Ontario Neurotrauma Foundation
Fondation ontarienne de neurotraumatologie

Ontario Acquired Brain Injury (ABI) Dataset Project Phase III

Highlights: Local Health Integration Networks (LHINs)

Acquired Brain Injury (ABI), which includes brain injury from traumatic (e.g., falls, motor vehicle collisions) and non-traumatic (e.g., anoxia, brain tumours) causes, is a leading cause of death and disability in Canada. ABI is more common than breast cancer, HIV/AIDS, spinal cord injury, and multiple sclerosis combined. Despite the large number of persons affected, ABI stakeholders have not previously benefited from a centralized data source to assist in planning and evaluation of services dedicated to ABI across the continuum.

The ABI Dataset Project, funded by the Ontario Neurotrauma Foundation, addressed this need by utilizing existing administrative data to answer important research questions about ABI in Ontario. Data were obtained from emergency departments (ED) from the National Ambulatory Care Reporting System (NACRS), acute hospital admission data from the Discharge Abstract Database (DAD), and inpatient rehabilitation admissions from the National Rehabilitation Reporting System (NRS). The data were obtained directly from the Ontario Ministry of Health Long-Term Care and housed at the Toronto Rehabilitation Institute. The project examined data from fiscal years 2003/04-2009/10.

The strengths of the project include:

- the ability to analyze **vast amounts of readily available data** from our publicly insured health-services in a cost-efficient manner
- identification of **acquired brain injury cases using ICD-10 diagnosis** for both traumatic (TBI) and non-traumatic brain injury (nTBI)
- the ability to **analyze and report data by geographical region, over time, and across the continuum of care**

The overall research questions addressed occurrence of ABI, causes of injury, outcomes, service provision, flow of service, and geographical information. **In this report, we present information on episodes of ABI (TBI and nTBI) by LHIN. The percentage of care provided inside a patient's LHIN of residence was presented by type of care (ED, acute care, or inpatient rehabilitation).**

The fact sheet provides highlights from our report available on the ABI Research Lab website (www.abiresearch.utoronto.ca), Ontario ABI Dataset.

Toronto Rehab | University Health Network | University of Toronto Faculty of Medicine

Research Team:

Angela Colantonio, Principal Investigator
Senior Research Scientist, Toronto Rehabilitation Institute
Professor of Occupational Science and Occupational Therapy, University of Toronto
416-978-1098, angela.colantonio@utoronto.ca
Lab: 416-946-8575, Fax: 416-946-8570

Vincy Chan, Research Analyst
Brandon Zagorski, Statistical Consultant
Daria Parsons, Consultant
Rika Vander Laan, Consultant

What was the rate of ABI?

Population based patient rates by LHIN were estimated excluding episodes of care with an ABI diagnosis in the previous 12 months based on ED and acute care data. The LHIN of patients' residence was used for this analysis.

The highest rates for TBI were found in North West (2.4 per 1000), North East (2.4 per 1000), and South East (2.4 per 1000) LHINs. The lowest rates were found in Central West (1.0 per 1000), Central (1.1 per 1000), and Toronto Central (1.2 per 1000) (see Figure 1).

The highest rates for nTBI were found in North East (2.1 per 1000), Erie St. Clair (1.9 per 1000), and South East (1.9 per 1000) LHINs. The lowest rates were found in Central West (1.1 per 1000), Central (1.1 per 1000), and Mississauga Halton (1.2 per 1000) (see Figure 1).

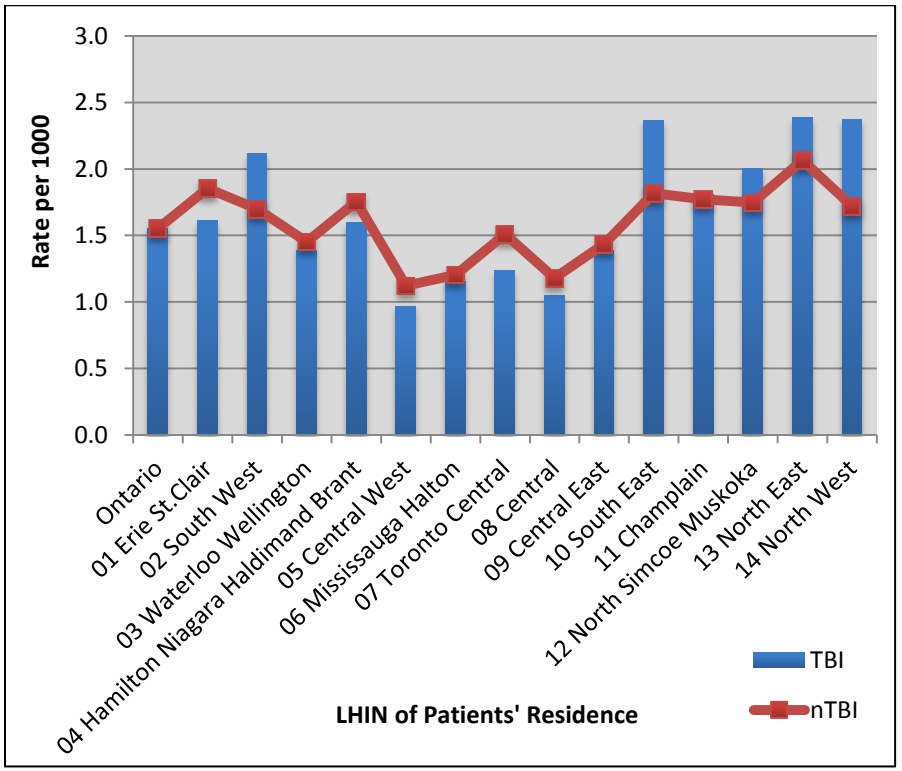

Figure 1. Rate of ABI by LHIN of Patients' Residence, 2003/04 – 2009/10

In 2009/10, the highest rates for TBI were found in North West (3.1 per 1000) and South West (2.5 per 1000) LHINs. The lowest rates were found in Central West (1.1 per 1000) and Central (1.4 per 1000) LHINs (see Figure 2).

The highest rates for nTBI in 2009/10 were found in North East (2.3 per 1000) and South East (2.2 per 1000) LHINs. The lowest rates were found in Mississauga Halton (1.2 per 1000) and Central West (1.3 per 1000) LHINs (see Figure 2).

