Epidemiology of traumatic brain injury in South Asia: A Systematic Review

Authors

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Abstract

Background

Traumatic brain injury (TBI) is a serious global health problem contributing significantly to disability and death. No systematic review existed on epidemiology of TBI in South Asia, where accurate data were essential for planning healthcare policy and injury prevention programs.

Methods

This systematic review adhered to PRISMA guideline and received registration from PROSPERO (CRD42022364511). This review included observational from 1 January 1950 to 28 December 2024. A systematic search was performed on PubMed, Scopus, and Google Scholar and included studies fulfilling predetermined criteria. The methodological quality of the included studies was evaluated by Methodological Evaluation of Observational Research (MORE) checklist and result were presented as narrative synthesis.

Findings

Analysis of 130 studies reported a high incidence of TBI in South Asia primarily from road traffic accidents (RTAs). Prevalence ranged from 8.4% to 95.9%, with elevated case fatality and mortality rates. RTAs, falls and assaults were the leading cause of severe TBI. Adult males aged 21-30 years showed highest risk.

Conclusion

The results highlighted urgent necessity for standardized case definitions, improved data collection, and strengthened healthcare capacity in South Asia. Further research is required to understand long-term consequences and guide evidence-based public health responses.

Keywords: Traumatic Brain Injury (TBI), Epidemiology, South Asia, Road Traffic Accidents (RTAs), Mortality, Case Fatality

Introduction

TBI is a major contributor to disability and death worldwide,[1] and over 60 million individuals suffering from a TBI every year.[2] The individuals surviving a TBI commonly experience prolonged physical, cognitive, and psychosocial disabilities.[3] The treatment of TBI is complicated and costly, and its cost ranged throughout a person's lifetime from $279 million to $1.22 billion.[4]

TBI is generally characterized as mild, moderate, and severe based on the Glasgow Coma Scale (GCS), a major prognosis predictor.[5] However, novel approaches have been proposed for further precision in rating TBI severity.[6] Newer tools, including advanced neuroimaging and biomarkers, are increasingly being combined with GCS scores.[7,8]

The epidemiology of traumatic brain injury (TBI) in South Asia is an emerging concern and rising rates have been documented in various countries in the region.[9] Traumatic brain injury is an increasingly urgent public health problem due to urbanization, rising motorization, and poor safety infrastructure.[10,11]

South Asian traumatic brain injury (TBI) is diverse based on road infrastructure, economic conditions, and gaps in policy. Road traffic accidents (RTAs) are primarily responsible for causing it, with Bangladesh (62%), India (56%), and Nepal (59%) being heavily impacted.[12-14]

South Asian rates of traumatic brain injury (TBI) vary based on data collection differences, case definitions, and economic circumstances. Higher-income countries have superior data quality relative to lower-and middle-income countries (LMICs), resulting in more precise estimates.[15,16]

Inconsistent case ascertaining makes comparison challenging,[17,18] whereas socioeconomic differences influence incidence and mortality.[16,19] Standardizing case definitions and data collection using Common Data Elements (CDEs) enhances research quality as well as comparison.[20,21] Standard practices and an improvement in healthcare infrastructure need to be instituted for improved management of TBI in South Asia.

High-quality observational research is essential for the understanding of TBI. Observational studies such as CENTER-TBI yield clinical and demographic data.[22] TRACK-TBI and PRECISION-TBI biomarker analyses support individualized treatment.[23,24] Observational studies contrast treatment outcomes[25] and monitor recovery over the long term.[26] Reliable and complete epidemiological data on South Asian TBI is vital for evidence-based planning at the level of public health as well as clinical management.[14]

Rapid urbanization and motorization and rising road traffic injuries resulted in a rising burden of TBI in the region, however available data remain fragmented and inconsistent. Recent advancements in healthcare infrastructure and the rising volume of observational studies conducted in the last few decades created a window of opportunity for a systematic review of existing evidence. Also, the absence of a previous systematic review on the subject points to an important gap in understanding the actual extent and magnitude of TBI in South Asia. With the pressure on public health systems to manage resources efficiently rising by the day, aggregating epidemiological data at present can be used to establish targeted prevention strategies. It can enhance trauma care and research directions for the future. This review therefore comes at a timely and imperative moment to facilitate policy-making informed by evidence and enhance clinical outcomes in the region. Our study addresses the following research questions:

1. What is the prevalence of traumatic brain injury in South Asia?
2. What is the mortality and case fatality of traumatic brain injury in South Asia?
3. What is the severity and mechanism of injury of traumatic brain injury in South Asia?
4. What are the age and sex distribution of traumatic brain injury in South Asia?

