hospitals in the country to determine their status in terms of health and functioning, access to resources including health services, and their needs and aspirations. Such a study could be used to help inform policy on addressing the rehabilitation needs of people with TBI in Kenya.

There is also an urgent need for the establishment of a clinical screening process to identify specific cognitive limitations as soon as possible following brain for the victims to receive appropriate rehabilitation services as inpatients and
upon discharge. Most importantly, urgent consideration needs to be given for the establishment of a rehabilitation facility for people with TBI in Kenya so that they too can have the opportunity to return to independent lifestyles and to participate in life activities like their counterparts.

Declaration of Conflicting Interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The author(s) received no financial support for the research and/or authorship of this article.

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