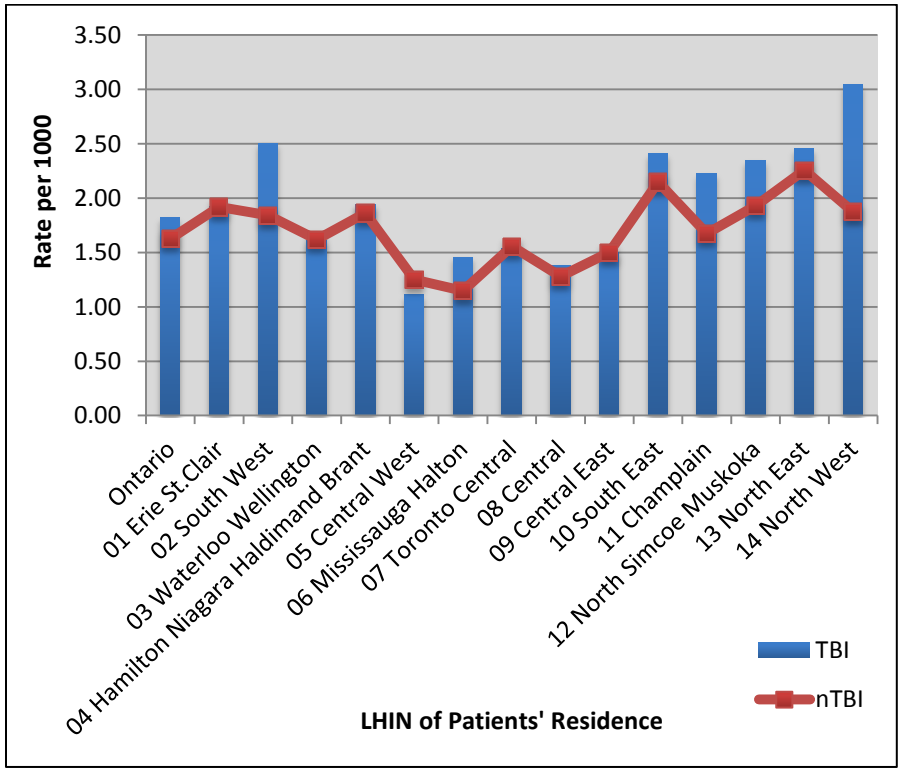

Figure 2. Rate of ABI by LHIN of Patients' Residence, 2009/10

The highest rates of inpatient rehabilitation for brain dysfunction[1] were found in North West (14 per 100,000) and South East (13 per 100,000) LHINs. The lowest rates were found in Waterloo Wellington (6 per 100,000) and Hamilton Niagara Haldimand Brant (6 per 100,000) LHINs (see Figure 3).

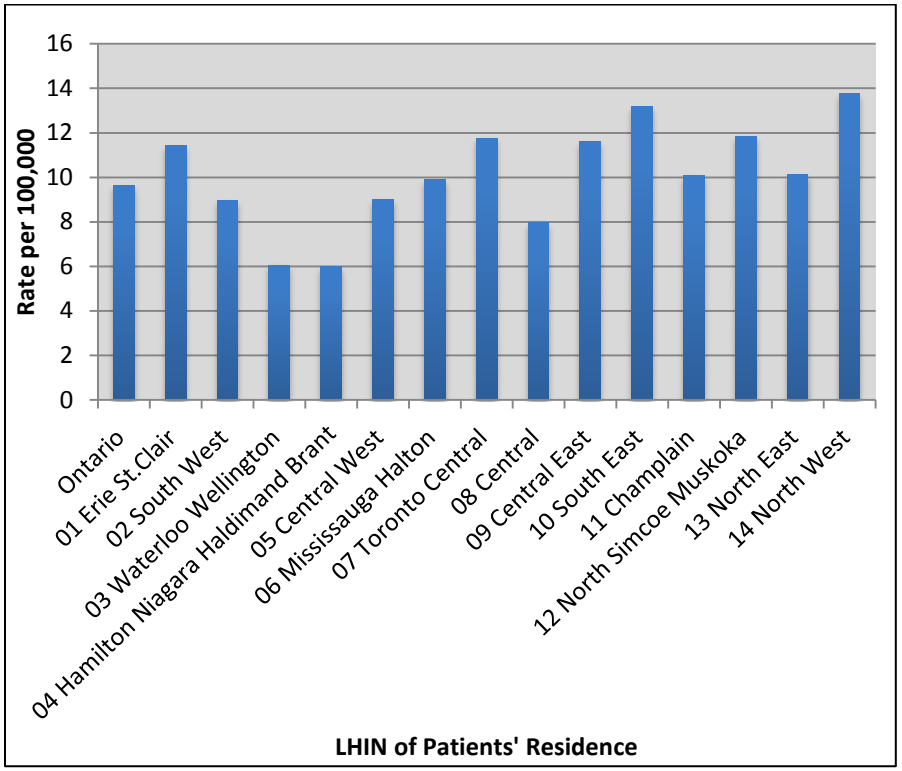

Figure 3. Rate of Inpatient Rehabilitation for Brain Dysfunction by LHIN of Patients' Residence, 2009/10

[1] RCG 2, brain dysfunction, includes both TBI and nTBI.

LHIN Concordance

LHIN concordance is the percentage of episodes of care occurring within the LHIN of patients' residence. In 2009/10, LHIN concordance was highest in Erie St. Clair (98%) and North West (98%) for ED visits. Erie St. Clair (99%) and North West (98%) also had the highest LHIN concordance percentage for acute care. LHIN concordance for inpatient rehabilitation was 100% for Waterloo Wellington. Toronto Central had the lowest LHIN concordance for all health care three settings (50% for ED visits, 38% for acute care, and 25% for inpatient rehabilitation) (see Figure 4).