4. Methods

Registration and Protocol:

This systematic review was reported and executed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement.[171] The protocol for this systematic review was registered on PROSPERO (registration number 2022: CRD42022364511). It can be accessible at https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42022364511

Search strategy and inclusion criteria

The databases searched included PubMed, Google Scholar and Scopus from January 1, 1950 through December 28, 2024. For all of them, combined key words and MeSH terms (S1 Appendix) were used for searching. To minimize publication bias risk, reference lists in included studies also were searched. The studies included were observational in nature, encompassing cross-sectional, case-control, and cohort designs. Studies providing retrospective and prospective descriptive data on the epidemiology of TBI in South Asia were included. To qualify for this research, studies also had to be an original study, have measured and reported on prevalence, mortality, case fatality, severity, and mechanism of injury of TBI in South Asia. There were no exclusions based on study size as data from hospitals, police records, relatives/persons accompanying them were included. Also, there were no exclusions based on dates of data, study performance and publication dates, age of participants, nor based on TBI severity.

For certain of those terms, including TBI, incidence, mortality, and case fatality, definition among authors was varied. For the purposes of this research, these terms were defined in the following ways:

- **TBI:** An injury to the head by blunt or penetrative injury causing enough harm so that the patient experiences a change in brain function; alternatively, more recently, as a change in brain function, or other indication of brain pathology due to an external pressure.[27] Ascertainment of a case of TBI might be through any one of the following: clinical diagnosis based on history and physical examination and imaging (CT scan, X-ray scans, MRI), autopsy, Glasgow coma scale (GCS), CDC criteria, ICD 9th and 10th revision codes and others.
- **Case fatality:** Proportion of people with TBI who subsequently died due to a cause related to the TBI at certain time-points.
- **TBI severity:** Categories of severity (severe, moderate, mild), as defined by the GCS or other classification system used by the authors.[5]

Exclusion criteria

Exclusion of studies were based on numerous criteria. First, those not from South Asia were excluded in order to be regionally relevant. Non-primary research studies, reviews, meta-analysis, and grey literature were excluded in order to secure primary data of observational studies. Studies without data on key outcomes, prevalence, mortality, case fatality, severity, or mechanism of injury were excluded. Those studies with inconsistent TBI case definitions or poor ascertainment methods were also excluded in order to ensure reliability. Studies with poor methodical reporting or ambiguous sampling and diagnostic requirements were also excluded in

88 order to secure quality. The above exclusions ensured only studies of relevance, reliability, and
89 quality were included in this review.
90

Screening and study selection

SH and SCP completed the initial screening of titles and abstracts to select studies that met inclusion criteria. Non-eligible studies were excluded and included studies were selected for full-text review. RH and MEH independently assessed study methodologies and reported results from full-texts to ensure eligibility. Disagreements were resolved through consensus and discussion.

Data Analysis

FS and KMYA extracted data from included studies using a standard data extraction form extracting study features, participant information, methodological details, and outcome data. MMM and JAI checked extracted data for accuracy and completeness by referencing against source articles. Discrepancies were discussed and resolved jointly. SH, SCP, RH, FS, KMYA, MMM, and JAI synthesized extracted data into an integrated narrative overview centered on primary epidemiological variables. They made sure that synthesis was thorough and all pertinent data were included.

SH, RH, MMM and JAI evaluated included study quality. The methodological quality of included studies was assessed using the Methodological Evaluation of Observational Research (MORE) checklist that has been utilized in an earlier systematic review.[17] The checklist evaluated a number of areas related to bias or quality, including study aim, funding of study, conflict of interest, ethical clearance, study design, sampling, case definition, bias addressed, data sources, reliability of estimates, incidence and mortality. Each area was ranked according to

specific criteria and scored as "OK, Minor Flaw, Major Flaw, or Poor reporting" (Appendix 2). No studies were removed from this research based on their methodological quality.

Narrative synthesis was written on this review findings. All data on prevalence, mortality, case fatality rates, severity and mechanism of TBI as well as important demographic information on age and sex distribution were extracted. Quantitative data on TBI outcomes were synthesized through categorization of results by prevalence rates, mortality and case fatality rates and severity classification (mild, moderate and severe) and mechanism of injury (e.g., road traffic accidents, falls and assaults).

Role of the funding source

There was no funding source for this study.

Ethical Considerations

This study is a systematic review of previously published data. All data were extracted from publicly available literature. Therefore, institutional review board approval and direct patient consent were not required for this study. The included primary studies were evaluated for their reporting of ethical approval. As this is a systematic review, it is not a clinical trial and does not require registration in a clinical trial registry. The review protocol was registered with PROSPERO.

