

Published in final edited form as:

Inj Prev. 2013 February ; 19(1): . doi:10.1136/injuryprev-2011-040309.

Injury risk and severity in a sample of Maryland residents with serious mental illness

Gail L. Daumit, MD, MHS,

Associate Professor of Medicine, Psychiatry, Epidemiology, Health Policy and Management and Mental Health, Johns Hopkins Medical Institutions, Division of General Internal Medicine, Welch Center for Prevention, Epidemiology and Clinical Research, Co-Chair, Institutional Review Board X, 2024 East Monument Street, Room 2-513

Emma Elizabeth McGinty, MS,

Johns Hopkins Bloomberg School of Public Health, Department of Health, Policy and Management, Baltimore MD, USA

Susan Baker, MPH, and

Johns Hopkins Bloomberg School of Public Health, Professor, Department of Health Policy and Management, Baltimore MD, USA

Donald Steinwachs, PhD

Johns Hopkins Bloomberg School of Public Health, Professor, Department of Health Policy and Management, Baltimore MD, US

Abstract

Adults with serious mental illness experience premature mortality and heightened risk for medical disease, but little is known about the burden of injuries in this population. We conducted a retrospective cohort study of 6234 Maryland Medicaid recipients with serious mental illness from 1994–2001. Injuries were classified using the Barell Matrix. Relative risks were calculated to compare injury rates among the study cohort with injury rates in the United States population. Cox proportional hazards modeling with time dependent covariates was used to assess factors related to risk of injury and injury-related death. Forty-three percent of the Maryland Medicaid cohort had any injury diagnosis. Of the 7298 injuries incurred, the most common categories were systemic injuries due to poisoning (10.4%), open wounds to the head/face (8.9%), and superficial injuries, fractures, and sprains of the extremities (8.6%, 8.5%, and 8.4%, respectively). Injury incidence was 80% higher and risk for fatal injury was more than four and a half times higher among the cohort with serious mental illness compared to the general population. Alcohol and drug abuse were associated with both risk of injury and risk of injury-related death with hazard ratios of 1.87 and 4.76 at the $P < .05$ significance level, respectively. The superficial, minor nature of the majority of injuries is consistent with acts of minor victimization and violence or falls. High risk of fatal and non-fatal injury among this group indicates need for increased injury prevention efforts targeting persons with serious mental illness and their caregivers.

Keywords

Injury; Serious Mental Illness; Schizophrenia; Bipolar Disorder; Barell Matrix

Corresponding author: Phone: (410) 614-6460, Fax: (410) 614-0588, gdaumit@jhmi.edu.

Competing interests: None

BACKGROUND

While it has been well established that adults with serious mental illness experience premature mortality and heightened risk for chronic diseases such as cardiovascular disease, hypertension, and diabetes compared to the overall population, little is known about the burden of injuries in this group.[1–5] The existing literature on injuries among persons with serious mental illness focuses primarily on risk for self-harm or suicide,[6] risk of injury among adults with substance abuse disorders,[7–8] and risk of unintentional injury among children with mental illness.[9–10]

Between 40 and 60 percent of persons with mental illness have a co-morbid substance use disorder,[11–13] an established risk factor for injury.[8] Evidence also supports mental illness as a risk factor for intentional injury, independent of substance abuse.[6, 14] A 2005 longitudinal study showed that persons presenting to the emergency department (ED) with self-inflicted injury had higher rates of mental disorders than a matched comparison group.[15] Substance use and abuse are clearly associated with both intentional and unintentional injuries in the literature. In one study of trauma fatalities, 43% tested positive for elevated levels of alcohol and/or illicit drugs.[16] Among children and adolescents, mental illnesses including anxiety, oppositional defiant disorder and depression have been shown to be positively associated with intentional injury as well as unintentional injuries including burns and fractures.[17–19]

Factors associated with serious mental illness and its consequences also may increase risk for injury. Prior research has suggested that changes in perceptions and awareness, such as decreased sensitivity to pain, may contribute to heightened risk of injury among persons with serious mental illness.[20–21] In addition, problems with social relationships are prevalent in serious mental illness,[22] and many persons with serious mental illness live in marginal housing and some are homeless.[23] These conditions could lead directly to injuries or to incidents of minor violence or victimization that cause injury.