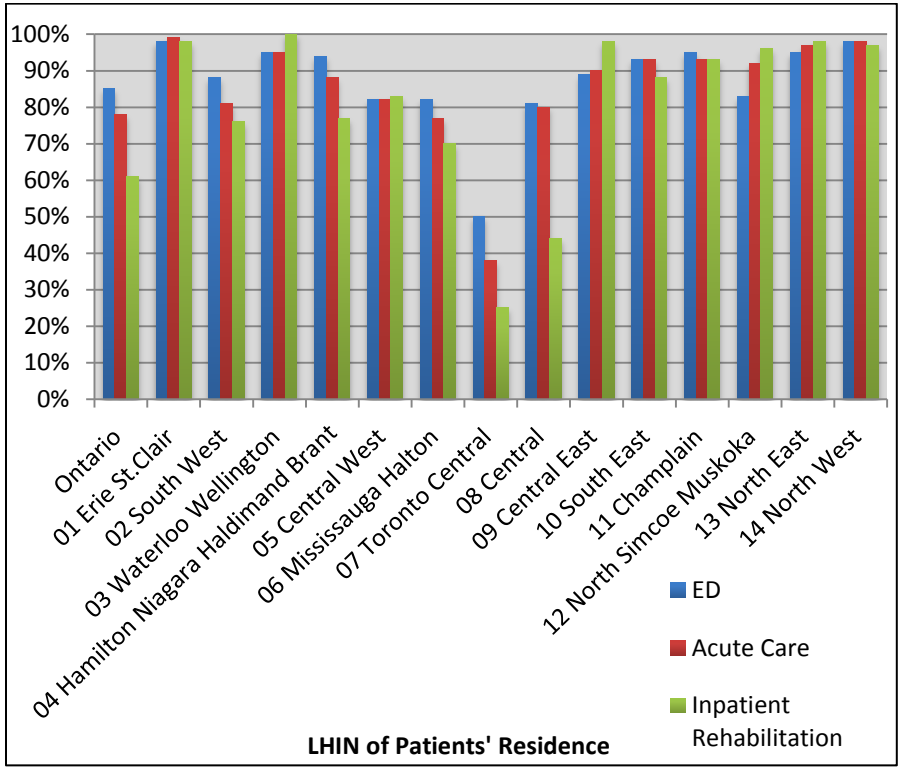

Figure 4.LHIN Concordance by LHIN of Patients' Residence, 2009/10

Alternate Level of Care (ALC)

The highest rates of ALC among TBI acute care episodes were in Central West (252 per 1000) and Central (248 per 1000) LHINs. The lowest rates were in South West (94 per 1000) and Erie St. Clair (95 per 1000) LHINs (see Figure 5).

The highest rates of ALC among nTBI acute care episodes were in North West (233 per 1000) and Waterloo Wellington (215 per 1000) LHINs. The lowest rates were in South West (82 per 1000) and Champlain (100 per 1000) LHINs (see Figure 5).

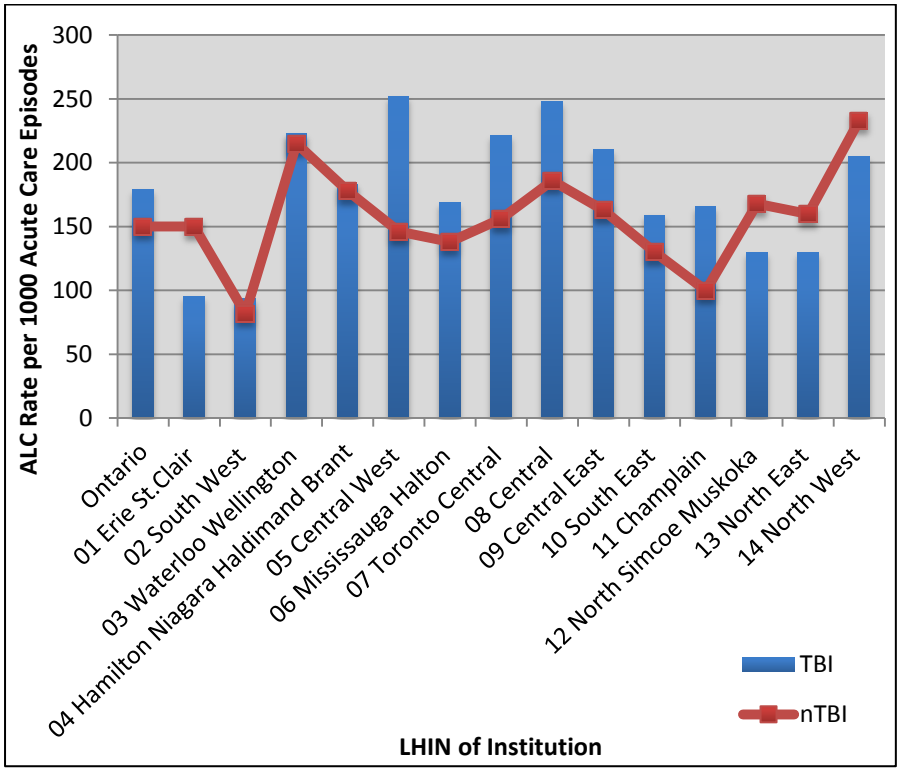

Figure 5. ALC Rate per 1000 Acute Care Episodes by LHIN, Ontario, 2009/10

Central West (25%) and Central (25%) LHINs had the highest percentage of acute care episodes with ALC days among TBI patients. South West (9%) and Erie St. Clair (10%) LHINs had the lowest percentage (see Figure 6).

North West (23%) and Waterloo Wellington (21%) had the highest percentage of acute care episodes with ALC days among nTBI patients. South West (8%) and Mississauga Halton (14%) LHINs had the lowest percentage (see Figure 6).

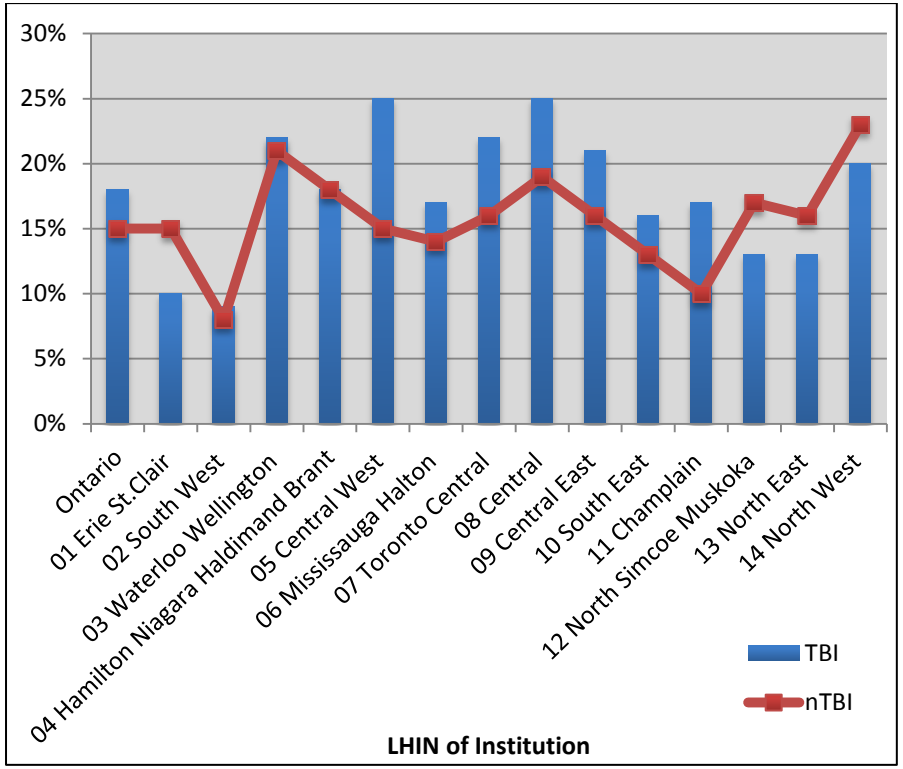

Figure 6. Percentage of Acute Care Episodes with ALC Days by LHIN, Ontario, 2009/10

