UNDERSTANDING MENTAL HEALTH CONSEQUENCES AND ASSOCIATED RISK FACTORS AMONG ADULT INJURY SURVIVORS IN KENYA

by
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Abstract

Background

An elevated level of mental health burden has been reported among various injury populations in high-income settings, and such burden has been associated with decreased social functioning, return to work and long-term impairment in functioning. Low- and middle-income countries (LMICs) have a much higher burden of injuries than high-income regions. However, there has been a lack of research on the mental health consequences among injury survivors in LMICs. The overall goal of this dissertation is to estimate the risk factors and trajectories of depressive, anxiety, and post-traumatic stress symptoms among adult injury survivors in Kenya, in terms of internationally applied mental health concepts as well as from the survivor's perspective.

Methods

The dissertation applied an explanatory mixed method design. The quantitative analyses included chapters 4 and 5. Data for quantitative analyses came from a prospective cohort study on Health, Economic and Long-term Social Impact of Injuries (HEALS). The HEALS study participants were recruited at Kenyatta National Hospital. Chapter 4 examined the trajectories of depressive and anxiety symptoms between hospitalization and up to seven months after discharge and associated risk factors of the trajectories. Analyses of chapter 4 included 644 adult injury patients. Depressive and anxiety symptoms were assessed using Hopkins Symptoms Checklist at baseline and follow-ups. Latent growth curve analyses were used to model the trajectories of depressive and anxiety symptoms and their risk factors. Chapter 5 examined the trajectories of post-traumatic stress symptoms between one and up to seven months after discharge and the

association with potentially traumatic events and other risk factors. Analyses of chapter 5 included 476 adult injury patients. Post-traumatic stress disorder symptoms were assessed using PTSD Checklist version 5 (PCL-5) at each follow-up and trauma history was assessed in the hospital using Brief Trauma Questionnaire. The level of disability was assessed at each follow-up interview. Latent growth curve analysis was conducted to estimate the trajectories of PTSD symptoms 4 to 7 months after hospital

discharge. Risk factors and trauma history characteristics were preliminarily assessed using R3Step and subsequently included in multivariate logistic regression using manual BCH methods.

Chapter 6 used a qualitative method to understand the different experiences and contributing factors of psychological distress and resilience among unintentional injury survivors in urban Kenya. In-depth interviews were conducted with 28 survivors of unintentional injuries in Nairobi and nearby area, four to eight months after the injury. Inductive thematic coding was performed on transcribed and translated interviews, after which the Conservation of Resources theory was adapted to identify the relationship between the resource losses, gains and psychological distress/resilience at the various stages of recovery, beginning with the injury event.

Results

In chapter 4, two trajectories of depressive and anxiety symptoms were found for the period between hospitalization and up to seven months after hospital discharge: elevated depressive and moderate anxiety symptoms (13%), and low depressive and anxiety symptoms (87%). The elevated depressive and moderate anxiety symptoms trajectory was associated with being female, residing in a rural area, prior trauma experience, longer hospitalization, worse self-rated health status while in the hospital, no household assets nor savings, and without monetary assistance during hospitalization.

In chapter 5, two trajectories of post-traumatic stress symptoms were found between 1-month post-discharge and 4- to 7-months post-discharge: persistently elevated PTSD symptoms (9%), and low PTSD symptoms (91%). Having previously been exposed to potentially traumatic events and the number of types of trauma exposed were associated with an elevated PTSD symptom trajectory, but no longer associated after controlling for having depressive symptoms while in the hospital. Having previously witnessed killings or serious injuries was associated with elevated PTSD symptoms trajectory class, controlling for other risk factors and direct association with disability level at 4 to 7 months. Being female, having elevated depressive symptoms during hospitalization and having no household savings nor assets were associated with elevated PTSD symptoms trajectory.

Chapter 6 found several types of resource loss described, including financial, property, condition, and physical health resources at different phases of recovery. Improvement in physical health, personal

resources, social support through family, friends, neighbors and church members, and spirituality have contributed to the adaptation and resilience demonstrated among injury survivors.

Conclusion

These findings show the burden of depressive, anxiety, and post-traumatic stress symptoms several months after physical injury in a predominantly male, urban population in a lower-middle income country. This underscores the importance to identify patients who experienced worse psychosocial outcomes to provide preventive and early interventions through follow-up after hospital discharge. Potential interventions on providing social welfare and facilitating social network building may also help reduce distress and overall functioning.

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Chapter 1. Introduction

Injuries account for one-tenth of the disability-adjusted life years (DALYs) lost globally (Haagsma et al., 2016). The most recent Global Burden of Disease findings suggest a declining global trend in the rates of DALYs compared to 1990; however, the rates in low- and middle-income regions remain much higher than high-income regions (Haagsma et al., 2016). Additionally, low- and middle-income countries (LMICs) comprise a large proportion of young people (United Nations, 2009), a sub-group known to be at an increased risk of injuries (Herbert, Hyder, Butchart, & Norton, 2011). A systematic analysis of the latest Global Burden of Disease Study found injuries were among the top three causes of DALYs in both young males and females (Mokdad et al., 2016).

Besides physical health consequences, physical injuries have multi-dimensional impacts on individuals, including psychological health and social consequences (Clay, Fitzharris, Kerr, McClure, & Watson, 2012; Michaels et al., 2000). An increased mental health burden has been identified among various injured populations in high-income settings, including motor vehicle injury survivors (Blanchard, Hickling, Taylor, & Loos, 1995; Coronas, Garcia-Pares, Viladrich, Santos, & Menchon, 2008; Heron-Delaney, Kenardy, Charlton, & Matsuoka, 2013), crime victims (Boccellari et al., 2007), fall-related injuries (Bosma et al., 2004), occupational injuries (Lin et al., 2012), burn injuries (Öster & Sveen, 2014; Sveen, Ekselius, Gerdin, & Willebrand, 2011), traumatic injuries (Bryant et al., 2010; Holbrook, Anderson, Sieber, Browner, & Hoyt, 1999; Mason, Turpin, Woods, Wardrope, & Rowlands, 2006; Michaels et al., 1998), and severe injuries (Forbes et al., 2015; O'Donnell et al., 2016). Many of these studies focused on post-traumatic stress disorder (PTSD), while depression and anxiety were comparatively less studied (Wiseman, Foster, & Curtis, 2013). Recent research from Australia has found a long-term mental health burden after injury (Bryant et al., 2015; O'Donnell et al., 2016). O'Donnell et al. (2016) found incidence rates of PTSD, depression, and anxiety were several times higher among post-injury populations 72 months after injury compared to a general community population. When studying the recovery pathway post-injury, mental health has been found to impact social functioning, return to work and long-term functioning (Clay et al., 2012; Holtslag, van Beeck, Lindeman, & Leenen, 2007; O'Donnell et al., 2013).

Despite the high burden of injuries in LMICs, a dearth of evidence exists on the mental health consequences and outcomes of injury among populations in these countries, where health systems are less developed to respond appropriately. The lack of research on this topic mirrors the broader lack of research on mental health in LMICs (Ipser & Stein, 2007; Saxena, Paraje, Sharan, Karam, & Sadana, 2006). The few longitudinal studies from LMICs focused on injuries examined mechanisms of injury in specific survivors and did not represent a general injury population (Pérez-Rincón Merlín, González-Forteza, Ramos Lira, & Jiménez Tapia, 2007; Sadeghi-Bazargani, Maghsoudi, Soudmand-Niri, Ranjbar, & Mashadi-Abdollahi, 2011; Yasan, Guzel, Tamam, & Ozkan, 2009). Findings from cross-sectional studies in urban Kenya indicate a high burden of PTSD and major depression while in the hospital (Ndetei et al., 2009; Ongecha-Owuor, Kathuku, Othieno, & Ndetei, 2004). To date, no information has been available on the short-term development of injury survivors' mental and physical health after injuries that include various injury mechanisms. Moreover, qualitative research on the effect and putative processes involved in the development of mental ill health symptoms in Kenya is lacking.

This dissertation study included three aims: (1) examine the risk factors for and trajectories of depressive and anxiety symptoms among adult injury survivors between hospitalization and up to 7 months after discharge, (2) estimate PTSD symptoms trajectories 4 to 7 months after discharge among adult injury survivors and associated risk factors, and (3) understand the experiences and coping with mental ill health symptoms from adult unintentional injury survivors' perspective. The study was nested in a longitudinal cohort of adult patients; therefore, I was able to explore the various patterns of symptoms and associated disability over time after hospital discharge. I also explored the psychological distress and resilience with the psychosocial consequences through aim 3 using qualitative methods.

The dissertation begins with a literature review of the burden of injuries, their consequences on mental health and impairment in functioning, and available background information on injuries and mental health burdens in Kenya. The methods chapter then focuses on the study design, study population, procedure of data collection and statistical analyses. Chapters 4-6 addresses the three aims of the study. The final chapter discusses the findings, strengths, and limitations of the dissertation and implications for programs, policy, and future research.

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Chapter 2. Background

Burden of injuries and Health Systems Responses

Globally, injuries accounted for approximately five million deaths and 248 million disability-adjusted life years (DALYs) lost in 2013 (Haagsma et al., 2016). This translates to roughly 10% of the global burden of diseases as expressed in DALYs. The proportion of DALYs lost due to injuries has remained similar to findings from the 2010 Global Burden of Disease (GBD) Study (2016). Despite an overall decline of all injury DALY rates globally between 1990 and 2013, the rate of change varied widely between regions and mechanisms (Haagsma et al., 2016). The rate of injuries leading to death or disabilities in developing countries has remained higher than developed countries (Haagsma et al., 2016). While several major mechanisms of injury burden decreased between 1990 and 2013, road traffic injuries have become the major cause of death among injuries during this period, while the health burden of falls also increased and remained the highest disability burden among all injuries (Barth, Kopfmann, Nyberg, Angenendt, & Frommberger, 2005; Haagsma et al., 2016). The less developed regions have predominantly young populations (United Nations, 2009), among which injuries constituted a major health burden. Among young people, 15 to 24 years, road traffic injuries and interpersonal violence were among the top causes of DALYs lost globally (Mokdad et al., 2016).

Injuries remain a neglected health burden in low- and middle-income countries (LMICs), where health care systems often lack critical infrastructure to prevent and treat the health burden associated with injuries (Gosselin, Spiegel, Coughlin, & Zirkle, 2009; Sakran, Greer, Werlin, & McCunn, 2012; Wong, Gupta, Deckelbaum, Razek, & Kushner, 2015). Sub-Saharan Africa has over 4000 DALYs lost to injuries per 100,000 in 2013, which was close to twice the rate of developed regions such as North America, Western and Central Europe (2016). Besides being a major contributor to mortality, injuries leave many more individuals temporarily or permanently disabled (Holbrook, Anderson, Sieber, Browner, & Hoyt, 1999; Rainer et al., 2014). Although a gross estimation, the rate of permanent disability resulting from an injury is estimated to be between 10 and 50 times higher than injury-related deaths (Debas HT, 2006).

Amid the growing burden of injuries in many developing countries, primary, secondary, and tertiary injury prevention are necessary for the health systems. While many LMICs have been implementing injury-specific interventions including secondary preventions for RTIs such as seatbelts,

child restraints, and drink-driving, less evidence has been available in LMICs on primary and secondary interventions for burns and falls (de Ramirez, Hyder, Herbert, & Stevens, 2012). Besides primary prevention interventions, a substantial reduction in the burden of injury deaths and disability have been estimated by strengthening trauma and emergency care system in LMICs, which was also considered as being cost-effective (Anderson et al., 2012). However, trauma care is often perceived as being restricted due to a mismatch of resources and health burden (Wisborg, Montshiwa, & Mock, 2011). It has been estimated that 11% of DALYs globally are due to conditions that could be treated with surgery, and the potential DALY reductions are disproportionately higher in LMICs, as compared to developed countries (Sakran et al., 2012). A recent study estimated that basic surgical care could potentially avert 21% of the injury burden in LMICs (Higashi et al., 2015). The study found Sub-Saharan Africa has the highest potentially avertable injury burden (25%) (Higashi et al., 2015), highlighting the health systems response gap. Initiatives that combine multiple approaches are required to effectively address the urgent need to improve trauma care in LMICs. In order to establish an essential package of trauma care that utilizes feasible low-cost improvements, global consultation has been held to establish an essential trauma care program in early 2000s (Joshipura, Mock, Goosen, & Peden, 2004), which was later reinforced by the World Health Assembly's (WHA's) Resolution on Health Systems: Emergency-Care Systems (2007). Critical elements in this essential package include identifying unmet needs in the prehospital and emergency trauma care systems and develop a core set of services, strengthening the provision of trauma and emergency care, and ensuring data sources being sufficient to objectively monitor the outcomes to strengthening trauma and emergency care systems (Mock, Arafat, Chadbunchachai, Joshipura, & Goosen, 2008; 2007).

Trauma care operates on a spectrum, ranging from pre-hospital care, hospital-based care, critical care, to rehabilitation. While strengthening the capacity for pre-hospital and hospital-based care has been the focus of local governments as well as international donors, there remains limited information on the need for long-term rehabilitation in many LMICs and patients' outcomes following hospital discharge.

Consequences of injuries

Short-term consequences of injury have been primarily studied in relation to injury severity as a predictor of survival. A number of measures have been developed to classify severity of injuries, including

the Abbreviated Injury Scale (AIS), which was developed in 1970 on the threat to life (*The Abbreviated Injury Scale*, 1998). Several other metrics have been developed to characterize the severity of injury, and serve to inform the need for care and treatment and the effective use of resources, including Injury Severity Score, the New Injury Severity Score, the Anatomic Profile, and the Anatomic Profile Score (Segui-Gomez & MacKenzie, 2003). However, their association with long-term outcome remains unclear due to various factors, including the availability of medical care and its quality, comorbidities, and economic status, among other factors. Additionally, consequences of non-fatal injuries may extend beyond the injured person to their families and the health care systems (Segui-Gomez & MacKenzie, 2003).

Beyond survival, health outcomes include impacts on physical, mental and social well-being after injury. Various types of measurements have been used to assess functioning status as a result of non-fatal injury. Measures of general health status and well-being such as activities of daily living (ADL) and instrumental activities of daily living (IADL) have been applied to different health conditions including injury, particularly in the United States (Segui-Gomez & MacKenzie, 2003). Other quantitative measures have been used to assess different domains of functionality, including physical health, mental health, and social functioning among injured individuals (Segui-Gomez & MacKenzie, 2003). However, the majority of these have only been applied in developed settings.

While some patients fully recover after having been injured, others are left with temporal or permanent disabilities. Traditionally, disabilities have been perceived as a separate spectrum from health and viewed solely as bodily impairment (Kostanjsek, 2011). As functionality has become a core component in the measurement of the burden of non-fatal injuries, a framework of disability – the *International Classification of Functioning, Disability and Health* (ICF) has been conceptualized to include dimensions of health conditions with functioning, activity and contextual factors (Kostanjsek, 2011). The ICF addresses limitations of the predecessor model – *The International Classification of Impairment, Disability and Handicap* (ICIDH), and adopts an integrative model that incorporates biological and psychosocial components in relation to the environmental context (World Health Organization, 2002). The ICF model has recently been applied on health outcomes and rehabilitation needs after major injury to align comprehensive measurements important for patients, health professional and trauma systems in a developed context (Hoffman, Playford, Grill, Soberg, & Brohi, 2016). Findings indicate that while patients

and health care professionals largely agreed on body structure and body functions categories in the ICF framework, patients and health care professionals identified larger discrepancy areas of concern in activity, participation and environmental components (Hoffman et al., 2016). Results from patients found stress management being considered the third most limiting factor in activity and participation (Hoffman et al., 2016).

Mental Health Consequences Post-injury

Besides the impact on physical health, injuries are associated with a range of psychological consequences, including higher rates of mental disorders (Richard A. Bryant et al., 2010) (Sareen et al., 2013)(Wiseman, Foster, & Curtis, 2013). Post-traumatic stress disorder (PTSD), major depressive episode, and generalized anxiety disorder have been recognized as significant mental disorders associated with traumatic injury (Wiseman et al., 2013), and substance use disorders and panic disorder to a smaller extent (Maes, Mylle, Delmeire, & Altamura, 2000). A study of injury patients in Australia found higher rates of a wide range of psychiatric disorders prevalent at 3- and 12-month post-injury (Richard A. Bryant et al., 2010).

Psychological consequences of physical injury have long been recognized (Malt, 1988; Mattsson, 1975). While PTSD is the only mental disorder that requires both a symptom profile and exposure to a severe stressor in its etiology, a range of other mental disorders is common in the aftermath of exposure to potentially traumatic events. PTSD has been the most commonly studied disorder among trauma patients (Wiseman et al., 2013); however, it may not be the most prevalent or relevant psychiatric disorders in such population. From a public health perspective, several researchers have recommended studying multiple mental disorders in the aftermath of exposure to major stressors (Wiseman et al., 2013). A study in Australia found major depressive episode, generalized anxiety disorder, and agoraphobia among the most common new psychiatric disorders developed post-injury from patients hospitalized for injuries (Richard A. Bryant et al., 2010). Another study from Australia following patients who had severe injury 72 months after hospital discharge found over a quarter of patients had at least one psychiatric disorder, and the most prevalent psychiatric disorder was a major depressive episode (11%), compared to 6% of patients with PTSD and 6% with generalized anxiety disorder at 72 months (O'Donnell et al., 2016). Dorrington et al. (2014) found that a population in Sri Lanka had a relatively low prevalence of lifetime PTSD despite high

exposure to traumatic events (Dorrington et al., 2014). The study also found statistically significant higher odds of having lifetime non-PTSD mental disorders, including major depressive disorder, dysthymia, generalized anxiety disorder, any anxiety disorder, panic disorder and social phobia among individuals exposed to trauma compared to individuals without trauma exposure, among which mood and anxiety disorders were the most common disorders (Dorrington et al., 2014). This strong association of non-PTSD mental disorder diagnoses with trauma exposure among a population in Sri Lanka and the high rates of various new psychiatric disorders developed post-injury in the Australia study highlight the importance of not limiting the investigation of mental health consequences of injury to PTSD alone.

Studies have illustrated several common psychiatric disorder comorbidities among survivors of traumatic injury (Richard A. Bryant et al., 2010; O'Donnell et al., 2016; O'Donnell, Creamer, & Pattison, 2004; Zatzick et al., 2008). PTSD has been found to be strongly comorbid with other lifetime mental disorders (Dorrington et al., 2014; Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995), as well as new cases post-injury (Richard A. Bryant et al., 2010). Among post-traumatic injury mental disorders, major depression has been found to be the most commonly comorbid with PTSD, as well as the most common mental disorder alone (Richard A. Bryant et al., 2010; Kessler et al., 2005; Shalev et al., 1998; Shih, Schell, Hambarsoomian, Belzberg, & Marshall, 2010).

With the high rates of comorbidity among post-injury mental disorders, the literature points to the possibility of a PTSD construct similar to that of depression. Although a cross-sectional study underlines the commonly associated factors with PTSD and major depression post-trauma (Roberts, Damundu, Lomoro, & Sondorp, 2009), longitudinal relationship between PTSD and major depression indicates a more complicated situation. O'Donnell et al. (2004) found shared risk factors among comorbid cases, but different sets of factors were associated with depression during the acute post-trauma phase (O'Donnell et al., 2004). A study by Shin et al. (2010) also noted differences in risk factors associated with the two disorders (Shih et al., 2010). Although an earlier study by Breslau et al. (2002) suggested that individuals exposed to trauma may not have a significantly higher risk of other mental disorders when compared to individuals unexposed to trauma among those who did not develop PTSD (Breslau, 2002), other studies found onset of other mental disorders post-trauma is highly common and does not always concentrate with PTSD (Richard A. Bryant et al., 2010; Shalev et al., 1998; Shih et al., 2010).

9

Post-traumatic Stress Disorder

The concept of a post-traumatic stress syndrome began to appear in clinical description during the 19th century among psychiatrists and physicians (Matthew J. Friedman, Keane, & Resick, 2014). Since its official introduction as a disorder in DSM-III in 1980, the criteria for diagnosis and classification of PTSD have been slightly modified in the latest DSM 5 (American Psychiatric Association, 2013). PTSD was recently re-categorized from being part of the class of anxiety disorders into a new class of "trauma and stressor-related disorders" in the DSM 5 (2013) Specifically, the criteria state that exposure to a traumatic event must meet "specific stipulations." Moreover, symptoms from each of four (previously three) symptom clusters: intrusion, avoidance, negative alternations in cognitions and mood, and alternations in arousal and reactivity" (American Psychiatric Association, 2013). The subjective experience of "fear, helplessness, and horror" (criterion A2 in DSM-IV) was removed from the exposure criteria as supported by both empirical data and the nature of emotional response may not exist in trained personnel or patients with traumatic brain injury (M. J. Friedman, Resick, Bryant, & Brewin, 2011).

While there has been critique that symptoms of PTSD may be misattributed to a traumatic event, Gilbertson et al. (2010) have supported the majority of psychopathologic symptoms in PTSD are due to exposure to traumatic events through a case-control study conducted among identical twin pairs (Gilbertson et al., 2010). The conditional probability that PTSD follows an exposure is also different by event. For instance, the conditional probability of PTSD after rape is much higher than witnessing killings or a serious injury (Breslau, 2009). While not all moderate or severe injuries involve trauma exposure, road traffic injuries and interpersonal violence are two of the most common causes of injury and are both considered traumatic in nature (Ehlers, Mayou, & Bryant, 1998; Wu & Cheung, 2006).

Despite there having been debates about the cross-cultural applicability of the PTSD diagnosis, a review by Hinton et al. has found ample studies supporting several types of cross-cultural validity of PTSD in response to trauma (Hinton & Lewis-Fernandez, 2011). PTSD has been associated with trauma exposure among several populations in post-conflict situations in low- and middle-income countries (de Jong et al., 2001). Numerous population surveys, including in countries with various developmental levels, have been conducted using the same methodology through the World Mental Health surveys (Karam et al., 2014). The study found varying 12-month PTSD prevalence between 0.3% and 3.8% among the twenty populations

with differing trauma exposures (Karam et al., 2014). In regards to structural validity, a few studies found some cultures had lower avoidance/numbing symptoms (Hinton & Lewis-Fernandez, 2011; Marsella, Friedman, Gerrity, & Scurfield, 1996; Norris & Aroian, 2008), but other symptoms were identified in various cultural groups (Hinton & Lewis-Fernandez, 2011). The review found that further research is needed in several areas of cross-cultural research, including understanding the relationship of PTSD symptom profiles to current non-traumatic stressors, and interpretation of the trauma and symptoms resulting from PTSD onset (Hinton & Lewis-Fernandez, 2011). Additionally, a systematic review of pre-trauma risk factors of PTSD found existing research on risk factors of PTSD has relied on cross-sectional studies, and called for the need of consistent measurement of pre-trauma conditions in longitudinal designs (DiGangi et al., 2013).

Prevalence of PTSD (General Population). Studies of PTSD among the general population suggest varying prevalence across regions, countries, and populations. Such differences are potentially due to differences in trauma exposure, the recovery environment, and other socio-cultural factors. For instance, in the U.S., estimates of the lifetime prevalence of PTSD in the general population ranges from 6-8% (Kessler et al., 2005; Kessler et al., 1995; Pietrzak, Goldstein, Southwick, & Grant, 2011), whereas national surveys in Europe (Belgium, France, Germany, Italy, the Netherlands and Spain) found much lower lifetime prevalence of roughly 2-3% (Alonso et al., 2004; Bonnewyn, Bruffaerts, Vilagut, Almansa, & Demyttenaere, 2007). More recently, the World Mental Health survey was implemented in twenty countries across the world, which included low-, lower-middle income countries, upper-middle income countries, and high-income countries (Karam et al., 2014). The study found the overall average of 12-month prevalence was 1.1%, with the range among countries between 0.3% and 3.8% (Karam et al., 2014). The difference of prevalence between country groups (lower-middle income countries: 0.8% (SE: 0.2%), upper-middle income countries: 0.7% (SE: 0.1%), and high income countries: 1.5% (SE: 0.1%), or countries were statistically significant (Karam et al., 2014).

Unlike developed countries, national mental health surveys have not been commonly implemented in developing countries, and information on population lifetime prevalence of PTSD is limited, particularly in the African region. From 2002 to 2004, South Africa conducted its first nationally representative study of mental disorders in Africa (Williams et al., 2004), which found 2.3% of lifetime prevalence of PTSD

(Atwoli et al., 2013). South Africa was the only African country included in the 12-month PSTD prevalence from World Mental Health survey, which was 0.4% (SE: 0.1%).

Prevalence of PTSD (sub-population of injured patients). Various studies have found substantial variability in the prevalence of PTSD among injured populations (O'Donnell, Creamer, Bryant, Schnyder, & Shalev, 2003). A systematic review published by Wade et al. including patients recruited from critical care units found that PTSD prevalence ranged between 8% and 27% of ICU patients, in studies conducted between 1997 and 2012 (Wade, Hardy, Howell, & Mythen, 2013). While ICU patients may have very different experiences as compared to other trauma patients, a review of studies on the PTSD burden among patients admitted for injury in developed settings found a prevalence between 18% and 42% at 1-6 months post-injury (O'Donnell et al., 2003). These studies highlight the much higher prevalence of PTSD compared to the prevalence in general populations. Several studies have found prevalence rates of PTSD remained high after three months to 12 months post-injury. A study in a trauma and burn center in Michigan, U.S., found that 42% of patients who were admitted primarily for traumatic injuries were classified as having PTSD six months post-injury (Michaels et al., 1999). Another longitudinal study similarly suggests a prolonged effect of trauma on injury patients. Starr et al. found that in patients from orthopedic trauma clinics in the U.S., 51% screened positive for PTSD 12 months post-injury (Starr et al., 2004).

However, it is important to recognize that many of these earlier studies are limited by using self-reported symptoms scale, small sample size, and in many cases do not address if their sample is representative of the target population (O'Donnell et al., 2003). The use of self-reported symptoms checklist risk confounding symptoms causes, and tends to inflate prevalence rate (O'Donnell et al., 2003; Sijbrandij et al., 2013). Other studies acknowledged these limitations and increased representativeness through sampling from multiple trauma centers (Holbrook et al., 1999; O'Donnell et al., 2009; Zatzick et al., 2008), continued to find elevated prevalence of PTSD one year after injury, and used clinician-administered assessment of PTSD (Richard A. Bryant et al., 2015; O'Donnell et al., 2010; O'Donnell et al., 2009). A multi-center prospective cohort study from 12 states in the U.S. found 20.7% of patients who suffered from moderate or severe injury had PTSD 12-month after the injury (Zatzick et al., 2008). A study in Australia from four major trauma centers found 12-month incidence of PTSD at nearly 10% (Richard A. Bryant et

al., 2010), and subsequent follow-up at 2-year after the injury found 24-month incidence of PTSD around 7% (Richard A. Bryant, O'Donnell, Creamer, McFarlane, & Silove, 2013). More recent studies from Australia following up with patients six years after discharge found long-term PTSD: Bryant et al. found 4% of patients had chronic PTSD, and 10% had worsening PTSD at 72 months (Richard A. Bryant et al., 2015); O'Donnell et al. found 6% of patients diagnosed with PTSD at 72 months (O'Donnell et al., 2016). Amid the range of elevated PTSD among trauma patients in developed countries, few studies have explored the longitudinal burden of PTSD among general trauma patients in LMICs. Additionally, research has mostly focused on the specific mechanism of injuries such as occupational injuries (Lin et al., 2012), road traffic injuries (Mosaku, Akinyoola, Olasinde, & Orekha, 2014; Pérez-Rincón Merlín, González-Forteza, Ramos Lira, & Jiménez Tapia, 2007; Yasan, Guzel, Tamam, & Ozkan, 2009) and burns (Sadeghi-Bazargani, Maghsoudi, Soudmand-Niri, Ranjbar, & Mashadi-Abdollahi, 2011).

Risk factors of PTSD. A 2013 review article examining risk factors for post-injury mental health issues highlighted a wide range of biological, psychological and social risk factors in the pre-, during and post-injury periods (Table 1) (Sareen et al., 2013). Biologically, while females are likely to be exposed to different types of trauma compared to males and may experience a different recovery environment, Insllcht et al. suggested that hormones may play a role in the higher observed incidence of PTSD among women following trauma exposure (Inslicht et al., 2014). Among pre-injury risk factors, a prior history of psychopathology is one of the major risk factors associated with higher risk of mental illness after injury (DiGangi et al., 2013; Sareen et al., 2013). Previous exposure to trauma such as the experience of abuse during childhood or death of a close family member, are also strongly correlated to the development of PTSD in adulthood among survivors of interpersonal violence (Schoedl, Costa, Fossaluza, Mari, & Mello, 2013).

Meta-analysis of risk factors for PTSD among study populations exposed to various types of potentially traumatic events found that effect sizes of most risk factors included in the analysis are highly variable. Of which psychiatric history, childhood abuse and family psychiatric history have relatively homogeneous effects on PTSD (Brewin, Andrews, & Valentine, 2000). Life stress, lack of social support and trauma severity were found to have larger effect sizes in pooled estimates (Brewin et al., 2000).

Risk factors related to the injury event may also contribute to the development of negative mental health consequences. Type of injury and the psychological and emotional experiences associated with a physical injury or trauma may increase one's risk for mental health issues (Yehuda, 2002) (Sareen et al., 2013). Of note, injuries resulted from interpersonal violence are more likely to develop PTSD than unintentional injuries (Kessler et al., 1995) (van der Westhuizen, Wyatt, Williams, Stein, & Sorsdahl, 2014). Furthermore, different trajectories of PTSD have been identified comparing population exposed to intentional traumatic events versus non-intentional traumatic events (Santiago et al., 2013). Systematic review of literature on longitudinal course of PTSD identified a general decline of PTSD over the course of one-year among unintentionally injured populations, while intentionally injured populations had an increasing prevalence of PTSD over time (Santiago et al., 2013). In a study of survivors of the 2011 terror attack in Norway, physical injury was found to be associated with higher post-traumatic stress reactions at 4-5 months after the attack, compared to individuals who had no physical injury (Bugge et al., 2015).

Potential post-injury risk factors are harder to distinguish, and require longitudinal designs to differentiate from the potential reverse causation relationship. For instance, depression may impede recovery and therefore affects rehabilitation, but can also be exacerbated due to limitations in physical health and functioning. Such bidirectional relationships may also hold true for pain and PTSD (Asmundson, Coons, Taylor, & Katz, 2002). Besides the importance of physical health outcomes for mental health, social support has been recognized as another factor that may have bi-directional relationship with PTSD symptoms. Recent longitudinal studies investigated the temporal relationship between perceived social support and PTSD symptoms reported mixed results (Nickerson et al., 2016; Robinaugh et al., 2011). Potential stress from social and financial situation may also be risk factors of PTSD, and the association requires further studies (Sareen et al., 2013).

Depression and Injury

Major depressive disorder is one of the leading causes of disability worldwide (Institute for Health Metrics and Evaluation (IHME), 2016). Major depressive disorder accounted for 2.2% of DALYs in Global Burden of Disease in 2013 and ranked as the second leading cause of years lived with disability (YLD) globally (Institute for Health Metrics and Evaluation (IHME), 2016). Data from the World Mental Health

surveys found twelve-month prevalence of major depressive disorder averaged 4.7% across surveys of 24 countries (4.0% in 10 LMICs, 5.1% in 14 HICs), and over a third had 12-month comorbid anxiety disorders (41.6% in 24 countries) (Kessler et al., 2015). Although major depression may occur in the absence of exposure to traumatic stressors, studies have found a higher onset of depression when assessed after traumatic injury (Holbrook et al., 1999; Shalev et al., 1998; Skogstad et al., 2014). A study by Kendler et al. showed a causal relationship between stressful life events and onset of depression, which included assault and serious injury (Kendler, Karkowski, & Prescott, 1999). Injury events may also be associated with subsequent lower intensity stressors, which are risk factors for depression. A literature review on mental health issues following traumatic physical injury identified depression as common psychological sequelae, with prevalence ranging between 28% and 42% among traumatic physical injury survivors (Wiseman et al., 2013). A study from Australia following patients with severe injury 72 months after discharge showed long-term negative mental health consequences, with 11% of patients having a major depressive episode at 72 months, as compared to 2% among a general Australian community sample (O'Donnell et al., 2016).

In addition to contributing the largest burden of psychiatric disorder following traumatic physical injury, depression is also the most common co-morbid disorder with PTSD in the early post-injury phase (O'Donnell et al., 2004; Shalev et al., 1998). Although PTSD is commonly comorbid with other psychiatric disorder(s), the study by O'Donnell et al. at long-term mental health outcome found a higher proportion of major depression and anxiety disorders occurring in the absence of PTSD as opposed to in the presence of PTSD six years after discharge (O'Donnell et al., 2016).

O'Donnell et al. have found complex relations between PTSD and major depression (O'Donnell et al., 2004). Depression and PTSD share a number of common risk factors: a history of depression, the severity of the traumatic event, childhood abuse and being female have been recognized to associate with both mental health conditions (Sareen et al., 2013). However, despite shared vulnerability, O'Donnell et al.'s findings suggest depression may be independent of PTSD in a minority of early post-injury cases (O'Donnell et al., 2004). On the other hand, other studies conclude that major depression and PTSD are independent sequelae of traumatic events and interact to result in greater dysfunction (Shalev et al., 1998;

Zatzick et al., 2008). These studies indicate that the longitudinal relationship between PTSD and major depression is complex, and requires further study.

Psychological Distress

Psychological distress is a term that is commonly used to describe symptoms of a broad dimension, including depression, anxiety, posttraumatic stress, and somatic symptoms that may be associated with moderate or severe functional impairment. It is commonly used to describe a suboptimal mental health state in the immediate context of serious stressors in the absence of a diagnosable mental disorder. While acute stress reaction in the International Classification of Diseases (ICD-10) is similar to the acute stress disorder in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) in describing the acute response to trauma, the time frame and range of symptoms differ in the two diagnostics systems. Acute stress reaction encompasses a wider range of distressing responses after trauma, which include psychological anxiety, mood disturbance, and sleep issues in the initial aftermath of trauma; while acute stress disorder focuses on mainly fear and anxiety responses that are similar to a precursor of PTSD at a slightly later time than acute stress reaction (R. A. Bryant, Friedman, Spiegel, Ursano, & Strain, 2011).

Psychological distress measured in the immediate period after injury should be considered separately from a mental disorder in longer term period as illustrated in the conditions described above. Studies conducted in emergency department found more than a third of emergency department patients with injury presented distress (Lewis et al., 2014; Pereira et al., 2014). However, a cross-sectional study that examines recent injury and association distress, measured by a generic screener for mental disorders, may indicate a longer term broad dimension of psychological distress without a specific diagnosable mental disorder (McAninch, Greene, Sorkin, Lavoie, & Smith, 2014). Due to the study design, however, the relationship between duration after injury and psychological distress could not be determined. The authors underlined the need for a longitudinal study to understand the timeline of injury in relation to the development of psychological distress.

Resilience and Post-Traumatic Growth

Despite injury survivors are at higher risk to develop mental ill-health, studies have shown a large proportion of injury survivors demonstrate resilience after surviving the injury (DeRoon-Cassini, Mancini,

Rusch, & Bonanno, 2010; Osenbach et al., 2014; Quale & Schanke, 2010). Resilience is an interactive construct, conceptualized as "the capacity of individuals to successfully maintain or regain their mental health in the face of significant adversity or risk"(Stewart & Yuen, 2011). A literature review by Davydov et al. found several mechanisms of resilience: reduced vulnerability against adverse events, and the ability to adapt to adversity or cope (Davydov, Stewart, Ritchie, & Chaudieu, 2010). Besides the maintaining or regaining of mental health, post-traumatic growth, defined as the "experience of positive change that occurs as a result of the struggle with highly challenging life crises" has been identified (Grace, Kinsella, Muldoon, & Fortune, 2015; Hefferon, Grealy, & Mutrie, 2009; Tedeschi & Calhoun, 2004).

Review of resilience has found different types of protective factors (Davydov et al., 2010). Davydov et al. (2010) conceptualized these factors as subject-related factors and experience and those that received from the society. A systematic literature review of resilience in the physically ill focused on individual factors, including psychological factors, social support, and appraisals of the adversity (Stewart & Yuen, 2011). A range of psychological protective factors was identified, including self-efficacy, self-esteem, optimism, and a sense of personal control and independence. Social support from family and friends were consistently found to be associated with resilience (Stewart & Yuen, 2011).

Consequences of Mental Health Sequelae

There has been ample evidence that mental health status post-injury affects physical recovery and is associated with long-term disability. Studies have found mental health sequelae from trauma associated with subsequent impaired functioning (O'Donnell et al., 2009; O'Donnell et al., 2013), as well as general health symptoms (Pacella, Hruska, & Delahanty, 2013). A meta-analytic review from Pacella et al. found strong links between PTSD or sub-threshold post-traumatic stress symptoms (PTSS) with various health measures and specific components of physical health, including general health, physical health-related quality of life, pain, gastrointestinal health, and cardio-respiratory health for both males and females (Pacella et al., 2013). In particular, PTSD and depression were the most strongly associated with functional impairment. Rytwinski et al. examined the relationship between (1) PTSD and depression severity and, (2) subjective and objective health, which revealed an indirect effect of depression on the relation between PTSD and subjective physical health (Rytwinski, Avena, Echiverri-Cohen, Zoellner, & Feeny, 2014). A

national US study following trauma patients after hospital discharge found PTSD and depression individually impeded both short and long-term recovery of these patients, including decreased ability to perform activities of daily living, less likely to return to work and poorer functioning, and such outcomes worsening when both disorders co-occurred (Zatzick et al., 2008). A meta-analysis of the effect of anxiety disorders on quality of life found PTSD had the most functional impairment compared to other anxiety disorders, especially when concerning physical health and social functioning components (Olatunji, Cisler, & Tolin, 2007). Besides disorders, patients with mental health symptoms falling below the diagnostic threshold also experience a significant impact on functioning and quality of life (Pacella et al., 2013; Rodriguez, Nuevo, Chatterji, & Ayuso-Mateos, 2012).

Mental disorders have been conceptualized not only as a psychological or behavioral syndrome but also associated with an impairment of functionality (Stein et al., 2010). Mental disorders post-injury not only have associated healthcare costs but also have costs associated with loss of productivity. Walker et al. studied healthcare costs associated with PTSD symptoms in women in U.S. found higher health care costs among women with moderate and high PTSD symptoms, after controlling for depression and chronic medical illnesses that potentially confound the relationship (Walker et al., 2003).

While O'Donnell et al. found motor vehicle survivors with PTSD had significantly higher healthcare costs compared to those without PTSD, the associated increase in healthcare costs was mostly mediated through physical health post-injury (O'Donnell et al., 2013). Another study from Australia which examined both health and economic costs of PTSD among motor vehicle survivors found that PTSD cases had much higher healthcare costs among those treated, but even higher economic costs were found among the non-treated PTSD cases (Chan, Medicine, Air, & McFarlane, 2003). However, the study relies on claim data and therefore is not likely a representative sample of trauma patients.