One study characterized injuries among persons with serious mental illness admitted to a level 1 trauma center in San Francisco with a diagnosis of unintentional injury.[24] Wan et al compared unintentional injury requiring admission among patients with diagnosed mental illness to those patients without a mental illness diagnosis and concluded that mental illness was an independent risk factor for unintentional injury.[24] The authors also found heightened injury recidivism among persons with mental illness. Compared to persons without a diagnosis of mental illness admitted to the trauma center for injury, persons with mental illness were more likely to have incurred an unintentional injury from falling or being hit by a car and less likely to have been injured in a motor vehicle crash.[24] In addition, several studies investigated falls among persons with schizophrenia or other specific diagnoses of mental illness and found this group to be at heightened risk.[25–27]

While Wan et al identified persons with mental illness among all persons admitted to a trauma center with an injury diagnosis,[24] to our knowledge, no study to date has attempted to describe the incidence of injuries among a cohort of persons with serious mental illness. In addition, little is known about the types of injuries most frequently incurred among persons with serious mental illness, or about how the burden of different types of injuries, such as burns and fractures, among adults with serious mental illness compares to the burden in the overall population. Our study attempts to fill these gaps in the literature by investigating injuries, both intentional and unintentional, incurred by Maryland Medicare beneficiaries with serious mental illness between 1994 and 2001. The objectives were, first, to describe the types of injuries experience by persons with serious mental illness. The second objective was to determine the incidence of injuries resulting in an emergency

department visit or hospitalization in a community based sample of adults with serious mental illness compared to the overall United States (US) population. The third objective was to determine the risk factors associated with injury and injury-related death among the cohort with serious mental illness.

METHODS

Study design and population

We conducted a retrospective cohort study of Maryland Medicaid recipients with serious mental illness. In Maryland, persons with serious mental illness are eligible for Medicaid if they receive supplemental security income (SSI),[28] Temporary Cash Assistance (TCA), [28] or are disabled (defined as a person who has significant physical or mental medical impairment for at least 12 months and is unable to work).[29] The cohort included adults, ages 21 to 62 years between July 1, 1992 and July 1, 1993, who had serious mental illness using criteria based on diagnosis, disability, and duration of illness. Criteria included having any schizophrenia diagnosis or being disabled (defined as eligibility for Supplemental Security Income) with a diagnosis of bipolar disorder, major depression, or other mental disorder diagnoses and specialty mental health care use. Other diagnoses included psychoses other than schizophrenia and affective psychoses, organic psychoses, obsessive compulsive disorder and other anxiety disorders but not substance induced psychoses or dementias. Participants needed two years continuous enrollment in Maryland Medicaid between July 1, 1992 and June 30, 1994, to be included in the study. Participants were not required to be free of medical or substance abuse diagnoses during the enrollment period. All Maryland Medicaid recipients meeting these criteria living in the Baltimore metropolitan area or the more rural Maryland Eastern Shore comprised the cohort. The Johns Hopkins Bloomberg School of Medicine and the Maryland Department of Health and Mental Hygiene institutional review boards approved the study.

Data sources

Medicaid administrative claims data files obtained from the Maryland Department of Health and Mental Hygiene provided information on age, gender, race, county, Medicaid enrollment and diagnoses. Mental health diagnoses (schizophrenia, bipolar disorder, depression, other) were established at the initiation of the cohort. Medical and alcohol/substance abuse diagnoses were obtained from administrative data for the study period, 1994–2001. To obtain dates and causes of death, we linked data in the cohort to the National Death Index from 1994 through 2001. Participants were considered to have an injury-related death if the underlying cause of death was injury or poison, ICD-9 codes 800–999.

To compare the overall rate of injuries by race and gender among our study cohort to national injury data, we used data from the Centers for Disease Control (CDC) Web-based Injury Statistics and Reporting System (WISQARS) for year 2000. The WISQARS system includes fatal and non-fatal injury data. Fatal injury data is comprised of death certificate data from the National Vital Statistics System. Non-fatal injury data in WISQARS is comprised of national estimates of injuries treated in US hospital emergency departments from the National Electronic Injury Surveillance System – All Injury Program (NEISS-AIP). [30]

Definition of injury

Our outcome variable was a primary ICD-9 diagnosis of injury from an inpatient hospitalization or emergency department visit (ICD-9 codes 800–999). Injury diagnoses were classified using the Barell Matrix.[31] This matrix categorizes injury by nature and location and provides a standard format for reporting of injury data. For our analyses, nature

of injuries was grouped into 7 categories: fracture, sprain, open wound, superficial, burn, poison and other. The 'other' category includes dislocation, internal injury, amputation, blood vessel injury, nerve injury, and crushing injury. The only excluded injuries (n=225) fell into three categories: late effects of complications of medical and surgical care; other and unspecified adverse events of drug, medicinal and biological substances due to correct medicinal substance properly administered; and allergy or urticarial related. Of the body regions classified by the Barell Matrix, we used the classification which distinguishes head/face, spine/neck, trunk, hands/wrists, extremities, systemic, and unspecified. Using ICD-9 codes, injuries were then classified in terms of nature and location, e.g. fracture of the hands/wrists.