5. Results

A total of 1347 articles were identified. After removing duplicates, 1122 were screened on title and abstract and 893 were excluded. Subsequently, 229 papers were screened for full-text eligibility, with 130 articles finally included in this review (Fig. 1).

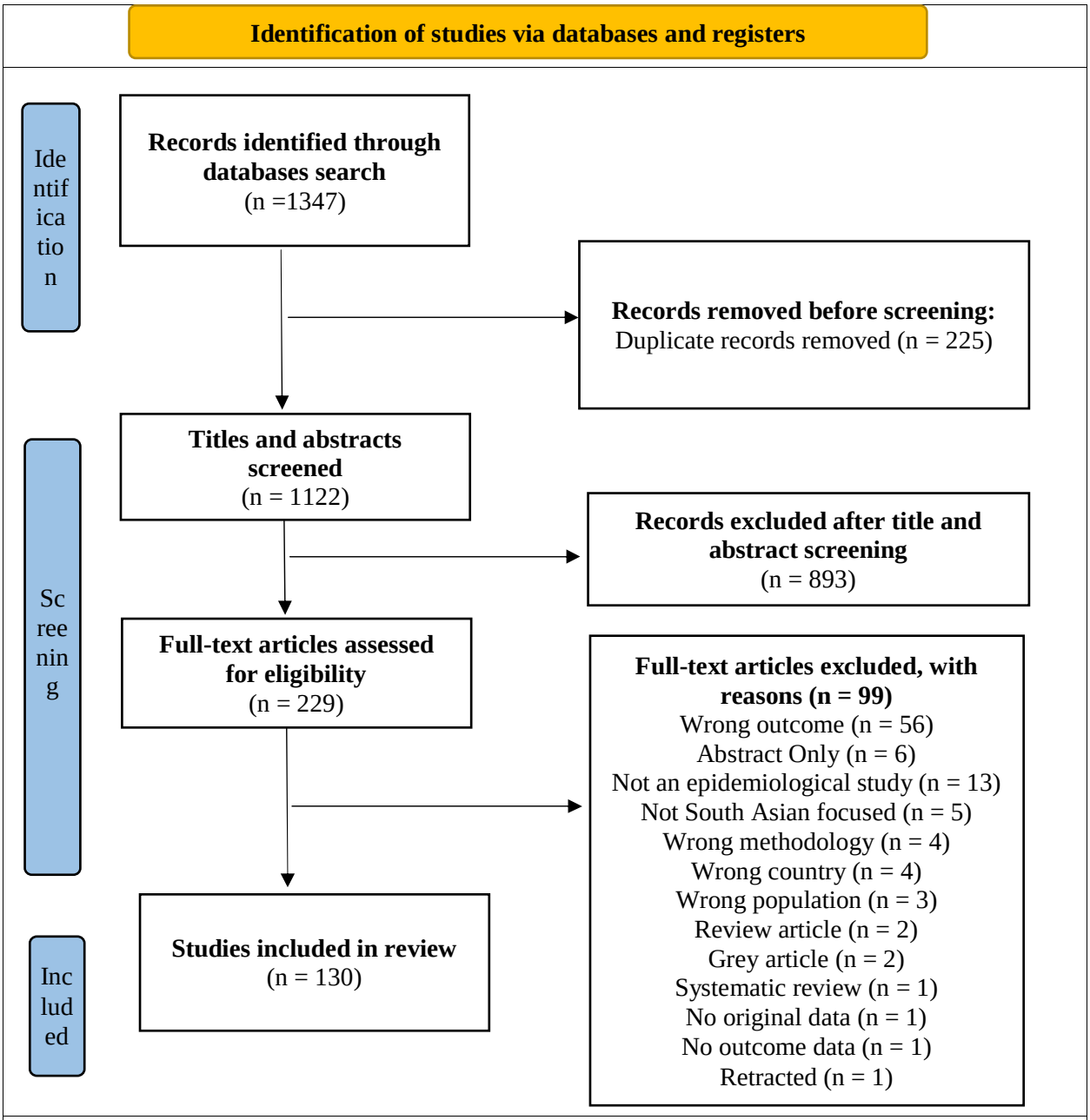

Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart of the study selection process