Although mental health research has focused predominantly on high-income countries, the critical need for high-quality research in this area has been recognized in LMICs, particularly those in the Sub-Saharan Africa region (Daar et al., 2014; Jenkins, Baingana, et al., 2010). In May 2013, the 194 member states of the WHO adopted the Comprehensive Mental Health Action Plan at the 66th World Health Assembly. Recognizing the essential role of mental health, the action plan has generated momentum for governments to take the lead and include other stakeholders to improve access to mental health services

and develop a National Mental Health Strategy and Plan to provide resources for both mental and physical health (Daar et al., 2014).

Research context and Burden of Injury in Kenya

Kenya is a rapidly growing lower-middle income country in eastern Sub-Saharan Africa. Its current constitution was recently enacted in August 2010, and legislation has been established in 47 county governments in 2013 (*Kenya Facts and Figures*, 2014). The country has a large young population, with over 50% of its population of 44.4 million below age 20, and less than 5% of the total population aged over 60 years (figure 2-1)("Population Pyramid," 2014). Table 2 includes some major demographics, health and economics indicators of the country. The indicator on out-of-pocket health expenditure shows nearly half of the total health expenditure was out-of-pocket payments from this predominantly low-income population. Estimates of the 2015 Global Burden of Disease Study suggest that while communicable diseases remain the major causes of premature deaths, the burden of communicable, maternal, neonatal and nutritional diseases has reduced between 2000 and 2015 while the burden of injuries increased during this period (Institute for Health Metrics and Evaluation (IHME), 2016). GBD estimates found the overall burden of injury has increased in Kenya in the last 15 years from 4.89% of total DALYs in 2000 to 7.25% of total DALYs in 2015 (Institute for Health Metrics and Evaluation (IHME), 2016). Among the young population between 15 and 49 years old, the health burden of interpersonal violence has increased to become the 4th leading burden and road traffic injuries have become the 12th leading burden in 2015, while depressive disorder remained as the 3rd leading health burden in this age group (Institute for Health Metrics and Evaluation (IHME), 2016).

Besides estimates of the 2015 Global Burden of Disease Study (which relied heavily on modeling assumptions), there is limited empirical data that comprehensively describes the injury burden in Kenya. Government statistics rely on passive reporting of outpatient and inpatient cases with limited information on causes and detail of the burden of injuries (only road traffic injuries, burns and poisoning resulting in health facility visits are recorded) (*Outpatient morbidity by provinces*, 2013). Amid the limit of sparse data, efforts have been made to link clinical and demographic surveillance data in a rural area in coastal Kenya to enable more comprehensive population data (Etyang et al., 2014). The study found injuries accounted for the second highest rate of hospital admissions of men in the rural population (Etyang et al., 2014). While

hospital admissions decline with increasing distance from the hospital, the high rate of admission from injuries among men suggests a large burden in the population. Additionally, head injuries and fractures were among the top 15 leading causes of hospital admissions among those living in proximity to the hospital, both of which resulted in high morbidity (Etyang et al., 2014). Studies from hospital surveillance in different regions of Kenya found a significant proportion of injury cases to result from road traffic injuries and assaults among males (Otieno, Woodfield, Bird, & Hill, 2004) (Ogendi & Ayisi, 2011). Another study on causes of adult deaths through verbal autopsy among informal urban settlements in Nairobi found injuries accounted for a fifth of all deaths between 2003 and 2012, with an increasing trend over time (Mberu, Wamukoya, Oti, & Kyobutungi, 2015). These findings underline both high morbidity and mortality of injuries in both rural and urban populations in Kenya.

Amid the high burden of injuries, case-study assessment of trauma care capacity at the district and provincial hospitals in Kenya found limited administrative capacity on determining the outcome of injured patients, and there was a lack of formal trauma care training at the time of the study (Wesson et al., 2013). Also, Stevens et al. underlined the absence of an integrated pre-hospital care and triage system to facilitate care (Stevens et al., 2013). Since 2010, the Bloomberg Philanthropies Global Road Safety Programme has been supporting a component of trauma care to reduce mortality from injury and improve care (Stevens et al., 2013). Efforts have since been made to strengthen the major areas of trauma care in the hospitals on trauma training, trauma registry development, trauma team development and quality improvement (Wesson et al., 2013). Despite realization of the importance of an increasing need for primary and secondary prevention of injuries, there are limited data on assessing the short-term outcome of injury patients.

Mental health Burden in Kenya

Estimates from the 2015 GBD suggest mental and substance use disorders have been the top 10 health burden in Kenya since the initiation of the study in 1990 (Institute for Health Metrics and Evaluation (IHME), 2016). While there have not been national estimates of various mental disorders from population-based surveys, results from several studies underlined the burden of depression and anxiety. In the 1980s, Dhadphale et al. found anxiety and depression to be the most frequent diagnostic psychiatric morbidity among patients attending out-patient clinics in rural and semi-urban settings in Kenya (Dhadphale, Ellison,

& Griffin, 1983). More recent studies found prevalent mental illness among patients in general medical facilities and primary health centers in Kenya (Aillon et al., 2014; D. M. Ndetei et al., 2009).

Several studies were conducted among specific sub-populations identified with potentially higher prevalence of mental disorder, including individuals exposed to terrorist events in a specific context (D. M. Ndetei et al., 2005; Zhang et al., 2013), among individuals living with HIV (Reece et al., 2007), and a rural community population in Kenya (Jenkins et al., 2012). A recent study by Jenkins et al. found a high prevalence (48%) of having experienced a severe trauma in a rural population in Kenya, and 10.6% of the population were detected to have probable PTSD (Jenkins et al., 2015). Table 3 illustrates the various studies in health care settings, and Table 4 included different general population studies in Kenya with different measures. Except for the study by Zhang et al., all other studies were of a cross-sectional design, and the mental health outcome of patients after medical treatment remains unknown.

Mental Health Systems in Kenya

Three decades ago, Kenya recognized the importance of mental health and established a national policy to integrate mental health care into the general health care system (Muga & Jenkins, 2010). Mental health was first added as an element of Primary Health Care in Kenya in 1982. However, no explicit policy on mental health was established then (Muga & Jenkins, 2010). In 1994, Kenya's mental health policy was defined by the Mental Health Programme of Action and the country's general health policy, under the influence of the Primary Health Care principles from WHO (Muga & Jenkins, 2010). The goal was to implement a comprehensive biopsychosocial model of health care and provide mental health care to people through primary health services.

Despite the establishment of a mental health policy, implementation of mental health care provision has been hampered by the limited resources allocated for mental health services and mental health training, resulting in a small number of mental health professionals in-country (Jenkins, Kiima, Njenga, et al., 2010). Kenya has about 30 clinical psychologists, less than 80 psychiatrists and about 500 psychiatric nurses, of which less than half work in the public sector (Jenkins, Kiima, Njenga, et al., 2010) (D. Ndetei, 2011). Recognizing the need to integrate mental health care into primary care through strengthening mental health care capacity by training the health care workforce, the Kenya Ministry of Health (MOH) partnered with the WHO Collaborating Center at the Institute of Psychiatry of London, the

Kenya Medical Training College (KMTC) and the Kenya Psychiatric Association to initiate a national program to train over half of the primary health care workers across Kenya beginning in 2005 (Jenkins, Kiima, Njenga, et al., 2010). The program also promoted coordination and supervision of mental health services in primary care by including capacity building courses for level 4 and level 5 health workers (Jenkins, Kiima, Okonji, et al., 2010).

Monitoring of the program found an improved knowledge of mental illness among the trained primary health workers (Jenkins, Kiima, Okonji, et al., 2010). However, a subsequent evaluation found that a very low proportion of patients who screened positive for psychological distress were identified by primary health workers in both intervention and control groups. However, the study did find improved psychological distress and functioning after three months compared with the controls (Jenkins et al., 2013). It was unclear whether there were potential confounders that affected the secondary outcome as there appear some imbalances in covariates examined, as no differences were observed with the identification of mental illnesses. This finding highlights the issue of a large proportion of psychological distress that was not recognized by primary health care workers despite the mental health training program. The issue of under-diagnosis is supported by findings from another study of mental disorders in adults in different general medical facilities in various regions in Kenya, where 42% of participants had symptoms of mild and severe depression, and only 4% of participants had a diagnosis of psychiatric condition (D. M. Ndetei et al., 2009). Othieno et al. also found patients went to primary health care facilities reported poor recognition of mental disorder symptoms by health care providers (C. Othieno et al., 2013). Quotes from clients suggested common somatic expressions of psychological suffering, which were often treated as physical illness (C. Othieno et al., 2013).

Research Rationale and Questions

While the burden of injuries is higher in LMICs, research on injury and its psychological consequences among survivors have predominantly been conducted in HICs. Studies from HICs have found increased risk of developing major depressive episode, generalized anxiety disorder, and PTSD among injury survivors from several months to years after injury. Additionally, sub-threshold mental disorder symptoms have also been associated with impaired functionality. However, little is known about

the post-injury mental ill-health symptoms trajectories and their risk factors among injury survivors in LMICs. While a previous cross-sectional study in Kenya has found high levels of depression, anxiety, and PTSD among patients at healthcare facilities and motor vehicle crash survivors in hospital, the longer period mental ill-health consequences post-hospitalization remained unknown.

The overall goal of this dissertation is to understand the risk factors and trajectories of depression, anxiety, and post-traumatic stress symptoms among adult injury survivors in Kenya, in terms of internationally applied mental health concepts as well as from the survivor's perspective. This study has three specific aims:

Aim 1: Estimate the risk factors and trajectories of post-injury depression and anxiety symptoms among adult patients who survived moderate or severe injury in Kenya starting from hospitalization and over the course of 4 to 7 months after hospital discharge.

Aim 2: Estimate the risk factors, role of previous trauma and trajectories of post-traumatic stress disorder symptoms among adult patients who survived moderate or severe injury in Kenya over the course of 4 to 7 months after hospital discharge.

Aim 3: Describe the context and experience of mental distress symptoms from the injury survivors' perspective

Tables and Figures

Table 1. Risk factors of post-traumatic stress disorder. (Sareen et al., 2013)

	Biological	Psychological	Social
Pre-injury	Female	Previous mental illness	Previous sexual trauma
	Genetics	Personality factors	Low income
Injury	Type of injury (Intentional vs. unintentional)	Perceived fear of death	Death or injury of someone else
	Mild TBI	Peri-traumatic dissociation	
	Inflammatory response		
Post-injury	High heart rate at initial presentation	Acute stress symptoms	Litigation issues
	Pain	Post-traumatic adjustment	Financial problems
	Intensive care admission		Low social support

Table 2. Health, demographic and economic indicators of Kenya

Name of indicator or statistics	Value	Year reported	Reference
Total population (in thousands)	46,050	2015	("World Developent Indicaors 2016,")
Population growth rate	2.6%	2015	("World Developent Indicaors 2016,")
Total fertility rate	4.3	2014	("World Developent Indicaors 2016,")
Life expectancy at birth	61.6	2014	("World Developent Indicaors 2016,")
Percent of population living in urban areas	25.6	2015	("World Developent Indicaors 2016,")
Under-5 mortality (per 1000 live births)	49.4	2015	("World Developent Indicaors 2016,")
Maternal mortality ratio (modeled estimate, per 100,000 live births)	510	2015	("World Developent Indicaors 2016,")
Adult literacy rate (% of people age 15 and above)	78	2015	("World Developent Indicaors 2016,")
Adjusted net national income per capita (current US$)	1227	2014	("World Developent Indicaors 2016,")
Poverty headcount ratio at $1.90 a day (2011 PPP) (% of population)	33.6	2005	("World Developent Indicaors 2016,")
Population living in slums (% of urban population)	25.6	2015	("World Developent Indicaors 2016,")
Out-of-pocket health expenditure (% of total expenditure on health)	26.1	2014	("World Developent Indicaors 2016,")
Health expenditure, public (% of government expenditure)	12.8	2014	("World Developent Indicaors 2016,")
Gini coefficient	47.7	2013	("World Developent Indicaors 2016,")

Table 3. Prevalence of various mental disorders in Kenya among clinical populations.

Type of mental disorder	Measure	Instrument	Study population	Year of study	Citation
Major depressive disorder	Prevalence: 26.3% (95% CI: 21.3%- 31.3%)	M.I.N.I. Plus Interview 5	Adult patients attended an integrated health center near slum area in Nairobi (N=300)	2010	(Aillon et al., 2014)
Generalized anxiety disorder	Prevalence: 9.3% (95% CI: 6.0%-12.6%)				
PTSD	Prevalence: 5.3% (95% CI: 2.8%-7.9%)				
Pain disorder	Prevalence: 12.3% (95% CI: 8.6% - 16.1%)				
Alcohol and substance-related disorders	Prevalence: 6.0% (95% CI: 3.3-8.7%)				
Psychotic syndrome	Prevalence: 1.3% (95% CI: 0 – 2.7%)				
Depression	Prevalence (from BDI): 42.3% with mild, moderate or severe symptoms Prevalence (from LSAD): 21.4% had severe depression, 26.5% had mild depression	BDI, LSAD, MMSE and CIDI	Adult patients from 10 health facilities (all levels of health provision) within 200 km to Nairobi (N=2770)	2005	(D. M. Ndetei et al., 2009)
PTSD	Prevalence: 13.3%; Females: 17.9% Males: 11.7%	Self Rating Questionnair e (SRQ), Impact of Event Scale-Revised (IES-R)	Motor vehicle crash survivors attending the orthopaedic and trauma clinic at Kenyatta National Hospital, Nairobi (N=264)		(Ongecha-Owuor, Kathuku, Othieno, & Ndetei, 2004)

Table 4. Prevalence of various mental disorders in Kenya among general populations.

Type of mental disorder	Measure	Instrument	Study population	Year of study	Citation
PTSD (symptoms)	Prevalence: 15.67%	Breslau's seven-item screener	University students (N=923)	NA	(C. J. Othieno, Okoth, Peltzer, Pengpid, & Malla, 2015)
Depression symptoms	Prevalence: 41.33% (35.71% mild–moderate symptoms and 5.62% severe)	Center for Epidemiological Studies Short Depression Scale			
Any common mental disorder	Prevalence (in the past 7 days): 10.8%	Clinical Interview Schedule-Revised (CIS-R)	Rural residents 16 to 65 years old in Kisumu, Western Kenya (N=876)	2004	(Jenkins et al., 2012)
Mixed anxiety and depression	Prevalence (in the past 7 days): 6.1% (SE: 0.24%)				
Panic disorder	Prevalence (in the past 7 days): 2.6% (SE: 0.16%)				
Generalized anxiety disorder	Prevalence (in the past 7 days): 1.6% (SE: 0.13%)				
Depressive episode	Prevalence (in the past 7 days): 0.7% (SE: 0.08%)				
Phobic disorder	Prevalence (in the past 7 days): 0.3% (SE: 0.05%)				
Obsessive compulsive disorder	Prevalence (in the past 7 days): 0.2% (SE: 0.04%)				

Figure 1. Population pyramid of Kenya. (Source: US Census Bureau)
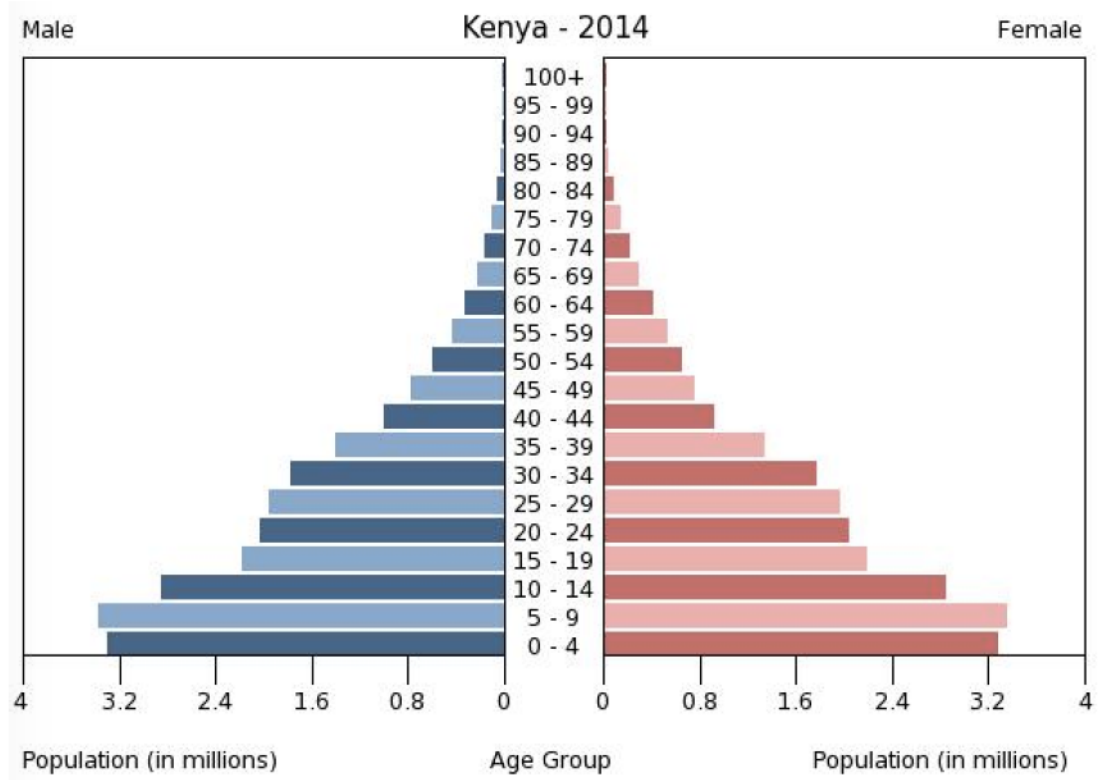
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Chapter 3. Methods

Study Design

This dissertation study was nested in the Kenya component of the multi-country prospective cohort study on Health, Economic and Long-term Social Impact of Injuries (HEALS) directed by JHSPH investigators in the Health Systems program in the Department of International Health. The HEALS study aimed to measure the functional impairment of survivors of non-fatal injuries, estimate the associated economic costs of injuries on individuals and household members, and the social impact of injuries over the course of one year after hospitalization. This dissertation study supplemented the HEALS study through an additional component focused on estimating the relevant mental disorder symptoms, and a qualitative component to further understand participant perspectives on psychological distress after surviving injury.

The overall dissertation applied an explanatory mixed method design. Papers 1 and 2 investigate the trajectories of depression, anxiety and PTSD symptoms, and associated risk factors of the trajectories. This was conducted through analyzing data from the quantitative longitudinal HEALS study, up to between four and seven months after hospital discharge. Paper 3 aims to explain the experience of distress symptoms through qualitative study using in-depth interviews of selected participants.

Study Setting

Kenyatta National Hospital (KNH) is located in Nairobi – the capital city of Kenya. It is one of the two highest level (level 6) hospitals in the country. Kenya's hospital is categorized into six levels, of which the sixth level is the national general and specialist referral hospital (Muga, Kizito, Mbayah, & Gakuruh, 2005). KNH is the largest public referral and teaching hospital in the country with 1800 beds capacity. It receives patients through direct admission from the Accidents and Emergency (A&E) Department, as well as referrals from other lower level hospitals.

This hospital was selected to recruit participants as it is the largest public referral hospital in Kenya and is one of the two referral centers for injury patients nationwide. It has a high volume of injury patients with over 600 injury patients are seen monthly at the Accidents and Emergency (A&E) Department (Stevens et al., 2013). More severe injuries were often transferred to the hospital instead of a lower level hospital. Overall, this hospital serves a population with lower socio-economic status as a public facility.

More than half of the injury patients served in this hospital had primary school education or no formal education, and over a third of the injury patients were casual laborers (Botchey et al., 2017). Over a third of the injury patients were from road traffic injuries and about a quarter injured from assaults (Botchey et al., 2017).

Study Population

The HEALS study recruited patients who were admitted to the Kenyatta National Hospital as a result of injury between May and December 2015. The HEALS study recruited patients consecutively, who met the following eligibility criteria: 1) was at least 18 years old, 2) admitted to the hospital for at least 24 hours, 3) could communicate in Swahili or English, 4) resided in Kenya and would continue to stay in Kenya after hospital discharge, 5) was able to provide informed consent and be interviewed at the time of enrollment. Individuals who were cognitively impaired were excluded from the study, as the study required ability to understand and communicate with data collectors. For the dissertation study, patients who were admitted due to self-harm or had a history of mental disorder(s) were excluded due to the higher potential of predisposed psychopathology and unstable emotion. Patients who did not survive the 4- to 7- month follow-up period, and those who were not yet eligible for the 4- to 7- month post-discharge follow-up by November 2017 were also excluded from analyses in this dissertation.

The HEALS study identified and approached 1038 individuals. Thirty-four patients (10 females, 24 males) (3.3%) declined to participate, and the study enrolled 1,004 individuals. Of those, 5 patients were admitted to hospital due to self-harm, 10 patients reported having previously diagnosed with any mental disorder(s), 17 individuals did not survive the follow-up period, and 12 individuals were not yet eligible for the 4- to 7-month post-discharge follow-up by November 2017. These individuals were excluded from the dissertation study, resulting in 961 patients who met the criteria listed above for the quantitative component (papers 1 and 2) of this dissertation.

Ethics

Both the quantitative component and qualitative component of the study required only informed verbal consent. Upon identifying eligible participants, data collectors approached the patient to introduce himself / herself and the HEALS study, following the informed consent script which also described the potential risk of participation in the study (Appendix 1). No compensation was provided at recruitment and

baseline, and subsequent follow-ups provided 100 Kenya Shillings (equivalent of 1 USD) of cellphone credit to compensate for the time taken to participate. After explaining the study, potential risks and benefits of participation, respondents were given opportunity to ask any questions regarding the study, after which verbal informed consent would be sought. Participants who provided verbal informed consent the proceeded with the baseline questionnaire. Patients who declined to participate in the study were thanked. A separate informed consent process was conducted for the qualitative component. The HEALS study staff first contacted eligible participants and asked if they would be interested in participating in the qualitative component of the study (Appendix 2). If they agreed, the study team would schedule a visit and an informed consent for the qualitative component was obtained before the interview (Appendix 3).

For individuals who gave verbal consent to participant in the study, those who screened above a conventional cut-off score of PTSD and / or depression and anxiety assessment during baseline and follow-up interviews were referred for care. These participants were referred to a non-governmental organization specialized in providing counseling services – Befrienders Kenya, to receive free on-the-phone counselling. They were given cell-phone credits to speak to the counselor on the phone. After assessment by the counselor at the organization, individuals who was identified for the need of an in-person counseling session were subsequently assisted to receive an in-person counselling session from the organization. For every patient, information on other local mental health providers (public or non-governmental organizations) were also provided. The study has been approved by the Institutional Review Board of the Johns Hopkins University Bloomberg School of Public Health in the U.S. and the Ethics Review Committee of the University of Nairobi and Kenyatta National Hospital in Kenya.

Procedure

Quantitative component (Aims 1 and 2)

Papers 1 and 2 utilized the quantitative data from the HEALS study, which followed a prospective cohort design. Eligible study participants were recruited in the hospital, and subsequently followed at 1, 2-3, and 4-7 months after hospital discharge. The third follow-up period was extended to include 7-month due to logistical reasons. Recruitment was conducted through face-to-face interview, and follow-ups were conducted through phone interviews.

Eligible patients were identified in all hospital wards which admit adult injury patients: neurosurgery, surgery, burns, orthopedics, ophthalmology, and intensive care unit in KNH. No recruitment was conducted at A&E Department. Hospital wards that admit injury patients were identified through discussion with local staff working at the hospital for trauma registry, and confirmed during the pilot phase of the study. Eligible patients were identified and recruited using convenience sampling by trained data collectors on a consecutive basis. All interviews were conducted in Swahili, unless the participant preferred being interviewed in English.

The baseline questionnaire (as designed in the HEALS study) included three parts: part I – upon recruitment, part II – physician interview and medical records, and part III – patient exit interview (Appendix 4). Part I consisted of questions on demographics, information regarding the injury event, experience of depression and anxiety symptoms since injury, level of disability prior to injury, and traumatic experience prior to injury. Level of disability was measured using the WHO Disability Assessment Schedule (WHODAS 2.0) Short Form with 12 items. Description of the instrument is included in the following section.

Part II of the baseline questionnaire involved medical record review on patients' diagnoses, vital signs at the time of hospital arrival, and treatment received prior to and after hospital admission. Up to three most serious injuries were recorded to estimate the overall injury severity that led to patients' hospitalization.

Part III of the baseline questionnaire was assessed before the patient was discharged. Questions included costs and care during hospitalization, insurance coverage and expenses incurred on participants and family members, as well as access to social protection or assistance through government or non-governmental organizations. Information on hospital costs were extracted from hospital's bill, through medical record review upon discharge.

Follow-ups were conducted in 1, 2-3, and 4-7 months after hospital discharge through phone interviews (Appendix 5). Questions focused on the costs and care of the injury recovery, experience of depression, anxiety and PTSD symptoms, level of disability, loss of productivity by the participant and family members, any social assistance received, and experience of any economic hardship including selling assets and borrowing money.

Qualitative component (Aim 3)

The qualitative component (paper 3) focuses on furthering understanding of mental distress experience among survivors of unintentional injuries in Kenya. Semi-structured in-depth interviews (IDIs) were conducted with 30 HEALS study participants to understand their experience of PTSD, depression and anxiety symptoms who resided within 70 km of Nairobi. Stratified, purposive sampling was used select participants for this component. These participants were identified from their responses in the quantitative questionnaire during baseline and at 1, 2-3, and 4-7 months after hospital discharge follow-ups. Two subgroups of participants were identified using purposive sampling. One subgroup were respondents reported having elevated PTSD and / or depression / anxiety symptoms based on the 2-3 and 4-7 months post-discharge follow-up and another subgroup were respondents reported low level of symptoms in the same period after hospital discharge. Exploratory descriptive analysis was performed to identify participants for the IDIs. These two groups of participants were balanced on sex and mechanism of injury.

Eligible participants were contacted between 4 to 8 months after the injury event. Potential participants were first contacted by phone to inquire their interest in participation. Informed consent was obtained during in-person visit prior to the interview. Consented participants were interviewed at their home, or a preferred nearby location if they chose not to be interviewed at their home. IDIs were performed using an interview guide that included topics to address and example probes for references. Interview topics included description of the injury event, aftermath of the injury, participant's experience of psychological distress since the injury event, effect on functioning, and help-seeking behavior and support received (Appendix 6).

All interviews were audio recorded after obtaining consent from the respondent, and notes were also taken during the IDI. Interviews were conducted in Swahili by local data collectors, unless study participant preferred to speak in English. Each interview took approximately between 30 minutes to 1 hour and 45 minutes. Field notes were incorporated in transcript during the transcription process.

Local data collectors had at least college level education and are fluent in both Swahili and English. Two of the data collectors participated in previous qualitative research data collection. The male data collector is a medical resident and had no prior qualitative research experience. All data collectors received three days of training. Daily and weekly debriefing was conducted to discuss the content of each

interview, among the local data collectors and YH. The qualitative study has been approved by the Institutional Review Board of the Johns Hopkins Bloomberg School of Public Health and the Ethics Review Committee of the University of Nairobi and Kenyatta National Hospital.

Instruments

Quantitative component (Aims 1 and 2)

This study used self-reported symptoms and severity measures of PTSD, depression and anxiety that have been applied in Kenya or nearby countries at the time of the study. Two symptom-based instruments – PTSD Checklist (PCL-5) and the Hopkins Symptom Checklist-25 (HSCL-25) were used to measure the outcomes.

HSCL-25, originally developed in the 1950s, is a widely used screening instrument to measure anxiety and depression, especially in low- and middle-income countries (Parloff, Kelman, & Frank, 1954). It was first utilized in a family planning service to identify level of anxiety and depression (Winokur, Winokur, Rickels, & Cox, 1984). HSCL-25 has been validated across various cultures and contexts, and demonstrated good reliability and validity (Bolton, 2001; Kaaya et al., 2002) (Lhewa, Banu, Rosenfeld, & Keller, 2007). HSCL-25 was selected for studying depression and anxiety in this study population based on its application in non-Western settings and particularly in Sub-Saharan countries, as it has been translated and validated in Tanzania (Kaaya et al., 2002) and Uganda (Ertl et al., 2010). Swahili translation of HSCL-25 was obtained through communication with Prof. Lee, the first author in the Tanzania study that examined the validity of the scale (Lee, Kaaya, Mbwambo, Smith-Fawzi, & Leshabari, 2008). According to Lee et al., the instrument was first translated into Swahili by two psychiatrists, back-translated to English by members outside the research team, then discussed among panel of translators and psychiatrists, and subsequently refined by pilot testing among clinic attendees (Lee et al., 2008).

The PTSD Checklist for DSM-5 (PCL-5) is a 20-item measure that reflected changes to existing symptoms and addition of symptoms in DSM-5 (Weathers et al., 2013). Previous PCL for DSM-IV has been widely applied in various non-Western contexts (Li et al., 2010; Tsutsumi, Izutsu, Poudyal, Kato, & Marui, 2008), and has been among the most frequently used self-reported measure of PTSD for clinical screening and symptoms checking (Elhai, Gray, Kashdan, & Franklin, 2005). Despite the recent revision of

PCL to measure PTSD according to DSM-5 definition, PCL-5 has been translated and adapted as a screening instrument for service provision in clinics supported by an international non-governmental organization – World Vision in Kenya. Pilot testing of the translated version has been conducted and analyses of the results have been undertaken by the iNGO. Using instruments that have been transculturally translated, adapted and applied in Kenya population ensure the applicability and equivalence of construct across culture, which was further examined in this dissertation. Swahili translation of PCL-5 was obtained through communication with the senior program advisor at World Vision, which has been utilizing the scale in their programs in Kenya.

History of trauma exposure was assessed using the Brief Trauma Questionnaire (BTQ). The scale included ten types of traumatic events that operationalized the definition of DSM-5 (Schnurr, Vielhauer, & Findler, 2002). BTQ provides a complete assessment of criterion A of PTSD in DSM-5, and has been used among nurses (Kubzansky et al., 2014) and civilians (Lancaster, Melka, & Rodriguez, 2009) to assess trauma exposure. The instrument includes common types of traumatic event while remains succinct and feasible for implementation. The BTQ is modified to include an additional question on age(s) of exposure for each traumatic event in order to enable the differentiation of traumatic experiences in this study population on the development of PTSD and major depression.

The Brief Trauma Questionnaire and other components of the questionnaire were translated into Swahili by professional translator in Kenya, then reviewed by the study coordinator in Kenya. Translation of all questionnaires (baseline and follow-ups), including the instruments, were subsequently finalized by group consensus with the local data collectors and study coordinator, comparing each question and response between Swahili and English during training sessions. Baseline questionnaire was field-tested by piloting with 10 patients at Kenyatta National Hospital.

Data Management

The first follow-up at 1-month post-hospital discharge included 443 participants (46.4%), second follow-up at 2-3 months post-hospital discharge included 549 participants (57.5%), and third follow-up at 4-7 months post-hospital discharge included 527 participants (55.2%). A total of 264 participants (27.6%) were completely lost-to-follow-up (i.e. missed all follow-ups).

Inclusion of participants were restricted by having at least one outcome measure(s), with missing data estimated using full-information maximum likelihood (FIML) as applied in Mplus 7.1. FILM estimation has been found to be unbiased and more efficient than other convention missing data methods, including listwise deletion, pairwise deletion, and similar response patterns simulations, under the condition of data missing at random (Enders & Bandalos, 2001; Raykov, 2005). For the analyses of depressive and anxiety symptoms trajectories, outcome measure of depressive an anxiety symptoms included baseline, and 964 participants were eligible. For PTSD symptoms, outcome measurement was included in follow-up interviews, and therefore 691 participants were eligible for the analyses.

To identify if lost-to-follow-up was associated with any observed characteristics, patients who remained in the study were compared with those who were lost-to-follow-up. For categorical characteristics, Pearson Chi-Square tests were performed to compare between the two groups of participants to determine if the difference was statistically significant. When continuous variables were compared, Student t-tests were performed to compare the difference in means between the two groups. The following variables were examined between participants who remained in one or more follow-ups and those who were lost-to-follow-up after baseline assessment: demographics (sex, age, occupation, education level, marital status, urban vs. rural residence), intent of injury, cause of injury, previous experience of trauma, number of trauma previously experienced, baseline HSCL depression subscale score, baseline HSCL anxiety subscale score, outcome upon hospital discharge, insurance coverage, whether the participant had savings or not, and whether the participant borrowed money for the hospital treatment.

The following participant characteristics were statistically significantly different between those who remained in the study vs. lost-to-follow-up, with lost-to-follow-up more likely to be: male (males: 29.9% lost-to-follow-up, females: 16.1% lost-to-follow-up; Pearson chi-square=13.36, p-value<0.001), participants who were injured from intentional injuries (assaults: 38.9% lost-to-follow-up, unintentional injuries: 25.0% lost-to-follow-up; Pearson chi-square: 14.02, p-value<0.001), participants who had burn injury (burns: 46.2% lost-to-follow-up vs. overall: 27.6% lost-to-follow-up, Pearson chi-square: 22.12, p-value: 0.005), and participants who had no insurance coverage (no insurance coverage: 29.3% lost-to-follow-up, had insurance coverage: 20.0% lost-to-follow-up, Pearson chi-square: 7.40, p-value: 0.007). Age distribution, highest education level, occupation, marital status, urban / rural residence, previous exposure

to trauma, baseline depression and anxiety subscales scores, household savings and borrowed money or not for medical treatment were not statistically significantly different between those remained in the study and those who were lost-to-follow-up.

Proportion and patterns of missing data of dependent and independent variables were assessed. Extent of missing data for each variable was first reviewed, then patterns of missing data were examined. In situations where no consistent patterns of missing data were found and proportion of missing data was less than 10%, listwise deletion was performed in analyses.

Statistics

Psychometric properties

Despite HSCL-25 and PCL-5 having been applied in similar populations, their psychometric properties had not been previously documented in a predominantly male clinical population in urban Kenya. As such, preliminary analyses were conducted to assess the reliability, factor structure and internal consistency of the measures.

Reliability. The two outcome measures' reliability were assessed by a combination of test-retest and inter-rater reliability. The local supervisor conducted phone follow-up interviews using selected questions from the original follow-up questionnaire, including HSCL-25 and PCL-5. Between 10% and 16% of participants who completed each follow-up were randomly selected for re-interview within 14 days of the original follow-up interview. Respondents who were randomly selected for re-interview were explained that it was part of the study procedure, and no association was made with the data collector who conducted the original interview to avoid recall of the previous responses. The local supervisor was also blinded to the original responses conducted by other data collectors.

Scores were computed by summing responses within the scales and subscale (depressive subscale and anxiety subscale of the HSCL-25). Reliability was assessed by intraclass correlation coefficient (ICC) with a two-way mixed effect model given the non-random nature of the raters (Shrout & Fleiss, 1979). Each of the follow-up schedule interviews and overall inclusion's reliability were assessed. Reliability of both within 7-day recall and within 14-day recall were determined. If a respondent was interviewed twice in the quality checks in different follow-up schedules, one of the follow-up quality check would be

randomly dropped in the overall reliability evaluation to ensure one comparison per respondent included in the quality checks.

Results from the ICC by data collector showed different inter-rater and test-retest reliability by data collectors. Data collectors 1 and 2 demonstrated acceptable reliability on the two scales (7-day overall range: 0.40-0.77), while data collector 3 had very low correlation of the results compared to the local supervisor on both HSCL-25 and PCL-5 (7-day overall range: -0.01 – 0.03) (table 3-1). Due to the low reliability, analyses of papers 1 and 2 exclude data collected by data collector 3 (n=317). Baseline characteristics of participants included in papers 1 and 2 are presented in table 3-3.

Internal consistency of the scales (HSCL-25 and PCL-5) and the subscales (anxiety and depressive subscales of HSCL-25) were assessed by calculating Cronbach's alpha at baseline (table 3-2). The anxiety subscale had lower internal consistency (0.65) than the depressive subscale (0.71) and PCL-5 (0.83).

Construct validity – factor structure. Due to potential latent characteristics of variables, measurements of these unobserved variables require more than one specific indicator, especially when the phenomenon manifest through multiple symptoms. As such, psychological instruments contain multiple items to measure the underlying latent structure(s). While conventional measures have been examined using various validity criteria during scale development, their application and appropriateness across culture often warrants considerations (Bass, Bolton, & Murray, 2007). Bass et al. underlined the assumption that description of mental illness developed in industrialized socio-cultural settings are directly applicable to other socio-cultural settings may not always hold true, unless evidence showed similar forms of the mental illness in that culture (Bass et al., 2007).

While previous studies have found depression, anxiety, and PTSD in similar forms in Kenya (Aillon et al., 2014; Dhadphale, Ellison, & Griffin, 1983; Ndetei et al., 2009), there have been a wide range of depression and anxiety levels found in general medical facilities using conventional cut-offs of different self-reported symptoms instruments (Ndetei et al., 2009). Recent studies that have investigated PTSD in Kenya applied various conventional PTSD scales in general population and university student population (Jenkins et al., 2015; Othieno, Okoth, Peltzer, Pengpid, & Malla, 2015), both of which found PTSD / probable PTSD prevalence higher than a study conducted among patients attending primary health center (Aillon et al., 2014).

Despite the wide use of HSCL-25 in various populations, the scale's dimensionality has not always been examined in the different target populations (Glaesmer et al., 2014). HSCL-25 has been applied both as a general distress measure (Anderson, Tegegn, Tessema, Galea, & Hadley, 2012; Mouanoutoua & Brown, 1995), and as depression and anxiety measure (through the subscales) (Jayasuriya, Jayasuriya, Tay, & Silove, 2016; Kaaya et al., 2002; Rimal & Papadopoulos, 2016). Moreover, other studies have identified varying number of factors other than the assumed two factors (Al-Turkait, Ohaeri, El-Abbasi, & Naguy, 2011; Lee et al., 2008). A recent study by Haroz et al. compared the performance of the depression subscale of HSCL-25 across multiple settings among adult populations in several LMICs using item response theory analysis (Haroz et al., 2016). The study found most questions performed well across the different settings except for two items (Haroz et al., 2016).

Whereas the HSCL-25 has been applied for over 30 years, the PCL-5 was recently developed based on the previous version of PCL using the DSM-V criteria in 2013 (Weathers et al., 2013). Previous version of PCL has been widely applied and well-validated (Wilkins, Lang, & Norman, 2011). Its underlying structure has also been investigated in African setting (Fodor, Pozen, Ntaganira, Sezibera, & Neugebauer, 2015). Despite PCL-5 has modified wordings and added items to PCL-4, PCL-5 was selected for the study based on its field application in the local setting. The instrument also demonstrated excellent reliability and validity in an initial psychometric evaluation in U.S. population (Blevins, Weathers, Davis, Witte, & Domino, 2015; Bovin et al., 2015). Given the recent development of PCL-5, limited literature has been available on the scale's psychometric properties in non-US populations. The scale's property and dimension were therefore investigated in this study.