Champlain (18 days) and North West (17 days) LHINs had the highest median number of ALC days among TBI patients. Erie St. Clair (4 days) and Central West (7 days) LHINs had the lowest median number of ALC days (see Figure 7).

Champlain (13 days) and South West (13 days) LHINs had the highest median number of ALC days among nTBI patients. North West (5 days) LHIN had the lowest median number of ALC days (see Figure 7).

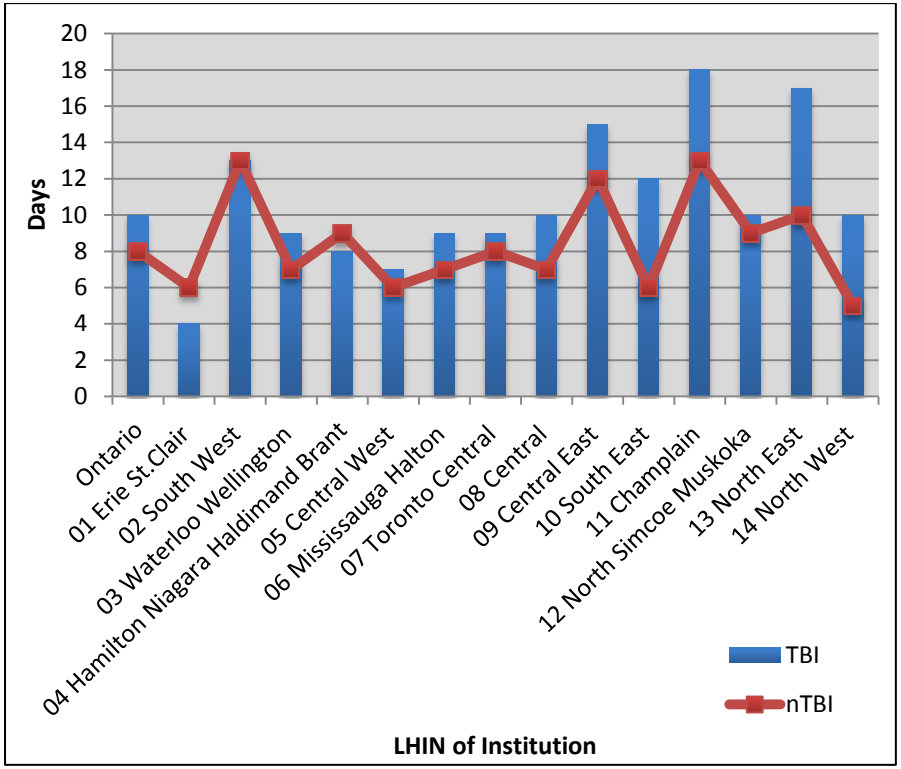

Figure 7. Median Number of ALC Days for ABI Episodes by LHIN, Ontario, 2009/10

Central East (43%) and Waterloo Wellington (42%) LHINs had the highest percentage of ALC episodes associated with psychiatric comorbidity among TBI patients. Central West (23%) and North West (23%) LHINs had the lowest percentage (see Figure 8).

Champlain (35%) and Central East (32%) LHINs had the highest percentage of ALC episodes associated with psychiatric comorbidity among nTBI patients. North Simcoe Muskoka (15%) LHINs had the lowest percentage (see Figure 8).

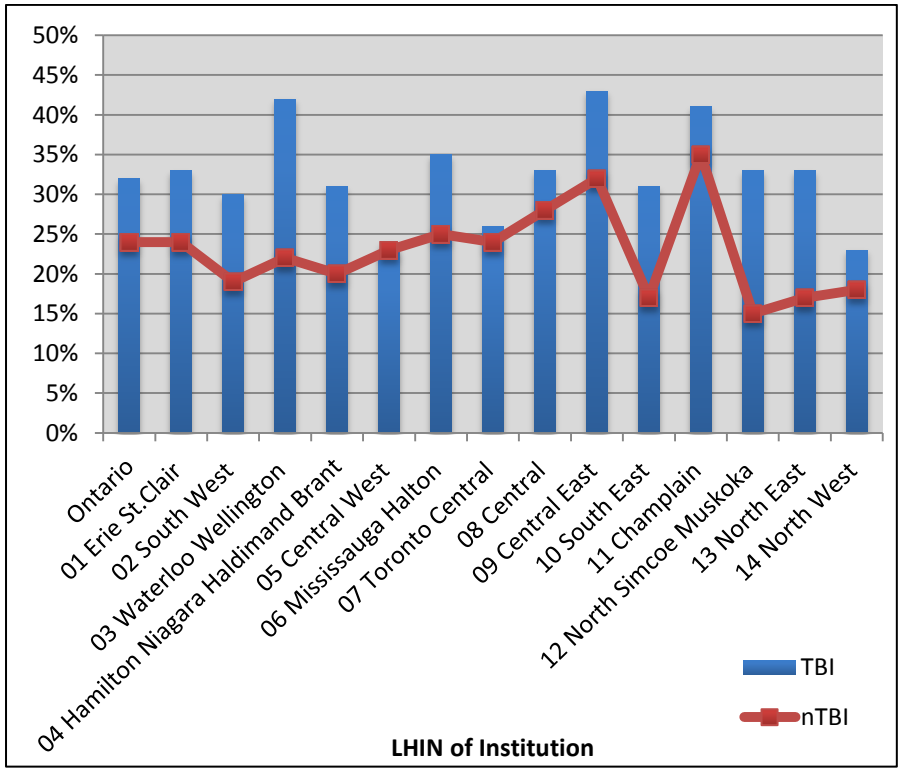

Figure 8. Percentage of ALC Episodes Associated with Psychiatric Comorbidity by LHIN, Ontario, 2007/08 – 2009/10

Median Lengths of Stay in ED, Acute Care, and Inpatient Rehabilitation

Among TBI patients, Central West and Toronto Central LHINs had the longest median length of stay in ED (4 hours). South West, North Simcoe Muskoka, and North West LHINs had the shortest (2 hours) (see Figure 9).