Statistical analyses

We conducted bivariate analyses to compare the proportion of persons in the Maryland Medicaid cohort with serious mental illness who had any inpatient or emergency department injury diagnosis during the study period to those who did not. Relative risks comparing rate of injury among the study cohort for the year 2000 with rate of injury in the US population for the same year were age-adjusted using the standard US 2000 population and stratified by age, race, and gender. Hazard ratios to assess risk factors for injury in the study cohort were calculated using Cox proportional hazards models that estimated the effects of age, sex, race, serious mental illness diagnosis, and the time dependent covariate substance use on any injury diagnosis. Hazard ratios were also calculated to assess risk factors for injury-related death including age, sex, race, prior injury hospitalization, and alcohol/drug abuse diagnosis.

RESULTS

Characteristics of serious mental illness cohort with injury

Among the 6234 persons in the Maryland Medicaid cohort with serious mental illness, 2655 (43%) had any injury diagnosis over the 7-year study. The mean age of adults with any injury diagnosis was 46 (SD 10.6) years, compared to 48 (SD 10.8) years among those with no injury diagnosis (Table 1). The majority (N=930, 35%) of injuries occurred among the 35–44 year old age group. Fifty-six percent of women in the cohort had any injury diagnosis compared to 44% of men. Whites and non-whites had similar burden of injury diagnosis (49% of whites and 51% of non-whites had any injury). More cohort members with any injury had bipolar disorder or major depression and fewer had schizophrenia compared to cohort members without any injury.

There were 7298 injuries overall during the seven-year study period. Among members of the study cohort with any injury, 42% had one injury, 23% had two injuries, 25% had 3–5 injuries, and 10% had 6 or more.

Types of injuries in the cohort with serious mental illness

Superficial injuries, open wounds, and sprains were the types of injuries most frequently experienced by the study cohort (Table 2): 22.7% percent of all injuries were superficial, 19.4% were open wounds, and 17.9% were sprains. Poisoning (10.4%) and burns (2.1%) were the least frequent types of injuries.

In terms of location of injury, the majority of injuries were to the extremities (33.9%), followed by the head/face (19.4%) and systemic injuries (15.2%). When we examined combined body region and type of injury, systemic injuries due to poisoning were the most common reported injuries (10.4%), followed by open wounds to the head/face (8.9%) and superficial injuries, fractures, and sprains of the extremities (8.6%, 8.5%, and 8.4%, respectively).

Injury classification by type and location was similar for persons with schizophrenia, bipolar disorder, major depression, and other disorders (results not shown). For all persons with serious mental illness, the three most common injury categorizations were open wounds to the head/face, fracture to the extremities and superficial wounds to the extremities.

Injuries in the cohort with serious mental illness compared to the US population

Table 3 shows the relative risk for injury in the Maryland Medicaid cohort with serious mental illness compared to the US population. The study cohort had heightened risk in all race/sex groups, with an overall relative risk of injury of 1.80 (95% CI 1.73–1.87) compared to the US population. White males with serious mental illness had 82% (RR 1.82, 95% CI 1.81–1.83) compared to the US population. This pattern was similar for non-white males, white females, and non-white females, who experienced risk of non-fatal injury 34% (RR 1.34, 95% CI 1.34–1.34), 243% (RR 2.43, 95% CI 2.41–2.45 and 49% (RR 1.49, 95% CI 1.49–1.50) higher than the overall population, respectively. Overall risk of fatal injury was more than four and a half times higher for the cohort with serious mental illness compared to the US population (RR 4.65, 95% CI 4.05–5.34). The relative risks comparing risk of fatal injury in the Maryland Medicaid cohort with serious mental illness to the US population were between three and seven times higher for each race/sex group with serious mental illness.