Factor analyses have been commonly applied in the literature to explain shared variance of selected set of measured variables that are assumed to have common underlying latent variables, and has been applied as an important tool in validating the measurement of psychological constructs (Hayton, Allen, & Scarpello, 2004). Exploratory factor analyses (EFA) have traditionally been used for exploratory purpose, and confirmatory factor analyses (CFA) have been assumed to be superior for studies designed based on hypothesis for the set of measured variables. However, Asparouhov and Muthén highlighted the restrictive nature of CFA approach that forces items to only load on one factor often result in inflation of CFA-based latent correlations (Asparouhov & Muthén, 2009). In Structural Equation Modeling (a second

course), Morin et al. underlined a number of studies that CFA failed to support well-defined EFA structured psychological instruments, and suggested that there was no statistical basis for preventing the use of EFA for confirmatory purposes (Hancock & Mueller, 2013).

Following the suggestions described above, EFA was conducted for HSCL-25 using baseline data and PCL-5 using first follow-up data. While a number of factor retention criteria are available, no consensus has been arrived on the appropriate criteria to determine the number of factor(s) to retain (Hayton et al., 2004). Despite being commonly applied, the K1 rule has been shown in various occasions to overfactor (Hayton et al., 2004), and was therefore not implemented here as a criterion. Alternative criteria including the scree test and parallel analysis have been suggested to be more accurate (Ford, MacCallum, & Tait, 1986; Hayton et al., 2004). Scree test examines the pattern of eigenvalues for discontinuities (Cattell, 1966), and is suggested to be effective when there are strong factors (Ford et al., 1986). Parallel analysis takes into account of sampling error and has been suggested as one of the most accurate criteria (Hayton et al., 2004). Both scree test and parallel analysis were conducted to guide the determination of the number of factor to retain. Parallel analysis and scree tests were performed using the psych package in R (W, 2016).

Parallel analysis was conducted without the question on suicidal thoughts for HSCL-25, as most of respondents (98.7% or higher at baseline or each follow-up) reported having no such symptom. Similarly, the question on "taking too many risks or doing things that could cause you harm" in the PCL-5 measure was excluded in the parallel analysis as only 1% of respondents reported having such symptoms. Results of parallel analyses suggested 2 factors to be retained for HSCL-25 and 1 factor to be retained for PCL-5, which were supported by the scree plots (see Chapters 4 and 5).

Exploratory factor analyses were performed using Mplus version 7 (Muthén & Muthén, 1998-2015). Geomin rotation (a type of oblique rotation) was used given the common correlation between anxiety and depression (Browne, 2001). Robust weighted-least squares mean and variance adjusted (WLSMV) estimator was used with ordinal data, due to its performance in producing accurate parameter estimates and better model fits in modeling ordinal data (DiStefano & Morgan, 2014). Between one and three factors were extracted to compare model fit indexes and item loadings to assess interpretability. EFA of HSCL-25 excluded the item on suicidal thoughts as inclusion of the symptom resulted in negative sample correlation. Model fits were compared using the Comparative Fit Index (CFI), the Tucker-Lewis

Index (TLI), Standardized root mean square residual (SRMR) and the root mean square error of approximation (RMSEA) (Hu & Bentler, 1999). General recommended criteria of good model fit were considered: CFI and TLI close to 0.95, SRMR close to 0.08, and RMSEA close to 0.06 (Hu & Bentler, 1999).

Measurement invariance. Subsequently, measurement invariance over time was assessed to examine the invariance assumptions embedded in longitudinal analyses, using the two-factor model as identified from EFA. Exploratory structural equation models were used to assess invariance of parameters across multiple time points for the study population. ESEM allows correlated uniqueness between the same items across the several times of measure, which was not possible with traditional EFAs nor CFAs (Hancock & Mueller, 2013). ESEM is a flexible approach, which allows imposing various constraints to identify levels of measurement invariance. A series of models were estimated following increasing parameter constraints, starting from configural invariance, loading invariance, factor variance-covariance invariance, threshold invariance, latent factor means invariance, and combinations of the various types of invariance. Model fit indexes, including CFI, TLI and RMSEA were examined to identify significant changes in model fit indexes between the series of models, which indicate lack of specific level of measurement invariance. Due to the low proportion of reported anxiety symptoms, only HSCL-25 depressive subscale were assessed for measurement invariance. Correlation on questions "crying easily" and "feeling no interest in things" were relaxed between the times of measure due to low proportion of reporting of the symptoms in the last occasion of data collection. Question on suicidal thoughts were excluded from the ESEM also due to low endorsement. For PCL-5, several items were excluded due to low endorsement (trouble remembering important parts of the stressful experience; having strong negative beliefs about yourself, other people, or the world; trouble experiencing positive feelings; taking too many risks or doing things that could cause you harm; feeling jumpy or easily startled; and having difficulty concentrating).

Trajectories modeling

Upon assessing the measurement invariance of depressive subscale of HSCL-25 and PCL-5, trajectories of HSCL-25 and PCL-5 were modelled separately using longitudinal latent mixture analyses. Conventional growth models estimate a single growth trajectory to approximate change in outcome of

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interest for the study population, under the assumption that the study population is homogenous. However, studies have suggested heterogeneity in common mood and anxiety symptoms after injury (DeRoon-Cassini, Mancini, Rusch, & Bonanno, 2010; Osenbach et al., 2014; Santiago et al., 2013). In order to identify the heterogeneous trajectories in the study population, longitudinal mixture modeling is used to estimate the various tentative patterns in depression, anxiety and PTSD symptoms after injury.

Based on results from the EFA phase, manifest scores were generated by computing means of the Likert-scale responses (HSCL-25: two subscales means; PCL-5: scale means). Longitudinal latent class analysis was first modelled to identify the pattern of outcome, followed by subsequent mixture models.

Longitudinal Latent Class Analysis (LLCA). Trajectories were first explored using longitudinal latent class analysis (LLCA). LLCA is a type of mixture model that models heterogeneous patterns of outcome across time without scaled change (Feldman, Masyn, & Conger, 2009). Class membership was determined by grouping similar outcome patterns over time, and LLCA makes no assumption about the form of change in outcome. Analyses were performed using MPlus version 7.2 (Muthén & Muthén, 1998-2015). Missing data was accounted for using full information maximum likelihood (FIML), with the assumption that data was missing at random. Models were estimated with incremental number of latent classes. Optimal number of latent classes was determined by several considerations: (1) model fit statistics including Akaike's information criterion (AIC), Bayesian information criterion (BIC), and sample-size adjusted BIC, (2) likelihood ratio test comparing n class to n-1 classes (Vuong-Lo-Mendell-Rubin-adjusted likelihood ratio test (VLMR likelihood ratio test)), (3) consideration of stable class size.

Latent growth curve analysis (LCGA). To assess the changes in depression, anxiety and PTSDsymptoms over time, latent growth curve analysis (LCGA) was modeled separately. LCGA models heterogeneous scaled changes in symptoms, and individual differences were accounted by class membership (Feldman et al., 2009). Piecewise latent growth curve analyses were used, as a result of the non-linear pattern shown from the LLCA model. Best-fitting unconditional model was identified based on the same criteria as described above.

Association between covariates and symptoms trajectories were then estimated using auxiliary command in Mplus (Asparouhov & Muthén, 2014a). Covariates of interest and those showed statistical significance in bivariate model were then included in a series of nested multi-variate logistic regression

models, with the optimal class previously determined by unconditional models. Covariates that were not associated with outcome trajectories were removed in a series of models to arrive at the most parsimonious model, determined by model fit statistics (AIC, BIC, sample-size adjusted BIC). Association between class membership and distal outcome on disability at 4 to 7 months was assessed using auxiliary command using BCH method in Mplus (Asparouhov & Muthén, 2014b). To estimate the potential direct and indirect association between covariates, class membership on symptoms trajectories and distal outcome on disability, the manual version of BCH method was applied (Asparouhov & Muthén, 2014b).

Qualitative Data Analysis

All interviews were recorded and transcribed verbatim in Swahili, then translated to English, except for one interview that was conducted in English. Transcription and translation were performed by the data collectors and the qualitative study coordinator. Names were removed during the transcription process and only study ID was used to ensure anonymity. Both Swahili and English transcripts were reviewed to ensure data quality by the qualitative study coordinator and a research assistant, both are Kenyans and speak fluent English. Swahili transcripts were checked by comparing against the original audio recordings for accuracy of transcription, after which English transcripts were reviewed against the Swahili transcripts to ensure correct translation. Transcripts transcribed by the qualitative study coordinator were checked by the research assistant. Any queries about the translation would refer to the original recording to ensure the translation captured the meaning.

Data were analyzed using thematic analysis by Yuen Wai Hung. Coding was conducted using an inductive approach. Analysis followed the general approached as described by Braun and Clarke (Braun & Clarke, 2006). During data collection, notes were taken on emerging ideas during debriefing after each interview, and at weekly group debriefings. All transcripts were read and re-read to ensure familiarity with the data.

Initial semantic codes were generated to identify aspects of repeated patterns and ideas that emerged from the data. After reviewing the initial codes, candidate themes and sub-themes were identified by comparing codes extracted from the data. Candidate sub-themes and themes were organized and reviewed together with all extracts to determine refinement, rearrangement or combination. Collated extracts for each

theme were then considered to assess the pattern and relationship among the themes for the entire data. Theories on trauma and resilience were explored to identify appropriate and relevant framework to conduct deductive coding from the initial inductive codes. Refined themes were then mapped and defined. Detailed analysis was written for each refined theme to give contexts and relationship among them. Analyses and themes were further reviewed before finalized. Themes would be shared with interviewers to review findings but may happen at a later time depending on interviewers' availability.

Tables and Figures

Table 1. Combination of test-retest and inter-rater reliability by intraclass-correlation consistency (combined for all follow-ups) by data collector

Overall	ICC (consistency)			ICC (absolute)		
PCL (14-day test-retest & different rater)	LP (n=76)	HW (n=50)	CW (n=51)	LP (n=76)	HW (n=50)	CW (n=51)
PCL total score correlation	0.691	0.256	0.024	0.662	0.205	0.006
HSCL (14-day test-retest & different rater)						
HSCL-total correlation	0.781	0.567	-0.014	0.782	0.572	-0.006
HSCL-anxiety subscale correlation	0.536	0.323	-0.006	0.515	0.326	-0.004
HSCL-depression subscale correlation	0.780	0.554	-0.009	0.783	0.557	-0.004
	ICC (consistency)			ICC (absolute)		
PCL (7-day test-retest & different rater)	LP (n=60)	HW (n=44)	CW (n=37)	LP (n=60)	HW (n=44)	CW (n=37)
PCL total score correlation	0.601	0.403	0.032	0.571	0.313	0.008
HSCL (7-day test-retest & different rater)						
HSCL-total correlation	0.770	0.557	-0.012	0.771	0.560	-0.006
HSCL-anxiety subscale correlation	0.430	0.230	-0.005	0.406	0.234	-0.004
HSCL-depression subscale correlation	0.790	0.552	-0.012	0.793	0.553	-0.005

Table 2. Cronbach's alpha of HSCL-25 anxiety subscale, depressive subscale, HSCL-25, and PCL-5

	HSCL-25 Anxiety subscale	HSCL-25 Depressive subscale	HSCL-25	PCL-5
First measure (baseline for HSCL-25 and first follow-up for PCL-5)	0.648	0.714	0.772	0.829

Table 3. Baseline characteristics of participants in papers 1 and 2

	Study population of PTSD trajectories		Study population of Depression and Anxiety trajectories		Lost to follow up after baseline	
	N	%	N	%	N	%
Sex (N=644, chi2(1) = 7.9579, Pr = 0.005)						
Female	79	16.60	92	14.29	13	7.74
Male	397	83.40	552	85.71	155	92.26
Citizen of Kenya (N=644, chi2(1) = 1.1937, Pr = 0.275)						
No	2	0.42	4	0.62	2	1.19
Yes	474	99.56	640	99.38	166	98.81
Occupation (N=644, chi2(8) = 6.3003, Pr = 0.614)						
Farmer	19	3.99	23	3.57	4	2.38
Civil servant	14	2.94	21	3.26	7	4.17
Semi-gov employee	2	0.42	2	0.31	0	0
Private employee	196	41.18	260	40.37	64	38.10
Self-employed	136	28.57	185	28.73	49	29.17
Student	33	6.93	42	6.52	9	5.36
Unemployed (other reason)	28	5.88	45	6.99	17	10.12
Not in workforce	9	1.89	13	2.02	4	2.38
Other	39	8.19	53	8.23	14	8.33
Highest education level (N=644, chi2(7) = 6.8906, Pr = 0.440)						
None	8	1.68	13	2.02	5	2.98
Some primary school	50	10.50	72	11.18	22	13.10
Completed primary school	131	27.52	186	28.88	55	32.74
Secondary / high school	209	43.91	278	43.17	69	41.07
Technical / vocational school	28	5.88	33	5.12	5	2.98
Some college	13	2.73	16	2.48	3	1.79
College/ undergrad	36	7.56	45	6.99	9	5.36
Postgrad	1	0.21	1	0.16	0	0
Marital Status (N=643, chi2(4) = 6.1951, Pr = 0.185)						
Single	151	31.72	215	33.44	64	38.32
Married	291	61.13	377	58.63	86	51.50
Widowed	12	2.52	16	2.49	4	2.40
Divorced	3	0.63	4	0.62	1	0.60
Separated	19	3.99	31	4.82	12	7.19
Residence: urban / rural (N=644, chi2(1) = 1.6310, Pr=0.202)						
Rural	33	6.93	40	6.21	7	4.17
Urban	443	93.07	604	93.79	161	95.83
Total	476	100	644	100	168	100

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Chapter 4. Risk Factors and Trajectories of Depressive and Anxiety Symptoms of Adult Injury Patients in Kenya

Abstract

Background

Injuries account for a significant proportion of the health and economic burden to populations in developing countries. Additionally, many injured individuals suffer from psychological distress; however, there is not much in the literature on the mental health consequences that these individuals face, especially in low- and middle-income countries.

Aims

To identify trajectories of depressive and anxiety symptoms four to seven months after hospital discharge and the risk factors associated with them.

Methods

Adult injury patients (n=647) admitted to Kenyatta National Hospital in Nairobi, Kenya, were enrolled. Each individual was interviewed in the hospital, and at 1, 2-3, and 4-7 months after hospital discharge through phone interviews. Depressive and anxiety symptoms were assessed using Hopkins Symptoms Checklist at baseline and follow-ups. Injury history was assessed in hospital. Level of disability was assessed at each follow-up interview, with the World Health Organization Disability Assessment Schedule 2.0. Latent growth curve analyes were used to model the trajectories of depressive and anxiety symptoms and their risk factors. A manual 3-step approach of auxiliary variables in mixture modeling was used to estimate the association between the risk factors and the trajectories of depressive and anxiety symptoms.

Results

Two trajectories of depressive and anxiety symptoms were found for the period between hospitalization and up to seven months after hospital discharge: elevated depressive and moderate anxiety symptoms (13%), and low depressive and anxiety symptoms (87%). The elevated symptoms trajectory was associated with being female, residing in a rural area, prior trauma experience, longer hospitalization, worse self-rated health status while in the hospital, and without monetary assistance during hospitalization.

Among individuals with elevated depressive and moderate anxiety symptoms, a statistically significantly higher disability level and not resuming normal daily activities was reported between 1 and 4-7 months after hospital discharge, compared to individuals in the low depressive and anxiety symptoms trajectory.

Conclusions

These findings show the burden of depressive and anxiety symptoms several months after physical injury in a predominantly male, urban population in a lower-middle income country. The persistence of elevated depressive and moderate anxiety symptoms trajectory after hospitalization and associated reduced functioning underscore the importance to identify patients who experienced worse psychosocial outcomes to provide preventive and early interventions through follow-up after hospital discharge.

Introduction

Injury is a major public health concern and the associated mortality and morbidity remains disproportionately high in low- and middle-income countries (LMICs) (Herbert, Hyder, Butchart, & Norton, 2011). As the focus on reducing injury mortality continues, there is a growing need to understand the consequences of injury among survivors in LMICs. Traumatic physical injury has a multi-dimensional effect on survivors. Besides physical health, traumatic physical injury has psychological and social consequences. Emerging research has found various mental health consequences of injury, including post-traumatic stress disorder, depression, and anxiety (Wiseman, Foster, & Curtis, 2013). These mental health problems are often associated with higher disability and have been found to be independent predictors of quality of life among injury survivors (Michaels et al., 2000), as well as not returning to work after injury (Zatzick et al., 2008). Studies in middle- and high-income contexts that have investigated depression and anxiety after injury have found depressive symptoms were frequently prevalent and elevated among injury patients (O'Donnell et al., 2009; Rytwinski, Avena, Echiverri-Cohen, Zoellner, & Feeny, 2014; Shih, Schell, Hambarsoomian, Belzberg, & Marshall, 2010; Van Horn, 2009; Woolrich, Kennedy, & Tasiemski, 2006). A literature review by Wiseman et al. on mental health following traumatic physical injury predominantly found studies with data collected from U.S., Australia, and northern Europe (Wiseman et al., 2013), highlighting the gap of research evidence between HICs and LMICs.

Prevalence estimates for anxiety and depression after injury remained higher than those in the general populations a long time after the injury (Wiseman et al., 2013). A 6-year follow-up study in Australia by O'Donnell et al. found a major depressive episode had the highest prevalence at 6 years after a severe injury, and the major depressive episode rate was several times higher than Australian community sample (O'Donnell et al., 2016). Additionally, Wiseman et al. (2015) and Kuhn et al. (2006) found new onset of depressive symptoms and major depression highest among other mental health outcomes studied within 6 and 12 months of injury (Bryant et al., 2010; Kuhn et al., 2006; Wiseman, Curtis, Lam, & Foster, 2015), underlining the elevated burden of depressive symptoms and their prolonged risk among the post-injury populations.

Mental health issues and injury are associated to disabilities, which include bodily impairments, activity limitations and participation restrictions (Kostanjsek, 2011). In addition to associated disability at

the time of experiencing the mental health issue, studies have shown that mental health issues are also associated with disability at a later time point. A study by O'Donnell on trauma patients in Australia found that individuals with depression at 3 months had significantly higher odds of disability at 12 months (O'Donnell et al., 2009), and a later study found that psychiatric symptoms accounted for the most variability of disability by 1 year after injury (M. L. O'Donnell et al., 2013). Another study followed severely injured patients for 6 years and showed much of the disability found at 6 years post-injury was associated with mental disorders, in which major depressive episode was the most prevalent (O'Donnell et al., 2016). These findings point to the need for understanding patterns of mental health states and their relationship with distal disability outcomes, and addressing mental health issues among injured individuals to avoid future disabilities.

While trauma exposure has been more commonly studied in relation to PTSD, McQuaid et al. found trauma history was more often associated with major depression than PTSD in a primary care sample in the U.S. (McQuaid, Pedrelli, McCahill, & Stein, 2001). Another study of primary care patients in an inner city in the U.S. found high levels of childhood and adult trauma, and increasing levels of both exposures were associated with higher depressive symptoms and PTSD symptoms (Gillespie et al., 2009). Besides U.S. populations, Dorrington et al. found the degree of exposure to trauma was associated with higher levels of depression, dysthymia, and anxiety disorder diagnosis in Sri Lanka (Dorrington et al., 2014).

Studies on mental health in LMICs and traumatic events have been more commonly conducted among post-conflict populations, where civilians experienced high levels of potentially traumatic events (Ayazi, Lien, Eide, Swartz, & Hauff, 2014; Ertl et al., 2010; Roberts, Damundu, Lomoro, & Sondorp, 2009; Sabino et al., 2015). However, post-conflict contexts are largely different from injuries in settings not affected by political violence. Emerging literature from LMICs has investigated the correlation of mental health states and injury, though many studies have focused on PTSD only (Iteke, Bakare, Agomoh, Uwakwe, & Onwukwe, 2011; Mosaku, Akinyoola, Olasinde, & Orekha, 2014; Ongecha-Owuor, Kathuku, Othieno, & Ndetei, 2004; Pérez-Rincón Merlín, González-Forteza, Ramos Lira, & Jiménez Tapia, 2007; Yasan, Guzel, Tamam, & Ozkan, 2009). A few studies that have examined the association between injury and depression suggest the existence of significant psychological burden post-injury in non-Western

settings associated with various types of injuries (Lin et al., 2012; Matsuoka et al., 2008; Nicholls et al., 2012; Park, 2011; Zhang et al., 2013).

Kenya is a lower middle-income country that is rapidly developing, with a largely young population and growing number of overall physical injuries, especially road traffic injuries and interpersonal violence . A previous cross-sectional study among medical facility patients in Kenya found depression and anxiety disorders to be prevalent (Ndetei et al., 2009). Comorbidity of depression and anxiety with injuries was particularly high, including in patients who had general surgery and had orthopedic injury, among several other medical conditions (Ndetei et al., 2009). More general types of injury were considered in a recent cross-sectional study among university students in Nairobi (Othieno, Okoth, Peltzer, Pengpid, & Malla, 2015), which found elevated depressive symptoms correlated with serious injuries in the past 12 months (Othieno et al., 2015). However, all these studies were cross-sectional and cannot examine how depressive and anxiety symptoms develop over time, and the persistency of these symptoms. A recent study by Zhang et al. followed survivors of the 1998 U.S. Embassy bombing in Nairobi, most of whom were injured and some required hospitalization (Zhang et al., 2013). They identified long-term psychopathology among survivors, including PTSD and major depression three years after the event, which was broadly comparable to findings from high-income disaster populations (Zhang et al., 2013). Among those required hospitalization for the injury, they found longer hospitalization was associated with non-remission of major depression (Zhang et al., 2013). While the long-term follow-up study provided important insight on post-terrorism mental health outcomes, there remains a gap in knowledge on mental health trajectories among survivors of general physical injuries and their risk factors in Kenya.

This study aimed to estimate the trajectories of depression and anxiety symptoms between hospitalization and up to 7 months after hospital discharge among adult injury survivors. We also examined risk factors and the associated disability and functioning at 4 to 7 months among individuals with elevated depression and anxiety symptoms.

Methods

Participants

The current study included adults (age 18 years or older) recruited to participate in a longitudinal study of Health, Economic and Long-term Social Impact of Injuries (HEALS) in Kenya. Participants were recruited between May and December 2015 in Nairobi, Kenya at Kenyatta National Hospital. This hospital was selected as the recruitment site because it is one of the two public hospitals that provide the highest level of care and is the largest referral and teaching hospital in the country. Recruitment was conducted in the orthopedics wards, general surgical wards, ear and throat wards, head and abdominal wards, burns ward and burns unit. Patients were recruited to the study based on the following criteria: 1) they had experienced one or more intentional or unintentional injuries (Herbert et al., 2011), 2) required hospital admission of at least 24 hours, 3) were 18 years or older, 4) were able to communicate in Swahili or English, 5) resided in Kenya, 6) intended to stay in Kenya after hospital discharge, 7) were able to provide informed consent and to be interviewed at the time of enrollment, based on consciousness and coherence in cases of head injury. Patients were excluded in this study if they were admitted to hospital due to self-harm, or reported having been diagnosed with any mental disorder(s), or if they did not survive through hospitalization.

Eligible patients were consecutively enrolled during weekdays over a seven-month period. Of 1038 patients approached for recruitment to the study, 1004 (96.7%) provided informed consent to participate in the parent study. Of those, 961 met the inclusion criteria for the current study. Due to issues with data quality of one data collector, participants recruited and followed up by this data collector were excluded from this study (n=317). This resulted in a final sample of 644 patients. First follow-up at 1-month after hospital discharge included 338 participants (52.5%), second follow-up at 2-3 months post hospital discharge included 378 (58.7%) participants, and third follow-up at 4-7 months after hospital discharge included 394 (61.2%) participants. In total, 167 (25.9%) were lost-to-follow-up after baseline interviews, and 397 (61.6%) completed at least 2 follow-up interviews post hospital discharge. Participants who were lost-to-follow-up after baseline interviews did not statistically significantly differ from those who completed at least 1 follow-up by age group, education level, type of occupation, marital status, residence, estimated injury severity level, household savings, having borrowed money for treatment, previous exposure to trauma, duration of hospital stay, having household savings or assets or not, in-hospital anxiety

and depressive symptoms. Those who were lost-to-follow-up after baseline assessments were more likely to be: male (27.9% vs. 14.1%, p=0.005), injured by assault (36.2% vs. 23.1%, p=0.002), and no medical insurance coverage (29.5% vs. 14.7%, p<0.001).

Procedure

Trained data collectors obtained informed consent and conducted baseline assessments in the hospital. Baseline assessments included an initial interview upon enrollment to obtain demographic information, information about the injury event, disability level pre-injury, prior exposure to trauma, and a self-report measure on depression and anxiety symptoms since the injury event. Each initial baseline interview took 40 to 50 minutes to complete. An exit interview was conducted with each participant regarding in-hospital payment, expenses and assistance received, which took 20 to 30 minutes. Subsequent follow-up interviews post hospital discharge were conducted by phone. For participants who could not be reached at first, data collectors tried contacting them at least three other times at different times of the day, and on both weekday and weekend. Participants who could not be reached at the first follow-up were contacted again in subsequent follow-ups.

Questions during follow-up included self-report measures on depression, anxiety and PTSD symptoms, assessment of disability, and rehabilitation and treatment received since injury. Each follow-up interview took 20 to 30 minutes to complete. Participants were compensated with 100 Kenyan Shillings (equivalence of USD 1) worth of cell-phone airtime credit for each follow-up interview. This study received Institutional Review Board approval from the Johns Hopkins University Bloomberg School of Public Health in the U.S. and the Ethics Review Committee of the University of Nairobi and Kenyatta National Hospital.

Measures

Hopkins Symptoms Checklist (HSCL-25). The HSCL-25 is a widely used instrument to measure anxiety and depression based on self-report (Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974; Lee, Kaaya, Mbwambo, Smith-Fawzi, & Leshabari, 2008; Mahfoud et al., 2013; Ventevogel, Jordans, Reis, & de Jong, 2013). The total score has also been used as a general measure of distress among general and patient populations (Anderson, Tegegn, Tessema, Galea, & Hadley, 2012; Mouanoutoua & Brown, 1995; Ventevogel et al., 2013). The instrument has previously demonstrated good interrater reliability, test-retest

reliability, and content validity in Tanzania (Lee et al., 2008), and has been commonly applied in the Eastern Sub-Saharan Africa region (Kaaya et al., 2002; Lundberg, Cantor-Graae, Rukundo, Ashaba, & Ostergren, 2009; Vinck, Pham, Stover, & Weinstein, 2007). A recent study examining the depression subscale performance across eight LMICs, including Uganda and Rwanda, demonstrated the robust performance of the HSCL-15 depression subscale (Haroz et al., 2016). As commonly applied in the literature (Lhewa, Banu, Rosenfeld, & Keller, 2007; Vinck & Pham, 2010), mean scores were generated using the anxiety subscale (10 items) and depressive subscale (15 items). Severity was ranked on a Likert scale from 1 (not at all) to 4 (extremely) with recall of past week's symptoms. Studies have found high internal consistency of the scale and subscales (Derogatis et al., 1974; Lee et al., 2008; Lhewa et al., 2007).

Brief Trauma Questionnaire. The 10-item self-report questionnaire was used to assess the exposure to various types of potentially traumatic events. Derived from the Brief Trauma Interview (Schnurr, Vielhauer, & Findler, 2002), the Brief Trauma Questionnaire provides a complete assessment of criterion A of PTSD in DSM-5, and has been used among nurses (Kubzansky et al., 2014) and civilians (Lancaster, Melka, & Rodriguez, 2009) to assess trauma exposure. The instrument includes common types of traumatic events but remains succinct and feasible for implementation. Questions on whether the participant was seriously injured, and whether the participant thought his or her life was in danger or might be seriously injured were included for each type of trauma. Additional questions on age of participants at the time of exposure for each traumatic event were included in the questionnaire to enable the study of prior traumatic experiences in this study population.

World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0). The WHODAS 2.0 12-item self-report instrument was used to assess participant's experiences of functional impairment or disability associated with a health condition. The scale encompasses six domains of functioning over the past 30 days to estimate a score of global disability: cognition, mobility, self-care, interaction with others, life activities, and participation ("Measuring Health and Disability: Manual for WHO Disability Assessment Schedule (WHODAS 2.0)," 2010). The instrument reflects the concepts that disability encompasses impairments, activity limitations and participation restrictions ("Measuring Health and Disability: Manual for WHO Disability Assessment Schedule (WHODAS 2.0)," 2010). WHODAS 2.0 has been recommended by DSM-5 for its inclusion in routine clinical use for assessing functioning (Gold,

2014). The instrument has been used to measure disability among general populations in different cultures (Bachani et al., 2016; Kimber, Rehm, & Ferro, 2015) (Rodriguez-Blazquez et al., 2016), as well as with various medical conditions (Hanass-Hancock, Myezwa, & Carpenter, 2015; Marom, Carel, Sharabi, & Ratzon, 2016). Its psychometric properties have been evaluated across cultures in LMICs, supporting the unidimensional property of the scale (Sousa et al., 2010). Items were ranked based on the level of difficulty due to health conditions, ranged between 0 (none) and 4 (extreme or cannot do). Scoring of the scale was computed according to the 12-item instrument scoring sheet to convert the item scores to a global disability scores that ranged between 0 (no disability) to 100 (full disability) ("WHO Disability Assessment Schedule 2.0 (WHODAS 2.0)," 2016).

Estimated Injury Severity Score and other injury-related covariates. Information of injury-related covariates and hospitalization were obtained from the patient's medical record. Diagnosis of injury, including anatomy and pathology of the injury, was recorded from each participant's medical record by a medical resident. Up to three injuries per patient were recorded on the baseline questionnaire. An estimated abbreviated injury scale was generated based on the anatomy and pathology of the injury. An Estimated Injury Severity Score (eISS) was then calculated from the estimated abbreviate injury scale for each patient (Juillard et al., 2014). Anatomy and pathology of injury was used to determine the presence of mild traumatic brain injury.

We used the translated Swahili version of Hopkins Symptoms Checklist (HSCL-25) adapted for Tanzania in this study. Other measures, including Brief Trauma Questionnaire and World Health Organization Disability Assessment Schedule (WHODAS 2.0), were translated to Swahili by a certified translator in Kenya. The translated measures were then reviewed by local supervisor and data collectors during training for data collection. Translation was adapted upon group discussion with local supervisor and data collectors and piloting of the questionnaire, upon consensus by local supervisor and data collectors. All questions were administered by the interviewer.

Analyses

Factor analysis. Exploratory factor analysis (EFA) was conducted for baseline data to examine the underlying constructs of the HSCL-25, to determine if data supported latent constructs of depression

and anxiety, or general distress. A parallel analysis was performed to estimate the number of factor(s) to be retained. The HSCL-25 item on suicidal thoughts was excluded in the EFA due to very low proportion (1% or less in each follow-up) of positive symptoms. Geomin rotation and robust weighted-least squares mean and variance adjusted estimator (WLSMV) were used for ordinal data (Browne, 2001; DiStefano & Morgan, 2014). Model fit indexes (RMSEA, CFI, TLI) and item loadings for each factor extracted were examined.

The assumption of longitudinal measurement invariance was tested using exploratory structural equation models (ESEM) (Asparouhov & Muthén, 2009). Due to the high proportion of null responses on anxiety symptoms and suicidal thoughts after hospital discharge on the HSCL-25, only the depressive subscale items were assessed with ESEM. Multiple ESEMs with increasing parameter constraints were estimated and compared to determine the extent of measurement invariance across time (Hancock & Mueller, 2013).

The graphical presentation of parallel analysis is shown in Figure 1. It indicated that two factors should be extracted from HSCL-25. When a model with two factors was compared to a model with one factor, model fit statistics showed two factors to have superior fit compared to a one-factor model (CFI: 0.93 vs. 0.855, TLI: 0.916 vs. 0.841, RMSEA: 0.043 vs. 0.059). Table 1 shows the factor loadings by items with 1, 2, and 3 factors. The three factor solution contained items that cross-loaded with the other factors and weak factor loadings on most items (<0.4).

In the two-factor model, items generally loaded according to the previously described sub-scale structure of items 1-10 on one factor, and items 11-25 on a second factor, which were originally designed as anxiety symptoms and depressive symptoms respectively. One exception was item 16 "difficulty falling asleep, staying asleep", which did not load with other symptoms loading on the depression factor.

Exploratory structural equation model was performed using the depressive subscale to test the assumption of measurement invariance. The "thoughts of ending your life" question on the depressive subscale could not be included in ESEM for testing measurement invariance also due to low proportion of participants reported having the symptom (less than 2% of participants reported having the symptom). A series of models with increasing constraints were estimated. Model fit indexes (CFI and TLI) improved between configural invariance and loading invariance, while RMSEA improved slightly from 0.025 to

0.024 (Table 2). This supported at least loading measurement invariance. When parameters were further constrained on threshold (M5 in Table 2), model fit indexes became slightly worse (CFI decreased from 0.896 to 0.873; TLI decreased from 0.885 to 0.871; and RMSEA increased from 0.024 to 0.026). Releasing the threshold of the item "difficulty falling asleep, staying asleep" as indicated by the modification index resulted in a slightly improved strong factorial invariance. This suggests partial strong factorial invariance.

Anxiety symptoms could not be assessed for measurement invariance due to high proportion of null responses. Symptoms including "heart pounding or racing", "trembling", "feeling tense or keyed up", "headache", and "spells of terror or panic" were reported none by majority (over 95%) of participants in the third follow-up.

Trajectory modeling. After establishing acceptable measurement invariance across time for depression factor, preliminary analysis using longitudinal latent class modeling was performed to explore longitudinal patterns of symptoms. Means of the HSCL-10 (anxiety subscale) and HSCL-15 (depression subscale) were computed, as concluded by EFA described above.

Longitudinal latent class analysis (LLCA) was first conducted to examine patterns of depression and anxiety symptoms trajectories after injury. Latent modeling allows us to identify heterogeneous groups based on their symptoms trajectories (B. O. Muthén, 2002). Unlike latent growth curve analysis and latent growth mixture modeling, longitudinal latent class analysis does not include a scaled growth factor in the model. LLCA has fewer assumptions than the family of growth models, in which it makes no assumptions about the distribution of the observed variables (Feldman, Masyn, & Conger, 2009), which allows for an exploratory approach to model distinct symptom patterns.

Parameters were estimated using full-information maximum likelihood (FIML) estimator with robust standard errors (MLR). FIML has demonstrated unbiased estimation under the condition of data missing at random (MAR) (Raykov, 2005). Models were estimated with the assumption of missing data being missing at random, with cluster by data collector to account for differences in inter-rater reliability. Unconditional trajectory models were first estimated with progressing number of classes, and the best fitting unconditional trajectory model was identified based on model convergence, the Lo-Mendell-Rubin likelihood ratio test (Yungtai, Mendell, & Rubin, 2001), the Bayesien Information Criterion (Schwarz, 1978), and the estimated class size for stable parameter estimates (Feldman et al., 2009).

A piecewise latent growth curve model was then estimated based on results from the LLCA, which indicated a non-linear trajectory of depression symptoms. The piecewise latent growth curve model enables flexible estimation of nonlinearity through the inclusion of additional latent growth factors (Flora, 2008). The estimation of the piecewise latent growth curve model followed the procedures described above for LLCA to identify the best fitting unconditional trajectory model.

Covariates were then integrated into the best fitting unconditional model as auxiliary variables to independently assess the relationship between the potential predictor auxiliary variables and the class membership (Asparouhov & Muthén, 2014a). The relationship between the latent classes and the following covariates were examined: age at admission (increment of 10 years), sex, highest education level attained, marital status (married vs. others), residence (rural or urban), intent of injury as perceived by the respondent (assault vs. unintentional), mechanism of injury (road traffic injury, burns, vs. other), injury severity level (estimated Injury Severity Score from medical diagnosis) (Juillard et al., 2014), proportion of hospital bill covered by medical insurance, financial status (have household savings or assets vs. none, borrowed money for hospital treatment or not), whether respondent received monetary assistance from government or non-governmental organizations, duration of hospitalization (with 2 weeks increment), and previous trauma exposure measured by the Brief Trauma Questionnaire (one or more vs. none). Variables that were statistically significantly related to class membership, as well as covariates that have previously found to be associated with depression and anxiety were retained for inclusion in the multivariate mixture model. The manual 3-step approach of auxiliary variables was used to estimate the multivariate mixture model (Asparouhov & Muthén, 2014a). Model fit indexes, including AIC, BIC, and sample size adjusted BIC, were compared among models with various covariates to identify the final conditional model. To assess the association of latent class membership with a global measure of disability, resumption of normal daily activities, and resumption of work, these variables were assessed as distal auxiliary variables using automatic BCH methods as described by Asparouhov and Muthen (Asparouhov & Muthén, 2014b). All analyses were conducted using Mplus version 7.2 (L. K. Muthén & Muthén, 1998-2015) and the psych package in R (W, 2016).

Results

Participant characteristics

Table 3 shows the demographic characteristics of the study population. Participants were predominantly males (85.6%), and the median age of participants was 31 years (IQR: 26 – 40). More than 40% of participants had not attended secondary school. Participants were mostly working as private employees (40.4%) or were self-employed (28.7%). The majority of the patients lived in urban areas (93.8%). Males and females differed with respect to education level, occupation, and marital status, with higher proportion of men having at least secondary / high school education, being a private employee, and married (Table 3).

Table 4 presents injury characteristics of the patients. More than one-fifth of the patients were injured as a result of intentional physical assault (21.4%). Among unintentional injuries, road traffic injuries were the most common (61.3%, male: 62.6%, female: 54.0%), followed by falls (male: 16.3%, females: 21.1%). Injuries from burns were comparatively rare (7.1%). About a tenth of all participants (n= 67) had mild traumatic brain injury. Half of patients had an estimated Injury Severity Score between 9 and 15 (moderate severity), and 6.7% had estimated Injury Severity Score higher than 15 (high severity). More than one-third of patients were hospitalized for less than 2 weeks (38.5%), while nearly one-fifth of patients remained hospitalized for more than 2 months (18.4%).

Latent depression and anxiety trajectories

Table 5 shows the model fit statistics of piecewise latent growth curve models. Results suggest that 2-class enumeration fits the data best as indicated by BIC and sample-size adjusted BIC criteria. Although VLR LRT and LMR-LRT suggested 3-class enumeration, the smallest class size and proportion was too low to be stable beyond a 2-class model.