Among nTBI patients, Central West, Toronto Central, and Central LHINs had the longest median length of stay in ED (6 hours). North East LHIN had the shortest (3 hours) (see Figure 9).

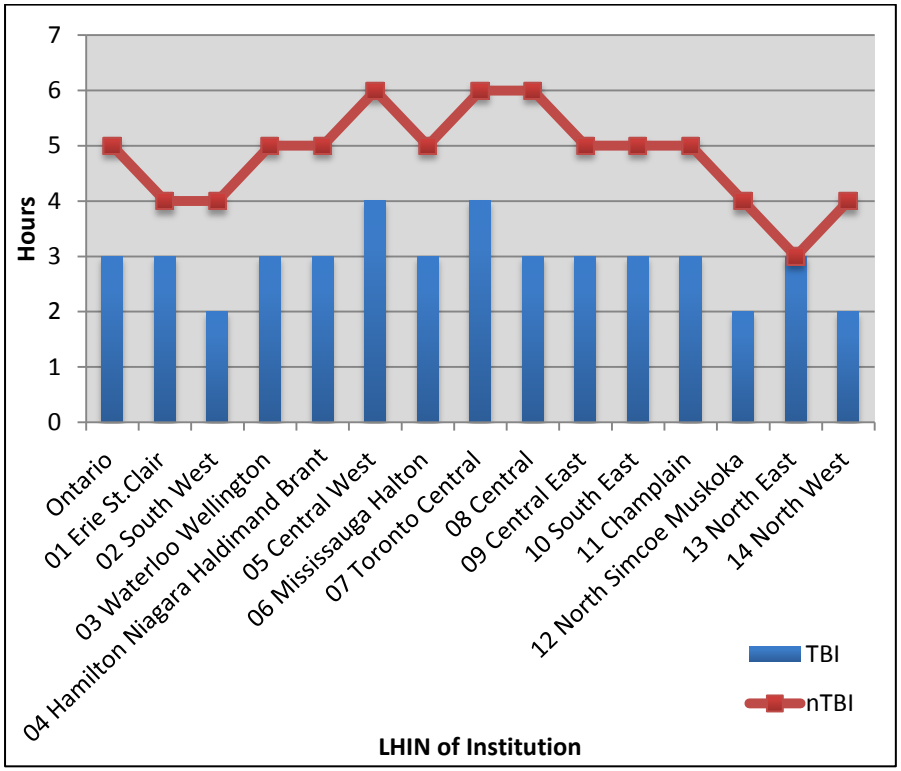

Figure 9. ED Median Lengths of Stay (Hours) for ABI Episodes by LHIN, Ontario, 2009/10

Champlain LHIN had the longest median length of stay in acute care among TBI patients (7 days). Central West LHIN had the shortest (4 days). Champlain LHIN also had the longest median length of stay in acute care among nTBI patients (9 days), followed by North West LHIN (8 days) (see Figure 10).

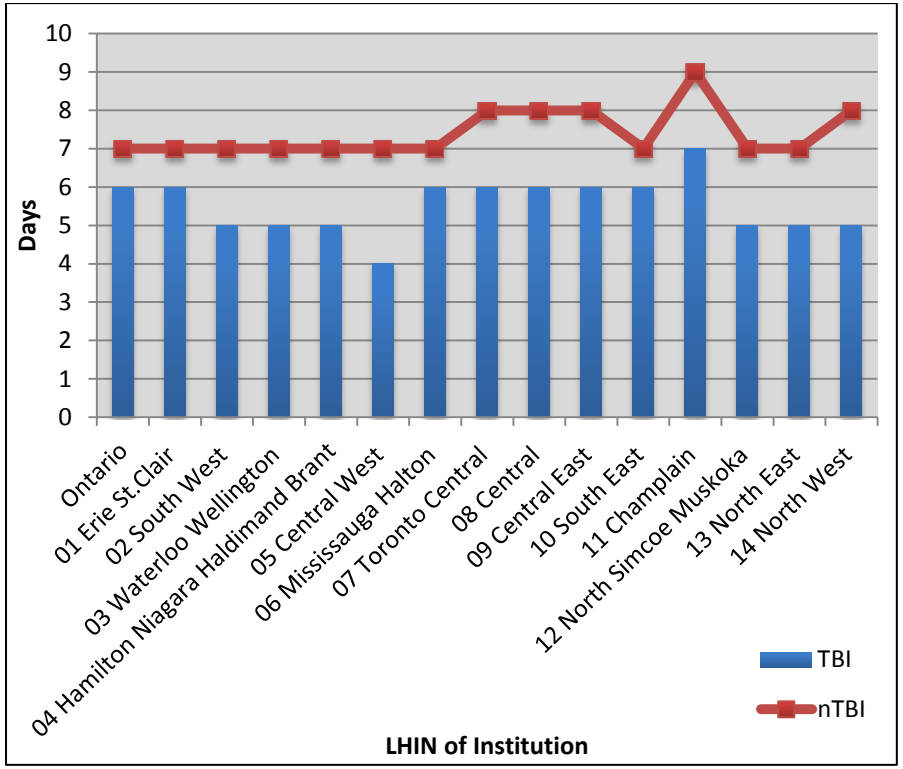

Figure 10. Acute Care Median Lengths of Stay (Days) for ABI Episodes by LHIN, Ontario, 2009/10

North West LHIN had the longest median length of stay (74 days), followed by Toronto Central LHIN (48 days). Erie St. Clair LHIN had the shortest median length of stay (15 days), followed by Mississauga Halton LHIN (19 days) (see Figure 11).