Factors associated with injury and injury-related death in serious mental illness

Table 4 shows the results of Cox proportional hazards modeling with time dependent covariates to assess predictors of injury among the Maryland Medicaid cohort with serious mental illness. Risk of injury was 40% higher for whites. Compared to persons with schizophrenia, persons with bipolar disorder, major depression, and other diagnoses had a heightened risk of injuries, with hazard ratios of 1.33, 1.34, and 1.14, respectively ($P < .05$ for all comparisons). In addition, risk of injury was 87% higher for persons with any prior alcohol or drug abuse diagnosis compared to those without such a diagnosis (hazard ratio 1.87, 95% CI 1.77–1.97).

Of the 7298 injuries experienced by the cohort, 117 (2%) resulted in death. Having an alcohol/drug abuse diagnosis increased the risk of injury-related death, with a hazard ratio of 4.76 (95% CI 3.10–7.30) for persons with prior alcohol/drug abuse compared to those without (Table 5). Injury-related death was also related to sex: men were 70% more likely to die from an injury than women (hazard ratio 1.70, 95% CI 1.11–2.61).

DISCUSSION

We conducted a retrospective cohort study of injuries among adult Maryland Medicaid recipients with serious mental illness between 1994 and 2001, one of the first to describe the incidence and types of injuries among persons with serious mental illness living in the community. We found a one-third to over two-fold increased risk for non-fatal injury by race/sex group and an over four-fold increased risk for fatal injury in persons with serious mental illness compared to the overall US population.

The most common categories of injuries from the Barell Matrix in the cohort of persons with serious mental illness were systemic injuries due to poisoning, followed by open wounds to the head/face and superficial injuries, fractures, and sprains of the extremities. The causal pathways between serious mental illness and injuries remain unclear. Poisonings are likely to be intentional injuries, and existing literature demonstrates that persons with serious mental illness are higher risk for intentional injuries than persons without serious mental illness.[32] However, the prevalence of open wounds to the head/face and superficial

injuries to the extremities found in this study suggests that persons with serious mental illness may be at heightened risk for unintentional injuries as well.

In a 2006 study using the National Inpatient Sample, the most common injury diagnosis was fracture and lower extremity was the most common anatomic region.[33] In our study, the most common types of injuries other than systemic injuries due to poisoning were superficial and the most common site was to the head/face. The leading causes of injury hospitalization in the National Inpatient Sample were falls and motor vehicle crashes.[33] In the current study, the majority of injuries were superficial injuries and sprains or fractures to the extremities. This injury pattern is inconsistent with more serious injuries incurred in motor vehicle crashes but consistent with falls.

A 2006 study examined unintentional injuries among trauma patients with mental illness and found that persons with mental illness had twice the rate of unintentional injury requiring admission to a level I trauma center compared to persons without mental illness.[24] This finding is similar to our results, which show that the risk of non-fatal injury among the overall cohort with serious mental illness is 82% higher than risk in the overall US population. The same study found that the most common mechanisms of unintentional injury among persons with mental illness were falls and being struck by motor vehicles.[24] While our study does not include information on mechanism of injury, our results show a higher proportion of superficial injuries, fractures, and sprains to the extremities consistent with injuries caused by falls and minor violence.

The cause of heightened risk for injury among persons with serious mental illness compared to the overall population is unclear. Two review articles conclude that there is a positive association between use of psychotropic drugs and falls among older adults, possibly due to sedation or ataxia caused by the drugs.[34–35] The relationship appears to differ by medication, with limited evidence suggesting that use of conventional antipsychotics,[35] but not atypical antipsychotics,[36] is associated with increased risk of falls. In addition, mood disorders like bipolar disorder are characterized by increased impulsivity that could cause injury.[37]

In our study, persons with bipolar disorder and major depression had higher risk of injury than persons with schizophrenia. The mechanisms leading to increased risk for persons with these conditions are unknown. Depression has been linked with decreased focus and awareness, which may lead to injury.[38] Bipolar disorder and major depression have both been linked with reduced responsiveness to pain, as has schizophrenia.[21] Persons with prior alcohol or drug abuse diagnoses also had increased risk of injury and injury-related death, a finding supported by the literature which shows heightened risk of injury associated with substance abuse.[8]

Socioeconomic status may also play an important role in risk for injury among persons with serious mental illness. The literature shows a clear association between low socioeconomic status and mental illness.[39] Whether the association is attributable to persons with low socioeconomic status being at higher risk for developing serious mental illness or a ‘downward drift’ phenomenon where persons with serious mental illness have difficulty obtaining and maintaining education, employment, and housing and therefore ‘drift’ into poverty is unclear, with evidence supporting both theories.[39] Regardless, risk of injury among persons of low socioeconomic status is well documented in the literature, suggesting that environmental risk factors related to poverty could put persons with serious mental illness at increased risk of injury.[40] Such risk factors could include unsafe housing, e.g. housing without appropriate railings to prevent falls, or residence in neighborhoods with poor pedestrian safety, for example neighborhoods lacking sidewalks.

