Supplemental Table 1: Rates of Each Reason for Rehospitalization at 1, 2, 5, and 10 years post-TBI (Level 1 Diagnoses)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Level 1 Diagnosis** | **Year 1** **Rate per 1000 persons with TBI** | **Year 2****Rate per 1000 persons with TBI** | **Year 5** **Rate per 1000 persons with TBI** | **Year 10** **Rate per 1000 persons with TBI** |
| 1. Infectious and parasitic diseases; operations for infection | 24.1 | 22.1 | 17.7 | 11.2 |
| 2. Neoplasms; operations for neoplasm/tumor/cancer | 5.8 | 5.3 | 4.9 | 7.8 |
| 3. Endocrine; nutritional; and metabolic diseases and immunity disorders; operations on the endocrine system | 7.5 | 4.4 | 6.9 | 6.7 |
| 4. Diseases of the blood and blood-forming organs  | 3.3 | 4.4 | 2.0 | 4.5 |
| 5. Mental Illness | 19.1 | 16.8 | 25.6 | 15.7 |
| 6. Diseases of the nervous system and sense organs | 49.9 | 38.1 | 34.4 | 22.4 |
| 7. Diseases of the circulatory system; operations on the cardiovascular system | 36.6 | 25.7 | 32.4 | 21.3 |
| 8. Diseases of the respiratory system | 10.8 | 9.7 | 17.7 | 11.2 |
| 9. Diseases of the digestive system; operations on the digestive system | 18.3 | 16.8 | 17.7 | 21.3 |
| 10. Diseases of the genitourinary system; operations on the genitourinary system | 12.5 | 15.1 | 11.8 | 11.2 |
| 11. Complications of pregnancy; childbirth; and the puerperium; obstetrical procedures | 0.8 | 1.8 | 5.9 | 4.5 |
| 12. Diseases of the skin and subcutaneous tissue | 7.5 | 0.9 | 3.9 | 6.7 |
| 13. Diseases of the musculoskeletal system and the connective tissue | 17.5 | 12.4 | 7.9 | 16.8 |
| 14. Congenital anomalies | 0.8 | 0 | 0 | 1.1 |
| 15. Certain conditions originating in the perinatal period | 0 | 0 | 0 | 0 |
| 16. Injury and poisoning | 53.2 | 61.1 | 42.3 | 47.0 |
| 17. Symptoms; signs; and ill-defined conditions and factors influencing health status | 20.8 | 15.1 | 14.7 | 6.7 |
| 18. Residual codes; unclassified; all E codes | 2.5 | 3.5 | 0 | 0 |

Supplemental Table 2: Rates of Each Reason for Rehospitalization at 1, 2, 5, and 10 years post-TBI (Level 2 Diagnoses)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Level 2 Diagnosis** | **Year 1** **Rate per 1000 persons with TBI** | **Year 2** **Rate per 1000 persons with TBI** | **Year 5****Rate per 1000 persons with TBI** | **Year 10** **Rate per 1000 persons with TBI** |
| **1 Infectious and parasitic diseases; operations for infection** |
| 1.1 Bacterial infection | 13.3 | 15.1 | 9.8 | 3.4 |
| 1.2 Mycoses | 0 | 0  | 0 | 0 |
| 1.3 Viral infection | 4.2 | 3.5 | 2.9 | 2.2 |
| 1.4 Other infections; including parasitic | 1.7 | 0 | 3.9 | 1.1 |
| 1.5 Immunizations and screening for infectious disease | 0.8 | 0 | 0 | 0 |
| **2 Neoplasms; operations for neoplasm/tumor/cancer** |
| 2.1 Colorectal cancer | 0.8 | 0 | 1.0 | 0 |
| 2.2 Other gastrointestinal cancer | 0  | 0  | 0 | 0 |