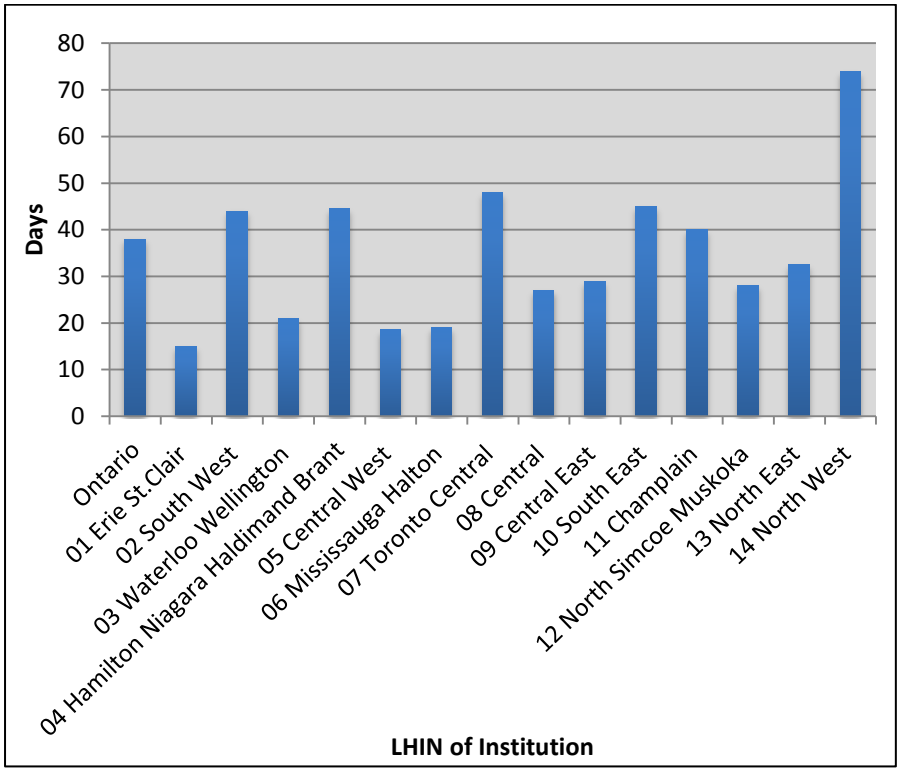

Figure 11. Inpatient Rehabilitation Median Lengths of Stay (Days) by LHIN, Ontario, 2009/10

Discharge Disposition from Acute Care

Central East LHIN had the highest percentage of deaths among TBI patients (14%) while Central West LHIN (8%) had the lowest. Central East LHIN also had the highest percentage of deaths among nTBI patients (33%) while Toronto Central LHIN had the lowest (15%). In each LHIN and in Ontario, a higher percentage of nTBI patients died compared to TBI patients (see Figure 12).

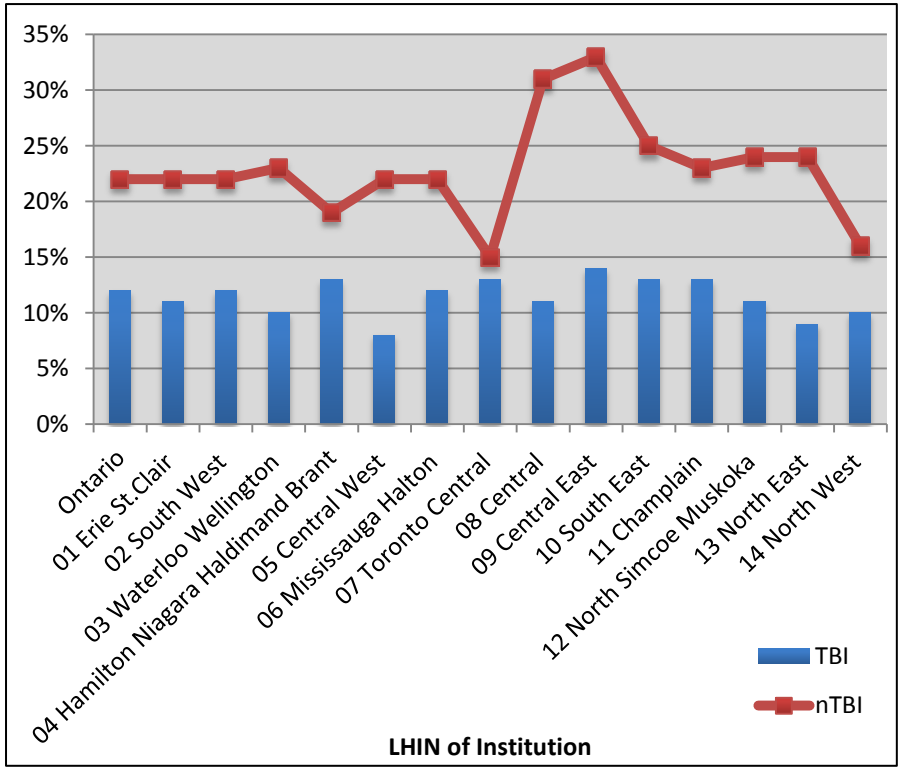

Figure 12. Percentage of Deaths among ABI Acute Care Episodes by LHIN, Ontario, 2007/08 – 2009/10

The North East LHIN had the highest percentage of TBI patients discharged home from acute care (58%) while Central East LHIN (48%) had the lowest percentage. Toronto Central LHIN had the highest percentage of nTBI patients discharged home (49%) while Waterloo Wellington LHIN had the lowest percentage (29%). Across each LHIN and in Ontario, a higher percentage of TBI patients were discharged home compared to nTBI patients (see Figure 13).