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
H. et al., 2016[28]	Retrospective study	India	Kolar, Karnataka	90	90	2012 - 2013	1	Hospital records	Patients admitted with head injuries due to highway road accidents	Glasgow Coma Scale (GCS), CT scan, X-ray	Glasgow Coma Scale (GCS), CT scan, X-ray	100%	3.50%	3 (3.5%)	Mild (15%) Moderate (52%) Severe (33%)	Road traffic accidents (100%)	Mean age: 34.6 years	75.0%	25.0%
Mohanta et al., 2019[29]	Cross-sectional study	India	Kolkata, West Bengal	100	100	2013 – 2014	2	Hospital records	First 100 post-mortem cases of fatal head injuries reported	Autopsy findings	Autopsy, skull fractures, CT scans	100%	100.0 %	100%	Severe (100%)	Road Traffic Accidents (RTA): 56%, Fall from staircase: 13%, Assaults and violent acts: 10%	41-60 years (46%) 21-40 years (32%) 1-20 years (14%) 61-80 years (6%) 81-100 years (2%)	74.0%	26.0%
Anwar, 2016[30]	Prospective observational study	India	Aligarh, Uttar Pradesh	149	130	2014 – 2015	2	Hospital records	All trauma patients admitted to the ICU	Clinical diagnosis with CT scan and neurological evaluation	Glasgow Coma Scale (GCS), CT scan	87.2%	28.9%	43 (28.8%)	Mild (13.4%) Moderate (18.8%) Severe (67.8%)	Road Traffic Accidents (RTA): 59.0% Fall from height: 18.7% Assault: 12.7%	Mean age: 32.1±21.32 years	71.1%	28.9%
Ahmed et al., 2015[31]	Cross-sectional study	Pakistan	Karachi	37	37	2013 – 2014	2	Hospital records	Children under the age of 12 with head	Clinical evaluation, GCS score, CT scans	Glasgow Coma Scale (GCS), CT scans, X-rays	100%	13.1%	13.1% (131 out of 1,000 patients)	Mild (43.2%) Moderate (21.6%	Road Traffic Accidents (RTA): 48.6% Fall from height:	Mean age: 6.93 ± 3.02 years	54.1%	45.9%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									injuries						) Severe (35.1%)	45.9% Penetrating Injury: 2.7%			
Sivakumar et al., 2018[32]	Retrospective and prospective study	India	Coastal Andhra Pradesh (Nellore district)	336	336	2011 – 2014	4	Hospital records	All patients with cranio-cerebral injuries admitted	Clinical evaluation, GCS score, CT scans	Glasgow Coma Scale (GCS), CT scan	100%	7%	22 (6.5%)	NR	Road Traffic Accidents (RTA): 75.6% Fall: 17.9% Assault: 6%	Mean age: 35.05 ± 16.36 years	80.0%	20.0%
Takalkar et al., 2022[33]	Prospective observational study	India	Mumbai, Maharashtra	168	168	2021 – 2022	2	Hospital records	Motorcycle riders with head injuries, classified by helmet use	Clinical evaluation, GCS score, CT scans	Glasgow Coma Scale (GCS), CT scans	100%	NR	NR	NR	Road traffic accidents (100%)	21–30 years: 32.1% 31–40 years: 32.7% 41–50 years: 19.6% <20 years: 9.5% >50 years: 6%	92.3%	7.7%
Basheer et al., 2021[34]	Prospective observational study	India	Calicut, Kerala	256	256	2017 – 2018	2	Hospital records	Patients with traumatic brain injury over the age of 5 years with 6-month follow-up	Clinical evaluation, GCS score, CT scans	Glasgow Coma Scale (GCS), CT scans, neurological examination	100%	NR	NR	Severe (31.1%) Mild-to-moderate (11% to 10%)	Road Traffic Accidents (RTA): 78.1% Low-velocity injuries: 21.9%	Mean age: 46.03 ± 20.08 years	74.6%	25.4%