| 2.3 Cancer of the bronchus; cancer of the lung; lobectomy or pneumonectomy or other excision of lung tissue due to tumor | 0 | 0.9 | 0 | 0 |
| 2.4 Cancer of skin  | 0 | 0 | 0 | 0 |
| 2.5 Cancer of breast; mastectomy | 0 | 0.9 | 0 | 1.1 |
| 2.6 Cancer of uterus and cervix | 0 | 0 | 0  | 0 |
| 2.7 Cancer of ovary and other female genital organs | 0 | 0 | 0  | 0  |
| 2.8 Cancer of male genital organs | 0 | 0.9 | 0  | 0  |
| 2.9 Cancer of urinary organs | 0 | 0 | 0  | 2.2 |
| 2.10 Cancer of lymphatic and hematopoietic tissue | 0 | 0 | 0  | 1.1 |
| 2.11 Cancer; other primary; bone marrow transplant; bone marrow biopsy | 2.5 | 0.9 | 1.0  | 0  |
| 2.12 Secondary malignancies; lymphatic excisions | 0 | 0 | 0  | 0  |
| 2.13 Malignant neoplasm without specification of site | 0 | 0 | 0 | 0  |
| 2.14 Neoplasms of unspecified nature or uncertain behavior | 0 | 0.9 | 0 | 0  |
| 2.15 Maintenance chemotherapy; radiotherapy | 0 | 0 | 0 | 0  |
| 2.16 Benign neoplasms | 0.8 | 0 | 0 | 2.2 |
| **3 Endocrine; nutritional; and metabolic diseases and immunity disorders; operations on the endocrine system** |
| 3.1 Thyroid disorders; thyroidectomy | 0 | 0 | 0 | 1.1 |
| 3.2 Diabetes mellitus without complication | 0 | 1.8 | 1.0 | 2.2 |
| 3.3 Diabetes mellitus with complications  | 1.7 | 1.8 | 2.9 | 3.4 |
| 3.4 Other endocrine disorders; other endocrine procedures | 0 | 0 | 0 | 0 |
| 3.5 Nutritional deficiencies; enteral and parenteral nutrition | 0.8 | 0 | 0 | 1.1 |
| 3.6 Disorders of lipid metabolism | 0 | 0 | 0 | 0  |
| 3.7 Gout and other crystal arthropathies  | 0 | 0 | 0 | 0  |
| 3.8 Fluid and electrolyte disorders  | 3.3 | 0.9 | 1.0  | 0  |
| 3.9 Cystic fibrosis | 0 | 0 | 0  | 0  |
| 3.10 Immunity disorders | 0 | 0 | 1.0  | 0  |
| 3.11 Other nutritional; endocrine; and metabolic disorders (includes obesity) | 0 | 0 | 0 | 0  |
| **4 Diseases of the blood and blood-forming organs**  |
| 4.1 Anemia; blood transfusion | 0 | 0.9 | 0 | 2.2 |
| 4.2 Coagulation and hemorrhagic disorders; control of the epistaxis (nose bleed) | 0 | 0.9 | 1.0  | 2.2 |
| 4.3 Diseases of white blood cells | 0 | 0  | 0  | 0 |
| 4.4 Other hematologic conditions | 0 | 0 | 0  | 0 |
| **5 Mental Illness** |
| 5.1 Adjustment disorders | 0.8 | 0.9 | 0  | 0 |
| 5.2 Anxiety disorders | 0.8 | 1.8 | 2.0  | 4.5 |
| 5.3 Attention deficit, conduct, and disruptive behavior disorders | 0 | 0 | 0  | 0  |
| 5.4 Delirium, dementia, and amnestic and other cognitive disorders | 0 | 1.8 | 2.0  | 1.1 |
| 5.5 Developmental disorders | 0 | 0  | 0 | 0 |
| 5.6 Disorders usually diagnosed in infancy, childhood, or adolescence  | 0 | 0 | 0  | 0 |
| 5.7 Impulse control disorders not elsewhere classified | 0.8 | 0 | 0  | 0 |
| 5.8 Mood disorders; electroconvulsive therapy | 5.0 | 2.7 | 6.9 | 1.1 |
| 5.9 Personality disorders | 0  | 0  | 0 | 0 |