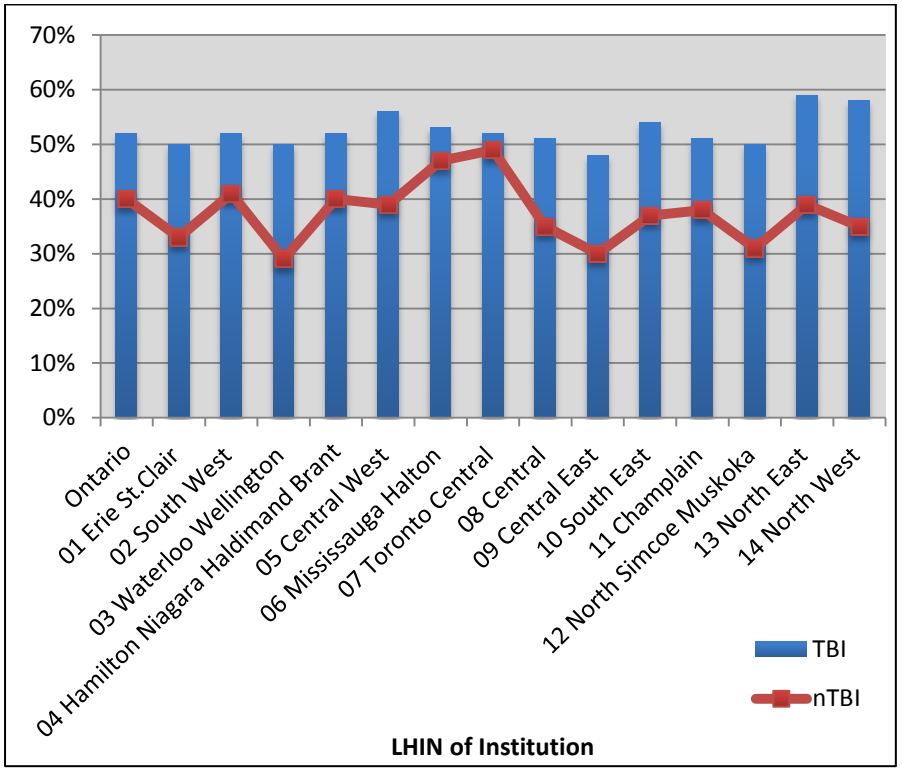

Figure 13. Percentage Discharged Home Among ABI Acute Care Episodes by LHIN, Ontario, 2007/08 – 2009/10

Central and Central East LHINs had the highest percentage of TBI patients discharged to long term care (24%) while North East LHIN had the lowest (13%). Waterloo Wellington LHIN had the highest percentage of nTBI patients discharged to long term care (23%) (see Figure 14).

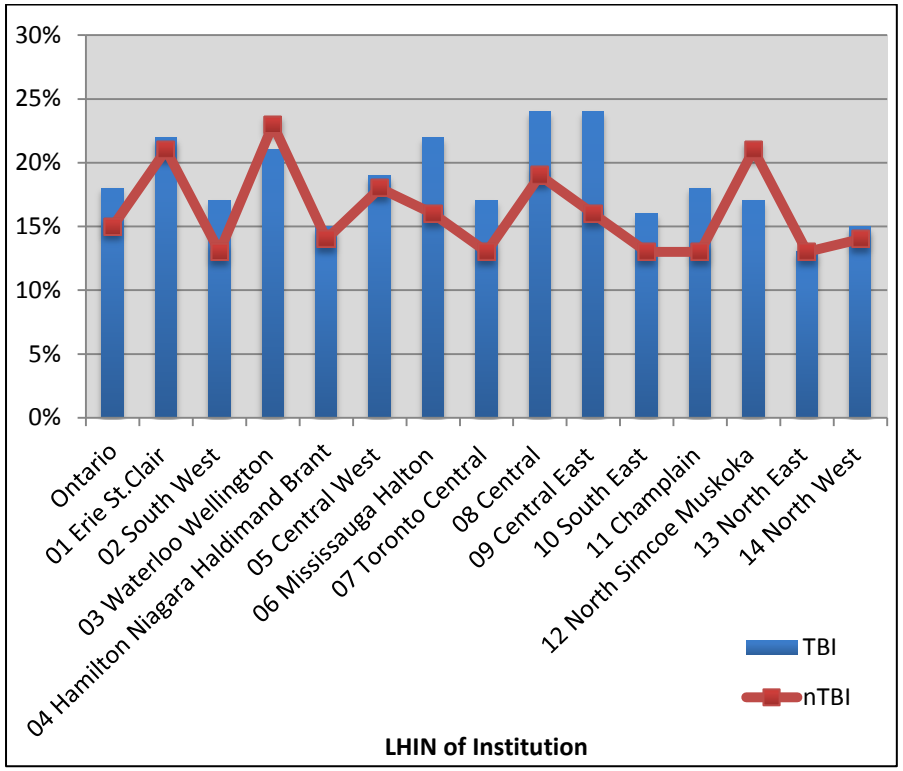

Figure 14. Percentage Discharged to Long Term Care Among ABI Acute Care Episodes by LHIN, Ontario, 2007/08 – 2009/10

Readmission to Acute Care within One Month

Central West, Toronto Central, and North Simcoe Muskoka LHINs had the highest percentage of TBI episodes readmitted to acute care within one month (5%). Toronto Central LHIN had the highest percentage of nTBI episodes readmitted to acute care within one month (12%) while Central LHIN had the lowest (6%). Across all LHINs and in Ontario, a higher percentage of nTBI patients were readmitted compared to TBI patients (see Figure 15).

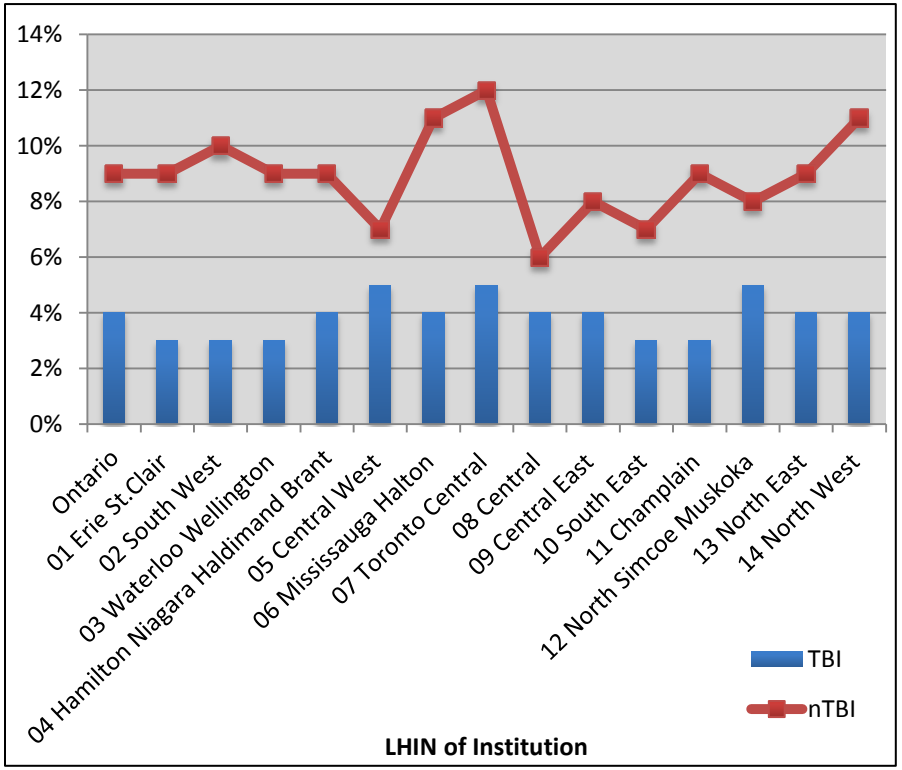

Figure 15. Percentage of ABI Episodes Readmitted to Acute Care Within One Month by LHIN, Ontario, 2007/08 – 2009/10