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Vinayak et al., 2014[35]	Cross-sectional study	India	Karad, Maharashtra	896	96	2013	1	Hospital records	Pediatric patients aged 0-15 years with head injuries	Clinical evaluation, GCS score, CT/MRI scans	GCS, CT scans, MRI scans	10.7%	3.1%	3 patients (3.1%)	Mild (80.2%) Moderate (13.5%) Severe (6.25%)	Road Traffic Accidents (RTA): 52% Falls: 40.6% Hit: 7.29%	Mean age: 7.90 years	52.1%	47.9%
Chakravarthi et al., 2014[36]	Retrospective study	India	Karnataka, South India	788	788	2012 – 2013	1.8	Hospital records, investigations, and treatment charts	All patients with head injury admitted to the Department of Surgery	Clinical evaluation, CT scan	Glasgow Coma Scale (GCS), CT scans	100%	4.3%	34 (4.3%)	Mild (60.4%) Moderate (26.6%) Severe (12.18 %)	Road Traffic Accidents (RTA): 93.65% Falls: 5.3% Assault: 1.0%	Mean age: 35.47 years	88.8%	11.2%
A. Agrawal et al., 2016[37]	Prospective study	India	Nellore, Andhra Pradesh	337	337	2015	1	Records of childrn admitted to the institute with head injury	All patients with traumatic brain injury admitted during the study period	Clinical diagnosis, GCS, CT scans	Glasgow Coma Scale (GCS), CT scan	100%	7.12%	7.1% (24 patients)	Moderate to severe (50%)	NR	Mean age: 36.26 ± 15.86 years	80.0%	20.0%
Mahore et al., 2017[38]	Retrospective study	India	Mumbai, Maharashtra	194	155	2011 - 2016	6	Hospital records	Elderly patients aged over 60 with head injuries	Glasgow Coma Scale (GCS), clinical assessment	GCS, Glasgow Outcome Scale (GOS)	79.8%	8.2-21.1	40.9-54.9	Severe (26.5%) Moderate (27.8%) Mild(45.7%)	Falls (59.3%) Road Traffic Accidents (36.8%) Assault (3.9%)	Mean age: 66 years	60.7%	39.4%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Shobhana et al., 2019[39]	Retrospective study	India	Bangalore, Karnataka	184	123	2006 – 2011	5	Hospital records	Medico-legal autopsy cases related to fatal head injuries	Autopsy reports, inquest forms	External and internal examination, fracture identification, hemorrhages	66.8%	123 (100 %)	123 (100%)	Severe head injuries (all fatal)	Two-wheeler: 58% Pedestrians: 37% Four-wheeler: 3%	1 to 80 years	89.0%	11.0%
Gunaratne and Wadanambi, 2009[40]	Retrospective study	Sri Lanka	Galle	108	108	2009	1	Patient files	Head injury patients admitted to the neurosurgical unit	Clinical diagnosis, GCS score, CT findings	Glasgow Coma Scale (GCS), CT scans	100%	13.90 %	15 patients (13.9%)	Mild (45.4%) Moderate (36.1%) Severe (14.8%)	Road Traffic Accidents (RTA) 46.1% Assault 23.1% Fall 28.7% Found unconscious 3.7% Firearms 1.8%	0 to >60 years	84.3%	15.7%
Gambhir Singh, 2022[41]	Prospective study	India	Chennai, Tamil Nadu	350	350	2016 – 2017	2	Hospital records	Fatal head injury cases due to mechanical violence	Autopsy findings	Clinical examination and autopsy	100%	100%	350 (100%)	Severe (due to fatal head injury)	Road Traffic Accident (RTA): 80.57% Fall from height: 8.85% Railway accidents: 6.28%	0-10 years (3.71%) 11-20 years (7.14%) 21-30 years (25.42%) 31-40 years (21.42%) 41-50 years (21.14%) 51-60 years (8.85%) 61-70 years (9.42%) Above 70 years (3.14%)	80.0%	20.0%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Shekhar et al., 2015[42]	Retrospective and prospective study	India	New Delhi	796	791	2007 – 2008	2	Hospital records	Patients admitted with clinical or radiological evidence of TBI	Clinical and radiological diagnosis	GCS, CT scan	99.3%	10.40 %	10.4% (83 cases)	Mild (62%) Moderate (22%) Severe (16%)	Fall from height 56%, RTI 36%, Alcohol-related 8%	Mean age: 24 years	72.0%	28.0%
Kumaran et al., 2019[43]	Cross-sectional study	India	Kancheepuram, Tamil Nadu	295	295	2016 – 2017	2	Hospital records	Patients presenting with traumatic brain injury in the emergency room	Glasgow Coma Scale (GCS), Clinical examination, CT scan	Glasgow Coma Scale (GCS), CT scan	100%	NR	NR	Mild (49.5%) Moderate (28.5%) Severe (22%)	Road Traffic Accidents (RTA): 86.7%, Self-fall: 6.4%, Assault: 2.1%	"21-30 years (32.5%) 31-40 years (19%) 41-50 years (15.6%) 11-20 years (12.5%)"	82.8%	17.2%