| 5.10 Schizophrenia and other psychotic disorders | 1.7 | 1.8 | 2.0 | 0 |
| 5.11 Alcohol-related disorders; Alcohol and drug rehabilitation and detoxification | 1.7 | 1.8 | 1.0 | 0 |
| 5.12 Substance-related disorders; Alcohol and drug rehabilitation and detoxification | 4.2 | 0.9 | 4.9 | 2.2 |
| 5.13 Suicide and intentional self-inflicted injury | 5.8 | 2.7 | 2.9 | 3.4 |
| 5.14 Screening and history of mental health and substance abuse codes | 0.8 | 0 | 2.0 | 0 |
| 5.15 Miscellaneous mental disorders | 0.8 | 1.8 | 2.0 | 2.2 |
| **6 Diseases of the nervous system and sense organs** |
| 6.1 Central nervous system infection | 0  | 0 | 1.0  | 0 |
| 6.2 Hereditary and degenerative nervous system conditions | 0  | 0 | 0  | 0 |
| 6.3 Paralysis | 0.8 | 0 | 1.0  | 0 |
| 6.4 Epilepsy; convulsions | 32.4 | 25.7 | 23.6 | 17.9 |
| 6.5 Headache; including migraine | 0 | 1.8 | 1.0 | 0 |
| 6.6 Coma; stupor; and brain damage | 3.3 | 3.5 | 2.9 | 1.1 |
| 6.7 Eye disorders; operations on the eye | 0  | 0.9 | 1.0 | 0  |
| 6.8 Ear conditions; operations on the ear | 0.8 | 1.8 | 0 | 0  |
| 6.9 Other nervous system disorders; other nervous system procedures | 5.8 | 0.9 | 3.9 | 3.4 |
| **7 Diseases of the circulatory system; operations on the cardiovascular system** |
| 7.1 Hypertension | 4.2 | 0 | 2.0 | 2.2 |
| 7.2 Diseases of the heart; heart procedures | 14.1 | 15.9 | 15.7 | 7.8 |
| 7.3 Cerebrovascular disease/stroke; endarterectomy; vessel of head and neck | 7.5 | 6.2 | 5.9 | 4.5 |
| 7.4 Diseases of arteries; arterioles; and capillaries; lower extremity vascular procedures | 5.0 | 3.5 | 4.9 | 2.2 |
| 7.5 Diseases of veins and lymphatics; procedures on spleen | 2.5 | 0 | 2.9 | 1.1 |
| **8 Diseases of the respiratory system** |
| 8.1 Respiratory infections | 5.8 | 6.2 | 8.8 | 5.6 |
| 8.2 Chronic obstructive pulmonary disease and bronchiectasis  | 0.8 | 0  | 1.0 | 1.1 |
| 8.3 Asthma | 0 | 0.9 | 2.0  | 0 |
| 8.4 Aspiration pneumonitis; food/vomitus  | 2.5 | 0.9 | 2.0  | 0 |
| 8.5 Pleurisy; pneumothorax; pulmonary collapse; incision of pleura; thoracentesis; chest drainage | 0.8 | 0 | 0 | 2.2 |
| 8.6 Respiratory failure; insufficiency; arrest (adult)  | 0 | 0 | 0 | 0 |
| 8.7 Lung disease due to external agents | 0 | 0 | 0 | 0 |
| 8.8 Other lower respiratory disease | 0  | 0 | 0 | 1.1 |
| 8.9 Other upper respiratory disease | 0  | 0.9 | 2.0  | 0  |
| **9 Diseases of the digestive system; operations on the digestive system** |
| 9.1 Intestinal infection | 2.5 | 2.7 | 1.0  | 0 |
| 9.2 Disorders of teeth and jaw | 0.8 | 0 | 0  | 0 |
| 9.3 Diseases of mouth; excluding dental | 0 | 0.9 | 0  | 0 |
| 9.4 Upper gastrointestinal disorders; upper gastrointestinal procedures | 2.5 | 1.8 | 2.9 | 2.2 |
| 9.5 Abdominal hernia; operations on hernias | 1.7 | 1.8 | 1.0 | 2.2 |
| 9.6 Lower gastrointestinal disorders; lower gastrointestinal procedures | 3.3 | 0.9 | 3.9 | 7.8 |