Table 1. ICD-10 Definition of TBI in ED and Acute Care

Diagnosis	ICD-10 Code and Description
1. Fracture and crushing of the skull and facial bones	✓ S02.0 Fracture of vault of skull ✓ S02.1 Fracture of base of skull ✓ S02.3 Fracture of the orbital floor ✓ S02.7 Multiple fractures involving skull and facial bones ✓ S02.8 Fractures of other skull and facial bones ✓ S02.9 Fractures of skull and facial bones, part unspecified ✓ S07.1 Crushing injury of skull
2. Intracranial injury, excluding those with skull fracture	✓ S06.0 Concussion ✓ S06.1 Traumatic cerebral oedema ✓ S06.2 Diffuse brain injury ✓ S06.3 Focal brain injury ✓ S06.4 Epideural hemorrhage ✓ S06.5 Traumatic subdural hemorrhage ✓ S06.6 Trauatmic subarachnoid hemorrhage ✓ S06.7 Intracranial injury with prolonged coma ✓ S06.8 Other intracranial injuries ✓ S06.9 Intracranial injury, unspecified
3. Late effects of injuries **The "sequelae" include conditions specified as such or as late effects, or those present one year or more after onset of the causal condition.**	✓ F07.2 Post concussion syndrome ✓ T90.2 Sequelae of fracture of skull and facial bones ✓ T90.5 Sequelae of intracranial injury

Table 2. ICD-10 Definition of nTBI in ED and Acute Care

Diagnosis	ICD-10 Code and Description
1. Toxic effect of substances, chiefly non-medical as to source	✓ T40.5 Poisoning: cocaine ✓ T42.6 Poisoning by other antiepileptic and sedative-hypnotic drugs, Methaqualone, Valproic acid ✓ T51 Toxic effect of alcohol ✓ T56 Toxic effect of metals ✓ T57.0 Toxic effect of arsenic and its compounds ✓ T57.2 Toxic effect of manganese and its compounds ✓ T57.3 Toxic effect of hydrogen cyanide ✓ T58 Toxic effect of carbon monoxide ✓ T64 Toxic effect of aflatoxin and other mycotoxin food contaminants ✓ T65.0 Toxic effect of cyanides
2. Anoxia	✓ G93.1 Anoxic brain damage (includes all causes of anoxia except those occurring following abortions, ectopic pregnancy, labour and delivery and newborn) ✓ T71 Asphyxiation, suffocation (by strangulation) ✓ T75.1 Drowning and nonfatal submersion ✓ R09.0 Asphyxia
3. Vascular insults (not captured in stroke analyses)	✓ I62.0 subdural hemorrhage ✓ I62.9 Unspecified intracranial hemorrhage
4. Brain tumours	✓ C70 Malignant neoplasm of brain ✓ C71 Malignant neoplasm of brain ✓ C79.3 Secondary malignant neoplasm of brain and cerebral meninges ✓ C79.4 Secondary malignant neoplasm of other and unspecified part of nervous system ✓ D32.0 Benign neoplasm of cerebral meninges ✓ D33.0 Benign neoplasm of brain, supratentorial ✓ D33.1 Benign neoplasm of brain, infratentorial ✓ D33.2 Benign neoplasm of brain, unspecified ✓ D33.3 Benign neoplasm of cranial nerves ✓ D42.0 Neoplasm of uncertain or unknown behavior of cerebral meninges ✓ D43 Neoplasm of uncertain or unknown behaviour of brain and central nervous system ✓ D43.2 Neoplasm of brain, unspecified ✓ G06.0 Intracranial abscess and granuloma ✓ G06.1 Intraspinal abscess and granuloma ✓ G06.2 Extradural and subdural abscess, unspecified ✓ G07 Intracranial and intraspinal abscess and granuloma in disease classified elsewhere ✓ G93.0 Cerebral cysts

Diagnosis	ICD-10 Code and Description
5. Encephalitis	✓ A81.1 Subacute, sclerosing encephalitis ✓ A83.0 Japanese encephalitis ✓ A83.2 Eastern equine encephalitis ✓ A86.0 Unspecified viral encephalitis ✓ B00.4 Herpes viral meningoencephalitis ✓ B01.1 Varicella encephalitis ✓ B02.0 Zoster encephalitis ✓ B05.0 Postmeasles encephalitis ✓ B94.1 Sequelae of viral encephalitis ✓ G04.0 Acute disseminated encephalitis ✓ G04.2 Bacterial meningoencephalitis and meningomyelitis, not elsewhere classified ✓ G04.8 Other encephalitis, myelitis and encephalomyelitis ✓ G04.9 Encephalitis, myelitis, and encephalomyelitis, unspecified ✓ G05 Encephalitis, myelitis, and encephalomyelitis in diseases classified elsewhere ✓ G09 Sequelae of inflammatory diseases of central nervous system
6. Metabolic encephalopathies	✓ E10.0 (Type I) ✓ E11.0 (Type II) ✓ E13.0 Other specified diabetes mellitus with coma ✓ E14.0 Unspecified diabetes mellitus with coma ✓ E15 Nondiabetic hypoglycaemic coma ✓ G92 Toxic encephalopathy ✓ G93.4 Encephalopathy, unspecified
7. Meningitis	✓ A87 Viral meningitis ✓ B01.0 Varicella meningitis ✓ B37.5 Candidal meningitis ✓ G00 Bacterial meningitis, not elsewhere classified ✓ G01 Meningitis in bacterial diseases classified elsewhere ✓ G02 Meningitis in other infectious and parasitic diseases classified elsewhere ✓ G03 Meningitis due to other and unspecified causes
8. Other brain disorders and infections	✓ G91.0 Communicating hydrocephalus ✓ G91.1 Obstructive hydrocephalus ✓ G91.2 Normal-pressure hydrocephalus ✓ G93.2 Benign intracranial hypertension ✓ G93.5 Compression of brain ✓ G93.6 Cerebral oedema ✓ G93.8 Other specified disorders of the brain (including post-radiation encephalopathy) ✓ G93.9 Disorder of the brain, unspecified ✓ G99.8 Other specified disorders of nervous system in diseases classified elsewhere ✓ R29.1 Meningismus