S. Khan et al., 2019[44]	Prospective study	Pakistan	Dera Ismail Khan	478	218	2018 – 2019	2	Autopsy records	All patients with head injuries from motorcycle accidents	Clinical diagnosis, GCS < 15, CT abnormalities	Glasgow Coma Scale (GCS), CT scans	45.6%	13%	13.4%	Severe (45.6%), Moderate (32.2%), Mild (22.2%)	Motorcycle to car: 31.1%, Motorcycle to truck: 25.3%, Motorcycle to wall: 21.3%	1-10 years (1.9%) 11-20 years (17.1%) 21-30 years (44.14%) 31-40 years (15.41%) 41-50 years (10.61%) 51-60 years (6.22%) 61-70 years (4.4%)	92.3%	7.8%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Rajasekhar and Dinesh, 2019[45]	Prospective observational study	India	Kurnool, Andhra Pradesh	60	60	2019	1	Autopsy reports and inquest forms	Deceased patients due to road traffic accidents, autopsy performed	Clinical and autopsy findings of head injuries from RTAs	Autopsy, identifying skull fractures, intracranial hemorrhage, brain injuries	100%	100%	100%	NR	Road traffic accidents (100%)	1-20 years (6.6%) 21-30 years (28.3%) 31-40 years (20%) 41-50 years (26.6%) 51-60 years (13.3%) Above 60 years (5.2%	81.6%	18.3%
Bhat et al., 2021[46]	Prospective study	India	Kashmir Valley	430	430	2015 – 2016	2	Hospital records	Patients with moderate and severe head injuries	Glasgow Coma Scale (GCS), CT scan, clinical symptoms and signs	Glasgow Coma Scale (GCS), CT scan, clinical examination	100%	26% (112/430)	26% (112/430)	Moderate (59.3%) Severe (40.7%)	Road Traffic Accidents (RTA): 47.55%, Falls: 32.44%, Firearm injuries: 4.18%	Mean age: 24.8 years	72.3%	27.7%
Naz et al., 2021[47]	Cross-sectional study	Pakistan	Karachi, Sindh	127	127	2018 – 2019	2	Hospital records	Patients with moderate and severe head injuries	GCS 3-12, clinical assessment, CT scan findings	Glasgow Coma Scale (GCS), CT scan, clinical examination	100%	26% (112 deaths out of 430 cases)	26% (112 deaths out of 430 cases)	Moderate GCS (59.3%) Severe GCS (40.7%)	Road Traffic Accidents (RTA): 47.55% Fall from height: 32.44%	Mean age: 24.8 years	72.3%	27.7%
Adhikari et al., 2019[48]	Cross-sectional study	Nepal	Dharan, Sunsari	450	220	2015 – 2016	1	Hospital records	All patients with suspected head injury referred for CT	Clinical diagnosis, GCS, CT abnormalities	GCS, CT scan	48.8%	NR	NR	Severe (40.7%) Moderate (28.5%) Mild (60.4%	Road Traffic Accidents (RTA): 44.6%, Falls: 20-25%, Assault: 10%	Mean age: 34.6 ± 19.75 years	68.2%	31.8%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									scan						)				
Narwade et al., 2015[49]	Prospective observational study	India	Rural area, Maharashtra	100	100	2012 – 2015	4	Autopsy records	Head injury patients with GCS ≤ 13	Clinical examination, GCS, CT scans	GCS, CT scans, X-ray skull	100%	16 deaths (14.4% in ≤ 12 hours; 33.33% after 12 hours)	16 deaths (14.4% in ≤ 12 hours; 33.3% after 12 hours)	Severe (100%)	Road traffic accident (57%), Fall from height (26%), Assault (12%)	Mean age 23.7 years	86.0%	14.0%
Roy et al., 2023[50]	Retrospective study	India	Mumbai, India	269	269	2018 – 2021	4	Hospital records	Children below 12 years of age with TBI presenting with cardinal symptoms	Head injury with GCS ≤ 15, based on clinical diagnosis and CT findings	Glasgow Coma Scale (GCS), CT scan	100%	4 (1.5%)	4 (1.5%)	Mild (92.2%) Moderate (6.3%) Severe (1.5%)	Fall from height (81.8%), Bicycle/Motor vehicle accidents (5.9%), Sports-related injury (8.5%)	Mean age 4.7 years	56.8%	43.2%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									(loss of consciousness, ENT bleed, vomiting, seizures)										
Lodha et al., 2020[51]	Prospective observational study	India	Tribal region, Rajasthan	345	345	2017 – 2019	3	Hospital records	Children up to 18 years with head injury	Clinical diagnosis based on history and physical examination, GCS score	Glasgow Coma Scale (GCS), CT scan	100%	37.5% in 1-3 years and 9-12 years age groups	6.09% (21 deaths)	Mild (63.1%) Moderate (26.6%) Severe (10.1%)	Fall from height (52%), Road traffic accidents (41%), Bull horn (3%)	Mean age 9.25 years	71.0%	29.0%
Madaan et al., 2020[52]	Retrospective study	India	Northern India	4833	1074	2014 – 2017	4	Hospital records	Children aged ≤16 years with suspected head injury	Based on Glasgow Coma Scale scores and CT imaging findings	Glasgow Coma Scale (GCS), CT scan	22.2%	3%	3% of patients	Mild (64%) Moderate (11%) Severe (25%)	Accidental falls: 59%, Road traffic accidents: 34%, Rail accidents: 4%	Mean age: 6.6 ± 4.9 years	65.1%	34.9%