Importantly, our study suggests that persons with serious mental illness may not experience the race and sex disparities in injuries observed in the overall population. In the cohort with serious mental illness, whites experienced higher risk of any injury diagnoses than non-whites and we found no differences in risk of injury by sex, trends inconsistent with those seen in the US population where non-whites and males are at increased risk for injury. Other studies have also shown a narrowing in health disparities experienced by the overall population among persons with serious mental illness.[41–42] Prevalence of factors that put disadvantaged groups at risk for experiencing health disparities – including low socioeconomic status, stigma, poor health behaviors and lack of social support – among persons with SMI may attenuate race and sex disparities in injury outcomes among this group.[22, 43]

Persons with serious mental illness experienced between a three and seven fold risk of injury-related death compared to the US population, with women of both racial groups experiencing the highest relative risk. While some of the injury risk in persons with serious mental illness is accounted for by suicide, it is likely that death due to unintentional injury is also heightened. A previous study of the same Maryland Medicaid cohort indicated that from 1999–2001,[41] 1.5% of all deaths in the cohort were from suicide and 0.8% were from homicide. In the current study, 5.2% of all deaths were attributable to injury. This suggests that unintentional injury plays an important role in injury-related deaths among persons with serious mental illness.

STRENGTHS AND LIMITATIONS

We conducted a population-based study on a cohort of Medicaid beneficiaries with serious mental illness. This study design enabled us to study risk of injury among a large cohort of adults with serious mental illness. We acknowledge that as E-codes were unavailable, we were unable to describe mechanism of injury or estimate intentional versus unintentional injuries. In addition, we lack information regarding how many persons in our cohort received care in institutional or supervised settings, potentially important information given that increased risk of injury among this group may be partially attributable to caregiver neglect or abuse. However, given that less than 5% of Maryland Medicaid beneficiaries with serious mental illness are chronically hospitalized or in long term care,[44] it seems likely that only a small proportion of our sample was institutionalized or in a supervised setting. Finally, we were unable to compare incidence of injury among the study cohort with serious mental illness to incidence of injury among adult Maryland Medicaid beneficiaries without serious mental illness. Nonetheless, to our knowledge this is the first study to characterize both type and site of injuries among a cohort of persons with serious mental illness.

CONCLUSIONS

Persons with serious mental illness are at heightened risk for injuries compared to the overall US population. The most common kinds of injuries among this population are systemic injuries due to poisoning, open wounds to the head and face, and superficial injuries, fractures, and sprains of the extremities. This distribution of injury burden suggests the importance of both intentional and unintentional injuries in this population. Additional research is needed to better understand the mechanisms driving heightened risk of injury among persons with serious mental illness and to develop strategies for injury prevention among this population. High risk of fatal and non-fatal injury among this group indicates need for increased injury prevention efforts targeting persons with serious mental illness and their caregivers. Primary care and mental health clinicians should consider counseling persons with serious mental illness and their caregivers on risk of injury. Counseling should include strategies recommended by clinical guidelines, including use of bicycle and

motorcycle helmets, safe firearm storage practices, and fall-prevention strategies such as home-hazard identification and modification.[45–46] In addition, clinicians should evaluate and address side effects from psychotropic medications, such as dizziness, that may lead to unintentional injury.