| 9.7 Biliary tract disease; cholecystectomy and common duct exploration; incision of bile duct | 0 | 0 | 0  | 0  |
| 9.8 Liver disease; biopsy of liver | 2.5 | 1.8 | 0  | 0  |
| 9.9 Pancreatic disorders (not diabetes); endoscopic retrograde cannulation of pancreas (ERCP) | 0.8 | 1.8 | 2.0  | 0  |
| 9.10 Gastrointestinal hemorrhage | 0.8 | 1.8 | 2.9 | 0  |
| 9.11 Noninfectious gastroenteritis | 0 | 0 | 0  | 0  |
| 9.12 Other gastrointestinal disorders | 3.3 | 3.5 | 2.0  | 3.4 |
| **10 Diseases of the genitourinary system; operations on the genitourinary system** |
| 10.1 Diseases of the urinary system; operations on the urinary system | 9.1 | 15.1 | 11.8 | 7.8 |
| 10.2 Diseases of the male genital organs; operations on the male genital organs | 2.5 | 0  | 0  | 1.1 |
| 10.3 Diseases of the female genital organs; operations on the female genital organs | 0  | 0.9 | 0  | 1.1 |
| **11 Complications of pregnancy; childbirth; and the puerperium; obstetrical procedures** |
| 11.1 Contraceptive and procreative management | 0 | 0  | 1.0  | 0 |
| 11.2 Abortion-related disorders | 0 | 0  | 0  | 0 |
| 11.3 Complications mainly related to pregnancy; removal of ectopic pregnancy | 0 | 0  | 0  | 2.2 |
| 11.4 Indications for care in pregnancy; labor; and delivery; procedures to assist delivery | 0 | 0  | 1.0  | 1.1 |
| 11.5 Complications during labor | 0 | 0  | 0  | 0  |
| 11.6 Other complications of birth; puerperium affecting management of mother | 0 | 0  | 0  | 0  |
| 11.7 Normal pregnancy and/or delivery; procedures related to normal delivery of pregnancy | 0 | 1.8 | 3.9 | 1.1 |
| **12 Diseases of the skin and subcutaneous tissue** |
| 12.1 Skin and subcutaneous tissue infections | 3.3 | 0 | 2.0  | 2.2 |
| 12.2 Other inflammatory condition of skin | 0  | 0 | 0  | 1.1 |
| 12.3 Chronic ulcer of skin | 0.8 | 0.9 | 0  | 1.1 |
| 12.4 Other skin disorders | 0 | 0 | 1.0  | 0 |
| **13 Diseases of the musculoskeletal system and the connective tissue** |
| 13.1 Infective arthritis and osteomyelitis (except that caused by TB or STD) | 0  | 0.9 | 0  | 0 |
| 13.2 Non-traumatic joint disorders; arthroplasty; other procedures on joints | 9.1 | 5.3 | 3.9 | 4.5 |
| 13.3 Spondylosis; intervertebral disc disorders; other back problems; laminectomy or spinal fusion | 0.8 | 1.8 | 1.0 | 0 |
| 13.4 Osteoporosis | 0 | 0.9 | 0 | 0 |
| 13.5 Pathological fracture | 0.8 | 0 | 0 | 2.2 |
| 13.6 Acquired deformities; heterotopic ossification resection (acquired deformities) | 2.5 | 0 | 2.9 | 2.2 |
| 13.7 Systemic lupus erythematosus and connective tissue disorders | 0  | 0 | 0  | 0  |
| 13.8 Other connective tissue disease | 0 | 0.9 | 0  | 1.1 |
| 13.9 Other bone disease and musculoskeletal deformities | 1.7 | 0.9 | 0  | 2.2 |
| **14 Congenital anomalies** |
| 14.1 Cardiac and circulatory congenital anomalies  | 0  | 0  | 0  | 0 |