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Islam et al., 2023[53]	Cross-sectional study	Bangladesh	Dhaka, Bangladesh	210	210	2019 – 2020	2	Hospital records	Adults aged 18 years and above with mild or moderate TBI, confirmed by clinical evaluation	Clinical diagnosis based on GCS and CT findings	Glasgow Coma Scale (GCS), CT scan	100%	NR	NR	Mild (78.0%) Moderate (22.0%) Severe (0.0%)	Road Traffic Accidents (56.2%), Assault (21.4%), Fall from Height (12.9%)	Mean age: 40.39 ± 17.43 years	91.4%	8.6%
Pal et al., 2015[54]	Prospective study	India	Bhopal, Madhya Pradesh	165	165	2011 – 2013	3	Hospital records	Pediatric patients (0-12 years) with head injury	Glasgow Coma Scale and CT scan for diagnosis	Glasgow Coma Scale (GCS), CT scan	100%	NR	NR	NR	Fall from height (50.90%), Road Traffic Accidents (RTA) (32.72%), Fall of Heavy Object	Most common in 6-9 years (46.66%)	65.5%	34.6%
Dara et al., 2018[55]	Prospective observational study	India	Jodhpur, Rajasthan	188	188	2014 – 2016	3	Hospital records	Children aged 1 month to 18 years with clinical or radiological evidence of head injury	Glasgow Coma Scale (GCS) and neuroimaging (CT/MRI)	Glasgow Coma Scale (GCS), CT scan, MRI	100%	NR	NR	NR	Fall from height (61.11%), Road traffic accidents (27.78%), Hit by animal (5.56%)	5.41 ± 4.20 years	55.6%	44.4%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Patil et al., 2019[56]	Prospective observational study	India	Maharashtra	1000	1000	2007 – 2008	2	Police inquest report, relatives, dead body challan, hospital records	Patients with head injury attending the emergency department	Glasgow Coma Scale (GCS), CT scan findings	Glasgow Coma Scale (GCS), CT scan	100%	1% (tertiary), 3% (rural)	100% (50 deaths)	NR	Road Traffic Accidents (47% tertiary, 43% rural), Fall from height (20.5% tertiary, 22% rural), Fall from bus/train (7.66% tertiary, 11% rural)	0 to >60 years	630 (tertiary), 78 (rural)	270 (tertiary), 22 (rural)
Jooma et al., 2005[57]	Cross-sectional study	Pakistan	Karachi	3008	3008	2003	1	Self - structured proforma	All patients presenting with head injuries at the emergency department	Clinical examination, Glasgow Coma Scale (GCS), CT scan	Glasgow Coma Scale (GCS), CT scan	100%	154 deaths (5% mortality rate)	154 deaths (5% mortality rate)	Severe head injuries (54% of admitted cases)	Fall from height (48%), Road traffic accidents (38%), Inter-personal violence (10%)	0-10 years (32.5%) 11-20 years (7.2%) 21-30 years (21%) 31-40 years (16.5%) Above 40 years (22.8%)	67.0%	38.0%
Rizwan et al., 2023[58]	Cross-sectional study	Pakistan	Rawalpindi, Pakistan	90	90	2021	1	Hospital records	Patients aged 12-60 years with head injury (both blunt and penetrating) referred for	Head injury caused by blow to head, scalp wound, or altered consciousness	Glasgow Coma Scale (GCS), CT scan	100%	NR	NR	Mild (63.3%) Moderate (22.2%) Severe (14.4%)	Road traffic accidents (67.24%), Fall from height (25.86%), Hit by object (6.89%)	22.21 ± 11.10 years	64.4%	35.6%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									CT scan										
Mahakul et al., 2022[59]	Retrospective study	India	New Delhi, India	10	10	2014 – 2018	5	Hospital records	Patients with cranial gunshot injuries due to country-made firearms (Desi-Kattas)	Cranial injuries due to gunshot wounds; CT scan and clinical evaluation used to determine severity	Glasgow Coma Scale (GCS), CT scan	100%	1 death (10%)	1 death (10%)	Mild (20%) Moderate (30%) Severe (50%)	Homicidal (60%), Suicidal (40%)	Mean age: 32.2 ± 11.1 years	90.0%	10.0%
Gouda et al., 2014[60]	Retrospective study	India	Mangalore, Karnataka	111	76	2008 – 2012	5	Hospital records	Autopsies of victims of fatal road traffic accidents	Autopsy reports, post-mortem examination	Clinical assessment, CT scan, post-mortem findings	68.4%	97.3% of TBI victims died	97.3% of TBI victims died	Severe (100%)	Road Traffic Accidents (RTA): 69%	0-10 years (1.9%) 11-20 years (9.9%) 21-30 years (21.6%) 31-40 years (19.8%) 41-50 years (18.0%) 51-60 years (6.3%) 61-70 years (10.8%) 71-80 years (8.1%)	82.9%	17.1%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