Acknowledgments

Funding: Funding was received from NIMH Grant R01MH074070

References

1. Miller BJ, Paschall CB, Svendsen DP. Mortality and medical comorbidity among patients with serious mental illness. *Psychiatr Serv*. 2006; 57(10):1482–7. [PubMed: 17035569]
2. Rosenberg SD, et al. Prevalence of HIV, Hepatitis B, and Hepatitis C In People With Severe Mental Illness. *American Journal of Public Health*. 2001; 91(1):31–7. [PubMed: 11189820]
3. Carney CP, Jones L, Woolson RF. Medical comorbidity in women and men with schizophrenia: a population-based controlled study. *J Gen Intern Med*. 2006; 21(11):1133–7. [PubMed: 17026726]
4. Brown S, Inskip H, Barraclough B. Causes of the excess mortality of schizophrenia. *Br J Psychiatry*. 2000; 177:212–7. [PubMed: 11040880]
5. Osby U, et al. Mortality and causes of death in schizophrenia in Stockholm county, Sweden. *Schizophr Res*. 2000; 45(1–2):21–8. [PubMed: 10978869]
6. Pompili M, et al. Suicide risk in first episode psychosis: A selective review of the current literature. *Schizophrenia Research*. 2011; 129(1):1–11. [PubMed: 21530179]
7. Rehm J, et al. Global burden of disease and injury and economic cost attributable to alcohol use and alcohol-use disorders. *The Lancet*. 2009; 373(9682):2223–2233.
8. Hingson RW, et al. Age of Drinking Onset and Unintentional Injury Involvement After Drinking. *JAMA: The Journal of the American Medical Association*. 2000; 284(12):1527–1533. [PubMed: 11000646]
9. Brehaut JC, et al. Childhood Behavior Disorders and Injuries Among Children and Youth: A Population-Based Study. *Pediatrics*. 2003; 111(2):262–269. [PubMed: 12563049]
10. Chen G, et al. Psychological symptoms and nonfatal unintentional injuries among Chinese adolescents: a prospective study. *The Journal of adolescent health : official publication of the Society for Adolescent Medicine*. 2005; 37(6):460–466. [PubMed: 16310123]
11. Cantor-Graae E, Nordstrom LG, McNeil TF. Substance abuse in schizophrenia: a review of the literature and a study of correlates in Sweden. *Schizophrenia Research*. 2001; 48(1):69–82. [PubMed: 11278155]
12. Elbogen EB, Johnson SC. The Intricate Link Between Violence and Mental Disorder: Results From the National Epidemiologic Survey on Alcohol and Related Conditions. *Arch Gen Psychiatry*. 2009; 66(2):152–161. [PubMed: 19188537]
13. McCreadie RG. Use of drugs, alcohol and tobacco by people with schizophrenia: case-control study. *British Journal of Psychiatry*. 2002; 181:321–325. [PubMed: 12356659]
14. Schecter WP, et al. Suicide: The Unmet Challenge of the Trauma System. *Arch Surg*. 2005; 140(9):902–904. [PubMed: 16175694]
15. Colman I, et al. Utilization of the ED after self-inflicted injury. *Acad Emerg Med*. 2004; 11:136–142. [PubMed: 14759954]
16. Demetriades D, et al. Alcohol and illicit drugs in traumatic deaths: prevalence and association with type and severity of injuries. *J Am Coll Surg*. 2004; 199:687–692. [PubMed: 15501107]
17. Bijur RE, Stewart-Brown RS, Butler N. Child behavior and accidental injury in 11,966 preschool children. *Am J Dis Child*. 1986; 140:487–492. [PubMed: 3962946]
18. Rowe R, Marghan B, Goodman R. Childhood psychiatric disorder and unintentional injury: findings from a national cohort study. *J Pediatr Psychol*. 2004; 29:119–130. [PubMed: 15096533]