| 14.2 Digestive congenital anomalies | 0  | 0  | 0  | 1.1 |
| 14.3 Genitourinary congenital anomalies  | 0  | 0  | 0  | 0  |
| 14.4 Nervous system congenital anomalies | 0.8 | 0 | 0 | 0 |
| 14.5 Other congenital anomalies | 0  | 0 | 0 | 0 |
| **15 Certain conditions originating in the perinatal period** |
| 15.1 Liveborn | 0 | 0 | 0 | 0 |
| 15.2 Short gestation; low birth weight; and fetal growth retardation | 0 | 0 | 0 | 0 |
| 15.3 Intrauterine hypoxia and birth asphyxia | 0 | 0 | 0 | 0 |
| 15.4 Respiratory distress syndrome | 0 | 0  | 0  | 0  |
| 15.5 Hemolytic jaundice and perinatal jaundice  | 0 | 0  | 0  | 0  |
| 15.6 Birth trauma | 0 | 0  | 0  | 0  |
| 15.7 Other perinatal conditions | 0 | 0  | 0  | 0  |
| **16 Injury and poisoning** |
| 16.1 Joint disorders and dislocations; trauma-related | 3.3 | 2.7 | 5.9 | 6.7 |
| 16.2 Fractures; treatment of fracture or dislocation | 10.8 | 22.1 | 16.7 | 19.0 |
| 16.3 Spinal cord injury  | 1.7 | 0.9 | 1.0 | 1.1 |
| 16.4 Intracranial injury; craniotomy or craniectomy | 15.0 | 11.5 | 2.9 | 5.6 |
| 16.5 Crushing injury or internal injury; amputation due to new crushing trauma | 0.8 | 1.8 | 0 | 0 |
| 16.6 Open wounds | 0 | 2.7 | 2.0 | 1.1 |
| 16.7 Sprains and strains | 0 | 0.9 | 0 | 0 |
| 16.8 Superficial injury; contusion  | 3.3 | 4.4 | 0 | 0 |
| 16.9 Burns | 0 | 0.9 | 1.0 | 0 |
| 16.10 Complications; hardware (plate, screw, shunt, etc.) removal | 7.5 | 4.4 | 0 | 1.1 |
| 16.11 Poisoning | 0.8 | 0.9 | 3.9 | 0 |
| 16.12 Other injuries and conditions due to external causes | 10.8 | 9.7 | 6.9 | 12.3 |
| **17 Symptoms; signs; and ill-defined conditions and factors influencing health status** |
| 17.1 Symptoms; signs; and ill-defined conditions and factors influencing health status | 10.0 | 7.1 | 5.9 | 2.2 |
| 17.2 Factors influencing health care (rehabilitation care, medical examination, other aftercare) | 9.1 | 6.2 | 5.9 | 2.2 |
| **18 Residual codes; unclassified; all E codes** | 2.5 | 3.5 | 0  | 0 |

Supplemental Table 3. Multivariable Ordinal Logistic Regression Model for Predictors of Likelihood of More Rehospitalizations (0, 1, 2+) at 1, 2, 5, and 10 years post-TBI

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Rehospitalization 1-year post-injury (n=1113) |  | Rehospitalization 2 years post-injury (n=907) |  | Rehospitalization 5 years post-injury (n=874) |  | Rehospitalization 10-year post-injury (n=708) |  |
| Variables | OR (95% CI) | p | OR (95% CI) | p | OR (95% CI) | p | OR (95% CI) | p |
| **Measured at baseline** |
| Sex Male (ref) Female | Ref1.23 (0.87, 1.73) | Ref0.235 | Ref0.95 (0.64, 1.41) | Ref0.784 | Ref0.75 (0.50, 1.11) | Ref0.152 | Ref1.23 (0.78, 1.94) | Ref0.384 |
| Race White (ref) Non-white | Ref0.77 (0.54, 1.08) | Ref0.127 | Ref0.65 (0.42, 0.99) | Ref0.047\* | Ref1.24 (0.83, 1.87) | Ref0.293 | Ref1.01 (0.63, 1.63) | Ref0.958 |