Figure 2 displays the depression and anxiety trajectories with a 2-class model: elevated depressive symptoms with moderate anxiety symptoms (12.7%), and low depressive and anxiety symptoms (87.3%). Individuals who were likely to be in the elevated symptoms class had moderate depressive symptoms at baseline (mean: 1.49, $p<0.001$). In the elevated symptoms class, depressive symptoms increased by 1-month post hospital discharge (slope: 0.22, $p<0.001$) then remained stable (slope: 0.015, $p=0.868$) between 1-month and 4-7 months post discharge, while anxiety symptoms remained stable (slope: -0.026, $p=0.346$).

The majority of participants (87.3%) had low levels of depressive and anxiety symptoms in hospital (HSCL-15: 1.24, HSCL-10: 1.13), which remained stable after discharge from hospital (p>0.1).

Latent regression with elevated depression and moderate anxiety symptoms class

Table 6 presents the bivariate association between various baseline patient characteristics with trajectory class. Being female was strongly associated with the elevated depressive and moderate anxiety symptoms class (OR: 2.99., 95%: 1.48-6.04). Previous exposure to potentially traumatic events (OR: 1.96, 95% CI: 1.49-2.57), residing in rural area (OR: 1.59, 95% CI: 1.51-1.68), increasing duration of hospitalization (increment of half a month, OR: 1.41, 95% CI: 1.06-1.87), increasing injury severity (OR: 1.36, 95% CI: 1.12-1.64), and borrowed money for hospital treatment (OR: 1.27, 95% CI: 1.25-1.28) were associated with elevated depression and moderate anxiety symptoms class. Having received monetary assistance from organization during hospitalization (OR: 0.47, 95% CI: 0.34-0.64), individuals had better self-rated health during hospitalization (OR: 0.70, 95% CI: 0.56-0.88), patients injured from burns (OR: 0.82, 95% CI: 0.69-0.99), and older adults (every 10 years increase in age, OR: 0.92, 95% CI: 0.84-1.00) were associated with low depressive and moderate anxiety symptoms. Mild traumatic brain injury, intent of the injury, and road traffic injury were not statistically significantly associated with the elevated symptoms trajectory class while burns had a bivariate association with lower odds of being in the elevated symptoms trajectory class.

Table 7 shows the results of a multivariate logistic regression on the mixture model. Female gender remained strongly associated with elevated depression and moderate anxiety symptoms class (aOR: 7.04, 95% CI: 3.82-12.98). Previous exposure to trauma remained statistically significantly associated with elevated depression and moderate anxiety symptoms class, after controlling for other covariates (aOR: 3.91, 95% CI: 3.18-4.81). The association between hospitalization duration and elevated depression and moderate anxiety symptoms class was also similar to the bivariate model (aOR: 1.51, 95% CI: 1.41-1.61). Mild traumatic brain injury was associated with the elevated depression and moderate anxiety symptoms class after controlling for covariates (aOR: 1.71, 95% CI: 1.38-2.13). Having received monetary assistance during hospitalization was less likely to have elevated depression and moderate anxiety symptoms trajectory, after adjusting for other covariates (aOR: 0.26, 95% CI: 0.16-0.42). Better self-rated health state during hospitalization was associated with lower odds of being in the elevated depression and moderate

anxiety symptoms class (aOR: 0.75, 95% CI: 0.68-0.82), while the associations with estimated injury severity level (aOR: 1.10, 95% CI: 0.60-1.85) remained not statistically significant in the multivariate mixture model.

Association between Symptoms Trajectories and Disability, normal activities and work

Comparisons between the elevated depression and moderate anxiety symptoms class vs. the low depression and anxiety symptoms class with disability level, proportion of participants resume of normal daily activities and work at various period after hospital discharge are illustrated in table 8. Results indicate a statistically significantly higher disability level between 1 and 4-7 months after hospital discharge among individuals with elevated depression and moderate anxiety symptoms (4-7 months mean of WHODAS 2.0: 28.4 among elevated depressive and moderate anxiety symptoms trajectory class, vs. 10.3 among low depressive and anxiety symptoms trajectory class, p<0.001). While nearly half of individuals with low depression and anxiety symptoms resumed some normal daily activities by 1 month after hospital discharge (43.5%), only 7.9% of individuals with elevated depression and moderate anxiety symptoms did so. By 4-7 months after hospital discharge, about a third of individuals with elevated depression and moderate anxiety symptoms resumed some normal daily activities, but only 7.5% had resumed work compared to 44.3% of individuals with low depression and anxiety symptoms.

Discussion

In this sample of mainly male urban adult inpatients with different mechanisms of injury in Kenya, we characterized the patterns of depressive and anxiety symptoms and changes between hospitalization and four to seven months after hospital discharge. We found two clusters of participants based on the course of their depressive and anxiety symptoms: a large class with low levels of both depressive and anxiety symptoms at any point, and a smaller class with elevated depressive and moderate anxiety symptoms with stable symptoms between one and four to seven months after hospital discharge. Individuals likely to be in this class had anxiety symptoms which remained stable, and the depressive symptoms worsened after hospital discharge and remained elevated four to seven months after hospitalization. This provides evidence for the burden of post-injury depressive symptoms several months beyond hospital discharge in a predominantly urban male population, and this associated with a high level

of disability. These consequences of injuries may have prevented many individuals from returning to work, further exacerbating the impact.

Our findings also highlighted the complex nature of these mental health issues and the importance of follow-up depressive symptoms screening. While individuals likely to be in these two classes differed on severity of depressive symptoms during early hospitalization, their gap widened after hospital discharge. Objective injury factors, including cause and severity of an injury, did not predict the trajectory of post-injury depression and anxiety. This is consistent with Bryant et al.'s findings in an Australian sample (Bryant et al., 2010) and Zatzick et al.'s findings in a large-scale U.S. sample (Zatzick et al., 2007). However, the increase of depressive symptoms among this subgroup of injury survivors one month after hospital discharge which remains persistent underlines the need of follow-up screening for depressive symptoms early post-discharge. Additionally, consistent with the literature in developed settings, being female and having a history of trauma are strongly associated with elevated depressive symptoms (Sareen et al., 2013) (Lopez Molina et al., 2014; Seedat et al., 2009; Wang et al., 2016). Health care providers following up with injury survivors can conduct the depressive symptoms screener while paying special attention to women and people with a potential traumatic exposure history. Such practice may be incorporated in both rehabilitation clinic and outpatient clinic that provides medical follow-up for injury survivors.

Similar to Shih et al.'s findings, the intent of injury (assault vs. unintentional) was not associated with depression and anxiety several months after hospitalization (Shih et al., 2010). In regards to treatment environment, our study found increasing duration of hospitalization was associated with the elevated depressive and moderate anxiety symptoms trajectory. Although the review by Sareen et al. (2013) found length of hospitalization not to be a strong predictor of mental health problems, Shih et al. and Lin et al. found lengthier hospital stay to be associated with development of major depression and higher depressive symptoms at 12 months after injury in a U.S. injury population and a Taiwan occupational injury population respectively (Lin et al., 2014; Shih et al., 2010). Compared with other longitudinal studies on post-injury mental health issues carried out in developed countries, injury patients in our study had much lengthier hospitalization than patients from other settings (Lin et al., 2014; O'Donnell et al., 2016; Schweininger et al., 2015; Skogstad et al., 2014). This difference in hospitalization duration may be

partially explained by the time intervals in treatment, for instance the treatment of fractured femur studied by Matityahu et al (Matityahu et al., 2014). The authors investigated the time intervals in the treatment of fractured femurs comparing hospitals in several low- and middle-income countries with high-income countries as indicators of quality of trauma systems and found significant longer treatment in low- and middle-income countries, illustrating the stark difference in resources and treatment availability between high-income and low-income settings (Matityahu et al., 2014).

Hospitalization duration also has social and economic implications. Phillips et al. studied the relation between negative life events and symptoms of depression and anxiety among residents in Scotland and found stressful burden (major life events that includes several domains, including health, marriage, relationships, bereavement, work, housing, finance, and general) was positively associated with later depression symptoms but not anxiety, and there was little indication of stressful life events generation from depression (Phillips, Carroll, & Der, 2015). Prolonged hospitalization does not only prevent patients from returning to normal activities and work but also places a large burden on the patient's family (as patients are not able to fulfil family roles) and produces an added financial burden. While the measure on hospitalization duration did not distinguish these individual potential aspects, the large reduction in risk of having elevated depressive and moderate anxiety symptoms trajectory with monetary assistance from the government or non-governmental organization during hospitalization underscores the financial stress affecting one's post-injury mental health. The risk reduction of financial assistance remained similar regardless of participants having household savings or assets, indicating consistent financial stress in this population.

The notable differences in disability between the two symptom level groups on disability is concerning. The elevated depressive and moderate anxiety symptoms group had a significantly higher level of disability between one and several months after hospital discharge. While the mean level of disability decreased in both groups, disability level was more than twice as high in the elevated depressive and moderate anxiety symptoms group than the low symptoms group as several months after hospital discharge. While a growing number of participants resumed some normal activities, only about a third of participants who were more likely to be in the elevated depressive and moderate anxiety symptoms class resumed some normal daily activities, and less than a tenth returned to work within several months after hospital

discharge. The patterns of the relationship between psychological symptoms and disability are consistent with previous findings that mental ill health is strongly associated with disability among injured populations (Meaghan L. O'Donnell et al., 2013; Zatzick et al., 2008). This study found that a low proportion of participants resumed work several months after discharge, underlining the effect on their livelihoods in this predominantly low-income population.

The inclusion of patients with various mechanisms of injury and intent of injury allowed us to comprehensively study the association between overall injury and the trajectory of depressive and anxiety symptomology in urban Kenya. This highlights the need to follow overall injury patients rather than a subtype of injury. While our in-hospital results may seem to differ with those of Ndetei et al. comparing their sample of patients with general surgery and orthopaedic or soft tissue injury (Ndetei et al., 2009), we used a different measure of depression and anxiety than they did and may not have captured the mild symptoms presented.

We identified several limitations in this prospective study. First, over a quarter of participants were lost-to-follow-up after hospital discharge. A large proportion of those participants were males, injured from assault, not covered by medical insurance and did not have household savings or assets. These differences in drop-out may have affected the results and the estimation of risk factors. Second, criterion validity of the outcome measure was not assessed in the study population. We used the Swahili translation from a previous study in Tanzania and piloted the instrument to assess its understandability in our study population. Third, we excluded data from one of the data collectors due to very low inter-rater reliability. To account for unobserved variability between interviewers, analyses were clustered by interviewer. Fourth, longitudinal measurement invariance of the anxiety subscale could not be assessed due to low endorsement of symptoms, so remains unknown. Fifth, we used a different modality of assessment between baseline and follow-up interviews. The baseline interview was conducted in-person while follow-up interviews were conducted by phone. Despite the change in modality, evidence has been shown for good agreement between the two modalities in other populations of similar age (Evans, Kessler, Lewis, Peters, & Sharp, 2004). Our study followed the recommendation by Evans et al. to establish good personal contact between researcher and subjects, including having the same interviewer consistently following the participant to establish rapport. Sixth, as the Injury Severity Score was unavailable in the Kenya setting, an

estimated Injury Severity Score was applied using clinical diagnosis information extracted from medical records (Juillard et al., 2014). The Estimated Injury Severity Score may not fully capture the injury severity due to the lack of diagnostic resources in the low-income setting, which may bias the estimation on association with elevated depressive and moderate anxiety symptoms. Additionally, this study included a largely male and urban sample, which may not generalize to females and rural residents.

Conclusion

We found that elevated depression and moderate anxiety symptoms to be associated with higher level of impairment several months after hospital discharge among predominantly male urban adult injury patients in Kenya. Our results point to the relationship between gender, prior exposure to potentially traumatic events, financial stress and increased depressive symptoms trajectory in this predominantly low-income population. As the majority of patients had low symptoms and improved functioning after hospital discharge, it is important to identify the subset of patients who experience worse psychosocial outcomes through follow-up after hospital discharge to provide early intervention.

Tables and Figures

Table 1. Factor loadings by item based on EFA results (n=644)

	1 factor	2 factors		3 factors		
HL1. Suddenly scared for no reason	0.877*	0.950*	-0.017	0.834*	0.599*	-0.004
HL2. Feeling fearful	0.866*	0.912*	0.002	0.815*	0.537*	0.002
HL3. Faintness, dizziness, or weakness	0.433*	0.292*	0.260*	0.494*	-0.089	0.041
HL4. Nervousness or shakiness inside	0.554*	0.330*	0.369*	0.682*	-0.229	0.005
HL5. Heart pounding or racing	0.378*	0.389*	0.096	0.551*	0.028	-0.094
HL6. Trembling	0.367*	0.265*	0.204*	0.448*	-0.094	0.003
HL7. Feeling tense or keyed up	0.510*	0.507*	0.14	0.499*	0.240*	0.099
HL8. Headache	0.334*	0.175*	0.241*	0.443*	-0.214*	-0.031
HL9. Spells of terror or panic	0.434*	0.370*	0.182	0.513*	0.002	0.015
HL10. Feeling restless, can't sit still	0.422*	0.237*	0.293*	0.391*	-0.075	0.127
HL11. Feeling low in energy - slowed down	0.552*	-0.015	0.641*	0.235*	-0.393*	0.416*
HL12. Blaming yourself for things	0.425*	0.132	0.380*	0.14	-0.003	0.360*
HL13. Crying easily	0.552*	-0.078	0.682*	0.037	-0.265*	0.590*
HL14. Loss of sexual interest or pleasure	0.396*	-0.095	0.527*	0.023	-0.248*	0.425*
HL15. Poor appetite	0.436*	0.138	0.396*	0.218*	-0.065	0.308*
HL16. Difficulty falling asleep, staying asleep	0.316*	0.304*	0.113	0.244*	0.200*	0.14
HL17. Feeling hopeless about the future	0.641*	-0.044	0.743*	-0.031	-0.148	0.732*
HL18. Feeling blue	0.558*	-0.183	0.759*	-0.009	-0.394*	0.617*
HL19. Feeling lonely	0.455*	0.088	0.446*	-0.102	0.157	0.599*
HL20. Feeling trapped or caught	0.424*	0.224*	0.304*	0.005	0.294*	0.478*
HL21. Worrying too much about things	0.706*	0.032	0.784*	0.015	-0.085	0.795*
HL22. Feeling no interest in things	0.816*	0.156	0.782*	0.103	0.014	0.811*
HL24. Feeling everything is an effort	0.517*	0.246*	0.398*	0.04	0.314*	0.539*
HL25. Feeling of worthlessness	0.583*	0.12	0.571*	-0.123	0.222	0.743*

Table 2. Exploratory structural equation models on estimating measurement invariance of HSCL Depression sub-scale

Model	Description	Chi-square	df	P-Value	CFI	TLI	RMSEA	90% CI RMSEA	
M1	Configural invariance	2012.526	1439	0.000	0.892	0.885	0.025	0.022	0.027
M2	Loading invariance (weak measurement invariance)	2030.893	1478	0.000	0.896	0.892	0.024	0.021	0.027
M4	Loading and factor variance-covariance invariance	2203.712	1481	0.000	0.864	0.859	0.027	0.025	0.03
M5	Loading and threshold invariance (strong factorial invariance)	2194.968	1517	0.000	0.873	0.871	0.026	0.024	0.029
M5p	loading and threshold partial invariance (strong factorial invariance) (Free Q16 threshold)	2146.411	1514	0.000	0.881	0.879	0.025	0.023	0.028
M8	Loading, factor variance co-variance, thresholds invariance	2366.997	1520	0.000	0.841	0.839	0.029	0.027	0.032
M8p	Loading, factor variance co-variance, partial thresholds invariance (Free Q16 threshold)	2318.299	1517	0.000	0.85	0.847	0.029	0.026	0.031
M10	Loading, thresholds, latent factor means invariance	2369.233	1523	0.000	0.841	0.839	0.029	0.027	0.032
M10p	Loading, partial thresholds, latent factor means invariance (Free Q16 threshold)	2318.411	1520	0.000	0.85	0.848	0.028	0.026	0.031
M12	Loading, factor variance co-variance, thresholds, latent factor means invariance	2369.233	1523	0.000	0.841	0.839	0.029	0.027	0.032
M12p	Loading, factor variance co-variance, partial thresholds, latent factor means invariance (Free Q16 threshold)	2318.411	1520	0.000	0.85	0.848	0.028	0.026	0.031

Note: Correlation between rounds were relaxed on questions 13 and 22. Question 23 was removed from this analysis due to low endorsement.

Table 3. Baseline demographic characteristics of male and female participants

	Female (n=92)		Male (n=551)		Total (n=644)	
	N	%	N	%	N	%
Age (chi2(3) = 3.2178 Pr = 0.359)						
18-29 years	35	38.04	246	44.65	281	43.7
30-44 years	40	43.48	227	41.20	267	41.52
45-59 years	14	15.22	71	12.89	85	13.22
60 years and above	3	3.26	7	1.27	10	1.56
Highest education level (chi2(7) = 21.5116 Pr = 0.003)						
None	2	2.17	11	1.99	13	2.02
Some primary school	19	20.65	53	9.60	72	11.18
Completed primary school	30	32.61	156	28.26	186	28.88
Secondary / high school	22	23.91	256	46.38	278	43.17
Technical / vocational school	6	6.52	27	4.89	33	5.12
Some college	3	3.26	13	2.36	16	2.48
College/ undergrad	10	10.87	35	6.34	45	6.99
Postgrad	0	0	1	0.18	1	0.16
Occupation (chi2(8) = 26.2257 Pr = 0.001)						
Farmer	4	4.35	19	3.44	23	3.57
Civil servant	2	2.17	19	3.44	21	3.26
Semi-gov employee	0	0	2	0.36	2	0.31
Private employee	28	30.43	232	42.03	260	40.37
Self-employed	35	38.04	150	27.17	185	28.73
Student	14	15.22	28	5.07	42	6.52
Unemployed (other reason)	7	7.61	38	6.88	45	6.99
Not in workforce (homemaker, non-paid worker / volunteer, retired)	0	0	13	2.36	13	2.02
Other	2	2.17	51	9.24	53	8.23
Marital Status (chi2(4) = 42.5793 Pr = 0.000)						
Single	32	34.78	183	33.21	215	33.44
Married	40	43.48	337	61.16	377	58.63
Widowed	9	9.78	7	1.27	16	2.49
Divorced	3	3.26	1	0.18	4	0.62
Separated	8	8.70	23	4.17	31	4.82
Residence: urban / rural (chi2(1) = 0.0178 Pr = 0.894)						
Rural	6	6.52	34	6.16	40	6.21
Urban	86	93.48	518	93.84	604	93.79

Table 4. Baseline injury characteristics of male and female participants

	Female (n=92)		Male (n=551)		Total (n=644)	
	N	%	N	%	N	%
Intent of injury (chi2(1) = 1.0391 Pr = 0.308)						
Unintentional	76	82.61	430	77.9	506	78.57
Assault	16	17.39	122	22.1	138	21.43
Cause of unintentional injury (chi2(9) = 22.8550 Pr = 0.007)						
Road traffic	41	53.95	269	62.56	310	61.26
Fall	16	21.05	70	16.28	86	17.00
Burn	13	17.11	23	5.35	36	7.11
Sharp object	4	5.26	23	5.35	27	5.34
Explosive	0	0.00	3	0.70	3	0.59
Animal / insect related	0	0.00	1	0.23	1	0.20
Blunt object	0	0.00	22	5.12	22	4.35
Electrocution	0	0.00	11	2.56	11	2.17
Other	2	2.63	8	1.86	10	1.98
Estimated injury severity level (chi2(2) = 4.3858 Pr = 0.112)						
eISS <9	44	51.76	213	40.73	257	42.27
eISS 9-15	38	44.71	272	52.01	310	50.99
eISS >15	3	3.53	38	7.27	41	6.74
Duration of hospital stay (chi2(4) = 9.7088 Pr = 0.046)						
Less than 2 weeks	33	35.87	214	38.91	247	38.47
2-4 weeks	12	13.04	104	18.91	116	18.07
4-6 weeks	22	23.91	76	13.82	98	15.26
6-8 weeks	5	5.43	58	10.55	63	9.81
More than 8 weeks	20	21.74	98	17.82	118	18.38

Table 5. Model statistics of unconditioned latent class enumeration (HSCL-25 depressive and anxiety symptoms subscales, n=644)

No. of class(es)	df	LL	AIC	BIC	Sample-size adjusted BIC	VLMR LRT		LMR-LRT		Entropy	Smallest class n (%)
						2*LL	p-value	2*LL	p-value		
1	13	141.791	-257.581	-199.501	-240.775	NA		NA		NA	NA
2	19	482.176	-926.351	-841.465	-901.789	680.77	0.8266	663.668	0.8344	0.847	82 (12.7%)
3	25	587.479	-1124.957	-1013.265	-1092.639	210.606	0.0072	205.315	0	0.843	12 (1.9%)
4	31	681.409	-1300.817	-1162.319	-1260.742	187.86	0.3907	183.141	0.3882	0.842	6 (0.9%)

Table 6. Bivariate association with elevated depression and moderate anxiety symptoms trajectory

Bivariate association with higher symptoms class				
Covariates	Estimate	p-value	95% CI	
Female (vs. male)	2.986	0.002	1.478	6.035
Age (increment of 10 years)	0.915	0.041	0.839	0.997
Highest education level (incremental)	0.922	0.575	0.694	1.225
Married (vs. single)	1.065	0.866	0.517	2.195
Residence (Rural vs. urban)	1.594	0.000	1.509	1.684
Self-rated health status during hospitalization	0.700	0.002	0.559	0.877
Mild traumatic brain injury	0.796	0.102	0.605	1.047
Estimated injury severity level (incremental increase from mild, moderate, severe)	1.358	0.002	1.123	1.642
Intent of injury (assault vs. unintentional)	0.767	0.077	0.573	1.027
Road Traffic injuries (vs. others)	1.644	0.249	0.706	3.826
Burn (vs. others)	0.824	0.036	0.688	0.987
Previous exposure to trauma	1.960	0.000	1.493	2.574
Duration of hospitalization (increment of half a month)	1.405	0.019	1.057	1.867
Household financial security (savings or assets vs. none)	0.702	0.542	0.225	2.192
Received monetary assistance during hospitalization	0.465	0.000	0.337	0.643
Borrowed money for hospital treatment	1.265	0.000	1.248	1.282
Proportion of medical bill covered by insurance (increment of 10%)	0.974	0.767	0.820	1.158

Table 7. Multivariate logistic regression with elevated depression and anxiety symptoms trajectories

Multivariate association with elevated depression and moderate anxiety symptoms class				
Covariates	Estimate	p-value	95% CI	
Female (vs. male)	7.043	0.000	3.821	12.981
Age (increment of 10 years)	0.766	0.068	0.574	1.021
Residence (Rural vs. urban)	2.438	0.000	1.690	3.517
Self-rated health status during hospitalization	0.748	0.000	0.684	0.819
Mild traumatic brain injury (vs. other injury)	1.713	0.000	1.375	2.133
Estimated injury severity level (severe, moderate, mild)	1.055	0.85	0.601	1.852
Intent of injury (assault vs. unintentional)	0.997	0.989	0.635	1.565
Road Traffic injuries (vs. others)	1.380	0.556	0.472	4.031
Burn (vs. others)	0.707	0.104	0.466	1.073
Previous exposure to trauma	3.908	0.000	3.175	4.810
Duration of hospitalization (increment of half a month)	1.508	0.000	1.414	1.609
Household financial security (savings or assets vs. none)	0.448	0.032	0.216	0.932
Received monetary assistance during hospitalization	0.257	0.000	0.157	0.422
Proportion of medical bill covered by insurance (increment of 10%)	0.955	0.398	0.859	1.062

Table 8. Level of disability, resumed normal daily activities, and resumed work comparing between elevated depression and anxiety symptoms class and low symptoms class

		Elevated depression and moderate anxiety symptoms class		Low depression and anxiety symptoms class		Overall test between class	
		Mean	SE	Mean	SE	Chi-square	P-value
Disability level	1-month	42.7	0.3	24.1	2.3	90.228	<0.001
	2-3 months	37.3	2	15.2	1.9	31.99	<0.001
	4-7 months	28.4	2	10.3	0.9	38.061	<0.001
		Proportion	SE	Proportion	SE	Chi-square	P-value
Resumed normal daily activities	1-month	0.079	0.146	0.435	0.18	108.488	<0.001
	2-3 months	0.188	0.098	0.634	0.161	50.809	<0.001
	4-7 months	0.356	0.103	0.778	0.13	262.351	<0.001
		Proportion	SE	Proportion	SE	Chi-square	P-value
Resumed work	1-month	0.044	0.067	0.107	0.05	14.202	<0.001
	2-3 months	0.031	0.058	0.296	0.077	197.098	<0.001
	4-7 months	0.075	0.053	0.443	0.122	28.235	<0.001

Figure 1. Scree plot of original and simulated factors (parallel analysis) (n=644)

Eigen values of tetrachoric/polychoric matrix

Eigen values of original and simulated factors and component

PC Actual Data
PC Resampled Data

Factor Number
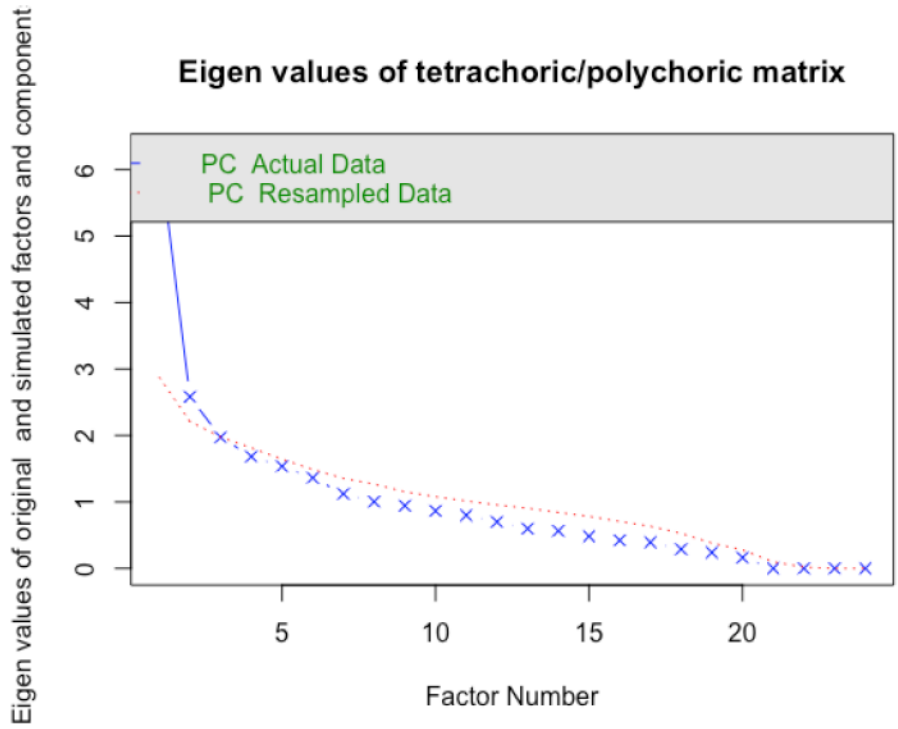
Note: Analysis excluded question 23 due to low endorsement

Figure 2. Trajectories of depression and anxiety symptoms between baseline in hospital and 4-7 months after hospital discharge (2-class model, n=641)

Depression and Anxiety symptoms trajectories (N=644)

Elevated symptom class (12.7%) Anxiety symptoms
Elevated symptom class (12.7%) Anxiety symptoms
Low symptom class (87.3%) Depression symptoms
Low symptom class (87.3%) Anxiety symptoms
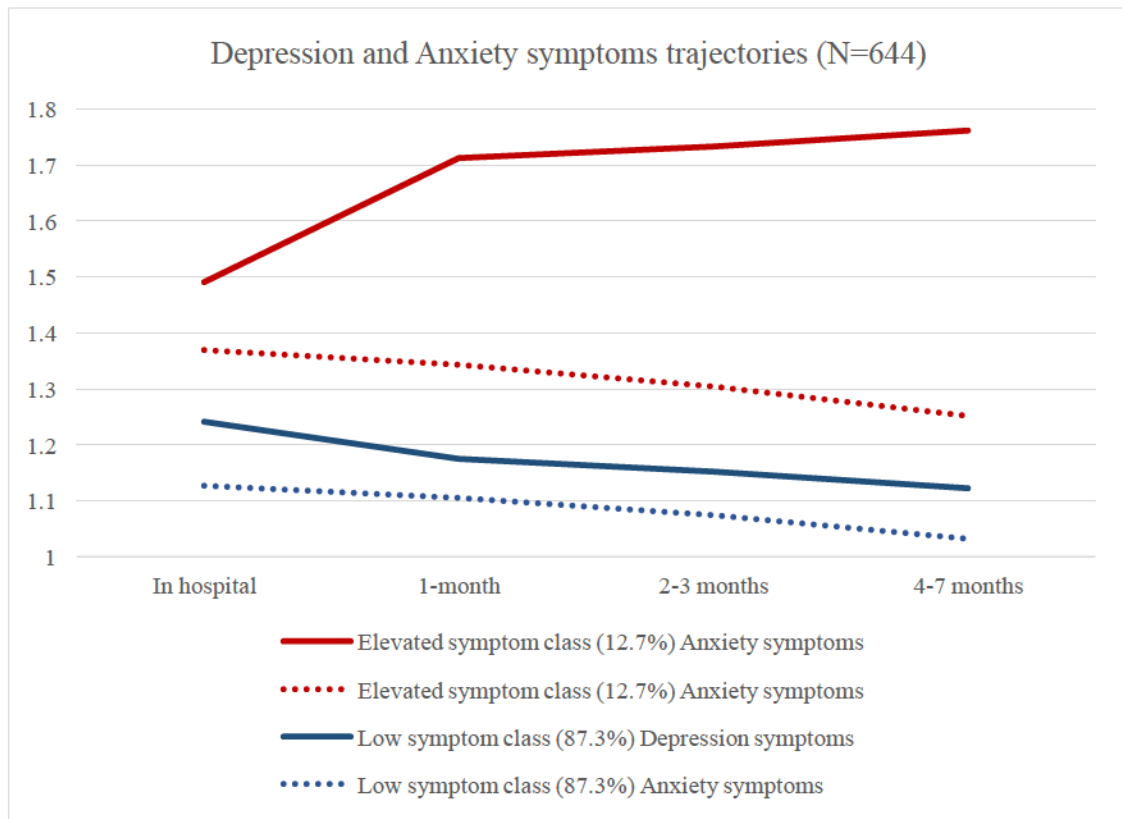
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Chapter 5. Association among Trauma History Characteristics, PTSD symptoms Trajectory, and Disability Level after Injury among Adult Injury Patients in Kenya

Abstract

Background

Prior trauma has been consistently found to be associated with PTSD, but the extent of association and attribution to subsequent disability varied, with limited studies conducted in urban low-income contexts. Limited research has been available on understanding the role of prior trauma and the longitudinal burden from PTSD symptoms from common types of injuries after traumatic injury and the associated disability level in low- and middle-income settings.

Aims

To estimate the trajectory of PTSD symptoms among adult patients hospitalized due to injury four to seven months after hospitalization and the associated disability level. We also aim to estimate the direct and indirect associations between trauma history characteristics, PTSD symptoms trajectory class, and disability level.

Methods

Adult injury patients (n=476) admitted to Kenyatta National Hospital in Nairobi, Kenya, were interviewed in hospital in person, and at 1, 2-3, and 4-7 months after hospital discharge through phone interviews. Post-traumatic stress disorder symptoms were assessed using PTSD Checklist version 5 (PCL-5) at each follow-up and trauma history was assessed in the hospital using Brief Trauma Questionnaire. The level of disability was assessed at each follow-up interview.

Latent growth curve analysis was conducted to estimate the trajectories of PTSD symptoms 4 to 7 months after hospital discharge. Risk factors and trauma history characteristics were preliminarily assessed using R3Step and subsequently included in multivariate logistic regression using manual BCH methods.

Results

Two trajectories of PTSD symptoms were found between 1-month post-hospitalization and four to seven months after hospital discharge: persistently elevated PTSD symptoms (9%), and low PTSD

symptoms (91%). Having previously been exposed to potentially traumatic events and the number of types of trauma exposed were associated with an elevated PTSD symptom trajectory, but no longer associated after controlling for having depressive symptoms while in the hospital. Having previously witnessed killings or serious injuries was associated with elevated PTSD symptoms trajectory class, controlling for other risk factors and direct association with disability level at 4 to 7 months. Being female, having elevated depressive symptoms during hospitalization and having no household savings nor assets were associated with elevated PTSD symptoms trajectory.

Conclusions

Our study found elevated PTSD symptoms persisted several months after hospital discharge, which was associated with a significantly higher level of disability after controlling for injury and demographic characteristics. Specific trauma characteristics should be examined when assessing trauma history exposure. Mechanisms of pathological association between witnessing trauma and elevated PTSD symptoms warrant future investigations.

Introduction

Globally, injuries affect hundreds of millions of people in a year, accounting for 10% of the global burden of disease (Haagsma et al., 2016). This burden has been disproportionately high in low- and middle-income countries (LMICs), where 90% of the injury burden occurred (Herbert, Hyder, Butchart, & Norton, 2011). Traumatic physical injury resulting in hospital admission has been found to be associated with a higher risk of PTSD incidence and a higher level of PTSD symptoms when compared with individuals who were not injured in these traumas (Verger et al., 2004)(Bugge et al., 2015). Studies from various high-income settings have found elevated PTSD prevalence and incidence among injury survivors from months to years after the traumatic injury (M. L. O'Donnell et al., 2016; Wiseman, Foster, & Curtis, 2013). Despite the majority of injury burden in LMICs, most of the literature on longitudinal PTSD outcome among injury populations were from high-income countries (Heron-Delaney, Kenardy, Charlton, & Matsuoka, 2013; Wiseman et al., 2013).

While PTSD diagnosis has been considered as the main factor contributing to the reduced quality of life and disability after traumatic injury (M. L. O'Donnell et al., 2016; Zatzick et al., 2008), subthreshold levels of PTSD have also been found to contribute to increased levels of impairment (Breslau, Lucia, & Davis, 2004)(Stein, Walker, Hazen, & Forde, 1997). A recent study of PTSD severity among injury patients from Australia found various trajectories of PTSD responses, highlighting the long-term PTSD impacts following traumatic injury (Bryant et al., 2015). The research measured psychiatric symptoms in a longitudinal study found these symptoms accounted for the most disability variance after injury, compared with physical factors and pain severity (Meaghan L. O'Donnell et al., 2013). Besides direct association between PTSD symptoms and distal outcome on disability after injury, prior exposure to psychological trauma has been suggested to be associated with physical health (Norman et al., 2006).

Meta-analysis of PTSD in the aftermath of various types of exposure to potentially traumatic events (PTEs) underlined the complex role of pre-, peri-, and post-trauma risk factors in affecting the development and maintenance of PTSD symptoms (Brewin, Andrews, & Valentine, 2000; Ozer, Best, Lipsey, & Weiss, 2003). While the associations between several factors commonly studied were not consistently found across different populations, prior trauma is among the several other factors consistent in predicting PTSD but to varying extents (Brewin et al., 2000). A subsequent review of PTSD symptoms in

adults focusing on specific predictors supported the significant effect of prior trauma, though with comparatively small effects among the predictors studied (Ozer et al., 2003). Epidemiological studies having found a high prevalence of PTE exposure in general populations (Karam et al., 2014). Yet, the varying association of prior trauma with subsequent PTSD symptoms development underscores the need for better characterization of previous trauma. A study in the U.S. by Irish et al. among motor vehicle accident survivors found trauma characteristics accounted for a small variance of PTSD, but the number of types of prior traumas and distress from prior trauma were the most significant trauma history risk factors for PTSD symptoms (L. Irish et al., 2008). While the study did not find the number of prior trauma, age at first trauma, nor having physical injury in prior trauma associated with PTSD symptoms development, the authors suggested the need for including various events and response characteristics to better understand the risk from prior traumatic experience (L. Irish et al., 2008).

It has been hypothesized that exposure to PTEs may increase the risk of negative appraisal (i.e., negatively evaluating the traumatic event or one's ability to respond to stressful environmental events), which increases vulnerability to the development of PTSD symptoms after subsequent trauma exposure. This concept aligns with Ehlers and Clark's cognitive model, which proposed two mechanisms for the pathological responses to trauma: negative appraisals of the trauma or its consequences, and the nature of trauma memory. Factors that increase the risk of negative appraisals include the thought process during the trauma and prior beliefs and experiences of trauma. The experience of PTEs may result in a negative perception of oneself as being unable to act upon the trauma and being vulnerable to danger. Ehler and Clark's cognitive model also suggests that poor memory processing of traumatic events may contribute to the formation of traumatic memory processes. They suggest that integration of traumatic experiences in the general autobiographical memory system is characterized by poor elaboration of the event memory and a lack of processing the complete context, this may lead to unintentional and easy physical triggered retrieval of associated trauma memory.

While there has been a growing body of literature on the development of PTSD after injury, most of these studies were conducted in high-income settings (Heron-Delaney et al., 2013; Wiseman et al., 2013). Despite the construct of PTSD having been identified across many different socio-cultural settings (Hinton & Lewis-Fernandez, 2011), limited research has been available on understanding the extent of the

longitudinal burden from PTSD symptoms from common types of injuries and the associated disability level in low- and middle-income settings. Additionally, limited literature has focused on the role of prior trauma in PTSD symptoms after traumatic injury in LMICs. Kenya is a rapidly developing lower-middle income country with increased burden of injuries in the last decade (Bachani et al., 2012). Studies suggested a high level of trauma experiences among the general population in Kenya (Harder, Mutiso, Khasakhala, Burke, & Ndetei, 2012; Jenkins et al., 2015; Johnson et al., 2014). However, the estimation of risk of PTSD / probable PTSD was based on conditional probability considering the incident event of trauma or specific trauma exposure, and these studies focusing on adults were mainly of cross-sectional design (Jenkins et al., 2015; Johnson et al., 2014). Studies focusing on trauma survivors showed evidence of elevated PTSD burden among survivors of certain trauma. Ongecha-Owuor et al. studied motor vehicle crash survivors attending the orthopedic and trauma clinic in the national hospital found PTSD prevalence of 13% at 1-month after injury (Ongecha-Owuor, Kathuku, Othieno, & Ndetei, 2004). Besides motor vehicle survivors, a more recent study following a specific terrorist event – the US Embassy bombing in Nairobi, found over a quarter of survivors remained to have active PTSD 3 years after the terrorist event (Zhang et al., 2013). The study identified overall similar longitudinal psychopathology among the terrorism event survivors compared with Western disaster populations (Zhang et al., 2013). As these studies underlined the elevated risk of PTSD development with a particular type of trauma or index trauma, it is unclear the burden of PTSD symptoms among general traumatic injury adult survivors and the role of previous trauma exposure on PTSD symptoms.