19. Rowe R, Simonoff E, Silberg JL. Psychopathology, temperament and unintentional injury: cross-sectional and longitudinal relationships. *Journal of Child Psychology and Psychiatry*. 2007; 48(1): 71–79. [PubMed: 17244272]
20. Dworkin RH, Clark WC, Lipsitz JD. Pain responsivity in major depression and bipolar disorder. *Psychiatry Res*. 1995; 1995(56):173–181. [PubMed: 7667442]
21. Bonnot O, et al. Are Patients with Schizophrenia Insensitive to Pain? A Reconsideration of the Question. *Clin J Pain*. 2009; 25:244–252. [PubMed: 19333176]
22. Mueser KT, McGurk SR. Schizophrenia. *Lancet*. 2004; 363(9426):2063–72. [PubMed: 15207959]
23. Olsson M, et al. Prediction of Homelessness Within Three Months of Discharge Among Inpatients With Schizophrenia. *Psychiatr Serv*. 1999; 50(5):667–673. [PubMed: 10332904]
24. Wan JJ, et al. Mental Illness as an Independent Risk Factor for Unintentional Injury and Injury Recidivism. *Journal of Trauma Injury, Infection and Critical Care*. 2006; 61(6):1299–1304.
25. Fang JF, et al. Pelvic fractures due to falls from a height in people with mental disorders. *Injury*. 2008; 39(8):881–888. [PubMed: 18617168]
26. Howard L, Kirkwood G, Leese M. Risk of hip fracture in patients with a history of schizophrenia. *Br J Psychiatry*. 2007; 190:129–34. [PubMed: 17267929]
27. Stubbs B. Falls in older adult psychiatric patients: equipping nurses with knowledge to make a difference. *Journal of Psychiatric and Mental Health Nursing*. 2011; 18(5):457–462. [PubMed: 21539692]
28. Maryland Department of Human Resources. Medical Assistance. 2011. Available from: <http://dhr.maryland.gov/fiaprograms/medical.php>
29. The People's Law Library of Maryland. Medical Assistance - Aged, Blind and Disabled (MA-ABD). 2011. Available from: <http://www.peoples-law.org/node/606>
30. US Consumer Product Safety Commission. National Electronic Injury Surveillance System (NEISS) On-line. 2011. Accessed at: <http://www.cpsc.gov/library/neiss.html>
31. Bergen, G., et al. Injury in the United States: 2007 Chartbook. Hyattsville, MD: National Center for Health Statistics; 2008.
32. Nock MK, et al. Suicide and Suicidal Behavior. *Epidemiologic Reviews*. 2008; 30(1):133–154. [PubMed: 18653727]
33. Greenspan AI, et al. Injury hospitalizations: using the nationwide inpatient sample. *J Trauma*. 2006; 61(5):1234–43. [PubMed: 17099535]
34. Sleeper R, Bond CA, Rojas-Fernandez CR. Psychotropic drugs and falls. *Pharmacotherapy*. 2000; 20(3):308–317. [PubMed: 10730686]
35. Leipzig RM, Cummings RG, Tinetti ME. Drugs and Falls in Older People: A Systematic Review and Meta-Analysis: I. Psychotropic Drugs. *Journal of the American Geriatrics Society*. 1999; 47:30–39. [PubMed: 9920227]
36. Hien LTT, et al. Atypical Antipsychotic Medications and Risk of Falls in Residents of Aged Care Facilities. *J Am Geriatr Soc*. 2005; 53:1290–1295.
37. Moeller FG, et al. Psychiatric Aspects of Impulsivity. *Am J Psychiatry*. 2001; 158(11):1783–1793. [PubMed: 11691682]
38. Buist-Bouwman BA, et al. Comorbidity of physical and mental disorders and the effect on work-loss days. *Acta Psychiatr Scand*. 2005; 111:436–443. [PubMed: 15877710]
39. Hudson CG. Socioeconomic Status and Mental Illness: tests of the Social Causation and Selection Hypotheses. *American Journal of Orthopsychiatry*. 2005; 75(1):3–18. [PubMed: 15709846]
40. Cubbin C, LeClere FB, Smith GS. Socioeconomic Status and the Occurrence of Fatal and Nonfatal Injury in the United States. *American Journal of Public Health*. 2000; 90(1):70–77. [PubMed: 10630140]
41. Daumit GL, et al. Pattern of mortality in a sample of Maryland residents with severe mental illness. *Psychiatry Res*. 2010
42. Daumit GL, et al. Prevalence and Correlates of Obesity in a Community Sample of Individuals with Severe and Persistent Mental Illness. *Journal of Nervous and Mental Disease*. 2003
43. Primm AB, et al. The role of public health in addressing racial and ethnic disparities in mental health and mental illness. *Prev Chronic Dis*. 2010; 7(1):A20. [PubMed: 20040235]

44. Daumit, G., editor. Personal Correspondence with the Maryland Department of Health and Mental Hygiene. State SMI and SED estimates. Baltimore: 2011.
45. Institute for Clinical Systems Improvement. Health Care Guideline: Preventive Services for Adults. Preventive Services for Adults. 17Sep. 2011 Available from: http://www.icsi.org/guidelines_and_more
46. Michael YL, et al. Primary Care-Relevant Interventions to Prevent Falling in Older Adults: A Systematic Evidence Review for the U.S. Preventive Services Task Force. Ann Intern Med. 2010; 153:815–825. [PubMed: 21173416]

Table 1

Baseline characteristics of Maryland Medicaid cohort with serious mental illness with and without injury (n=6234)