| Education Less than HS (ref) HS+ | Ref1.08 (0.71, 1.66) | Ref0.713 | Ref0.96 (0.58, 1.59) | Ref0.870 | Ref1.54 (0.92, 2.58) | Ref0.103 | Ref0.88 (0.52, 1.49) | Ref0.637 |
| Rehab payor source Government insurance (ref) Other | Ref1.04 (0.75, 1.45) | Ref0.815 | Ref0.56 (0.39, 0.85) | Ref0.006\* | Ref0.85 (0.58, 1.25) | Ref0.397 | Ref0.83 (0.52, 1.32) | Ref0.426 |
| Length of stay during rehabilitation | 1.00 (1.00, 1.01) | 0.219 | 1.00 (0.99, 1.01) | 0.913 | 1.00 (0.99, 1.01) | 0.849 | 1.00 (0.99, 1.01) | 0.880 |
| FIM Motor at Rehabilitation discharge | 0.98 (0.97, 0.99) | <0.001\* | 0.99 (0.97, 1.00) | 0.034\* | 0.98 (0.97, 1.00)  | 0.006\* | 0.99 (0.98, 1.00) | 0.182 |
| FIM Cognitive at Rehabilitation Discharge | 1.03 (1.01, 1.06) | 0.020\* | 1.02 (0.99, 1.05) | 0.278 | 1.03 (1.00, 1.06) | 0.100 | 0.99 (0.96, 1.03) | 0.764 |
| Cranial surgery status No cranial surgery (ref) Craniotomy and/or Craniectomy  | Ref2.28 (1.65, 3.16) | Ref<0.001\* | Ref0.91 (0.60, 1.38) | Ref0.654 | Ref0.93 (0.61, 1.41) | Ref0.725 | Ref0.92 (0.57, 1.48) | Ref0.728 |
| Pre-index history of TBI(yes vs. no) | 0.96 (0.67, 1.38) | 0.815 | 0.51 (0.33, 0.80) | 0.003\* | 1.22 (0.83, 1.78) | 0.307 | 0.76 (0.47, 1.21) | 0.242 |
| **Measured at prior TBIMS follow-up interview** |
| Problem substance use(yes vs. no) | -- | -- | 0.62 (0.37, 1.05) | 0.075 | 0.78 (0.49, 1.25)  | 0.300 | 1.12 (0.67, 1.86) | 0.667 |
| Post-index rehospitalization(yes vs. no) | -- | -- | 3.32 (2.28, 4.83) | <0.001\* | 2.51 (1.69, 3.74) | <0.001\* | 3.10 (2.00, 4.80) | <0.001\* |
| PART summary | -- | -- | 0.89 (0.64, 1.24) | 0.481 | 1.03 (0.75, 1.42) | 0.853 | 0.89 (0.62, 1.28) | 0.46525 |
| Driving independence(yes vs. no) | -- | -- | 0.90 (0.57, 1.44) | 0.671 | 0.85 (0.55, 1.31) | 0.459 | 1.37 (0.83, 2.25) | 0.213 |
| **Measured at the same follow-up interview as rehospitalization variable** |
| Age 16-29 (ref) 30-49  50-64 65+ | Ref0.92 (0.60, 1.40)0.92 (0.58, 1.46)1.04 (0.63, 1.71) | Ref0.6950.7280.894 | Ref1.99 (1.15, 3.45)1.83 (1.01, 3.30)1.64 (0.86, 3.13) | Ref0.014\*0.046\*0.136 | Ref0.69 (0.40, 1.18) 1.39 (0.80, 2.42)1.59 (0.88, 2.88) | Ref0.1790.2410.124 | Ref2.21 (0.91, 5.38)2.38 (0.92, 6.14)3.55 (1.33, 9.50) | Ref0.0800.0720.012\* |
| Seizures in the past year (yes vs. no) | 5.24 (3.60, 7.64) | <0.001\* | 3.18 (1.95, 5.20) | <0.001\* | 3.88 (2.35, 6.38) | <0.001\* | 3.80 (2.15, 6.72) | <0.001\* |
| Total number of medical comorbidities(2+ vs. 1 or 0) | 2.84 (2.00, 4.03) | <0.001\* | 1.66 (1.09, 2.53) | 0.019\* | 1.72 (1.14, 2.60) | 0.009\* | 2.24 (1.40, 3.58) | <0.001\* |
| Total number of mental health comorbidities§ (1+ vs. 0) | 1.20 (0.88, 1.63) | 0.263 | 1.64 (1.12, 2.41) | 0.011\* | 1.65 (1.13, 2.42) | 0.010\* | 1.14 (0.73, 1.78) | 0.567 |
| **Model C-statistic:** | 0.753 |  | 0.776 |  | 0.740 |  | 0.756 |  |

 \* indicates statistical significance at p<0.05