This study aimed to estimate the trajectory of PTSD symptoms among adult patients hospitalized due to injury four to seven months after hospitalization and the association with disability level at four to seven months. We also estimated the risk factors of PTSD symptoms trajectory, including characteristics of prior trauma, controlling for their association with disability outcome.

Methods

Participants

This study included adults (age 18 years or above) recruited to participate in a longitudinal study of Health, Economic and Long-term Social Impact of Injuries (HEALS) in Kenya. Participants were

recruited between May and December 2015 in Nairobi, Kenya at Kenyatta National Hospital. This hospital provides the highest level of care and is the largest referral and teaching hospital in the country. Recruitment was conducted in wards that admit trauma patients: orthopedics wards, general surgical wards, ear and throat wards, head and abdominal wards, burns ward and burns unit. Patients were recruited to the study with the following inclusion criteria: 1) they had experienced one or more injuries (including intentional and unintentional) that required hospital admission of at least 24 hours, 2) were 18 years or older, 3) were able to communicate in Swahili or English, 4) resided in Kenya and intended to stay in Kenya after hospital discharge, 5) were able to provide informed consent and to be interviewed at the time of enrollment, based on consciousness and coherence in cases of head injury. Patients were excluded in this study if 1) they were admitted to hospital due to self-harm, or 2) self-reported to had been diagnosed with a mental disorder, or 3) they did not survive through hospitalization.

Eligible patients were consecutively enrolled during weekdays over a seven-month period. Of 1038 patients approached for recruitment to the study, 1004 (96.7%) provided informed consent to participate in the parent study. Of those, 961 met the inclusion criteria for the current study. Due to issue with data quality of one data collector, participants recruited and followed up by the data collector were excluded from this study (n=317). Among the 644 patients completed the baseline interview, the final sample of the current study consisted of 476 patients (73.6%) who completed at least 1 follow-up after hospital discharge that included PTSD symptoms measure. In comparison with patients completed baseline interview, this final sample of participants were less likely to be: male (27.9% lost-to-follow-up vs. 14.1% females lost-to-follow-up, p=0.005), injured by assault (36.2% lost-to-follow-up vs. 23.1% of unintentional injuries lost-to-follow-up, p=0.002), and no medical insurance coverage (29.5% lost-to-follow-up vs. 14.7% with medical insurance coverage lost-to-follow-up, p<0.001). Participants who did not complete the follow-up by 4-7 months after discharge did not statistically significantly differ from those who completed the last follow-up by sex, age, highest education level, occupation, urban vs. rural residence, marital status, cause of injury, injury severity level, coverage of medical insurance, having household savings or assets, having borrowed money for hospital treatment, and the various types and number of PTEs. Participants who did not complete the last follow-up by 4-7 months after discharge compared to those completed among those in the study were more likely to have been injured by assault (75.0% of assault survivors completed

last follow-up vs. 84.3% of unintentional injury survivors completed last follow-up, p=0.037), and had longer hospitalization (54 days among those did not complete the last follow-up vs. 36 days among those completed last follow-up, p=0.001).

Procedure

Trained data collectors obtained informed consent and conducted baseline assessments in the hospital. Baseline assessment included an initial interview upon enrollment to obtain demographic information, information about the injury event, disability level pre-injury, prior exposure to trauma, and a self-report measure of depression and anxiety symptoms since the injury event. An exit interview was conducted with each participant regarding in-hospital payment, expenses and assistance received. Subsequent follow-up interviews post hospital discharge were conducted by phone. For participants who could not be reached at first, data collectors tried contacting them at least three other times at different times of the day, and on both weekday and weekend. Participants who could not be reached at the first follow-up were contacted again in subsequent follow-ups.

Questions during follow-up included self-report measures of depression, anxiety and PTSD symptoms, assessment of disability, and rehabilitation and treatment received since the injury. Each follow-up interview took 20 to 30 minutes to complete. Participants were compensated with 100 Kenyan Shillings (equivalence of USD 1) worth of cell-phone airtime credit for each follow-up interview. This study received Institutional Review Board approval from the Johns Hopkins University Bloomberg School of Public Health in the U.S. and the Ethics Review Committee of the University of Nairobi and Kenyatta National Hospital.

Measures

PTSD Checklist for DSM-5 (PCL-5). The PCL-5 is a 20-item instrument to measure PTSD symptoms that reflected changes to previously included PTSD symptoms and the addition of PTSD symptoms in DSM-5 (Weathers et al., 2013). The previous version of the PTSD Checklist for DSM-IV (PCL-4) has been widely applied in various non-Western contexts (Li et al., 2010; Tsutsumi, Izutsu, Poudyal, Kato, & Marui, 2008), and has been the most frequently used self-reported measure of PTSD for clinical screening and symptoms checking (Elhai, Gray, Kashdan, & Franklin, 2005). Despite the recent revision of PCL to measure PTSD according to the DSM-5 definition, PCL-5 has been translated and

adapted as a screening instrument for service provision in clinics supported by an international non-governmental organization – World Vision in Kenya. Pilot testing of the translated version has been conducted, and analyses of the results have been undertaken by the international non-governmental organization. We used the translated Swahili version of PCL-5 implemented by the non-governmental organization in this study.

Hopkins Symptoms Checklist – Depression subscale (HSCL-25). The HSCL-25 is a widely used instrument to measure anxiety and depression based on self-report (Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974; Lee, Kaaya, Mbwambo, Smith-Fawzi, & Leshabari, 2008; Mahfoud et al., 2013; Ventevogel, Jordans, Reis, & de Jong, 2013). The instrument has previously demonstrated good interrater reliability, test-retest reliability, and content validity in Tanzania (Lee et al., 2008), and has been commonly applied in the eastern Sub-Saharan Africa region (Kaaya et al., 2002; Lundberg, Cantor-Graae, Rukundo, Ashaba, & Ostergren, 2009; Vinck, Pham, Stover, & Weinstein, 2007). A recent study examining the depression subscale performance across eight LMICs, including Uganda and Rwanda, demonstrated the robust performance of the HSCL-25 depression subscale (Haroz et al., 2016). As commonly applied in the literature (Lhewa, Banu, Rosenfeld, & Keller, 2007; Vinck & Pham, 2010), the mean score was generated using the depressive subscale (15 items) (Tsai et al., 2016).

Brief Trauma Questionnaire. The 10-item self-report questionnaire was used to assess the exposure to various types of PTEs. Derived from the Brief Trauma Interview (Schnurr, Vielhauer, & Findler, 2002), the Brief Trauma Questionnaire provides a complete assessment of criterion A of PTSD in DSM-5, and has been used among nurses (Kubzansky et al., 2014) and civilians (Lancaster, Melka, & Rodriguez, 2009) to assess trauma exposure. The instrument includes assessment of ten types of PTEs: 1) served in a war zone or non-combat jobs that exposed to war-related casualties, 2) serious car accident or accident at work or elsewhere, 3) in a major natural or technological disaster including fire, 4) had a life-threatening illness, 5) physically punished or beaten as a child that result in injury or very frightened, 6) physical assault (attacked, beaten or mugged), 7) had unwanted sexual contact, 8) in other situations being seriously injured or fear might be seriously injured or killed, 9) close family member or friend died violently, and 10) witnessed situation in which someone was seriously injured or killed. Besides asking whether the specific event has happened, the questionnaire includes questions on whether the individual

was seriously injured or the person thought he / she may be seriously injured or life threatened. Additional questions on age(s) of participants at the time of exposure for each traumatic event were included in the questionnaire to enable the study of when participants experienced the trauma. Up to three incidents of each type of trauma were recorded.

World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0). The WHODAS 2.0 12-item self-report instrument was used to assess participant's experiences of functional impairment and disability associated with a health condition. The scale encompasses six domains of functioning over the past 30 days to estimate a score of global disability: cognition, mobility, self-care, interaction with others, life activities, and participation ("Measuring Health and Disability: Manual for WHO Disability Assessment Schedule (WHODAS 2.0)," 2010). The instrument reflects the concepts that disability encompasses impairments, activity limitations and participation restrictions ("Measuring Health and Disability: Manual for WHO Disability Assessment Schedule (WHODAS 2.0)," 2010). DSM-5 has recommended WHODAS 2.0 for its inclusion in routine clinical use for assessing functioning (Gold, 2014). The instrument has been used to measure disability among general populations in different cultures (Bachani et al., 2016; Kimber, Rehm, & Ferro, 2015) (Rodriguez-Blazquez et al., 2016), as well as with various medical conditions (Hanass-Hancock, Myezwa, & Carpenter, 2015; Marom, Carel, Sharabi, & Ratzon, 2016). Its psychometric properties have been evaluated across cultures in LMICs, supporting measurement invariance and the unidimensional property of the scale (Sousa et al., 2010). Items were ranked based on the level of difficulty due to health conditions, ranged between 0 (none) and 4 (extreme or cannot do). Scoring of the scale was computed according to the 12-item instrument scoring sheet to convert the item scores to a global disability score that ranged between 0 (no disability) to 100 (full disability) ("WHO Disability Assessment Schedule 2.0 (WHODAS 2.0)," 2016).

Estimated Injury Severity Score and other injury-related covariates. Information of injury-related covariates and hospitalization were obtained from the patient's medical record. Diagnosis of injury, including anatomy and pathology of the injury, were recorded from each participant's medical record by a medical resident. Up to three injuries per patient was recorded on the baseline questionnaire. Estimated abbreviated injury scale was generated based on the anatomy and pathology of the injury. Estimated Injury Severity Score (eISS) was then calculated from the estimated abbreviate injury scale for each patient

(Juillard et al., 2014). Anatomy and pathology of injury was used to determine the presence of mild traumatic brain injury.

Socio-demographic variables and post-injury assistance. Socio-demographic variables, including age at admission, sex, urban vs. rural residence, highest level of education attained, and marital status were obtained through the baseline interview while the patient was in the hospital. Information on household financial status (have household savings or assets vs. none, borrowed money for hospital treatment or not), and assistance from the government or non-governmental organization during hospitalization were obtained during the exit interview before the patient left the hospital.

We used the PCL-5 version adapted by the NGO and the Tanzania version of HSLC-25 adapted by Lee et al (2008). All other measurements were translated into Swahili by a certified translator in Kenya. The translation was then reviewed by local supervisor and data collectors, and adapted upon consensus through group discussion with local supervisor and data collectors during data collectors training, and after piloting of the questionnaire. All questions were administered by the interviewer.

Analyses

Factor Analysis. Parallel analysis and scree plot were performed to determine the number of the latent construct(s) of PCL-5 to retain in the study population. Parallel analysis was conducted using the psych package in R (W, 2016). Item on "taking too many risks or doing things that could cause you harm" was excluded in the exploratory factor analysis due to very low proportion of positive symptoms (1.2%) reported. Subsequently, exploratory factor analysis was conducted for the first follow-up data to examine the item loadings on the construct. Exploratory factor analysis was performed using Mplus version 7.2 (Muthén & Muthén, 1998-2015). Geomin rotation and robust weighted-least-squares mean and variance adjusted estimator (WLSMV) were used for ordinal data (Browne, 2001; DiStefano & Morgan, 2014). Model fit indexes (RMSEA, CFI, TLI) and item loadings for each factor extracted were examined.

The parallel analysis found one-factor solution the most fitting for the PCL-5 data (Figure 1). Exploratory factor analysis with one factor found item loadings to be statistically significant for each item (Table 1). One factor model also showed relatively good model fit statistics (CFI: 0.929, TLI: 0.920, RMSEA: 0.051). Cronbach's alpha of PCL-5 of each follow-up also suggested high internal consistency (follow-up 1: 0.8256, follow-up 2: 0.8523, follow-up 3: 0.8551). Results of exploratory structural equation

modeling excluding the several low endorsement items indicated loading and factor variance invariance, as model fit indices improved with increasing constraints from configural invariance (Table 2).

To examine the assumption of longitudinal measurement invariance, a series of exploratory structural equation models were estimated to assess the invariance of parameters across the three waves of data collection (Asparouhov & Muthén, 2009). Due to the high proportion of null response on several items, especially in the 4-7 months follow-up data, some items could not be assessed for longitudinal measurement invariance. These items were "trouble remembering important parts of the stressful experience", "trouble experiencing positive feelings (for example, being unable to feel happiness or have loving feelings for people close to you)", "taking too many risks or doing things that could cause you harm", "feeling jumpy or easily startled", and "having difficulty concentrating". Categorical responses were collapsed to binary, due to insufficient data in each category of responses for assessment. Exploratory structural equation models with increasing parameter constraints were estimated to identify the level of measurement invariance across the three waves of data (Hancock & Mueller, 2013).

Trauma Factor. Exploratory factor analysis was conducted to identify the construct of the various types of common trauma. Out of the ten trauma items assessed in the Brief Trauma Questionnaire, 6 were the pool for the trauma factor(s). Four items were dropped from analysis due to low proportion reported having experienced the trauma (life threatening illness (n=12), life threatening or serious injury from childhood physical punishment (n=5), unwanted sexual contact (n=1), other serious injuries (n=2)). Exploratory factor analysis was performed using Mplus version 7.2 (Muthén & Muthén, 1998-2015). Geomin rotation and robust weighted-least-squares mean and variance adjusted estimator (WLSMV) were used for the binary data of trauma exposure (Browne, 2001; DiStefano & Morgan, 2014). Model fit indexes (RMSEA, CFI, TLI) and item loadings for each factor extracted were examined. Results from the exploratory factor analysis found one-factor solution fit the six types of trauma exposure. Rotated item loadings were statistically significant at 5% level in most items, except for having been in a major natural or technological disaster.

Unconditional Model. A longitudinal latent class analysis was first conducted to examine the patterns of PTSD symptoms trajectories after hospital discharge, without making assumptions on the distribution of the observed variables (Feldman, Masyn, & Conger, 2009). Parameters were estimated using

full-information maximum likelihood (FIML) estimator with robust standard errors (MLR). FIML has demonstrated unbiased estimation under the condition of data missing at random (Raykov, 2005). Models were estimated with cluster by data collector to account for differences in inter-rater reliability. Unconditional trajectory models were first estimated with progressing number of classes. The best fitting unconditional trajectory model was identified based on model convergence, the Lo-Mendell-Rubin likelihood ratio test comparing k classes with k-1 class(es) (Yungtai, Mendell, & Rubin, 2001), the Bayesien Information Criterion (Schwarz, 1978), and the estimated class size for stable parameter estimates (Feldman et al., 2009). Latent class models were estimated using Mplus version 7.1 for Mac (Muthén & Muthén, 1998-2015). Subsequently, based on the results of LLCA, latent growth curve models were estimated to detect a change in PTSD symptoms in each trajectory. The best fitting unconditional trajectory model was identified based on the same criteria used for LLCA.

Conditional Model. Association between the latent trajectory classes and various prior trauma characteristics were assessed. These included: whether the participant experienced prior trauma (yes vs. no), number of prior traumas experienced (total number of prior trauma experienced, regardless of the type of trauma), number of types of prior trauma experienced (total number of different trauma types previously experienced, with a maximum of 10), each type of prior trauma experienced (except for very uncommon type of trauma experienced, as reported by less than 1% of participants), and prior trauma factor.

The bivariate association between each of these trauma characteristics and latent trajectory classes were assessed. Bivariate association between latent trajectory classes and other covariates were also examined, which include: socio-demographic variables (age at admission, sex, urban vs. rural residence, highest level of education attained, marital status), injury event (intent of injury perceived by respondent, major mechanisms of injury), injury severity level (mild: eISS<9, moderate: eISS 9-15, severe: eISS>15), duration of hospital stay (increment of 2 weeks), household financial status (have household savings or assets vs. none, borrowed money for hospital treatment or not), and monetary assistance from government or non-governmental organization. The automatic 3-step approach of auxiliary variables in the mixture model was used to assess the bivariate associations (Asparouhov & Muthén, 2014a).

Variables that were marginally statistically significantly related to class membership, previously found associated with PTSD symptoms or diagnosis in the literature, as well as each prior trauma

characteristics of were included in the multivariate logistic regression mixture model. These variables were integrated using the manual 3-step approach of auxiliary variables in mixture modeling (Asparouhov & Muthén, 2014a). Model fit indexes, including AIC, BIC, and sample size adjusted BIC, were compared among models with various covariates to identify the final conditional model.

To assess the direct and indirect association of these covariates with the class membership of PTSD symptoms, and with the distal outcome of disability at 4-7 months after hospital discharge, they were included as auxiliary variables using the manual BCH methods in Mplus 7.2 (Asparouhov & Muthén, 2014b). Variables that were tentatively associated with disability outcome were also included in the manual BCH modeling.

Results

Participant characteristics

Among the 476 participants included in the study, nearly half (48.7%) of them reported prior PTE exposure. The study population included predominantly an urban (93.1%), young to middle-aged (median: 31.4 years) population. The study population was predominantly male (83.4%), and men were more likely to report having been exposed to trauma ($p<0.001$). A slightly higher proportion of middle-aged respondents and married respondents reported exposed to trauma before the injury event ($p<0.05$), as well as higher proportion of respondents who had household savings or assets. The two groups were similar in their education level, occupation, intent, and cause of current injury event (Table 3).

Latent PTSD symptoms trajectories

A various number of class solutions of PTSD symptoms were tested (Table 4). Results from the model fit statistics did not concur on the same solution. VLMR LRT indicated a three-class solution was statistically significantly better than a two-class solution, while BIC and sample-size adjusted BIC had the largest drop in a two-class solution. However, a three class solution would have resulted in unstable class size as the smallest class was only estimated to be comprised of three individuals. Therefore, a two-class solution was selected. The two classes were distinct from each other as indicated by the high entropy (0.923).

Figure 2 displays the trajectories identified in the two-class solutions of PTSD symptoms. Results of the latent growth curve modeling found an elevated symptoms class (9.2%) and a low symptoms class (90.8%). The elevated symptoms class has a mean of 0.88 of PCL-5 at 1-month after hospital discharge, as compared to 0.20 of the low symptoms class. Between 1-month and 4-7 months post-discharge, the elevated PTSD symptoms class had persisting symptoms (slope: -0.03, p=0.607), while there was a very slight decrease of PTSD symptoms among the low PTSD symptoms class over time (slope: -0.01, p=0.001).

Potentially traumatic events

Ten types of PTEs were assessed using the Brief Trauma Questionnaire (Table 5). The most common types of trauma were: having "a close family member or friend in violent death" (19.3%), "witnessed a situation in which someone was seriously injured or killed, or a situation in which he/ she feared someone would be seriously injured or killed" (19.1%), being "attacked, beaten, or mugged by anyone, including friends, family members or strangers" (17.4%), or involved in a "serious car accident, or a serious accident at work or somewhere else" (15.8%). Four types of PTEs: "Had a life-threatening illness such as cancer, a heart attack, leukemia, AIDS, multiple sclerosis, etc." (0.8%), "physically punished or beaten by a parent, caretaker, or teacher before age 18 that he/she was very frightened, thought he/she would be injured, or was seriously injured" (0.6%), "someone made or pressured respondent into having some type of unwanted sexual contact" (0.4%), and "in any other situation in which the respondent was seriously injured, or in which one feared he/she might be seriously injured or killed" (0.2%) were excluded from the specific types of PTEs analyses due to the very low endorsement. Among those who have experienced PTEs, close to half reported experienced more than one trauma (median: 1, range: 1-7). Regarding types of trauma experienced, about a fifth of respondents experienced at least two types of trauma, ranging from one and four types of trauma (21.43%, n=102).

Covariates associated with PTSD trajectory class and level of disability

Preliminary bivariate associations were examined between baseline covariates and the elevated PTSD symptoms trajectory class (Table 6). There were no substantial bivariate associations between different characteristics of trauma (binary prior trauma exposure, the number of PTEs experienced, and the

number of types of PTEs experienced) and the elevated PTSD symptoms trajectory class. Being female, having elevated depressive symptoms during hospitalization (depressive subscale of HSCL-25>=1.75), and having received monetary assistance during hospitalization were associated with being in the elevated PTSD symptoms trajectory class (p<0.01). Having household assets or saving, and injured in road traffic was associated with the low PTSD symptoms trajectory class (p<0.05).

A subset of covariates from Table 6 was examined in subsequent multivariate models to compare the association between the covariates and the elevated PTSD symptoms trajectory, as well as disability level at 4-7 months after hospital discharge. Several covariates, including marital status, education level, residence (rural vs. urban), medical insurance coverage and monetary assistance were not associated with trajectory class and distal outcome on disability in the multivariate regression model and were excluded in the subsequent more parsimonious model.

Table 7 shows the adjusted association between various PTEs modeled separately with elevated PTSD symptoms trajectory class, controlling for injury-related and socio-demographics and their direct association with disability level at 4-7 months. Having any PTEs (aOR: 1.25, 95% CI: 1.13 – 1.37) and having experienced an additional type of PTEs (aOR: 1.28, 95% CI: 1.02 – 1.61) were associated with the elevated PTSD symptoms trajectory class. However, when the level of depressive symptoms during hospitalization was controlled for, the association between these prior trauma characteristics and the elevated PTSD symptoms trajectory class became non-significant (Table 7). Having an additional PTE was associated with the elevated PTSD symptoms trajectory class (aOR: 1.23, 95% CI: 1.22-1.23), but the association was reduced when controlled for the level of depressive symptoms during hospitalization (aOR: 1.18, 95% CI: 1.05-1.34). All prior trauma characteristics were not directly associated with the disability level at 4 to 7 months after hospital discharge.

Examining the specific type of PTEs showed varying association with elevated PTSD symptoms trajectory class, controlling for other covariates and their direct association with disability level at 4-7 months (table 8). Having previously witnessed killing or serious injury was statistically significantly associated with elevated PTSD symptoms trajectory class (aOR: 2.32, 95% CI: 1.07-5.05) (table 8). Other types of trauma were not statistically associated with the elevated PTSD symptoms trajectory class, when controlling for other covariates and their association with disability level at 4-7 months.

Besides PTEs, a few other characteristics were associated with the elevated PTSD symptoms trajectory class or disability level at 4-7 months after hospital discharge. Controlling for other covariates and the association with disability at 4-7 months post discharge, being female (aOR: 4.74, 95% CI: 4.53 – 4.96) and having elevated depressive symptoms during hospitalization (aOR: 2.96, 95% CI: 1.28 – 6.83) remained several times more likely to be associated with the elevated PTSD symptoms trajectory class. Having household financial security (with assets or savings) (aOR: 0.78, 95% CI: 0.70 – 0.88) was less likely to be in the elevated PTSD symptoms trajectory class, controlling for other characteristics. While some covariates were not statistically significantly associated with the elevated PTSD symptoms trajectory, they were associated with disability level at 4-7 months after hospital discharge. A better self-rated health status during hospitalization was associated with lower risk of disability at 4-7 months after hospital discharge, despite the lack of association with PTSD symptoms trajectory. More severe injury, measured by estimated Injury Severity Score, did not associate with PTSD symptoms trajectory class but associated with higher level of disability at 4-7 months post-discharge (aOR: 1.28, 95% CI: 1.07-1.52). Longer hospital stay was also associated with a higher level of disability outcome at 4-7 months (aOR: 1.26, 95% CI: 1.08-1.47).

PTSD symptoms trajectory class was associated with a statistically significantly difference in the level of disability at 4-7 months after hospital discharge: elevated PTSD symptoms trajectory had a mean of 29.1 in WHODAS 2.0 vs. 10.9 of the low PTSD symptoms trajectory (p<0.001).

Discussions

This study found two trajectories of PTSD symptoms from 1-month post-discharge to four to seven months after hospital discharge from injury among this predominantly male urban population in Kenya. We found a small class of elevated PTSD symptoms trajectory that was maintained over the several months after hospital discharge (9%) and another low symptoms class throughout the same period. Consistent with the literature, the elevated PTSD symptoms trajectory class was associated with a statistically significantly higher level of disability at several months after discharge (Bryant et al., 2010; M. L. O'Donnell et al., 2009; Meaghan L. O'Donnell et al., 2013). Our finding of this associated difference in disability level by PTSD symptoms trajectory class is further strengthened by controlling for the direct

associations between socio-demographic and injury characteristics that were associated with the distal disability level.

Our study also examined the relationships between various characteristics of prior trauma PTSD symptoms trajectory class, after controlling for direct association with disability level at 4 to 7 months after hospital discharge. Nearly half of our study population was previously exposed to at least one trauma, and nearly one-sixth were seriously injured in those events. While we found having previously experienced trauma and having experienced an additional type of trauma were associated with the elevated PTSD symptoms trajectory class, these associations became non-significant when the model further controlled for depressive symptoms severity during hospitalization. As depressive symptoms are commonly comorbid with PTSD symptoms (M. L. O'Donnell, Creamer, & Pattison, 2004; Zatzick et al., 2008), our results suggested the association between PTEs and PTSD symptoms may be mediated by depressive symptoms during hospitalization. Study by Irish et al. on the association between prior trauma characteristics on PTSD symptoms 6 weeks and 1 year after a serious motor vehicle accident in the U.S. found a number of event trauma characteristics correlated with PTSD symptoms at 6 weeks and 1 year, but only number of types of traumas and distress during prior trauma were marginally significant predictors of 1-year PTSD symptoms after controlling for depression and other covariates, among a variety of prior trauma characteristics examined (L. Irish et al., 2008). Similar to findings from Irish et al., we also did not find an association between having a prior serious traumatic injury with elevated PTSD symptoms trajectory after injury (L. Irish et al., 2008).

Limited studies have investigated the relationship between prior trauma characteristics or types and PTSD symptoms after traumatic injury longitudinally among civilians. A recent study by Irish et al. examined the mediated association between PTEs and physical health outcomes after injury, which found a lack of association between PTE characteristics and post-traumatic stress symptoms but these characteristics associated with adverse physical health (L. A. Irish et al., 2013). In our study, despite the lack of association between PTE characteristics and elevated PTSD symptoms trajectory class after injury when controlling for depressive symptoms during hospitalization, we found no association between PTEs and subsequent disability after injury, when controlled for PTSD symptoms trajectory class.

As we examined the relationship between specific trauma events and PTSD symptoms trajectory class after injury, we found having witnessed a situation in which someone was seriously injured or killed had twice the likelihood of being in the elevated PTSD symptoms trajectory class after injury, which was the only PTE that was associated with PTSD symptom trajectories. This association remained statistically significant after controlling for depressive symptoms severity during hospitalization. While meta-analysis has found traumatic experience involving non-combat interpersonal violence such as civilian assault to be associated with subsequent PTSD development in other populations (Ozer et al., 2003), we did not find an association between prior physical attack with elevated PTSD symptoms trajectory after injury in this study. A recent study using cross-sectional data in the World Mental Health (WMH) Surveys in 24 countries found witnessed atrocities to be associated with PTSD risk, among several other traumatic experiences (Kessler et al., 2014). Results from a nationally representative survey of South African adults also found witnessing atrocities had among the highest conditional risk of PTSD, while witnessing death, dead body or saw someone hurt was among the most common PTE exposed (Atwoli et al., 2013). Witnessing or experiencing harm to others may relate to vivid memory formation and recall, as well as potentially subject to feelings of helplessness and the inability to act upon the trauma (Hackett, 2009). These prior experiences of helplessness in the event of witnessing killings and serious injuries may increase the negative appraisals of the trauma, which is one of the mechanisms of pathological responses to trauma in the development of PTSD in the Ehler and Chark's cognitive model. It is also possible that such killings and serious injuries happened to loved ones and families, forming distinct experiences. While this study did not examine the thought processes during PTEs and the details of each PTE, potential mechanisms of having witnessed killings and serious injuries and later elevated PTSD symptoms warrant further research.

Besides characteristics of PTEs, we found several other factors associated with elevated PTSD symptoms trajectory class, controlling for association with the distal outcome of disability. Consistent with the literature, females were more likely to have elevated PTSD symptoms than males (Brewin et al., 2000) (Bryant et al., 2015) (Frans, Rimmo, Aberg, & Fredrikson, 2005). Our findings also aligned with the literature that lower socioeconomic status was a risk factor for PTSD (Brewin et al., 2000). More specifically, we found that financial insecurity, as indicated by a lack of household saving or assets, may be of higher risk of elevated PTSD symptoms after injury. The population-based studies from Vietnam and

Cambodia found strong associations between lower economic status and current post-traumatic stress, as compared to prior trauma exposure or natural disaster experience (Jarl, Cantor-Graae, Chak, Sunbaunat, & Larsson, 2015; Pollack, Weiss, & Trung, 2016). This underlined the potentially increased vulnerability of individuals without financial security when faced with adversity. In addition to pre-injury risk factors, post-injury psychological distress was associated with subsequent elevated PTSD symptoms trajectory in our study. While depression is commonly comorbid with PTSD (M. L. O'Donnell, Creamer, Pattison, & Atkin, 2004; Zatzick et al., 2008), studies suggested higher post-injury distress symptoms, including depressive symptoms, may be associated with the development of PTSD symptoms (Quale, Schanke, Froslie, & Roise, 2009; Zatzick et al., 2002; Zatzick et al., 2007). Despite the association of post-injury depressive symptoms while in a hospital and subsequently elevated PTSD symptoms trajectory class, having elevated depressive symptoms during hospitalization was not directly associated with disability level at 4 to 7 months after discharge. The mediation of depressive symptoms during hospitalization on exposure to PTEs and elevated PTSD symptoms trajectory may also suggest exposure to PTE contributed to negative appraisals after injury, which subsequently contributed to elevated PTSD symptoms. These findings provide additional evidence to demonstrate the predominant burden of PTSD symptoms on disability level after injury in this low-income urban setting. Our results underlined the need to further understand the relationship between PTE and elevated depressive response in the hospital with PTSD symptoms development, as well as witnessing killings and injuries with PTSD symptoms.

This study has several strengths and limitations. Our prospective longitudinal study included adult patients admitted due to major traumatic injuries in Kenya, providing a general estimate for overall traumatic injuries in a mostly urban population in a lower-middle income country context. We also examined the direct and indirect relationship between pre-injury and post-injury risk factors and disability at 4 to 7 months after hospital discharge, and the mediation through PTSD symptoms trajectory. However, nearly a quarter of participants could not be reached by 4 to 7 months after discharged from the hospital, who were more likely to be injured by assault and had a longer hospital stay. These differences may have affected the risk factors estimation and may not be generalizable to patients with these characteristics. Second, there was no criterion validation of the PCL-5. We used the version applied by the non-governmental organization who provided mental health care services locally, which has been adapted to the

local context. Third, we excluded data from one of the data collectors due to very low inter-rater reliability. Analyses were clustered by the interviewer to account for unobserved variability between interviewers. Fourth, PTE was assessed retrospectively. The Brief Trauma Questionnaire was also not designed to include age during prior trauma exposure. Recall of earlier traumatic exposure may be biased. Our study population also reported very few prior unwanted sexual contacts and childhood physical abuse, which may not be representative of the overall injury population. Fifth, the Injury Severity Score was estimated with information extracted from medical records. The estimated Injury Severity Score may not fully capture injury severity, due to the lack of diagnostic resources in the low-income setting. This may bias the estimation on association with elevated PTSD symptoms despite our findings concurred with the literature on the lack of association between objective injury severity and PTSD development. Also, this study included a largely male and urban sample, which may not generalize to females and rural residents. The relationship between PTEs, in particular, specific types of trauma and PTSD symptoms among females after injury warrant future investigations.

The current findings extend the literature by providing additional evidence of the association between specific type of PTE and elevated PTSD symptoms trajectory after subsequent injury, and demonstrating the burden of elevated PTSD symptoms on disability in a predominantly male, urban low-income context.

Conclusion

Our study of adult injury patients found elevated PTSD symptoms persisted several months after their hospital discharge, which was associated with a significantly higher level of disability after controlling for injury and demographic characteristics. While a number of prior trauma characteristics were not associated with PTSD symptoms trajectory after the injury when elevated depressive symptoms during hospitalization were considered, having witnessed killings had higher odds of being in the elevated PTSD symptoms trajectory class. Prior overall trauma exposure was not independently associated with disability several months after hospital discharge.

Tables and Figures

Table 1. Factor loading of 20 items in follow-up 1

Item number	Item	Factor loading
1	Repeated, disturbing, and unwanted memories of the stressful experience?	0.797*
2	Repeated, disturbing dreams of the stressful experience?	0.659*
3	Suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)?	0.712*
4	Feeling very upset when something reminded you of the stressful experience?	0.831*
5	Having strong physical reactions when something reminded you of the stressful experience (for example, heart pounding, trouble breathing, sweating)?	0.828*
6	Avoiding memories, thoughts, or feelings related to the stressful experience?	0.875*
7	Avoiding external reminders of the stressful experience (for example, people, places, conversations, activities, objects, or situations)?	0.862*
8	Trouble remembering important parts of the stressful experience?	0.669*
9	Having strong negative beliefs about yourself, other people, or the world (for example, having thoughts such as: I am bad, there is something seriously wrong about me, no one can be trusted, the world is completely dangerous)?	0.755*
10	Blaming yourself or someone else for the stressful experience or what happened after it?	0.440*
11	Having strong negative feelings such as fear, horror, anger, guilt, or shame?	0.638*
12	Loss of interest in activities that you used to enjoy?	0.567*
13	Feeling distant or cut off from other people?	0.612*
14	Trouble experiencing positive feelings (for example, being unable to feel happiness or have loving feelings for people close to you)?	0.783*
15	Irritable behavior, angry outbursts, or acting aggressively?	0.801*
16	Taking too many risks or doing things that could cause you harm?	0.743*
17	Being "super alert" or watchful or on guard?	0.340*
18	Feeling jumpy or easily startled?	0.405*
19	Having difficulty concentrating?	0.575*
20	Trouble falling or staying asleep?	0.448*

Table 2. Longitudinal measurement invariance with PCL-5 (excluded items 8, 14, 16, 18, and 19 due to low endorsement in one or more follow-up(s))

Model	Chi-square	df	P-Value	CFI	TLI	RMSEA	RMSEA 90% CI		RMSEA p<0.05
Configural invariance	1541.984	914	0.000	0.86	0.848	0.038	0.035	0.041	1
Loading invariance (weak measurement invariance)	1502.62	942	0.000	0.875	0.868	0.035	0.032	0.039	1
Loading and factor variance invariance	1484.522	944	0.000	0.879	0.873	0.035	0.031	0.038	1
Loading and threshold invariance (strong factorial invariance)	1557.451	970	0.000	0.869	0.866	0.036	0.032	0.039	1
Loading, factor variance, thresholds invariance	1538.583	972	0.000	0.873	0.871	0.035	0.032	0.038	1
Loading, thresholds, latent factor means invariance	1562.914	972	0.000	0.868	0.865	0.036	0.032	0.039	1
Loading, factor variance, thresholds, latent factor means invariance	1543.989	974	0.000	0.873	0.871	0.035	0.032	0.038	1

Table 3. Demographic and injury characteristics

	No experience of trauma (n=244)		Previously experienced trauma (n=232)		Total		
	N	%	N	%	N	Pearson chi-square	p-value
Sex							
Males	187	47.10	210	52.90	397	chi2(1) =	< 0.001
Females	57	72.15	22	27.85	79	16.5468	
Age							
18-29 years	117	58.21	84	41.79	201		
30-44 years	86	44.10	109	55.90	195	chi2(3) =	0.038
45-59 years	36	52.17	33	47.83	69	8.4109	
60 years and above	4	40.00	6	60.00	10		
Highest education level							
None	4	50.00	4	50.00	8		
Some primary school	32	64.00	18	36.00	50		
Completed primary school	70	53.44	61	46.56	131		
Secondary / high school	99	47.37	110	52.63	209		
Technical / vocational school	14	50.00	14	50.00	28	chi2(7) = 6.0066	0.539
Some college	6	46.15	7	53.85	13		
College/ undergrad	19	52.78	17	47.22	36		
Postgrad	0	0.00	1	100.00	1		
Occupation							
Farmer	10	52.63	9	47.37	19		
Civil servant	9	64.29	5	35.71	14		
Semi-government employee	0	0.00	2	100.00	2		
Private employee	95	48.47	101	51.53	196	chi2(8) =	0.146
Self-employed	76	55.88	60	44.12	136	12.1125	
Student	19	57.58	14	42.42	33		
Unemployed (other reason)	18	64.29	10	35.71	28		
Not in workforce	3	33.33	6	66.67	9		
Other	14	35.90	25	64.10	39		
Residence: urban / rural							
rural	22	66.67	11	39.46	33	chi2(1) =	0.066
urban	222	50.11	221	54.64	443	3.3685	
Marital status							
Single	112	60.54	73	39.46	185		0.001

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Married	132	45.36	159	54.64	291	chi2(1) = 10.4309	
Intent of injury							
Unintentional	195	50.13	194	49.87	389	chi2(1) = 1.0915	0.296
Assault	49	56.32	38	43.68	87		
Cause of unintentional injury							
Road traffic	119	48.18	128	51.82	247		
Fall	37	54.41	31	45.59	68	chi2(4) = 5.8519	0.210
Burn	14	66.67	7	33.33	21		
Sharp object	8	34.78	15	65.22	23		
Other	17	56.67	13	43.33	30		
Estimated Injury Severity Score							
Mild (eISS<9)	99	53.51	86	46.49	185		
Moderate (eISS 9-15)	105	45.85	124	54.15	229	chi2(2) = 3.6149	0.164
Severe (eISS>15)	19	59.38	13	40.63	32		
Have household assets or savings							
No	164	57.54	121	42.46	285	chi2(1) = 10.5791	0.001
Yes	79	42.25	108	57.75	187		

Table 4. Latent growth curve analysis model fit statistics

No. of class(es)	df	LL	AIC	BIC	Sample-size adjusted BIC	VLMR LRT		LMR-LRT		Entropy	Smallest class n (%)
						2*LL	p-value	2*LL	p-value		
1-class	5	-256.133	522.266	543.093	527.224		NA		NA	NA	NA
2-class	8	-115.504	247.007	280.331	254.94	281.259	0.8689	266.832	0.8892	0.923	44 (9.2%)
3-class	11	-53.231	128.462	174.281	139.369	124.546	0.0000	118.157	0.0000	0.932	3 (0.6%)
4-class	14	4.929	18.142	76.458	32.024	116.319	0.3126	110.353	0.3037	0.923	3 (0.6%)

Table 5. Types of trauma and factor score (1 factor)

	n	%	1 factor
Served in a war zone, or a noncombat job that exposed the person to war-related casualties	14	2.94	0.720*
Serious car accident, or a serious accident at work or somewhere else	75	15.76	0.203
In a major natural or technological disaster	7	1.47	0.491*
Had a life-threatening illness such as cancer, a heart attack, leukemia, AIDS, multiple sclerosis, etc.	4	0.84	NA
Physically punished or beaten by a parent, caretaker, or teacher before age 18 that he / she was very frightened, thought he / she would be injured, or was injured	3	0.63	NA
Attacked, beaten, or mugged by anyone, including friends, family members or strangers	83	17.44	0.345*
In any other situation in which the respondent was seriously injured, or in which one feared he / she might be seriously injured or killed	1	0.21	NA
Someone made or pressured respondent into having some type of unwanted sexual contact	2	0.42	NA
A close family member or friend in violent death	92	19.33	0.688*
Witnessed a situation in which someone was seriously injured or killed, or a situation in which he/ she feared someone would be seriously injured or killed	91	19.12	0.530*

Table 6. Bivariate analysis with latent growth curve trajectory

	Bivariate association with elevated PTSD symptoms trajectory class			
	Odds ratio	p-value	95% CI	
Demographic characteristics				
Female (vs. male)	3.819	0.000	3.665	3.980
Age (increment increase of 10 years)	0.855	0.633	0.449	1.629
Highest education level (increment increase of education level)	0.892	0.421	0.675	1.179
Married (vs. others)	1.141	0.850	0.290	4.491
Separated (vs. others)	2.482	0.494	0.184	33.511
Urban residence (vs. rural)	1.751	0.393	0.484	6.333
Self-perceived health state				
Self-rated health status during hospitalization (increment increase of 10 units of better health, range 0-100)	0.962	0.560	0.842	1.099
Depressive symptoms severity during hospitalization				
Elevated depressive symptoms during hospitalization (HSCL-D>=1.75 vs. lower)	3.796	0.000	2.925	4.927
Injury characteristics				
Assault (vs. unintentional)	0.812	0.578	0.390	1.691
Road traffic injuries (vs. others)	0.910	0.036	0.833	0.994
Mild traumatic brain injury (vs. others)	0.451	0.177	0.142	1.434
Estimated injury severity level (increment increase from mild: eISS<9, moderate: eISS=9-15, severe: eISS>15)	0.797	0.665	0.285	2.230
Duration of hospitalization (increment increase of 2 weeks)	1.153	0.419	0.818	1.624
Financial burden				
Covered by medical insurance (vs. not)	1.224	0.582	0.597	2.508
Received monetary assistance during hospitalization (vs. not)	1.196	0.000	1.180	1.213
Household financial security				
Household savings or assets (vs. none)	0.654	0.002	0.499	0.858
Previous trauma				
Previous exposure to trauma (vs. none)	1.065	0.398	0.921	1.231
Previous serious traumatic injury (vs. none)	0.612	0.634	0.081	4.626
Number of traumatic events previously experienced	1.065	0.558	0.864	1.314
Number of type of traumatic events previously experienced	1.018	0.917	0.721	1.438
Types of trauma previously experienced				
Experienced war	0.719	0.770	0.078	6.585
Serious / life threatening unintentional injury	0.624	0.076	0.371	1.052
Got seriously injured / life threatening physical attack (mugged, beaten)	0.696	0.443	0.276	1.760
Witnessed killing or fear life threatened	1.534	0.503	0.438	5.368

| Close family or friend died violently | 1.092 | 0.704 | 0.694 | 1.717 |

Table 7. Adjusted odds ratio of various prior trauma characteristics with elevated PTSD symptoms trajectory, controlling for direct association with disability

Trauma characteristics (each modeled separately)	Elevated PTSD symptoms trajectory (controlled for depressive symptoms severity in hospital)				Elevated PTSD symptoms trajectory			
	Adjusted odds ratio	p-value	95% CI		Adjusted odds ratio	p-value	95% CI	
Previously experienced trauma (vs. none)	1.146	0.155	0.949	1.383	1.247	0.000	1.133	1.373
Previous serious traumatic injury (vs. none)	0.696	0.742	0.080	6.025	0.666	0.717	0.073	6.049
Number of traumatic events previously experienced	1.183	0.007	1.046	1.338	1.226	0.000	1.224	1.229
Number of type(s) of traumatic events previously experienced	1.237	0.242	0.866	1.768	1.283	0.032	1.022	1.610
Trauma factor score	1.528	0.455	0.502	4.652	1.709	0.152	0.821	3.557

Note: 1) Each model was controlled for sex, age (increment of 10 years), estimated Injury Severity Score (mild, moderate, severe), self-rated health status during hospitalization, road traffic injuries (vs. others), duration of hospitalization (increment of half a month), and household financial security (having savings or assets vs. none).