	No injury diagnosis (n=3579) Freq (%) or Mean (SD)	Any injury diagnosis (n=2655) Freq (%) or Mean (SD)	P-Value
Mean age (years)	48.1 (10.8)	46.3 (10.6)	<.001
Age groups (%)			
21–24	1 (3%)	0 (0%)	<.001
25–34	386 (10.8%)	354 (13.3%)	
35–44	1132 (31.6%)	930 (35.0%)	
45–54	961 (26.9%)	729 (27.5%)	
55–64	813 (22.7%)	466 (17.6%)	
65–74	286 (8.0%)	176 (6.6%)	
Sex			
Men (%)	1697 (47.4%)	1163 (43.8%)	0.005
Women (%)	1882 (52.6%)	1492 (56.2%)	
Race (%)			
White	1745 (48.8%)	1291 (48.6%)	0.907
Non-white	1834 (51.2%)	1365 (51.4%)	
Mental health diagnoses (%)			
Schizophrenia	1578 (44.1)	1005 (37.9)	<.001
Bipolar disorder	614 (17.2)	556 (20.9)	
Major depression	587 (16.4)	647 (24.4)	
Other	800 (22.3)	447 (16.8)	

Table 2

Barell Matrix of injuries classified by body region and nature of injury for Maryland Medicaid cohort with serious mental illness (n=7298 injuries), 1994–2001

	Fracture	Sprain	Open Wound	Superficial	Burn	Poison	Other ^b	Total Observations
Head/ Face	66 0.9%	3 0.4%	669 8.9%	421 5.6%	9 0.1%	0 0.0%	249 3.3%	1417 19.4%
Spine/ Neck	36 0.5%	310 4.1%	9 0.1%	0 0.0%	1 0.0%	0 0.0%	5 0.1%	361 5.0%
Trunk	95 1.3%	169 2.3%	83 1.1%	243 3.2%	17 0.2%	0 0.0%	90 1.20%	697 9.6%
Hands/ Wrists	130 1.7%	94 1.3%	348 4.6%	187 2.5%	42 0.6%	0 0.0%	61 0.8%	862 11.8%
Extremities.	643 8.5%	633 8.4%	294 3.9%	649 8.6%	56 0.7%	0 0.0%	200 2.6%	2475 33.9%
Systemic	0 0.0%	0 0.0%	0 0.0%	0 0.0%	0 0.0%	757 10.4%	353 4.8%	1110 15.2%
Unspecified	5 0.1%	97 1.3%	11 0.2%	155 2.1%	26 0.4%	0 0.0%	82 1.1%	376 5.2%
Total Observations	975 13.4%	1306 17.9%	1414 19.4%	1655 22.7%	151 2.1%	757 10.4%	1040 14.3%	7298 100%

^b Other includes dislocation, internal injury, amputation, blood vessel injury, nerve injury, and crushing injury

Table 3

Injury rates per 100,000 persons and relative risk for injury in Maryland Medicaid cohort with serious mental illness (SMI) and US Population, 2000*

	Non-fatal Injury				Fatal Injury			
	SMI rate	US rate	RR	95% CI	SMI rate	US rate	RR	95% CI
Total	14420	8000	1.80	1.73–1.87	266	57	4.65	4.05–5.34
White male	15459	8493	1.82	1.81–1.83	358	83	4.34	3.88–4.85
Non-white male	14268	10659	1.34	1.34–1.34	358	108	3.32	3.05–3.62
White female	15473	6371	2.43	2.41–2.45	188	29	6.58	5.27–8.22
Non-white female	12642	8457	1.49	1.49–1.50	192	30	6.37	5.14–7.89

* Age-adjusted

Table 4

Factors associated with risk of any injury diagnosis in the Maryland Medicaid cohort with serious mental illness, 1994–2001

	Risk of Injury	
	Hazard Ratio	95% CI
Age (per year incidence)	0.97	0.97, 0.97
Sex		
Women	Reference (1.00)	Reference
Men	1.03	0.98–1.08
Race		
Non-White	Reference (1.00)	Reference
White	1.40	1.34–1.47
Diagnosis		
Schizophrenia	Reference (1.00)	Reference
Bipolar disorder	1.33	1.25–1.41
Major depression	1.34	1.26–1.42
Other	1.14	1.06–1.22
Alcohol/Drug Abuse Diagnosis		
No	Reference (1.00)	Reference (1.00)
Yes	1.87	1.77–1.97

Table 5

Factors associated with risk of injury-related death in the Maryland Medicaid cohort with serious mental illness, 1994–2001

	Hazard Ratio	95% CI
Age	0.98	0.96–1.00
Sex		
Women	Reference (1.00)	Reference
Men	1.70	1.11–2.61
Race		
Non-White	Reference (1.00)	Reference
White	1.28	0.84–01.94
Alcohol/Drug Abuse Diagnosis		
No	Reference (1.00)	Reference (1.00)
Yes	4.76	3.10–7.30
Prior Injury Hospitalization		
No	Reference (1.00)	Reference
Yes	3.24	1.02–10.3