Table 8. Multivariate association between covariates (including types of trauma) and elevated symptoms trajectory

	Multivariate association with elevated symptoms trajectory			Multivariate association with disability at 4-7 months (every increment of 10 out of total 100)			
	Adjusted odds ratio	p-value	95% CI		Adjusted odds ratio	p-value	95% CI	
Demographic characteristics								
Female (vs. male)	4.740	0.000	4.531	4.958	1.456	0.183	0.836	2.536
Age (increment increase of 10 years)	0.678	0.119	0.415	1.824	1.191	0.000	1.112	1.276
Self-perceived health status								
Self-rated health status during hospitalization (increment increase of 10 units of better health, range 0-100)	1.045	0.682	0.847	1.289	0.875	0.000	0.870	0.881
Depressive symptoms severity during hospitalization								
Elevated depressive symptoms during hospitalization (HSCL-D>=1.75 vs. lower)	2.959	0.011	1.282	6.834	0.997	0.988	0.634	1.568
Injury characteristics								
Road traffic injuries (vs. others)	1.002	0.929	0.948	1.059	1.413	0.062	0.984	2.031
Estimated injury severity level (increment increase from mild: eISS<9, moderate: eISS=9-15, severe: eISS>15)	0.767	0.523	0.340	1.730	1.279	0.006	1.074	1.523
Duration of hospital stay (increment increase of 2 weeks)	1.250	0.308	0.814	1.920	1.257	0.004	1.077	1.468
Household financial security								
Household savings or assets (vs. none)	0.783	0.000	0.695	0.883	1.051	0.742	0.780	1.416
Types of trauma previously experienced								
Experienced war (vs. none)	1.747	0.635	0.175	17.445	0.784	0.541	0.359	1.711
Serious / life threatening unintentional injury (vs. none)	1.536	0.110	0.906	2.602	1.207	0.279	0.858	1.697
Got seriously injured / life threatening physical attack (mugged, beaten) (vs. none)	0.937	0.361	0.815	1.077	0.943	0.738	0.665	1.336
Witnessed killing or fear life threatened (vs. none)	2.321	0.034	1.066	5.054	1.133	0.727	0.562	2.286

Close family or friend died violently (vs. none)	0.499	0.126	0.204	1.216	1.106	0.000	1.083	1.130
	Mean	SE			Mean	SE		
Level of disability	28.05	1.5			11.13	1.12		
	Wald test of difference: value: 83.810; p<0.001							

Figure 1. Parallel analysis of PCL-5 with follow-up 1 data

Eigen values of tetrachoric/polychoric matrix

FA Actual Data
FA Resampled Data

Eigen values of original and simulated factors

Factor Number

Figure 2. Mean PTSD symptoms trajectories

PTSD symptoms trajectories between 1 and 4-7 months after hospital discharge (N=476)

Elevated symptoms class
(9.2%, r= -0.03, p=0.60)

Low symptoms class
(90.8%, r= -0.01, p=0.001)

1-month   2-3 months   4-7 months

Elevated symptoms class   Low symptoms class
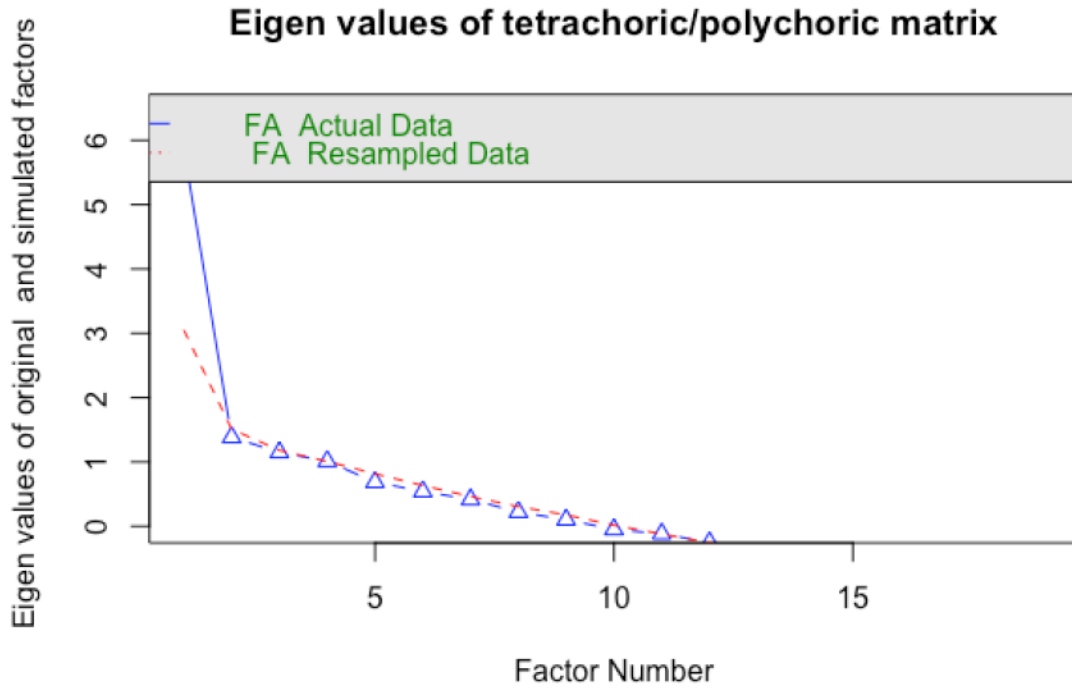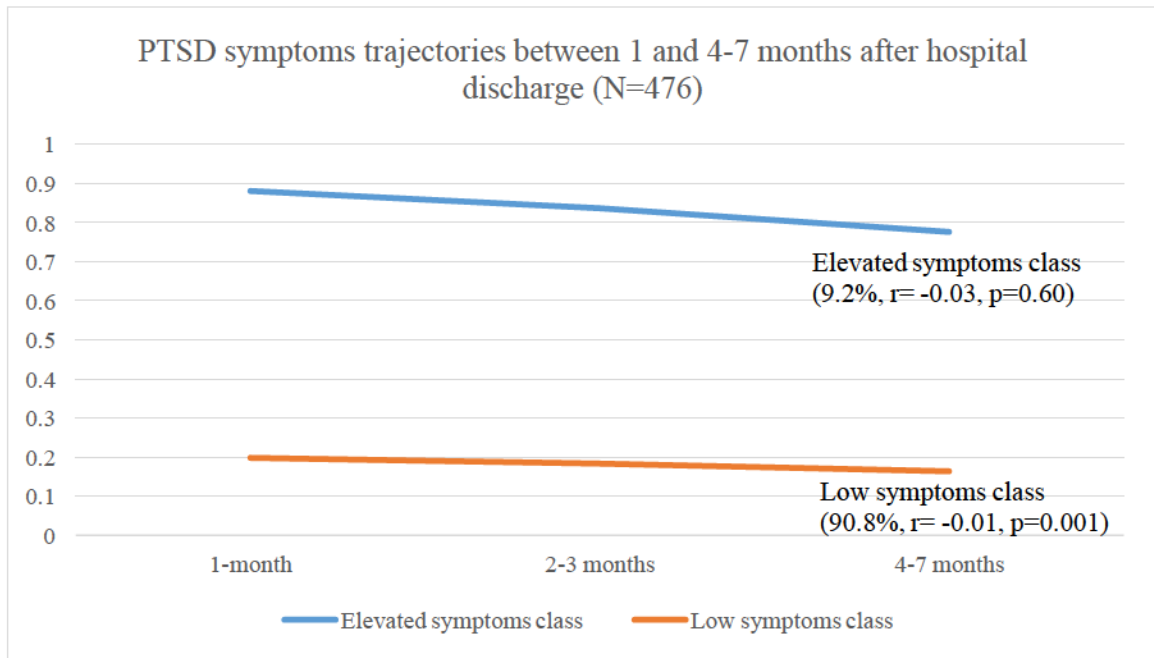
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Chapter 6. Understanding Psychological Distress and Resilience among Adult Survivors of Unintentional Injuries in urban Kenya

Abstract

Survivors of moderate or severe unintentional injuries that required hospitalization are at risk of psychological distress, although prior research suggested many people show resilience over the course of recovery. While studies have described the psychosocial consequences of injury in some low- and middle-income countries, little is known about the different experiences and contributing factors of psychological distress and resilience among unintentional injury survivors in these contexts. We examined the various social consequences and mental health over the course of injury and recovery, with adapted Hobfoll's Conservation of Resources (COR) theory. In-depth interviews were conducted with 28 survivors of unintentional injuries in Nairobi and nearby area, four to eight months after the injury. Interviews were conducted at injury survivors' home or nearby location they preferred between January and February 2016. We identified potential respondents through purposive sampling based on their reported depressive and post-traumatic stress symptoms through the structured questionnaire interviews in the parent study. Half of the respondents were selected based on their low depressive symptoms on Hopkins Symptoms Checklist depression sub-scale (HSCL-D score <1.5) and post-traumatic stress disorder checklist (PCL-5<1) in the 2-3 and 4-7 months follow-ups; and half of the respondents were selected based on their elevated depressive symptoms (HSCL-D score >1.6) and post-traumatic stress symptoms (PCL-5>1) in either 2-3 or 4-7 months follow-ups. Inductive thematic coding was performed on transcribed and translated interviews using ATLAS.ti, after which the COR theory was used to identify the relationship between the resource losses, gains and psychological distress/resilience at the various stages of recovery, beginning with the injury event. Several types of resource loss were described, including financial, property, condition, and physical health resources at different phases of recovery. Improvement in physical health, personal resources, social support through family, friends, neighbors and church members, and spirituality have contributed to the adaptation and resilience demonstrated among injury survivors. Potential interventions on social welfare and facilitating social network building may help reduce distress and overall functioning.

Introduction

Unintentional injuries attributed a major proportion of global disability. Over 30 million years living with disability was estimated due to unintentional injuries in 2013 (Haagsma et al., 2016). Consequences of injury encompass multiple dimensions, including psychosocial and mental well-being (Sareen et al., 2013; T. Wiseman, Foster, & Curtis, 2013). Despite predominant unintentional injuries burden occurred in low- and middle-income countries (LMICs), the studies on the risk of mental ill-health post-injury have been mostly conducted in high-income countries (T. Wiseman et al., 2013). These studies reported elevated risk of mental distress and disorders from several months to several years after the injury event, including depression, anxiety, and post-traumatic stress disorder (O'Donnell et al., 2016) (T. A. Wiseman, Curtis, Lam, & Foster, 2015; Zatzick et al., 2008). A literature review identified several social factors for post-injury mental health problems, including low income, death or injury of someone else, post-injury financial problems, and limited post-injury social support (Sareen et al., 2013). While these quantitative studies have highlighted the burden of mental distress and risk factors, questions remain on the contexts and mechanisms of mental distress and resilience over the course of injury and adaptation. Despite increasing studies have explored the spectrum of psychosocial experience from injury survivor's perspective, studies have commonly described mental distress as a part of other psychosocial experiences, rather than the phenomenon to be explored (Ogilvie, Foster, McCloughen, & Curtis, 2015; Sleney et al., 2014; Tan, Lim, & Chiu, 2008).

Compared with other regions, Sub-Saharan Africa has a high rate of disability among young adults from injuries, mainly driven by road injuries (Haagsma et al., 2016). Although there has been limited literature on quantifying mental distress after injury in this region, qualitative studies exploring the experience of injury survivors have been emerging (Kohler et al., 2017; Kuzma, Lim, Kepha, Nalitolela, & Reynolds, 2015; Mbakile-Mahlanza, Manderson, & Ponsford, 2015; Morrow, Barnett, & Vujcich, 2014; O'Hara, Mugarura, Slobogean, & Bouchard, 2014; Soeker, Van Rensburg, & Travill, 2012). Studies have explored the experiences of survivors of specific injuries, including traumatic brain injury (Mbakile-Mahlanza et al., 2015; Soeker et al., 2012), lower extremity injury (Kohler et al., 2017), and orthopedic injury (O'Hara et al., 2014); as well as the specific phase of experience such as pre-hospital (Kuzma et al., 2015), inpatient (O'Hara et al., 2014), and return to work (Soeker et al., 2012). Kohler et al. and Morrow et

al. have found a central theme of financial hardship and poverty in their studies in Malawi, Ethiopia, India, Vietnam, and Peru, suggesting its prominence in LMICs contexts (Kohler et al., 2017; Morrow et al., 2014). Similar to the high-income countries literature, injury survivors' experience of psychological distress was portrayed in several settings, including rural and urban areas (Kohler et al., 2017; Morrow et al., 2014; Soeker et al., 2012).

Kenya is a lower-middle income country with a high proportion of a young population. Injuries have been an increasing health burden over the last 15 years in Kenya ("GBD Compare," 2016), in which an increasing trend of road traffic injuries has been observed in the context of growing motorization (Bachani et al., 2012). Besides road traffic injuries, a study among urban poor found increasing incidence of males dying from injuries (Mberu, Wamukoya, Oti, & Kyobutungi, 2015). Studies have found that injury mechanism is not associated with depression, anxiety, and stress post-injury, except particular injury including traumatic brain injury that affects survivors' cognitive ability (Gabert-Quillen, Fallon, & Delahanty, 2011; T. A. Wiseman et al., 2015). While a few studies have identified several themes of psychosocial impact from specific injuries in other Sub-Saharan African countries (Kohler et al., 2017) (O'Hara et al., 2014), limited studies have focused on understanding the mental health consequences of those survived unintentional injuries in the urban contexts in LMICs through a qualitative method.

Understanding the trajectory of psychological distress and resilience at different phases after injury and the contextual factors is crucial in identifying the potential window of interventions and type of assistance. In this study, we aim to explore the experience of distress and resilience among adult injury survivors from the time between injury event through adaptation in urban Kenya. We first explored the themes regarding psychological distress based on respondents' experience, then identified the most relevant theories to provide a framework that facilitated the presentation of our findings. The Conservation of Resources (COR) Theory has been among the leading theories studying stress and trauma and has recently been applied in positive psychology (S. E. Hobfoll, 1989)(Stevan E. Hobfoll, 2011). Emphasizing on the objective reality of threats and loss, this theory provides a framework to examine the circumstances where distress or resilience occurs. According to Hobfoll, resources have been categorized as object resources, condition resources, personal resources, and energy resources (S. E. Hobfoll, 1989). The principles of COR theory regarding loss and investment of resources reflects the aspect of time and change, instead of a static

process in approaching stress and trauma (Stevan E. Hobfoll, 2011). The COR theory is selected based on the alignment of the objective view on understanding distress and resilience concerning resources and the descriptions that emerged from the data. Based on the guidelines from Van Beeck et al., the types of resources loss and gain from the COR Theory are applied in each phase. These include the injury event, acute treatment phase (hospitalization), rehabilitation phase (early post-discharge), and adaptation phase (3-6 months after injury)(Van Beeck et al., 2007). We identify progression through these phases to provide a distinction over the course of recovery and correspond to transitions of environment and circumstances experienced by injury survivors. In this study, we aim to understand the experience of psychological distress and resilience after injury over the course of recovery among adult injury survivors in urban Kenya, with the different resources loss and gain according to Hobfoll's COR theory.

Methods

Participants

This study was nested in the longitudinal prospective study of Health, Economic and Long-term Social Impact of Injuries (HEALS) in Kenya. The HEALS study recruited adult patients who were at least 18 years old at Kenyatta National Hospital in Nairobi, admitted to the hospital for at least 24 hours due to injury. The parent study recruited participants and conducted baseline interview at Kenyatta National Hospital and followed up with participants at 1, 2-3, and 4-7 months after the hospital discharge through phone interviews. Structured questionnaires were conducted at each follow-up interview. Hopkins Symptoms Checklist (HSCL-25) and Post-Traumatic Stress Disorder Checklist (PCL-5) were conducted at each of the follow-up interviews.

In-depth interviews were conducted with 28 adults (nine females and 17 males) who resided within 70km of Nairobi. Respondents were purposefully sampled from the HEALS cohort to participate in this nested qualitative study. We excluded patients who self-reported having previously diagnosed with any mental disorder(s). In order to include respondents with different post-injury responses, we purposefully selected two groups of respondents based on their depressive and PTSD symptoms. Fourteen respondents were selected with Hopkins Symptoms Checklist depression sub-scale mean score less than 1.5 and post-traumatic stress disorder checklist (PCL-5) mean score of less than 1 in the 2-3 and 4-7 months follow-ups.

Another fourteen respondents were selected with Hopkins Symptoms Checklist depressive subscale mean score of higher than 1.6 and post-traumatic stress symptoms (PCL-5) mean score greater than 1 in either 2-3 or 4-7 months follow-ups. Research assistants conducting the parent HEALS study contacted the identified respondents through phone, through which he/she introduced the interviewer. The interviewer provided a brief description of the qualitative study and purpose and asked for their interest in participating in the qualitative study. All identified respondents agreed to participate in the study. The in-depth interviews were conducted between four and eight months after the injury that resulted in hospitalization.

Respondents' demographics information and type of injury are presented in Table 1. Respondents were between 20 and 53 years old when they were recruited (median: 30 years old), and the age distribution between males and females were similar. The majority were married (64%, n=18), and employed (including self-employed) before their injury (86%, n=24). A quarter of the respondents were single. Half of the participants completed secondary or high school education, and nearly a quarter had some or completed primary school education. All participants were admitted to hospital due to unintentional physical injury. Most of them were injured from road traffic injuries (64%, n=19), followed by falls (25%, n=7). Participants differed in their duration of hospitalization, ranged between three and 116 days (median: 37 days).

Procedure

The study was conducted between January and February 2016. Each respondent was interviewed once. We conducted the interviews in the respondent's home or a nearby location preferred by the respondent. Local research assistants performed the interviews in Swahili, except when the respondent preferred to speak in English. An interview guide focusing on the experience of the injury event, mental distress symptoms, and help-seeking behavior and coping was provided to facilitate the interviews (Appendix 6). All in-depth interviews were audio recorded. Duration of the interviews ranged between 30 minutes and 1 hour 45 minutes.

Ethics

Before each interview, the interviewer distributed an information sheet containing information and contacts of local non-governmental organizations that provide mental health information or mental health services to each potential participant. The interviewer explained the purpose and process of the study to

each potential respondent and answered any questions about the study. The interviewer obtained a verbal informed consent before each interview. The study provided small monetary compensation equivalent to approximately 2 USD to each participant. If the participant expressed current distress during the interview, the interviewer would halt the interview and refer the participant to a local mental health organization that provides a free counseling service. If the participant mentioned having suicidal thoughts, the interviewer would follow the procedures per protocol and contact the local mental health organization to assess the risk and offered to accompany the respondent to access care. During our study, we referred and followed up with two respondents to the local mental health organization to seek care. The Institutional Review Board at Johns Hopkins University Bloomberg School of Public Health, the Ethics Review Committee at Kenyatta National Hospital and the University of Nairobi in Kenya approved our study.

Analytic Methods

Audio recordings of all in-depth interviews were transcribed verbatim and translated by the interviewer. Another study staff whose native language is Swahili and is fluent in English then reviewed each Swahili and English transcripts. Based on the audio recordings, the study staff examined and edited the Swahili transcripts and reviewed the English translation. Subsequently, the first author compared the first translation and edited English transcripts. When translations required clarifications, the study staff referred to the audio recording.

The first author applied inductive thematic coding to the English transcripts (Braun & Clarke, 2006). The analysis focused on the experience of distress and resilience and their contexts over the course of injury and recovery among unintentional injury survivors in urban Kenya. Upon completion of inductive thematic coding of all transcripts, emerging themes that align with Hobfoll's Conservation of Resources Theory were identified (S. E. Hobfoll, 1989). In the second phase of coding, inductive codes were categorized and labeled using constructs of resources in the COR theory. The principles of COR theory were used to guide the understanding of objective reality, circumstances, and environments that may contribute to the distress and resilience in the urban Kenya contexts. All coding was implemented using ATLAS.ti (Friese & Thomas, 2013).

Results

Figure 1 presents a framework that applies the Conservation of Resources Theory by Hobfoll to the level of distress/resilience experienced by adult injury survivors in urban Kenya over several months after the injury event. It illustrates the different types of resource loss and gains starting from the injury event, to hospitalization, early rehabilitation and adaptation phase. These resources loss and gain, with the caravan passageways, play a crucial role in the individual's level of distress or resilience over time. Injury survivors may experience some or all of these resources loss and gain at the different phases, with a changing level of distress/resilience over time. While respondents differed in their level of resources before the injury, the injury event marked a sudden resource loss, which, in many cases were aggravated by further losses. Social support through family, relatives, friends, neighbors, and communities served to counter some of these losses and encompassed different means, including material, advice, care, and emotional support.

Injury Events

All respondents experienced an unintentional injury with a severity that led to their hospitalization. While the level of injury severity differed by respondent, many expressed being shocked about the incident. Besides the loss of health, some respondents also had property loss.

Traumatic experience. All respondents recalled how the injury occurred. However, some respondents had lost consciousness when the injury occurred. Many of them did not regain consciousness until being transported to hospital or arrival in hospital. Almost all of the injury survivors expressed being shocked about the incident and the fact that they were injured when they regained consciousness. One female respondent who was involved in a road traffic crash described the event preceding the crash, in which people started screaming and crying when the driver began losing control of the minibus, and she screamed until she lost consciousness before the crash happened. Another respondent who passed out at the time of injury described seeing "darkness" approached when the injury occurred and did not remember subsequent happenings until arrival at the hospital. For those who remained conscious during the event, some respondents mentioned feeling overwhelmed by the pain from the injury, while a few respondents described being confused and trying to seek help. One young male who was injured while traveling to

home from work, described his feelings when the lorry he was traveling rolled aside and the bricks that it was carrying fell on him:

"I thought I was dreaming. My voice was gone, I tried to call out for help but couldn't. It was [as] if I was in a dream. I was confused." (Male, 22 years old, road traffic injury)

Besides the shock of injury and pain, some respondents mentioned that they thought not they would not survive the injury or they might be permanently disabled and expressed a sense of despair. Among those who were the breadwinner of the family, they began worrying about implications on their livelihoods. One respondent who was a single-mother described her concerns the moment she got injured, which was common among other injury survivors who were breadwinners:

"I lost my senses… You see, I am a single mother… I have children to take care of and I had a child in secondary school. How will the others survive? I do this business so that they can eat. That is what made me worried, and then the pain and the way I saw a lot of blood spilling." (Female, 37 years old, road traffic injury)

In three cases, family members of the injury survivors were involved in the injury event, and two of the injury survivors had lost one or more of their children. One incident was a road traffic crash happened when she was traveling with her child and her sister's family, in which her two-year-old child, her sister's child and brother-in-law died. She remembered seeing her young daughter died in hospital and was then taken away by the doctors. In another case, the respondent thought his brother died in the crash and only realized much later that his brother had survived the injury. At the time, he felt the rescuers should let him die as he thought there was no need for him to live given the death of his brother. One respondent had carbon monoxide poisoning and burns from burning charcoal overnight at home, and she lost two of her children and her sister's child.

Associated property resources loss. In some situations, the injury event did not only result in health loss and traumatic experience but also property loss. One respondent had a road traffic crash in an unsafe neighborhood, and thugs stole everything he had, and he was worried that the vehicle would also be stolen. Another male respondent mentioned losing a large sum of money that was given to him to purchase

materials for work, and he said he "almost went crazy" when he realized that the money was lost. One respondent also lost his vehicle cabin in the crash which he spent a lot of money on.

Acute Treatment Phase

During hospitalization, respondents came to realize the health loss, and some of them began going through further losses, namely financial loss in treatment, income, as well as employment loss in many cases. The realization of health loss and immense pain, together with the concern of permanent disability exacerbated distress among the patients. However, a few injury survivors demonstrated self-efficacy, and they felt encouraged about their survival and reassured by other fellow patients. Social support through family and friends were essential in protecting against the resource losses.

Realization of health loss. As respondents arrived at the first hospital, they continued to realize the health loss after diagnosis and continual treatment. Some respondents were initially sent to a lower level hospital, but the facilities were not equipped to treat their injuries. One respondent was told that he would lose his fingers if he were not treated at a higher level facility promptly. Other respondents who were unconscious during the injury event realized their injuries upon arrival in hospital, and some of them mentioned thinking they were dying given the pain. In many cases where the respondents had an orthopedic injury, they stayed in the ward for several weeks while undergoing treatment. As respondents described being concerned about their health condition, they worried whether they would return to normal later. Some injury survivors endured a lot of pain, which also affected their sleep and mood. One respondent recalled having so much pain that she wanted to die while she was in hospital,

"I just wanted... I even thought that maybe if I get a chance to commit suicide I can just grab that chance and do it... But there was no opportunity because you are tied on that hospital bed so there is no way you can actually do something" (Female, 26 years old, road traffic injury)

Several respondents became concern about their treatment progress. Some of them described feeling impatient about the wait before surgical procedures, while others mentioned being confused about the treatment process. These also added to their level of anxiety and became worried about the deterioration of their health.

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Financial resource loss. During hospitalization, injury survivors had realized not only the physical health loss but also the financial loss, especially among individuals who did not have medical insurance coverage. In addition to a lack of income due to the injury, hospital treatment costs were frequently mentioned as a major source of stress among individuals without medical insurance coverage. The following description from one respondent was a typical example:

> "That was causing the most stress on my mind… I was just thinking how I could get out of Kenyatta, [with] that bill! I didn't have any money in my account or elsewhere." (Male, 35 years old, fall)

Several respondents described the financial burden was an imminent issue, as they thought about the financial implication of every service received,

> "Just touching your leg for a simple dressing is also added to the bill… This was quite distressing. It was all about the money… Theatre (surgery) costs money. Xray costs money, everything." (Female, 38 years old, road traffic injury)

Despite medical insurance coverage, some respondents were under financial constraints to purchase the medical equipment needed for treatment. In some situations, the financial burden was so disturbing that the injury survivor had thought that the accident should have killed him/her. Often, these individuals who could not afford to pay the hospital bill continued staying in the hospital but were subsequently approached by a social worker in the hospital to waive the medical bill or pay a partial amount. One respondent explained that he stayed in the hospital for one month after he was medically discharged due to inability to pay the medical charge.

Conditional resource loss. Besides being temporarily out of work due to the injury, about a third of respondent mentioned that they also lost their jobs. Some of them felt it was related to the extended period of hospitalization, during which they got replaced; others indicated that they were unable to work. Some respondents had tight finance situations. When their income stopped, it affected their immediate family members including children and parents. For some injury survivors who have children, "how my

children would have food" was often brought up, and that their children were sent away from school due to inability to pay tuition,

"That income is not mine it's for my family… My children are sent away from school all the time and it's not my wish that I don't have money" (Male, 38 years old, road traffic injury)

Personal resource and social support. Although many respondents experienced some or several types of resource loss, a number of them showed their belief in overcoming the challenge and mentioned feeling encouraged that they had survived the injury. Some respondents were thankful that they did not die and expressed their spiritual belief. One respondent who had a lot of worries about being permanently disabled and the inability to provide for her children during hospitalization described a changed perception,

"On the other hand I thought, God has been good to me… even though my leg was injured, I was still breathing [alive]… The doctor is going to take care of it and even if one leg is amputated, I will still have one and can still watch my children." (Female, 37 years old, road traffic injury)

Some respondents thought of others who died in the injury event or encountered other patients who were more seriously injured. A number of respondents described feeling "consoled" by seeing how others in the ward have survived from serious injuries, or through encouragements from other patients in the ward. The respondent who thought she was not going to make it after the injury recounted a change in perspective,

"You know when I reached there, I actually thought I was the only one who had bad injuries. But when I arrived there at the Kenyatta ward, I found people who had even much worse [injuries] than mine so I just consoled myself with them"

Interviewer, "Okay, before the consolation, what were you feeling?"

Respondent, "I can't lie. When I just entered the door and saw other people, I just got consoled because the moment you enter that ward, you find other people who were brought there before. They always give you hope. They encourage you, I didn't lose hope." (Female, 26 years old, road traffic injury)

Many respondents received a range of support through family, friends, and religious groups. Some respondents had strong social support. One female injury survivor reported that her friends would take turns to visit her in the hospital every day, and that gave her "morale" that she would recover and join her friends. Another respondent felt surprised when he saw friends coming to visit him in hospital whom he did not expect to.

Level of distress/resilience. Many respondents described feeling distressed while in the hospital. Some connected the different sources of stress, including one's health condition, finance needed for treatment, and lack of savings to support the treatment and their family. Helplessness was expressed by a few respondents, as they felt no one was there to assist their situation or to navigate for resources. Additionally, some respondents worried about the acceptance from family and other people's perception. The perceived societal perception could be very burdening, to the extent described as the following:

> "You wonder how the society will treat you… The feeling that you can't provide for your family. I was so afraid of that to the point that I sometimes thought that it would have been better if I was not alive." (Male, 31 years old, road traffic injury)

Respondents often described that these thoughts would disturb one's mind and would not leave. A male respondent who lost his job when he was admitted to the hospital for treatment mentioned the situation was "worse than just the accident" and he remembered being overpowered by these concerns,

> "… all these thoughts were eating into my mind. My head was going to burst." (Male, 28 years old, fall)

Despite many respondents expressed feeling distress during hospitalization, a few others mentioned acceptance of the injury soon after it happened; one respondent described the visits by family and friends changed his beliefs,

> "During that time I felt pain, and I did not have hope if I would ever walk again. But after that, it was those who came to visit me, they gave… (pause) they just gave me hope, and I just accepted that [injury] has happened." (Male, 25 years old, road traffic injury)

Rehabilitation Phase

Rehabilitation phase marks a period of increasing personal capacity on functioning and is generally expected between one and three months after injury. Here, we consider rehabilitation as the early post-discharge period which occurred around the same timeline. However, although personal capacity is expected to improve, this period also reflected several types of resource loss experienced by injury survivors which were countered by continual social support in some situations. Respondents underwent different degrees of resource loss and gain, in which a few of them showed an initial loss of resources became more vulnerable to further losses.

Further financial resource loss. After being discharged from the hospital, the majority of the respondents could not immediately return to work as they have not fully recovered or they have lost their jobs. Not having an income remained the most salient source of financial resource loss. Among the injury survivors who were breadwinners of their family, many struggled on their livelihood. Different degrees of financial hardship were narrated. In a few cases, the financial situation was more taxing as the injury survivors' wives were pregnant or they just had a baby. For some respondents, they relocated to cut costs on rent and sold household items. While a few respondents managed to borrow money to pay for rent and meet basic household needs, several others could not afford to pay rent or have delayed payments. Some respondents mentioned occasions when they came home to find the place being locked by the landlord. One respondent described his situation in more details,

> "[Landlord] told me he/she is coming to lock the house. I told him/her it is okay, if he/she came, first, on that day, I was sick so I knew that when you (refers to the landlord) come, it is just going to be alright, you can lock the house when I am inside then." (Male, 28 years old, road traffic injury)

Condition resource loss. The financial constraints were often felt not only by the injured survivors but also by their families. Family members sometimes had to take over the income generation role. While in some cases, the partner would take up casual work such as washing clothes for people, one respondent mentioned her young daughter who was in school had to take over her business to sell fish in the market. Among the respondents who have children, financial difficulties affected their children's education even though they had not taken up the income generation role. Several respondents said their

children were sent away from school because of not able to pay school fees. The following respondent narrated a conversation she had with her son,

"I usually feel bad; sometimes I wake up with a very heavy heart. Mm, maybe my child wakes me up tells me, 'Mum, today, we shall be caned because of school fees [non-payment].' I tell him, 'Baba just go I don't have money. Right now I don't have money, don't I give it to you when I have it? Today I don't have money.' The child goes, crying. Now he usually leaves me with a lot of thoughts." (Female, 50 years old, burns and poisoning)

For others, as the family could not support themselves, they have agreed to temporarily separate to lessen the financial burden on the family and to enable their children's continual education. Their children, sometimes including the spouse, moved to stay with the in-laws' family. A middle-aged male who was injured in a road traffic crash and stayed in the hospital for two months summarized the change in his family after discharged from hospital,

"I had a wife and a young daughter… My wife was not earning much. She was working as a hairdresser. We could not pay our rent. Before I used to stay down here in a one bedroom. And then when I was admitted, it forced [us] to move up here so that we can afford to pay rent. Since she couldn't pay by herself. All the savings I had, got used. So she has now gone back to her mother's house as we wait and see how things turn out." (Male, 30 years old, road traffic injury)

Despite most of these family separations were temporary and agreed between the partners, a couple of respondents described their wives left the family without having an agreement, which had a damaging impact on the relationship. Relationships with partner and close family members were also affected and a few respondents remembered having felt the stigma. Several respondents mentioned the word "cripple" (*kiwete*), which was often perceived as an insult. One respondent remembered being rejected by his wife after discharged from the hospital, who left with their child:

"Besides this, rejection has worsened the situation. Because the child I love and my wife, they have fled from me. And they were the ones who were the best and I loved them. Finance has been a problem. I cannot support myself. Then it happened that they rejected me. My wife called me a

cripple (*kiwete*), you see? I love my child and I would really love to see him. But I can't. He was sent to the countryside…" (Male, 28 years old, fall)

In a couple of situations, respondents disclosed having used alcohol and drugs sometime after being discharged from hospital to "feel better" about themselves. One respondent further revealed that he got drunk everyday at some point after he got discharged, and he began engaging in illegal gambling business. This had affected his relationships with neighbors and former colleagues, and he admitted having "chased away" his wife.

Stable / further physical health loss. After respondents had been discharged from the hospital, many described they spent a lot of time in bed, especially among respondents who had an orthopedic injury on their leg or hip. Many described being immobile and needed help on many functions, including going to the bathroom, bathing, eating, doing laundry, etc. One respondent described how he felt being immobile:

"There was a day I told my mum that I wished I had broken my hand. At least with the hand you can still get somewhere. I have trouble going to the toilet and, right now as you can see, it's been raining; and you are rained on. Around here there are also wild animals from the park, there is this cheetah that has been eating goats from time to time, yet I am not able to walk around and cannot even carry anything for myself. That is the problem." (Male, 24 years old, fall)

Soon after the discharge, respondents were usually asked to follow up on treatment and medications. Despite these expenses were not as high as hospitalization, many respondents reported not having the financial means to maintain medical appointments. It was a common issue that respondents missed or delayed medical follow-ups, did not purchase the prescribed medications, or not getting medical equipment. In some cases, respondents still had open wounds that required frequent routine dressing after hospital discharge. While the health implication was unclear for some individuals who skipped their medical follow-ups, others have mentioned complications, including wound infection. One respondent recalled the time his wound got infected:

"There was a time I didn't have money. I decided to wait till I get the money. It took four days." Interviewer, "Without dressing?"

Respondent, "Mmh. When I got to the clinic, that man (clinician) told me, 'it would have been better if you just came at once [even without money].' The wound now had a green discharge." (Male, 31 years old, road traffic injury)

Deterioration in health condition was not only due to lack of medical follow-up. Several respondents mentioned having other medical conditions besides the injury, some of which were described as a pre-existing health condition. However, one respondent attributed her high blood pressure during early rehabilitation due to the high-stress level:

"I was so stressed that my [blood] pressure went up. My [blood] pressure went above 200. I was really stressed. So I fell ill again and was taken back to hospital where they found that stress was what had caused the high blood pressure" (Female, 37 years old, road traffic injury)

Social support. Similar to hospitalization, social support played a major role in respondents' well-being. Many respondents could not take care of themselves on their own after returning home. A number of them were assisted by family, friends, and neighbors. Some described their siblings moving in to live with them; others mentioned having friends volunteered to stay with them and help with daily activities. One respondent described being cared by friends after discharged from hospital:

"For me, most times I had company. I had friends who came to live here with me. There were many people so I couldn't feel… there was no time for me to feel lonely." (Female, 26 years old, road traffic injury)

A few respondents said they have come to depend on friends, including material and monetary support. Female respondents commonly mentioned the assistance of friends through coming to the house to help and providing companionship, while male respondents mainly described their friends providing monetary support and occasionally companionship. Female respondents also tended to share their emotions with family and friends than male respondents. Male respondents explained that they didn't share their thoughts and feelings with family and friends because they felt others could not help them. One respondent felt that he would be "shamed for going around sharing your problems," and that some people would tell

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him that if he could not "handle it here in Nairobi," then he should "go back home [upcountry]." Besides friends, some respondents were active in religious activities and were visited by other fellow church members, and they prayed for the respondents. Many respondents described having someone to talk to made them feel encouraged. One respondent elaborated the social support he received from friends that typically mentioned among other respondents:

"I just feel as if I am the same with them. Mm, instead of just sitting, sitting here you know I am still supporting myself. But when we are with friends we can talk. I find the day is over, the day ends earlier...... Also, they give me hope, one day one time, I will get to walk, I will walk like them." (Male, 25 years old, road traffic injury)

Although many respondents described having one or more intimate friends or family, the amount of social support varied among respondents. Whereas some respondents noted being surrounded by friends and families, a few respondents felt neglected by their friends after they were discharged from the hospital as their visits reduced, or they have kept away from the respondents and even disappeared. Some respondents suspected that their friends had found them a bother and burden. One female respondent described half of her friends were supportive, while others were "close when all is well, when you have problems, many of them keep away."

Level of distress/resilience. The transition from hospitalization to returning home involved some adjustments and additional resource loss described. These factors added or moderated strains on injury survivors. Some respondents expressed a sense of freedom when discharged from hospital because of the limited movement during hospitalization, as well as relieved after being assisted by the government on hospital charge. However, many felt being dependent on others and some described themselves as "being a burden" as they had to rely on their family and friends:

"I was dependent on people. Yes, there are some people who feel pity for you for some time. But it will reach a time, where you will be a burden to them. (In English): You are a burden. If I was active, it could be something else. You are now a luggage to other people. And these people don't want to tell you directly. Yes, and this makes someone feel really bad." (Male, 30 years old, road traffic injury)

In addition to the inability to take care of oneself, some respondents encountered multiple resource loss that typified a loss spiral. One respondent attributed his "low spirit" from several resource losses: "social life, interaction, job, career all…" and "all bad thoughts" came to his mind when he spirit was low. Another male respondent who was the breadwinner of the family expressed a sense of despair, after describing a sequence of events after hospitalization: having sent his daughter to stay with his in-laws, experiencing financial difficulty purchasing prescribed medications and had owed rent for several months.

"Now that it's like that, it has made me lose weights, makes my body go… start thinking. When you think, and you are hurt, it's different, you think about other things." (Male, 28 years old, road traffic injury)

These feelings and worries also affected their appetite and sleep. Despite some respondents described their financial hardship to the extent that lacked money to have a nutritious meal, they distinguished the difference that they were lacking appetite even if they had food. Many also recalled having difficulty sleeping due to having a lot of "thoughts." Some respondents described the negative and disturbing thoughts as "bad thoughts," which included suicidal thoughts. One respondent summarized his experience of loss spiral and the negative thoughts:

"The world means rejection. That is what I was seeing. The world is rejection. And when you've been rejected, wouldn't you rather die?...... You know the devil does his work by feeding you with bad thoughts. Your employer turns against you. Now that I have fractured my leg, I do not work; wife also has left me. You cannot catch up you see? Now all these things disturb me a lot…… Sometimes I cannot even sleep at night." (Male, 28 years old, fall)

Two women who have lost their child/children during the injury event experienced a significant loss and went through a difficult grieving process. One respondent described how she could not be alone, as she would begin to "think too much," and found herself weeping and could not do anything else. Their minds were preoccupied with the lost child/children instead of their injuries, and both talked about not wanting to eat whenever thought of them.

Among the others who were not in grieve, majority mentioned feeling stressed during this period, although some of them remained hopeful in the recovery process. They explained that "it's life," and that "life is a challenge." Acceptance of their situation, the belief that their situation was temporary, and that they would get back to life was commonly mentioned among respondents who had been hopeful after hospital discharge. One respondent who disclosed that she thought of committing suicide if there was a chance described she could cope by the time she left the hospital while still having difficulty sleeping:

"I have been strong. I have been trying to cope with everything. Adjust – make any adjustment."

Interviewer, "Mmh. Like which ones?"

"Like you accept that life. You are grounded. You stay in the house. There is no moving. Like you don't live your life the way you used to. You just get used to the life of being indoors." (Female, 26 years old, road traffic injury)

Adaptation Phase

Several months after the injury, survivors began feeling an improvement in their functioning and finding a balance between their capacity and demand despite most respondents have not fully recovered. As many respondents had increased their physical health condition, a few survivors did not observe major improvement. Among those feeling physically better, many of them expressed having hope and that they were "getting there," but some respondents mentioned continue having some distress symptoms.

Stable/improved health and function. A few months after discharge from the hospital, many respondents described resuming some basic functions such as standing, walking a short distance, and going to the bathroom, while a few respondents mentioned their health condition remained similar. Although the majority of respondents have not yet returned to work or their education, some respondents became more mobile and could leave the house. That has served as a significant sign of hope for recovery, and the belief that one can get back to their life after having the injury. The description below was a typical example of improvement in function, seven months after her injury:

"The way I got the accident… both my legs got broken… Then, I had a lot of stress, but right now, the way I am right now, I see that I am recovering. I was walking with two crutches; now I am walking with one crutch." (Female, 20 years old, road traffic injury)

However, not all respondents improved their health condition or functions after several months of the injury. Even in those situations, a sense of hope or acceptance was articulated at the stage of adaptation. Despite worries about the extent of their recovery remained, several respondents said they have adapted to this way of life. One respondent who had a pelvic dislocation and fractured ankle remained bedridden six months after the injury, and he described himself being "just here on this bed, pushing life and moving on."

Spirituality. A strong sense of spirituality emanated among about half of the respondents. "God" was mentioned in many stages. For a few respondents, spirituality was brought up throughout the survival of injury. More commonly, spirituality was discussed in the adaptation phase at times of struggles, a change in perspective, or an explanation for a change or an improvement in circumstance. The following is a typical response from someone who expressed a strong sense of spirituality, who talked about his difficulties relying on others and that life is very hard:

> "All these thoughts, I took them…I have adapted to this way of life. I have realized that I cannot force things. This is just a chapter. It depends on God. Whether I will return to normal when I can start walking, then that will be okay. If God says it, then I will just go on like this as along I am not dead." (Male, 31 years old, road traffic injury)

Some respondents described leaving their concerns to God as a way of relieving themselves from the continual stress, such as the worries about paying debts and livelihood of the family. A male respondent said while he would think about the finance for rent and food, it would get to a point where he would "leave it to God" and asked God to "take over from there." Another female respondent who has gotten back to work to sell fish in the market explained:

> "I am still concerned about money because I still have debts to pay but I leave all to God. I tell myself that, if I had died, it would be no good. Now that am still breathing, I can go on! I can go on! I don't allow too much stress nowadays." (Female, 37 years old, road traffic injury)

Additionally, "God" also provided a sense of companion and guidance. As some respondents said they felt being on their own, a few respondents said that "God" saw them through. One respondent explained that he was experiencing many problems at home, said:

> "As someone who works with his hands, and now that he has gotten hurt, even to lift he can't lift. Let's say there are tears falling in spirit. That's for sure, you are on your own. With full of tears but there is God who guides you." (Male, 45 years old, road traffic injury)

Level of distress/resilience. Among the respondents began seeing improvement in health condition and functioning, having the hope to recover and feeling encouraged was a prominent theme. A few respondents felt that they have come a long way. As they described having been slowly getting better and no longer spent as much time in the house as before, some respondents said they could meet people and chat to reduce the worries. "Thinking too much" has been realized that would "bring problems" to the health condition. Several respondents also felt encouraged when hearing examples of people recovering from multiple injuries through friends and testimonies on radio programs. However, despite some improvement in health, not all respondents felt that they have mentally become better. The following quote came from a respondent who mentioned having improved physical strength to leave his home and can make a small amount of money to pay medication:

> "Regarding thoughts, I see they haven't changed. I haven't recovered completely. And the number of jobs I used to get has gone down. Even people I used to partner with doing jobs do not involve me anymore because they can see that I am still unwell."
>
> "I feel lonely. Yes, am just struggling and losing friends. I feel lonely. But I have to move on. Anyways, I was born alone and should not expect much. But sometimes I just long for the days when I was fine." (Male, 30 years old, electrocuted)

Sometimes, these emotions also affected functioning and livelihood when respondents mentioned losing concentration when they wanted to do something. A female respondent who lost her child in the injury event said she has been "down" financially and could not concentrate, and further explained that she would "forget what customers have ordered and what change to give at the kiosk," which has affected her

family business. Another respondent who was a carpenter who described the improvement in physical ability felt he got confused at times and ended up "forgetting what I was meant to make in the first place."

Several respondents disclosed having received some counseling, through a range of channels including former colleagues, church group, a relative who is a counselor, and referral from the parent study. After being counseled, they mentioned having more positive thoughts and a reduction of negative thoughts, which at times included suicidal ideation and post-traumatic stress. One respondent talked about the changes in her fear of being on a vehicle after hospitalization:

> "There has been a change because of these Catholic nuns from Precious Blood (a nearby parish). One of them would come and provide me with counseling. I was so fearful, I could not even board a bus to town. So the longer I was with the nuns, the more guidance and counseling I received. Now am not as terrified as before." (Female, 42 years old, road traffic injury)

Despite the general physical health improvement among many respondents, a few continued experiencing distress and affected their interaction with others, especially when they did not feel an improvement in their health condition. A male respondent who stayed indoor after five months of his injury reported having a change in mindset regarding recovery that he became having faith that he would recover. However, he continued blaming himself for the injury, had "no joy," and avoided seeing people:

> "You keep to yourself. I can't walk out there on the road because people will see me. I don't want them to laugh at me. I don't want to meet someone like you. When I hear that we have people visiting our home from church, I don't want them to see me. I refused to get out of bed." (Male, 24 years old, fall)

He also distinguished that that one "can't compare someone having abdominal issues with someone with a bone fracture." He felt that people with fractures would be "usually not in the mood" and that one would be lonely.

Besides feeling stigma, other respondents also mentioned not wanting to spend time with people, including friends. A mother who lost her children in the injury and remained to be in grief eight months after the injury incident said she just felt her "heart does not want many issues" and she does not like

talking to others, and she would "just see them there." Another female respondent said she just stayed indoors and no longer enjoyed "going out or talking to other women."

Discussion

We presented the psychological distress and resilience at different phases after adults survived injuries that required hospitalization in urban Kenya, with a range of resource losses and employment of available resources from the environment using the COR theory. Through the inductive analysis, we identified several psychosocial consequences and distress symptoms over the course of the injury event and recovery period. Albeit many of the psychosocial effects of injury were similar with situations in other studies conducted in LMICs, the application of COR theory guided the formation of linkages among this variety of resource losses and use of available resources to explain the psychological distress and resilience in the low resource context.

The COR theory is a stress and trauma theory, based on the underlying expectation that individuals aim to "retain, protect, and build resources and that what is threatening to them is the potential or actual loss of these valued resources" (S. E. Hobfoll, 1989). Psychological distress is an integral component of mental health, and thus we considered psychological distress as a response to the challenges after injury. When applicable, we integrated the COR principles in our study to understand how people react in the face of a major stressor – surviving an injury, and the subsequent losses and employment of resources. Similar to the recent study by Seguin et al. which applied COR theory in describing multiple losses experienced by Georgian internally displaced women as a result of trauma due to the war with Russia in 2008, we had difficulty labeling some specific types of losses. While physical health is tied to mental health, it also aligns with the definition of condition resource - a state that is valued and sought after or served as a means of attainment of these valued objects, personal characteristics, conditions, or energies (S. E. Hobfoll, 1989). We identified physical health as a kind of resource, though distinctive from other condition resources due to its different nature, particularly concerning the injury. Additionally, we labeled finance as a separate kind of resource instead of under energy resource in this study, due to the central theme of finance resources in the absence of other energy resources.

As we applied the COR theory after inductive analysis, the corollary of resource loss primacy was evidenced in several examples in our findings. Our sample population consisted of individuals with generally low socio-economic status, who were more vulnerable to resource loss. The initial injury and traumatic event often set off a loss spiral, with one resource loss affected subsequent resource losses. Several pathways of losses were demonstrated among some respondents. The initial loss of health resulted in hospitalization, which led to financial loss through treatment costs and loss of income, and subsequently further financial loss due to unemployment. These losses depleted their financial resource pool, and in some situations resulted in further physical health loss due to inability to pay for follow-up treatment, and even consequently condition resource loss through the separation of family. In some cases, individuals attempted short-term risky gain strategies, such as borrowing money from acquaintances and engaging in illegal business, which exposed them to potential further loss. These losses also included more tragic loss including the death of a child, whose family experienced tremendous grief and distress, which in turn also affected their ability to gain financial resource. In spite of the resource losses, some respondents had strong social support and sometimes self-efficacy throughout the different phases after injury demonstrated resilience, counteracting with the impact of resource loss.

The prominent relation between financial resource loss and psychological distress among adult injury survivors in urban Kenya relates to the findings from other injury survivors in LMICs. A large personal and household financial burden due to the loss of economic productivity was reported by survivors of lower extremity injury in Malawi, after returning home from treatment (Kohler et al., 2017). Financial distress was described as a central theme in the Malawi study and was related to a feeling helpless due to the inability to provide income (Kohler et al., 2017). Similarly, a high financial burden of hospitalization and medical equipment was also found among injury patients in Tanzania (Kuzma et al., 2015). As described by Gabbe et al., financial burden after injury has not been limited to LMICs (Gabbe et al., 2014). However, these economic consequences were buffered by compensation schemes or welfare among the severely injured survivors in the Australian study, and many reported financial support from employers (Gabbe et al., 2014). Compensation schemes, welfare, and financial support were commonly absent from the narratives in the LMICs studies. Although there is a consistent association between financial burden

and psychological distress in community-based studies in LMICs (Lund et al., 2010), the financial burden is likely exacerbated in the event of injury, as illustrated in our findings.

The focus on mental health state over the period from injury to recovery allowed us to understand both psychological distress and resilience. Rather than focusing on psychopathological symptoms, the application of COR theory facilitated our understanding of both phenomena in the spectrum. As resilience means more than the absence of psychopathology (Davydov, Stewart, Ritchie, & Chaudieu, 2010), our findings mainly presented the resilience mechanism of the adapting responses against the adverse outcome. These adaptation responses happened at different recovery phases after injury for individuals. Some respondents reported adapting to the situation several months after the injury and described their recovery had come "a long way" after a stressful period; others had been experiencing psychological distress symptoms but explained not losing hope and managed to cope over the course of their recovery. Factors related to resilience emerged from our findings are comparable with the resilience literature among the physically ill and those who experienced trauma (Agaibi & Wilson, 2005; Stewart & Yuen, 2011). Psychological factors, namely acceptance, and hope were commonly expressed among injury survivors in the adaptation phase, while a few respondents had accepted their injuries in early rehabilitation phase. Several behavioral mechanisms similar to those described in the literature review of resilience in physical illness were described in our findings, including effective self-regulation of emotions by socializing with people, finding a meaning of the injury and experience through spirituality, and staying active when possible (Stewart & Yuen, 2011). Spirituality/religion have been practiced through belief and praying, while some individuals joined communal activities through the church which also contributed to social support.

Consistent social support was another theme linked to the reduction of psychological distress and resilience after injury. Social support included a broad range of assistance, including financial, object, companionship, and emotional support. Besides providing companionship and financial support, some of the respondents reported having been counseled and encouraged by family and church members who assisted with overcoming their fear of traveling in a vehicle after the road traffic crash. Additionally, new support groups were also formed informally in some occasions during hospitalization and remained after hospitalization. These resource exchanges through family and social networks can be perceived as resource

caravans in the COR theory. The importance of social support has been identified in both qualitative and quantitative literature (O'Hara et al., 2014; Quale & Schanke, 2010; Sareen et al., 2013; Sleney et al., 2014). O'Hara et al. found the importance of social supports as one of the three overarching themes among orthopedic trauma patients in Uganda (O'Hara et al., 2014). A literature review by Sareen et al. on quantitative studies also found post-injury low social support associated with mental health issues after injury (Sareen et al., 2013). Facilitation in building social networks among injury survivors may help to enhance social connection and functioning, especially in situations where the available social support became depleted.

There are several limitations to the study. First, the findings were based on one-time interviews several months after respondents' injuries. The recall of their feelings and experience at the time of injury and early rehabilitation may be biased by their current outlook, although the research team had multiple previous engagements with the respondents throughout various stages of their recovery in the parent study. Second, the two grief cases were relatively distinct from other unintentional injuries, and we were not able to reach saturation on themes regarding grief. While the COR theory could be applied in the grief cases, the loss of child/children were more salient than other resource loss and the distress felt should not be generalized to other unintentional injuries. Third, the resource investment concept could not be thoroughly explored in our study as we focused on the injury events and after, with limited information on predisposed circumstances. We acknowledge that predisposed factors played an important role in people's caravan of resources, but they were beyond the scope of our study. Fourth, the majority of the interviews were conducted in Swahili and some of the meaning in the spoken language might be lost when translated into English. We aimed to ensure capturing the meanings in the original language by having all transcripts reviewed by a separate research assistant, and referred to the original audio recording when needed. Also, all the coding was conducted by the first author.

Recognizing the role of psychosocial consequences of injury on psychological distress and resilience is an important step to identify the need of interventions towards improving the psychological well-being among survivors of unintentional injuries in urban Kenya. These findings underscore the extent of psychosocial effects and social support contribute to the resource caravan in this low-income setting, and the need for social services and support to facilitate resilience and recovery. Interventions may be targeted

to improve national insurance coverage of hospitalization and follow-up treatment to reduce the financial burden among injury survivors, and potential programs to enhance social support after hospitalization.

Conclusion

Our study aimed to improve the understanding of psychological distress and resilience among survivors of unintentional injuries considering their resource loss and protection experienced over the course of injury event and recovery in urban Kenya, guided by the framework of COR theory. The findings underscore the different types of resource loss and protection through social support, which related to people's mental health state during the acute treatment phase, rehabilitation phase, and recovery phase. It also illustrates the corollary concept of COR theory on loss spiral and the importance of resource protection from family and friends in this population with predominantly low socioeconomic status. These results further our understanding of the pathways and extent of financial and conditional resource loss after injury and support the need for social services and future research on interventions to facilitate the building of social networks among injury survivors to improve the psychological well-being and overall functioning.

Acknowledgement

Tables and Figures

Table 1. Demographics and mechanisms of injury of participants

	Male (n=19)	Female (n=9)	Total (n=28)
Age			
Median (range)	30 (21-52)	30 (20-50)	30 (20-52)
Marital status			
Single	5	3	8
Married	13	5	18
Widowed/Separated	1	1	2
Employment status prior to injury			
Employed	17	7	24
Student	1	2	3
Unemployed	1	0	1
Education level			
Primary school	4	4	8
Secondary school	12	2	14
Technical/vocational school	2	1	3
College/Undergraduate	1	2	3
Mechanism of injury			
Road traffic	13	6	19
Fall	5	2	7
Burn	0	1	1
Electrocution	1	0	1
Duration of hospitalization			
Median (range)	48 (11-117)	7 (3-65)	37 (3-117)

Figure 1. Framework adapted from Hobfoll's Conservation of Resources Theory on Injury
Recovery
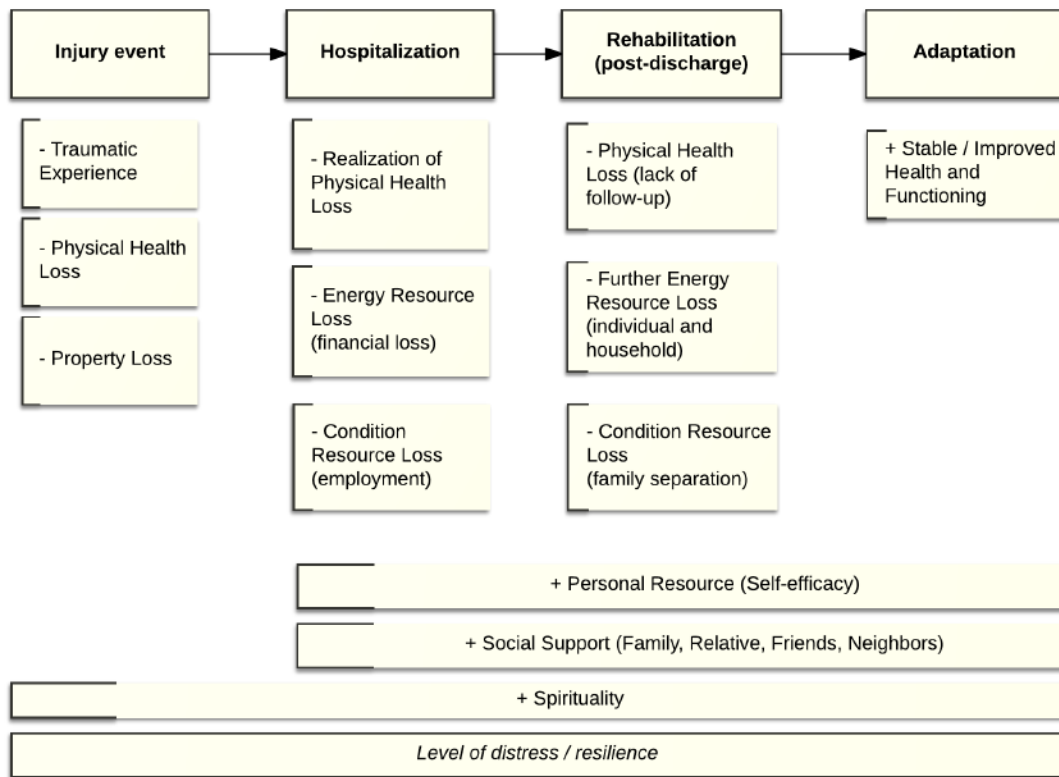
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Chapter 7. Discussion and Conclusions

Summary of Results

The primary objective of this thesis was to improve the understanding of the short-term trajectories of depressive, anxiety, and post-traumatic stress symptoms and their associated risk factors among adult injury survivors in Kenya, as well as these mental health consequences from survivor's perspective. The three papers assessed different aspects of mental health consequences. Chapter 4 applied quantitative analytic methods to estimate the trajectories and associated risk factors of post-injury depressive and anxiety symptoms among adult injury survivors beginning from hospitalization and over the course of four to seven months after hospital discharge. Chapter 5 assessed the risk factors, the role of previous traumatic events, and trajectories of post-traumatic stress symptoms among adult injury survivors in Kenya over the course of four to seven months after hospital discharge. Chapter 6 used a qualitative approach to understand psychological distress and resilience among adult survivors of unintentional injuries in urban Kenya. The findings underline the need to identify injury survivors with elevated depressive and post-traumatic stress symptoms early after hospital discharge, as well as to design programs to reduce psychosocial consequences of injury.

Chapter 4 identified two trajectories of depressive and anxiety symptoms between hospitalization and up to seven months after hospital discharge and their associated risk factors among adult injury survivors. Results identified 13% of respondents had elevated depressive and moderate anxiety symptoms, while the majority of respondents had low levels of depressive and anxiety symptoms. Among the elevated depressive and anxiety symptoms group, their depressive symptoms increased after hospital discharge and remained elevated up to seven months, while their anxiety symptoms level remained moderate. The study identified several characteristics associated with the elevated depressive and moderate anxiety symptoms trajectory: being female, lack of monetary assistance during hospitalization, prior traumatic exposure, residing in the rural area, longer hospitalization, and having worse self-rated health status while in the hospital.

Among individuals with elevated depressive and moderate anxiety symptoms, they had a statistically significantly higher disability level and reported a lack of resumption in normal daily activities

in all post-discharge follow-ups up to seven months, compared to individuals in the low depressive and anxiety symptoms trajectory. These findings highlight the burden of persistence depressive and anxiety symptoms several months after injury and associated impairment among predominantly urban male adult injury survivors in a low-income population in Kenya. While the majority of patients had low levels of depressive and anxiety symptoms with improved functioning after hospital discharge, it is important to identify the subset of injury survivors who experience worse psychosocial outcomes through follow-up after hospital discharge to provide early intervention. As we found the elevated symptoms persisted after one month post-discharge, early intervention may be helpful in reducing the elevated symptoms trajectory.

Chapter 5 identified two trajectories of post-traumatic stress symptoms between 1-month and 4- to 7-months post-discharge among the adult injury survivors population: a smaller proportion (9%) of respondents estimated to be in the persistent elevated symptoms group, and predominant respondents (91%) reported a low level of post-traumatic stress symptoms. Approximately half (48.7%) of the injury survivors reported having prior potentially traumatic exposure. Examining the association between potentially traumatic events characteristics and the elevated post-traumatic stress symptoms trajectory, we found that having been (1) exposed to potentially traumatic events, (2) the number of potentially traumatic events experienced, and (3) the number of types of potentially traumatic events were associated with the elevated post-traumatic symptoms trajectory. But these relationships were confounded by depressive symptoms while in the hospital, except for the number of potentially traumatic events experienced.

The most common potentially traumatic events experienced among the adult injury survivors were having a close family member or friend in violent death (19.3%), witnessed a situation in which someone was seriously injured or killed (19.1%), and having been attacked, beaten, or mugged by anyone (17.4%). Having witnessed killings or serious injury was associated with the higher post-traumatic stress symptoms trajectory class, controlling for other risk factors and direct association with disability level at 4- to 7-months. Being female, having elevated depressive symptoms during hospitalization, and having no household savings nor assets were also associated with the higher post-traumatic stress symptoms trajectory. While several characteristics were not associated with the higher post-traumatic stress symptoms trajectory, they were associated with an increase in disability level at 4- to 7-month after hospital discharge. These characteristics are: increasing age, self-rated health status during hospitalization, estimated injury

severity level (an incremental increase from mild: eISS<9, moderate: eISS=9-15, severe: eISS>15), and duration of hospitalization. After accounting for these factors, there remained a statistically significantly higher level of associated disability in the elevated post-traumatic stress symptoms class compared to the low level of post-traumatic stress symptoms class. These results underlined the need to examine specific trauma characteristics when assessing trauma history exposure and follow up with injury survivors after hospital discharge to screen for post-traumatic stress symptoms.

Chapter 6 described psychological distress and resilience among unintentional injury adult survivors, in the context of various social consequences of injury in urban Kenya. After inductively coding the in-depth interviews, we examined these mental health consequences and social factors between the injury event and recovery, using Hobfoll's Conservation of Resources theory. Our findings suggest several types of resource loss happened over this period, including physical health, financial, property, and condition resources, which contributed to their experience of psychological distress. On the other hand, their spiritual/religious belief, self-efficacy, and social support received from family members, friends, colleagues, neighbors, and church members, played a critical role in protecting against these resources loss. The injury event was a significant loss of physical health and property loss in some situations. These initial loss(es) tend to set off a sequence of resource loss. In a couple of situations, family members also died in the injury event. After the injury event, many respondents began to realize their physical health loss as they began the acute treatment phase. During this phase when most respondents remained in hospital, they often experienced financial loss due to becoming employment or a loss of income being unable to work, as well as financial loss from hospital treatment costs. While some respondents were under coverage of the national health insurance, they still faced financial burden to purchase medical equipment. Despite these resources loss was often mentioned as a source of distress described in this period, some respondents felt encouraged by their fellow patients or having survived the traumatic injury event and expressed a sense of resilience. After hospitalization, some respondents experienced additional financial loss as they stayed unemployed or unable to get back to work, and a few of them described depleting their savings or started to take up loans to pay for their daily expense. These resources loss affected those with least resources, and led to a further resource loss, for instance sending their child/children to stay with their in-laws, or the partner also left the household.

This loss spiral was often accompanied by an increased distress, which at times affected respondents' appetite, sleep, concentration, and some even reported having suicidal thoughts. Some respondents described not being able to "catch up" after all these changes and felt being rejected. Whereas different types of social support were commonly mentioned among respondents who expressed resilience, respondents with a loss spiral lacked these support and described friends disappeared after they got injured. Whereas losing friends contributed to their distress, the lack of family support was more salience in emotional response.

The qualitative findings in Chapter 6 also provide more contexts and potential explanation of the quantitative results in chapters 4 and 5. Having worse self-rated health status in the hospital may reflect the realization of health loss, which in turn affected one's distress level in the hospital. Results from Chapter 4 also identified longer hospitalization as a risk factor of an elevated depressive and moderate anxiety symptoms trajectory. Although prolonged hospitalization may indicate injury severity, the duration of hospital stays after controlling for injury severity may be a result of waiting for treatment and other potential health conditions that were not measured. A few respondents mentioned having an extended waiting period before receiving surgical treatment, and they became worried about the delay would cause further deterioration of their physical health. The qualitative findings also highlight the different situations when asked to compare between hospitalization and post-discharge. Many respondents felt being back at home was better than staying in the hospital, and several of them described hospitalization was similar to imprisonment. The hospital environment may also contribute to discomfort, besides a loss of freedom. One respondent mentioned the hospital ward became crowded with patients, and some patients had to sleep on a mattress on the floor. Additionally, injury survivors who were unable to pay for their medical costs would have to wait in the hospital after they were medically discharged. One respondent described staying in the hospital for an extra month until he was given government assistance after evaluated by a social worker in the hospital. Among those who reported being unable to pay the hospital bill, they described having removed that financial burden was a tremendous relief, which helps to explain the government assistance on hospital charge reduced the financial burden that contributed to the stress.

Although Chapters 4 and 5 do not include factors after hospitalization, the findings in chapter 6 and the concepts of resource caravan and loss spiral suggest potential mechanisms of the increased depressive and moderate anxiety symptoms trajectory. Resource losses, initiated through the injury event, had a disproportionate impact on the injury survivors. They affected those with the least resources the most, and resource loss cycles may occur in accelerating speed which extended beyond the injury and hospitalization, contributing to the persistent symptoms. Continual financial losses often occurred beyond hospitalization and rehabilitation phase, during which many injury survivors relied on social support through family and friends, or depleted their savings. Some individuals even owed rents or became in debts. Furthermore, individuals who lack supports from their network became more vulnerable to these losses. In some situations, they had to part with family members after discharged from the hospital, so that their family could be cared by the in-laws. Occasionally, such separation was not agreed by the partner and caused further distress. However, the connection between the higher post-traumatic stress symptoms trajectory and the qualitative findings was less clear as we did not focus on prior potential traumatic exposure. Although respondents in the qualitative study described having post-traumatic stress symptoms such as dreams about the injury event and imagining the event occurring, they did not attribute these symptoms to a particular cause.

According to the COR theory, individuals strive to obtain and protect resources that they value. Very often, the social support includes different forms and means, ranging from assistance through care and accompany to material and monetary support. Individuals who showed resilience usually reported having support from family in addition to other sources, while some of them had strong religious beliefs. They often expressed having a strong sense of hope and confidence that they can get through this stage and become better. As their injury began to recover and their physical ability improved, this resource gain often elicited positive expectations and reinforced their belief of recovery.

Limitations

There are several limitations in this dissertation. First, the quantitative studies are based on self-reported symptoms, which could be affected by the physical injury and hospital environment at baseline for both HSCL-25 and PCL-5 measures. In fact, the longitudinal measurement invariance of difficulty falling

asleep and staying asleep was lower than other depressive symptoms, suggesting potential partial longitudinal measurement invariance. However, since difficulty falling asleep and staying asleep is one of the depressive symptoms, we decided to keep the item in the depressive symptoms measured for consistency at baseline and each subsequent follow-up. The inclusion of difficulty falling asleep and staying asleep symptom across baseline and all follow-ups may result in an inflated depressive symptoms score at baseline.

Second, due to some of the very low frequency of reported anxiety symptoms by the third follow-up at 4-7 months after hospital discharge, the longitudinal measurement invariance of anxiety symptoms could not be assessed. It is possible that some of the anxiety symptoms measured could also differ between hospitalization and post-discharge, or tentatively influenced by the physical injury.

Third, we excluded participants recruited by one data collector in the quantitative studies due to the very low inter-rater/ test-retest reliability. There were some differences between participants recruited and followed up between those in the current studies and from the excluded data collector, such as a slightly higher proportion of female participants, slightly higher proportion of rural participants, and a lower proportion of patients injured by assault recruited by the excluded data collector. These differences potentially limit the generalizability of our results, especially to rural population due to the very low proportion of rural residents included in the study.

Fourth, comparisons between assault injury survivors and unintentional injury survivors may be biased due to the higher proportion of loss to follow-up among assault injury survivors. The comparison of unintentional injury survivors vs. assault survivors on having elevated depressive symptoms and moderate anxiety symptoms trajectory should be further examined in future studies. Additionally, injury survivors of assault were not included in the qualitative study. Our findings on mental health consequences and resource loss and gain may not be translated to intentional injury survivors.

Fifth, due to the loss to follow-up between baseline during hospitalization and subsequent post-discharge follow-up, we did not study the comorbidity of depressive, anxiety, and post-traumatic stress symptoms. Major depression episode and post-traumatic stress disorder are commonly comorbid as found in other post-injury populations (O'Donnell, Creamer, Pattison, & Atkin, 2004; O'Donnell et al., 2016). Due

to the nature of self-reported measures, there may be potential symptom overlap between the symptomology.

Sixth, this thesis excluded injury survivors who self-reported having previously been diagnosed with any mental disorder(s). This was intended to exclude individuals who had predisposed psychopathology prior to the injury event as history of mental disorders is a consistent predictor of higher levels of psychological distress or mental disorder after exposure to traumatic events. This would limit the generalizability of the findings to people without mental disorder before the injury event. However, the proportion of excluded patients was small in our study (1.0%). This may be due to the limited mental health care and diagnosis received in this population, as suggested by previous study (Ndetei et al., 2009). Our study population may include individuals with predisposed psychopathology but did not receive diagnosis.

Seventh, our qualitative findings were generated based on a one-time interview with each respondent. While we had a prolonged engagement with the participant through the parent study, the interviewers were meeting the respondents for the first time. Due to the conclusion of the study and limited resource, we could not validate our findings with respondents through member checking. We plan to member check our results with the available interviewers who have conducted these interviews.

Recommendations for Future Research

While the dissertation is limited to the four to seven months post-discharge follow-up of injury survivors, future research should extend the follow-up schedule to measure long-term mental health outcomes in Kenya. Previous research in high-income countries found multiple courses of PTSD response and depression among traumatic injury survivors, in which a subset of these patients had later symptoms onset which might not be captured in the current study due to our short-term follow-up (Bryant et al., 2015) (O'Donnell et al., 2016). Little is known about the long-term mental health outcome and association with disability level among injury survivors in LMICs. As we explored the short-term trajectory among injury survivors in the predominantly urban Kenya population, more research is needed to understand the longer trajectory of mental health and functioning, as many of our participants remained unemployed and not yet resuming normal daily activities several months after their hospital discharge.

The current study included population predominantly in an urban area, with limited comparisons with injury survivors residing in the rural. Future research can expand recruitment in more major hospitals serving a higher rural population to improve the representativeness of populations in the country. Rural and urban populations differ in various characteristics, including demographics, resources, and access to care. Comparisons should be made between injury survivors in rural and urban areas to identify differences after controlling for these factors.

As our study experienced a disproportionate attrition among injury survivors from assaults, future implementation research may be performed to determine methods to improve retention and follow-up of assault survivors. Our data suggest that survivors of assaults were less likely to have medical insurance coverage, which may indicate having more financial hardship. Having a relocation was also common among our study participants who remained in the study, of which 20% reported relocating between hospital discharge and four to seven months after discharge. Of those who remained in the study, there seems to be a difference between survivors of assault and unintentional injuries on recent relocation after injury, although the difference was not statistically significant. Participants lost-to-follow-up may be more likely to have relocated than those remained in the study. Detailed characteristics of those lost-to-follow-up and reasons of attrition remain to be investigated in this context.

Self-reported depressive and post-traumatic stress symptoms may suffer from an inflated reporting due to the undifferentiated medical or psychological feature (O'Donnell, Creamer, Bryant, Schnyder, & Shalev, 2003). Future research may examine the criterion validity of the symptom-based measures among adult injury survivor population using structured interview such as the Composite International Diagnostic Interview (CIDI), to determine the sensitivity and specificity for these symptom measures as screening tools for clinical purpose. Additionally, there may be potential differences in measurement of depressive, anxiety, and post-traumatic stress symptoms between males and females, which should also be assessed in future studies with a larger female participant population.

Our qualitative findings underline the potential influence of stressful life events on psychological distress. While the relationship between negative life events and depressive and anxiety symptoms have been examined among general populations in a high-income setting, there needs to be more research on understanding the negative life events pre- and post-injury and their association with mental ill-health

suitable in LMICs contexts in longitudinal studies. Future study should also include multiple sites that include both urban and rural catchment populations in LMICs. This will enable to examining the similar and context-specific factors.

Implications for Policy and Practice

An important aspect of mental health screening is to identify individuals how are at risk and detect those who are in need of mental health services. The longitudinal analyses of injury survivors identified an elevation of depressive symptoms and persistent moderate anxiety symptoms among a subset of injury patients after discharged from the hospital. Results from this study suggest that while injury patients experienced depressive and anxiety symptoms in the hospital, some patients' depressive symptoms increased after hospital discharge and persisted over several months. This indicates the importance to include screenings of depression, anxiety, and post-traumatic stress symptoms in the early rehabilitation phase, which may be incorporated during the medical follow-up treatment.

While the majority of injury survivors would continue medical follow-up on their treatments after hospital discharge, individuals who lacked the financial resource were less likely to attend the follow-up clinic at the hospital as suggested by our findings. As the integration of mental health in primary care has demonstrated feasibility in Kenya, it is important to reinforce the training and identify the linkage between mental and physical health, including post-injury recovery (Jenkins et al., 2010). Short structured general mental health training has been experimented in Nyanza province in Kenya, which showed improvement in patient outcomes but not detection of mental disorders (Jenkins, Othieno, Okeyo, Kaseje, et al., 2013). Literature has identified task-sharing of mental health care among nurses in primary care settings as a critical need to improve delivery of services in urban and rural Kenya (Mendenhall et al., 2016). The inclusion of mental health in the national health sector reform strategy are also important at community, district and primary care level instead of only at high-level care (Jenkins, Othieno, Okeyo, Aruwa, et al., 2013).

Our findings also underline the psychosocial factors associated with depressive, anxiety, and potentially on post-traumatic stress symptoms. Our quantitative results indicate the financial burden of injury and a lower household financial security were associated with elevated mental ill-health symptoms

post-injury, and our qualitative results provide further contexts on the many resource loss continued after hospital discharge. These findings speak to the importance of psychosocial and financial support in this population. Injury survivors often mentioned insufficient support beyond family and friends, and particularly the lack of assistance from the government or non-governmental organizations during the rehabilitation phase. While there are social workers in the hospital to identify patients eligible for a reduction in hospital bill, the long processing time when patient continued to remain hospitalized may result in prolonged hospitalization and may contribute to mental distress. The current social service support can extend beyond hospitalization to follow up and provide linkage to social services through government and non-governmental organizations. Having a social service program after hospitalization can facilitate reduction of the psychosocial burden and prevent individuals from further resource loss.

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Appendixes

Appendix 1. Verbal informed consent script for quantitative component of the study

[seal: APPROVED BY JHSPH Institutional Review Board]	Approval Date: April 23, 2015 Approved Consent Version No.:2 PI Name: Abdulgafoor Bachani IRB No. 00004972

Appendix 9. Verbal consent script for prospective HEALS participants - Kenya

Institutional Review Board
JHSPH IRB Office
Suite E1100, SPH
Phone (410) 955-3193   Fax (410) 502-0584
Toll free # 1-888-262-3242

Verbal Consent Script for Prospective HEALS Participants

Study Title: Understanding Health, Economic, and Long-term Social Impact of Injuries (HEALS): A Pilot Cross-country Study
Principal Investigator: Dr. Abdulgafoor Bachani
IRB#: IRB00004972

Hello. I am _____. I work with Handicap International, University of Nairobi, and Johns Hopkins Bloomberg School of Public Health in the USA. We are doing a research study to understand the long-term physical and mental health, economic, social impact of non-fatal injury in Kenya. We want to know more about how injury affects individuals, their families, and the community through this study.

We are approaching you because you have suffered an injury. We would like to ask you some questions about your recent injury. We will ask how, when and where the injury happened. We will also ask you about your overall well-being and ability to complete certain tasks, recent substance use, mental health symptoms, exposure to trauma, and costs for treating the injury. Because of the nature and timing of the information, we would like to speak with you more than once, and need permission to look at your medical records. Should you agree to be a part of this study, here is a brief description on the procedures:

- Today, we would like to ask you about yourself, the injury incident, and your physical and mental health status within the past 30 days. This interview will take about 40 to 50 minutes in total.
- On the day before your hospital discharge, I (or my colleague) will visit you again to collect information on how much you spent during hospitalization by reviewing your medical bill, and any other expenses you had. This interview will take about 20-30 minutes.
- We would also like to ask for your permission to review your medical record and to contact your doctor. This is because we would like to collect some information on your injury diagnosis and treatment during your hospital stay.
- After you are discharged from the hospital, we would like to follow-up with you to understand how you are coping with the injury. The follow-up interviews will be at your home. We would like to follow up with you at your home at 1, 2, 4, and 12 months. We will ask you a few questions about the impact of injury on you and your family. Each follow-up interview will take about 20–30 minutes. We will not come back or contact you again as part of this study after these interviews.

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There will be a possible direct benefit to you from being in the study. This study provides screening on mental health symptoms, which may help to identify distress that may otherwise be undetected. This study also provides referral to a mental health provider if a certain amount of distress symptoms are identified. The information collected as part of this study will provide us with a better understanding of the impact of injury. The findings of the study may help inform the development of policies and programs to reduce the burden of injury. The study may also help improve overall health in your country.

The risks of this study are minimal. However, you may feel uncomfortable discussing the recent injury you have experienced, any psychological symptoms you have experienced or the related medical costs. You may choose not to answer any question(s). You may choose to stop the surveys at any point. The information gathered in this interview will be strictly confidential and will not be released to anyone, except in the event that you report suicidal thoughts or serious distress. In such cases, information may be shared with other people, including family members, to ensure your safety. It is your decision whether or not to be in this study. Nothing will happen if you chose not to participate, and your care and treatment will not be affected. You can say yes now and change your mind later as well.

If you have any questions about the study you can ask at any time; now or later as well. You can ask the head of the project in Kenya, Prof. Saidi Hassan, at +254 734 510 541, or the Kenyatta National Hospital – University of Nairobi Ethics Research Committee as given below:

Address: University of Nairobi, College of Health Sciences, P.O. Box 19676 - 00202
Telephone: (254) 020 2726300 Ext 44355

You can also call the head of the project at Johns Hopkins University (Dr. Abdulgafoor Bachani at +1443-287-8726) or the Institutional Review Board at Johns Hopkins University (1-410-955-3193 or Toll Free at 1-888-262-3242).

Would you like to participate?   Yes / No

_____

Print name of person obtaining consent

_____

Signature of Person obtaining consent

_____

Date

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Appendix 2. Recruitment script for individual in-depth interview

PI: A. Bachani
IRB#: 4972
Appendix 17. Recruitment script for Individual in-depth Interview on mental health (Kenya only)

RECRUITMENT SCRIPT FOR INDIVIDUAL IN-DEPTH INTERVIEW
Qualitative study on mental health among trauma patients

Hi, can I speak to (name of participant)?

Hi, (name of participant), I am _____. I work with University of Nairobi, and Johns Hopkins Bloomberg School of Public Health in the USA with the HEALS research study team. We are conducting a new study to better understand the mental health consequences of non-fatal injury in Kenya. We have a few questions we would like to ask you in an in-person interview about the experience of your distress symptoms and the context of your injury. The interview will take about 45 minutes to an hour. Would you be interested to participate in this study for a one-time in-person interview?

(If participant express interest, proceed to read the consent script. Otherwise, thank the participant.)

Appendix 3. Verbal consent script for qualitative component

	Approval Date: September 24, 2015
(APPROVED BY JHSPH Institutional Review Board stamp)	Approved Consent Version No.: 1 PI Name: Abdulgafoor Bachani IRB No.00004972

PI: A. Bachani
IRB#: 4972
Appendix 15. Verbal Consent Script for Qualitative component on mental health (Kenya only)

Institutional Review Board
JHSPH IRB Office
Suite E1100, SPH
Phone (410) 955-3193   Fax (410) 502-0584
Toll free # 1-888-262-3242

Verbal Consent Script for Qualitative component on mental health of HEALS Participants

Study Title: Understanding Health, Economic, and Long-term Social Impact of Injuries (HEALS): A Pilot Cross-country Study
Principal Investigator: Dr. Abdulgafoor Bachani
IRB#: IRB00004972

Hello. I am _____. I work with Handicap International, University of Nairobi, and Johns Hopkins Bloomberg School of Public Health in the USA. We are from the HEALS research study team who aim to understand the long-term physical and mental health, economic, social impact of non-fatal injury in Kenya. We are conducting this component of the research study to better understand the mental health consequences of non-fatal injury in Kenya. For this component of the study, we are specifically seeking to understand the mental health issues that affect injury survivors. This information will be used to inform the mental health screening for people who are moderately or severely injured.

We ask you to help us in this component of the study because of your injury and mental distress experience. We have a few questions we would like to ask you about the experience of these distress symptoms and the context of your injury. The interview will take about 45 minutes to an hour.

If you agree to participate in this component of the study, we will schedule a time and date that we can conduct the interview at your home, or at a nearby location that you feel comfortable to have the interview.

There will be no direct benefit to you from participating in this component of the study. The information collected as part of this study will provide us with a better understanding of the psychological impact of injury. Findings of the study can help to inform the use of screening tools in programs to reduce the psychological burden of injury. The study may also help improve overall health in your country in the future.

We will offer Ksh 200 cell phone airtime credit to compensate for your time to participate in the interview.

1

PI: A. Bachani
IRB#: 4972
Appendix 15. Verbal Consent Script for Qualitative component on mental health (Kenya only)

The risks of this study are minimal. However, you may feel uncomfortable discussing the distress you experienced and the context of your injury. You may choose not to answer any question(s). You may choose to stop the interview at any point. The information gathered in this interview will be strictly confidential and will not be released to anyone, except in the event that you report suicidal thoughts or serious distress. In such cases, information may be shared with other people, including family members, to ensure your safety. It is your decision whether or not to be in this component of the study. Nothing will happen if you chose not to participate in this component of the study, and your care and treatment will not be affected. You can say yes now and change your mind later as well.

If you have any questions about this component of the study you can ask at any time; now or later as well. You can ask the head of the project in Kenya, Prof. Saidi Hassan, at +254 734 510 541, or the Kenyatta National Hospital – University of Nairobi Ethics Research Committee as given below:

Address: University of Nairobi, College of Health Sciences, P.O. Box 19676 - 00202
Telephone: (254) 020 2726300 Ext 44355

You can also call the head of the project at Johns Hopkins University (Dr. Abdulgafoor Bachani at +1443-287-8726) or the Institutional Review Board at Johns Hopkins University (1-410-955-3193 or Toll Free at 1-888-262-3242).

Would you like to participate?   Yes / No

_____
Print name of person obtaining consent

_____
Signature of Person obtaining consent

_____
Date

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Appendix 4. Baseline questionnaire (mental health questions)

Study ID ___ ___ ___ ___ ___ ___ ___ ___ IF TRANSFER TO ANOTHER DEPT., from dept. _____ to dept. _____ Name of nurse receive form: _____

Part I. PATIENT ADIMISSION INTERVIEW

[The following questions will be administered upon completion of WHODAS from appendix 2]

MENTAL HEALTH ASSESSMENT

I0. Have you ever been diagnosed with any mental disorder?

Yes ☐
No ☐

HOPKINS SYMPTOM CHECKLIST-25 (HSCL-25)

The following are symptoms or problems that people sometimes have. Please listen to each one carefully and describe how much the symptoms bothered you or distressed you in the last month.

HL1. Suddenly scared for no reason

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL2. Feeling fearful

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL3. Faintness, dizziness, or weakness

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐

Extremely (4) ☐

HL4. Nervousness or shakiness inside

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL5. Heart pounding or racing

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL6. Trembling

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL7. Feeling tense or keyed up

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL8. Headaches

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL9. Spells of terror or panic

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL10. Feeling restless, can't sit still

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL11. Feeling low in energy – slowed down

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL12. Blaming yourself for things

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL13. Crying easily

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL14. Loss of sexual interest or pleasure

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL15. Poor appetite

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL16. Difficulty falling asleep, staying asleep

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL17. Feeling hopeless about the future

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL18. Feeling blue

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL19. Feeling lonely

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL20. Feeling trapped or caught

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL21. Worrying too much about things

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

2

HL22. Feeling no interest in things

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL23. Thoughts of ending your life

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL24. Feeling everything is an effort

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL25. Feelings of worthlessness

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

ALCOHOL, SMOKING AND SUBSTANCE INVOLVEMENT SCREENING TEST (ASSIST v.3)

J13. In the past three months, which of the following substances have you ever used?

Check ALL that apply

Alcoholic beverages (beer, wine, spirits, etc.) ☐
Cannabis (marijuana, pot, grass, hash, etc.) ☐
Cocaine (coke, crack, etc.) ☐
Amphetamine type stimulates (speed, diet pills, ecstasy, etc.) ☐
Inhalants (nitrous, glue, petrol, paint thinner, etc.) ☐

Sedatives or sleeping pills (Valium, Serepax, Rohypnol, etc.) ☐
Hallucinogens (LSD, acid, mushrooms, PCP, Special K, etc.) ☐
Opioids (heroin, morphine, methadone, codeine, etc.) ☐
Other, specify _____ ☐

If NONE of the above is checked, go to BRIEF TRAUMA ASSESSMENT

J14. In the past three months, how often have you used the substances you mentioned (first drug, second drug, etc.)?

First drug: _____

Never ☐
Once or twice ☐
Monthly ☐
Weekly ☐
Daily or almost daily ☐

Second drug: _____

Never ☐
Once or twice ☐
Monthly ☐
Weekly ☐
Daily or almost daily ☐

Third drug: _____

Never ☐
Once or twice ☐
Monthly ☐
Weekly ☐
Daily or almost daily ☐

Fourth drug: _____

Never ☐
Once or twice ☐
Monthly ☐
Weekly ☐
Daily or almost daily ☐

J15. During the past three months, how often have you had a strong desire or urge to use (first drug, second drug, etc.)?

First drug: _____

Never ☐
Once or twice ☐
Monthly ☐
Weekly ☐
Daily or almost daily ☐

Second drug: _____

Never ☐
Once or twice ☐
Monthly ☐
Weekly ☐
Daily or almost daily ☐

Third drug: _____

Never ☐
Once or twice ☐
Monthly ☐
Weekly ☐
Daily or almost daily ☐

Fourth drug: _____

Never ☐
Once or twice ☐
Monthly ☐
Weekly ☐
Daily or almost daily ☐

J16. During the past three months, how often has your use of the drugs you mentioned led to health, social, legal, or financial problems?

Never ☐
Once or twice ☐
Monthly ☐
Weekly ☐
Daily or almost daily ☐

BRIEF TRAUMA QUESTIONNAIRE (BTQ)

K1. Have you ever served in a war zone, or have you ever served in a noncombat job that exposed you to war-related casualties (for example, as a medic or on graves registration duty)?

Yes ☐
No ☐

K1a. If yes, did you think your life was in danger or you might be seriously injured?

Yes ☐
No ☐

K1b. (If yes on K1), were you seriously injured?

Yes ☐
No ☐

K1c. (If yes on K1), at what age did that happen?

_____ years old

K2. Have you ever been in a serious car accident, or a serious accident at work or somewhere else?

Yes ☐
No ☐

K2a. If yes, did you think your life was in danger or you might be seriously injured?

Yes ☐
No ☐

K2b. (If yes on K2), were you seriously injured?

Yes ☐
No ☐

K2c. (If yes on K1), at what age(s) did that happen?

_____ years old

K3. Have you ever been in a major natural or technological disaster, such

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as a fire, tornado, hurricane, flood earthquake, or chemical spill?

No ☐

_____ years old

Yes ☐
No ☐

K6. Not including any punishments or beatings you already reported in question 5, have you ever been attacked, beaten, or mugged by anyone, including friends, family members or strangers?

Yes ☐
No ☐

K3a. If yes, did you think your life was in danger or you might be seriously injured?

Yes ☐
No ☐

K7c. (If yes on K7) At what age(s) did that happen?

_____ years old

K8. Have you ever been in any other situation in which you were seriously injured, or have you ever been in any other situation in which you feared you might be seriously injured or killed?

Yes ☐
No ☐

K3b. (If yes on K2), were you seriously injured?

Yes ☐
No ☐

K6a. If yes, did you think your life was in danger or you might be seriously injured?

Yes ☐
No ☐

K8b. (If yes on K8), were you seriously injured?

Yes ☐
No ☐

K3c. (If yes on K2), at what age(s) did that happen?

_____ years old

K6b. (If yes on K6), were you seriously injured?

Yes ☐
No ☐

K8c. (If yes on K8), at what age(s) did that happen?

_____ years old

K4. Have you ever had a life-threatening illness such as cancer, a heart attack, leukemia, AIDS, multiple sclerosis, etc.?

Yes ☐
No ☐

K6c. (If yes on K6), at what age(s) did that happen?

_____ years old

K9. Has a close family member or friend died violently, for example, in a serious car crash, mugging, or attack?

Yes ☐
No ☐

K4a. If yes, did you think your life was in danger?

Yes ☐
No ☐

K7. Has anyone ever made or pressured you into having some type of unwanted sexual contact?

(Note: By sexual contact we mean any contact between someone else and your private parts or between you and someone else's private parts)

Yes ☐
No ☐

K9c. (If yes on K9) At what age(s) did that happen?

_____ years old

K5. Before age 18, were you ever physically punished or beaten by a parent, caretaker, or teacher so that: you were very frightened; or you though you would be injured; or you received cruises, cuts, welts, lumps or other injuries?

Yes ☐
No ☐

K10. Excluding the event(s) that you have already reported in the previous questions, have you ever witnessed a situation in which someone was seriously injured or killed, or have you witnessed a situation in which you feared someone would be seriously injured or killed?

Yes ☐
No ☐

K5a. If yes, did you think your life was in danger or you might be seriously injured?

Yes ☐
No ☐

K7a. If yes, did you think your life was in danger or you might be seriously injured?

Yes ☐
No ☐

K5b. (If yes on K2), were you seriously injured?

Yes ☐

K7b. (If yes on K7), were you seriously injured?

Yes ☐
No ☐

K10c. (If yes on K10) At what age(s) did that happen?

4

Study ID ___ ___ ___ ___ ___ ___ ___ ___IF TRANSFER TO ANOTHER DEPT., from dept. _____ to dept. _____Name of nurse receive form: _____

> *Thank you for your participation!*
> *We will visit you again upon your hospital discharge.*

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Appendix 5. Follow-up Questionnaires (mental health questions)

FOLLOW-UP QUESTIONNAIRE – 1 MONTH AFTER HOSPITAL DISCHARGE

E. COSTS AND CARE DURING FOLLOW-UP

[The following questions will be administered upon completion of WHODAS section from appendix 3]

MENTAL HEALTH ASSESSMENT

HOPKINS SYMPTOM CHECKLIST-25 (HSCL-25)

The following are symptoms or problems that people sometimes have. Please listen to each one carefully and describe how much the symptoms bothered you or distressed you in the <u>last month</u>.

HL1. Suddenly scared for no reason
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL2. Feeling fearful
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL3. Faintness, dizziness, or weakness
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL4. Nervousness or shakiness inside
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL5. Heart pounding or racing
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL6. Trembling
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL7. Feeling tense or keyed up
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL8. Headaches
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL9. Spells of terror or panic
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL10. Feeling restless, can't sit still
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL11. Feeling low in energy – slowed down
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL12. Blaming yourself for things
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL13. Crying easily
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL14. Loss of sexual interest or pleasure
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL15. Poor appetite
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL16. Difficulty falling asleep, staying asleep
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL17. Feeling hopeless about the future
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL18. Feeling blue
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL19. Feeling lonely
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL20. Feeling trapped or caught
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL21. Worrying too much about things
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL22. Feeling no interest in things
Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL23. Thoughts of ending your life

FOLLOW-UP QUESTIONNAIRE – 1 MONTH AFTER HOSPITAL DISCHARGE

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL24. Feeling everything is an effort

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

HL25. Feelings of worthlessness

Not at all (1) ☐
A little (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

PTSD CHECKLIST (PCL-5)

There are a list of problems that people sometimes have in response to extremely stressful experiences: keeping the worst event in mind, please indicate how much you have been bothered by that problems in the past month.

L1. In the past month, how much were you bothered by repeated, disturbing, and unwanted memories of the stressful experience?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L2. In the past month, how much were you bothered by repeated, disturbing dreams of the stressful experience?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L3. In the past month, how much were you bothered by suddenly feeling or acting as if the stressful experience were actually happening again (as if you were actually back there reliving it)?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L4. In the last month, how much were you bothered by feeling very upset when something reminded you of the stressful experience?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L5. In the last month, how much were you bothered by having strong physical reactions when something reminded you of the stressful experience (*for example, heart pounding, trouble breathing, sweating*)?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L6. In the last month, how much were you bothered by avoiding memories,

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thoughts, or feelings related to the stressful experience?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L7. In the last month, how much were you bothered by avoiding external reminders of the stressful experience (*for example, people, places, conversations, activities, objects, or situations*)?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L8. In the last month, how much were you bothered by trouble remembering important parts of the stressful experience?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L9. In the last month, how much were you bothered by having strong negative beliefs about yourself, other people, or the world (*for example, having thoughts such as: I am bad, there is something seriously wrong about me, no one can be trusted, the world is completely dangerous*)?

Not at all (0) ☐
A little bit (1) ☐

Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L10. In the last month, how much were you bothered by blaming yourself or someone else for the stressful experience or what happened after it?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L11. In the last month, how much were you bothered by having strong negative feelings such as fear, horror, anger, guilt, or shame?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L12. In the last month, how much were you bothered by loss of interest in activities that you used to enjoy?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L13. In the last month, how much were you bothered by feeling distant or cut off from other people?

Not at all (0) ☐
A little bit (1) ☐

FOLLOW-UP QUESTIONNAIRE – 1 MONTH AFTER HOSPITAL DISCHARGE

Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L14. In the last month, how much were you bothered by trouble experiencing positive feelings (*for example, being unable to feel happiness or have loving feelings for people close to you*)?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L15. In the last month, how much were you bothered by irritable behavior, angry outbursts, or acting aggressively?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L16. In the last month, how much were you bothered by taking too many risks or doing things that could cause you harm?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L17. In the last month, how much were you bothered by being "superalert" or watchful or on guard?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L18. In the last month, how much were you bothered by feeling jumpy or easily startled?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L19. In the last month, how much were you bothered by having difficulty concentrating?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

L20. In the last month, how much were you bothered by trouble falling or staying asleep?

Not at all (0) ☐
A little bit (1) ☐
Moderately (2) ☐
Quite a bit (3) ☐
Extremely (4) ☐

BRIEF TRAUMA QUESTIONNAIRE (BTQ)

K2. Since our last visit, have you been in a serious car accident, or a serious accident at work or somewhere else?

Yes ☐
No ☐

K2a. If yes, did you think your life was in danger or you might be seriously injured?

Yes ☐
No ☐

K2b. (If yes on K2), were you seriously injured?

Yes ☐
No ☐

K3. Since our last visit, have you been in a major natural or technological disaster, such as a fire, tornado, hurricane, flood earthquake, or chemical spill?

Yes ☐
No ☐

K3a. If yes, did you think your life was in danger or you might be seriously injured?

Yes ☐
No ☐

K3b. (If yes on K2), were you seriously injured?

Yes ☐
No ☐

K4. Since our last visit, have you had a life-threatening illness such as cancer, a heart attack, leukemia, AIDS, multiple sclerosis, etc.?

Yes ☐
No ☐

K4a. If yes, did you think your life was in danger?

Yes ☐

No ☐

K6. Since our last visit, have you been attacked, beaten, or mugged by anyone, including friends, family members or strangers?

Yes ☐
No ☐

K6a. If yes, did you think your life was in danger or you might be seriously injured?

Yes ☐
No ☐

K6b. (If yes on K6), were you seriously injured?

Yes ☐
No ☐

K7. Since our last visit, has anyone made or pressured you into having some type of unwanted sexual contact?

(Note: By sexual contact we mean any contact between someone else and your private parts or between you and someone else's private parts)

Yes ☐
No ☐

K7a. If yes, did you think your life was in danger or you might be seriously injured?

Yes ☐
No ☐

K7b. (If yes on K7), were you seriously injured?

Yes ☐
No ☐

K8. Since our last visit, have you been in any other situation in which you were seriously injured, or have you been in any

FOLLOW-UP QUESTIONNAIRE – 1 MONTH AFTER HOSPITAL DISCHARGE

other situation in which you feared you might be seriously injured or killed?

Yes ☐
No ☐

K8b. (If yes on K8), were you seriously injured?

Yes ☐
No ☐

K9. Since our last visit, has a close family member or friend died violently, for example, in a serious car crash, mugging, or attack?

Yes ☐
No ☐

K10. Excluding the event(s) that you have already reported in the previous questions, since our last visit, have you witnessed a situation in which someone was seriously injured or killed, or have you witnessed a situation in which you feared someone would be seriously injured or killed?

Yes ☐
No ☐

Others, specify:_____ ☐

M3. If yes, how much have you spent on the care or treatment for the psychological symptoms you experienced?

Item	Amount
Consultation	
Drugs (prescribed/over the counter)	— — · — — —
	— — · — — —
Equipment (wheelchair, splint ...)	— — · — — —
Transportation	— — · — — —
Other, specify_____	— — · — — —
Other, specify_____	— — · — — —

Thank you for your participation!
We will visit you again in a month. We will contact you in about 3 weeks to schedule a date and time to visit.

ACCESS TO MENTAL HEALTH CARE

M1. Since our last visit, have you obtained any care or treatment for the psychological symptoms you experienced?

Yes ☐
No ☐

M2. If yes, from whom have you obtained the care and/or treatment?

Public outpatient mental health clinic ☐
Public inpatient mental health clinic ☐
Private outpatient mental health clinic ☐
Traditional healers ☐

Appendix 6. Guide for individual in-depth interview (qualitative component)

Approved: 24Sept15

IRB No.: 00004972

GUIDE FOR INDIVIDUAL IN-DEPTH INTERVIEW
Qualitative study on mental health among trauma patients

Background and Purpose of the individual in-depth interview

The purpose of this interview guide is to provide general direction of the interview. The content of the interview may be adjusted based on individual's response. The interview aims to understand the participant's perspective and experience on his / her recovery from traumatic injuries and the impact and experience of mental disorders symptoms.

The key objectives of the interview are: 1) to understand the experience of having mental disorder(s) symptoms among recovering trauma patients, 2) to understand the context of injury and its role in mental disorder(s) symptoms, 3) to understand help-seeking behavior and support.

The target population for the interview is patients who have reported having symptoms of mental disorder(s) after having traumatic injuries. The in-depth interviews will be conducted with 25 to 30 individuals.

Beginning Script

My name is [Insert name]. I am working for a research project led by Johns Hopkins University Bloomberg School of Public Health in the U.S. to better understand the long-term physical and mental health, social and economical impact of injuries, also known as "HEALS" study.

Thank you for meeting with me today. This interview will take between 45 minutes to an hour. I would like to learn about your experience since your injury 5 – 7 months ago. The questions I am going to ask do not have right or wrong answers. We are interested in your own opinion about the questions. The information you provide will help us to have a better understanding of mental distress and the related context. We hope this information will guide future programs to support individuals who suffer from traumatic injuries.

Overview of topics:
- Experience in mental disorder(s) symptoms
- Context of injury and its relation with mental disorder(s) symptoms
- Help seeking behavior and support

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Appendix 16. Guide for Individual in-depth Interview on mental health (Kenya only)

Experience in mental disorder(s) symptoms

1. How have you been feeling in the past few months?
   [Probe: symptoms of PTSD, depression and anxiety that the respondent reported having]

2. Since your hospital discharge, have these feelings changed? If so, how has it changed?
   [Probe: Have there been any differences over time, or does it stay the same?]

3. How has these feelings affected you? In what way?
   [Probe: daily activities and occasional activities]

Context of injury and its relation with mental disorder(s) symptoms

1. Can you tell me about the injury that led to your hospitalization?

2. How did you feel at the time of injury? And when you were hospitalized?

3. What do you think have contributed to these feelings after the injury and hospital discharge? How?

Help-seeking behavior and coping

1. Have you sought care or help from anyone since you experienced these symptoms? Can you tell me what the reason for that?

2. Since these _____ [summarize feelings] appeared, what have you done to lessen its effect?

3. What has helped you feel better?

Wrap-up

This is the end of our interview today. Thank you very much for your time. Do you have any questions for me?

If you have any additional thoughts or questions, please feel free to contact me.

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Curriculum Vitae

Yuen Wai Hung
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Education

PhD, Health Systems   Expected May 2017
Department of International Health, Johns Hopkins University Bloomberg School of Public Health
Dissertation: Understanding the mental health consequences and associated risk factors among adult injury survivors in Kenya
Certificate in Public Health Economics

Master of Health Science (MHS), Global Disease Epidemiology and Control   May 2010
Department of International Health, Johns Hopkins University Bloomberg School of Public Health
Dissertation: The Changing Health Needs in Iraq: Injury Burden and the Emergency Medical Care Development
Certificate in Humanitarian Assistance

Bachelor of Science (BS), Molecular Environmental Biology   May 2008
College of Natural Resources, University of California, Berkeley

Scholarly Publications

Hung YW, He H, Mehmood A, Botchey IM, Saidi H, Hyder AA, Bachani AM. Exploring injury severity measures and in-hospital mortality: a multi-hospital study in Kenya. (Submitted)

Bachani AM, Taber N, Mehmood A, **Hung YW**, Botchey IM, Saidi H, Al-Kashmiri A, Hyder AA. Adolescent and Youth Injuries in developing economies: A comparative analysis based on Trauma Registry data from Oman and Kenya. (Submitted)

Bachani AM, Zia N, **Hung YW**, Adetunji R, Hyder AA. 2017. Speeding in urban South East Asia: results from a multi-site observation study. Journal of the Australasian College of Road Safety: 28: 2: 27-35.

Botchey IM, **Hung YW**, Bachani AM, Paruk F, Saidi H, Hyder AA. 2017. Understanding Patterns of Injury in Kenya: Analysis of Trauma Registry Data from a National Referral Hospital. Journal of Surgery. DOI: http://dx.doi.org/10.1016/j.surg.2017.02.016

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Bachani AM, **Hung YW**, Mogere S, Akungah D, Nyamari J, Steves KA, Hyder AA. 2013. Prevalence, Knowledge, Attitude and Practice of Speeding in Two Districts in Kenya: Thika and Naivasha. Injury,

Int. J. Care Injured: 44 (S4): S24-S30.

Burnham G, Hoe C, **Hung YW**, Ferati A, Dyer A, Al Hilfi T, Aboud R, Hasson T. 2011. Perceptions and utilization of primary health care services in Iraq: findings from a national household survey. BMC Int Health Hum Rights: 16;11(1):15.

Shanovich PK, Donaldson RI, **Hung YW**, Hasoon T, Evans GE. 2011. Iraqi Community Members' Knowledge, Attitude and Practice of Emergency Medical Care: Assessing Civilian Emergency Medicine in an Area of Conflict. Medicine, Conflict & Survival: 27(3): 151-164.

Donaldson RI, **Hung YW**, Shanovich P, Hasoon T, Evans G. 2010. Injury Burden during an Insurgency: The Untold Trauma of Societal Breakdown in Baghdad, Iraq. Journal of Trauma: Injury, Infection, and Critical Care: 69 (6): 1379-1385.

Hung YW, Remais J. 2008. Quantitative Detection of Schistosoma japonicum Cercariae in Water by Real-Time PCR. PLoS Neglected Tropical Diseases 2(11): e337 doi:10.1371/journal.pntd.0000337

Conference Presentations

Hung YW, Bachani AM, Aketch S, Duly R, Tol W, Saidi H, Hyder AA. Understanding Trajectories of Mental Distress after Moderate or Severe Injury among Adults in Kenya. *Oral presentation* at Safety 2016 - 12th World Conference on Injury Prevention and Safety Promotion; Tampere, Finland; Sep 18-21 2016.

He H, **Hung YW**, Botchey IM Jr, Bachani AM, Saidi H, Hyder AA. Unintentional Childhood Injuries in Kenya: Epidemiological Patters based on Hospital Trauma Registry Data. *Poster presentation* at Safety 2016 - 12th World Conference on Injury Prevention and Safety Promotion; Tampere, Finland; Sep 18-21 2016.

Bachani AM, **Hung YW**, Akunga D, Mogere S, Nyamari J, Hyder AA. Burden of Road Traffic Injuries in Thika and Naivasha, Kenya. *Poster presentation* at Safety 2016 - 12th World Conference on Injury Prevention and Safety Promotion; Tampere, Finland; Sep 18-21 2016.

Botchey IM Jr, **Hung YW**, He H, Bachani AM, Saidi H, Hyder AA. Road Traffic Injuries in Kenya: a hospital-based surveillance study. *Poster presentation* at Safety 2016 - 12th World Conference on Injury Prevention and Safety Promotion; Tampere, Finland; Sep 18-21 2016.

Bachani AM, **Hung YW**, Aketch S, Duly R, Hyder AA. Level of Disability among Adult Injury Patients in Kenya. *Poster presentation* at Safety 2016 - 12th World Conference on Injury Prevention and Safety Promotion; Tampere, Finland; Sep 18-21 2016.

Honors and Awards

Graduate student Employment Award – Runner-up Johns Hopkins University	Apr 2016
Health Systems Program Doctoral Student Award Johns Hopkins University Bloomberg School of Public Health	Jan 2016
Honors at College of Natural Resources University of California, Berkeley	May 2008
High Distinction at College of Natural Resources University of California, Berkeley	May 2008

Related Professional Experience

Graduate Research Assistant   Nov 2012-present
International Injury Research Unit, Department of International Health, JHSPH
- Analyze observation data and draft reports and presentations for Road Safety project in Bandung, Indonesia
- Monitor data collection of the Health, Economic and Long-term Social Impact of Injuries (HEAL) study in Kenya
- Analyze data of the HEAL study in Kenya
- Created and maintain electronic data entry form for the HEAL study
- Trained data collectors for the longitudinal HEAL study in Kenya and observation study data collection in Indonesia
- Reviewed and analyzed data collected from hospital-based trauma registries in Kenya
- Presented findings of Kenya trauma registries at International Injury Research Unit trauma care meeting
- Conducted site visit to observe data collection for road safety project and hospital-based trauma registry and collected secondary data on injury burden in Kenya
- Reviewed and analyzed primary and secondary data collected for Road Safety project in Kenya
- Managed, coded and analyzed trauma registry data

Graduate Research Assistant   Feb 2015-Aug 2015
Department of Sociology, JHU
- Analyzed data from cross-sectional national labor survey in China to assess intergenerational transfers between midlife parents and adult children in China

Short-term Project Consultant   Apr 2015-Jun 2015
Brad Herbert Associates
- Conducted strategic review of the Center for Health Market Innovations (CHMI)
- Reviewed the framework, activities and monitoring and evaluation strategy of CHMI
- Conducted in person and phone interviews with stakeholders of CHMI
- Drafted sections of strategic review of the Center for Health Market Innovations (CHMI) report

Short-term Project Consultant   Feb 2015-Apr 2015
Amend
- Developed an interim project evaluation plan for School Area Road Safety Assessments and Improvements (SARSAI) program
- Communicated with Amend to ensure feasibility of implementation and incorporate changes to interim project evaluation plan

Global Health Program Management Fellow   Sep 2011-Aug 2012
Workforce Management Office
Association of Schools of Public Health / Centers for Disease Control and Prevention, Atlanta
- Coordinated a multi-program workgroup to correct the supervisory designation of CDC staff overseas in related HR systems to reflect the positions' supervisory duty
- Analyzed, presented and produced reports on organization perception survey completed by overseas CDC staff
- Managed data on personnel and positions of locally employed workforce in CDC offices overseas

- Drafted policy and administrative documents on hiring mechanism for overseas offices
- Coordinated and facilitated CDC regional supervisory trainings in Kenya and South Africa
- Consolidated data from various sources of human resource information of overseas locally employed staff

Global Health Epidemiology Fellow   Sep 2010-Sep 2011
Association of Schools of Public Health / Centers for Disease Control and Prevention, Guyana
- Provided technical assistance on revising HIV/AIDS case surveillance system in Guyana
- Piloted the revised HIV/Advanced HIV case surveillance form at high volume facilities, summarized and presented findings at local Ministry of Health (MOH)
- Worked with MOH to develop a Prevention from Mother to Child Transmission (PMTCT) case tracking system for HIV positive mothers and HIV exposed infants in Guyana
- Designed report forms and database for the PMTCT case tracking system
- Coordinated with CDC implementing partners on program monitoring
- Conducted a 3-day Epi Info training for health officers and health-related personnel
- Drafted an update of Epidemiology Profile of HIV/AIDS epidemic in Guyana

Research Assistant   Jun 2010-Aug 2010
School of Public Health and Primary Care, Chinese University of Hong Kong
- Prepared teaching materials for a summer course in Public Health Response in Disasters and Humanitarian Crisis
- Prepared and conducted a household survey on knowledge, attitude and practice of maintaining sanitation and hygiene in a rural village in Gansu Province in China
- Drafted a discussion paper on Epidemiological transition and implication for Disaster and Conflict Health and Medical response

Monitoring and Evaluation Program Officer   Nov 2009-May 2010
International Medical Corps, Iraq
- Designed surveys to evaluate health project process and analyzed findings
- Organized and provided training to surveyors to conduct a national primary health care survey
- Designed database on Access for survey data entry
- Wrote reports to donors on implementation of various health projects and project outcomes
- Coordinated with program managers to facilitate planning and monitoring of health programs
- Drafted Program Monitoring Plan for health programs
- Conducted literature reviews to provide updated information on health organization accreditation for a project on health system strengthening

Health Program Assistant   Jun 2009-Nov 2009
International Medical Corps, Iraq
- Drafted reports to donors on progress of different health projects
- Planned and coordinated household survey to guide development of an injury prevention program
- Conducted training on household survey data collection in Baghdad
- Analyzed household survey data and drafted results

Research Assistant, Initiative of Victims of Torture Fund   Dec 2008-May 2009
Department of International Health, JHSPH

- Provided administrative and technical support to JHSPH faculty working on the initiative of Victims of Torture Fund
- Conducted literature review on interventions for torture survivors
- Collected information on types of therapy practiced globally for torture victims from NGOs

Research Assistant, Independent Research project   Jun 2007-May 2008
School of Public health, University of California, Berkeley

- Conducted literature review on molecular assay methods to detect / quantify *Schistosoma japonicum* cercariae
- Designed and performed experiments to develop a q-PCR assay to quantify the parasite
- Analyzed data and wrote the manuscript
- Conducted two months research in Chengdu, China, on handling and harnessing *Schistosoma japonicum* cercariae, and conducting PCR in local research laboratory

Teaching Experience

Teaching Assistant   Aug 2013 – present
Department of International Health, JHSPH
Courses: Introduction to International Health, Health systems in Low and Middle Income Countries, Health Economics III, Evaluation of Safety Interventions in Low and Middle Income Countries, Confronting the Burden of Injuries: A Global Perspective, Hospital-based Injury/Trauma Surveillance in Low- and Middle-Income Countries

- Assist with in-class / online activities
- Maintain CoursePlus site
- Co-lead live talk discussions (online course)
- Collaborate with Professors and other TA's on course material and grading policies
- Held office hours to assist student in completion of assignments or concepts in class
- Graded essays and provided feedback to students
- Led discussion groups in assigned class sessions

Skills

Relevant coursework: Psychiatric Epidemiology, Psychopathology for Public Health, The Intersection between Physical and Mental Health, Qualitative Research I & II (Theory, Methods, and Data Analysis), Statistics for Psychosocial Research, Spatial Analysis and GIS I, Longitudinal data analysis, Multilevel statistical Models in Public Health
Software: STATA, Mplus, R, MS Access, Epi Info, ArcGIS, MS Office Word, PowerPoint and Excel
Language: Fluent in Mandarin and Cantonese