																	81-90 years (2.7%) 91-100 years (0.9%)		
Rashid et al., 2010[61]	Retrospective study	India	Kashmir, India	3794	3794	1988 – 2009	22	Patient files and hospital records	Civilians with craniocerebral missile injuries from conflict zones	Clinical assessment, CT scan, Glasgow Coma Scale (GCS) scoring	GCS, CT scan	100%	87.69 % (3327 deaths out of 3794)	87.6% (3327 deaths out of 3794)	NR	NR	Mean age: 40.07 ± 18.31	80.7%	18.1%
Sharma and Deshwal, 2020[62]	Retrospective study	India	Western Uttar Pradesh, Meerut	986	986	2019	1	Hospital records	All patients with head injury admitted to emergency department	Clinical examination, GCS, CT scan	Glasgow Coma Scale (GCS), CT scan	100%	44% (434/ 986)	44% (434/986)	Mild (22.31 %) Moderate (25.96 %) Severe (51.72 %)	Road Traffic Accident (48.37%), Fall from Height (29.00%), Physical Assault (19.07%)	1-5 years (4.05%) 6-10 years (16.32%) 11-20 years (5.57%) 21-30 years (30.32%) 31-40 years (20.28%) 41-50 years (13.38%) 51-60 years (6.80%) 61-70 years (2.12%) Above 70 years	70.0%	30.0%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
																	(1.11%)		
Thapa et al., 2023[63]	Cross-sectional study	Nepal	Sindhupalchowk, Chautara, Nepal	61	61	2021 – 2022	2	Hospital records	Patients with traumatic brain injury (TBI)	Glasgow Coma Scale (GCS) grading, Clinical assessment	GCS, Clinical exam	100%	NR	NR	Mild (37.7) Moderate (3.2) Severe (8.1)	Falls from height: 37.7% Physical assaults: 34.4% Road traffic accidents: 27.9%	Mean age 42.5 years	47.5%	52.5%
Kirankumar et al., 2019[64]	Prospective observational study	India	Tirupati, Andhra Pradesh	247	247	2016 – 2017	2	Hospital records	Patients presenting with traumatic brain injury in the emergency room	Glasgow Coma Scale (GCS), Clinical examination, CT scan	Glasgow Coma Scale (GCS), CT scan	100%	7.7% (19 patients)	7.7% (19 patients)	Mild (52.2%) Moderate (28.7%) Severe (19.0%)	Road Traffic Accidents (RTA): 96.8%, Assault: 1.6%, Other: 1.6%	Mean age: 38 ± 14.4 years	72.3%	27.7%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Bhole et al., 2007[65]	Retrospective study	India	Wardha, Maharashtra	200	200	2002 – 2005	4	Hospital records and police records	Patients with cranio-cerebral trauma attending the hospital	Clinical examination, X-rays, CT scans	Glasgow Coma Scale (GCS), CT scan	100%	NR	NR	NR	Motor vehicular accidents (82%), Fall from height (9.5%), Assault (7.5%)	Mean age 32.64 years	86.5%	13.5%
Saxena et al., 2008[66]	Retrospective study	India	Jhansi, Uttar Pradesh	67	67	2006 – 2008	3	Hospital records	Patients with traumatic brain injury managed at the general surgical unit	Clinical examination, Glasgow Coma Scale (GCS), CT scans (when available)	Glasgow Coma Scale (GCS), Clinical monitoring, CT scan	100%	6 deaths (9%)	6 deaths (9%)	Mild (53.7%) Moderate (32.8%) Severe (13.4%)	Road Traffic Accidents (71.6%), Fall from height (16.4%), Unknown (7.6%)	NR	86.5%	13.5%
Kumar et al., 2012[67]	Cross-sectional study	India	Chandigarh	84	84	2007 - 2008	2	Police reports and information from accompanying relatives/friends	Patients with head injuries reported to the tertiary care hospitals	Based on the National Advisory Neurological Diseases and Stroke Council (NANDSC) definition; patients with structural changes in the scalp, skull, and/or skull contents due to	NR	100%	100% (as all cases in the study are deceased patients)	NR	NR	Road traffic accident (92.86%) Fall from height (3.6%) Assault (2.4%)	2 to 75 Years	81.0%	19.0%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
										mechanical forces									
Khanal et al., 2020[68]	Prospective study	Nepal	Biratnagar, Eastern Nepal	65	65	2018 – 2020	3	Hospital records	Pediatric head injury patients requiring surgical management	Glasgow Coma Scale (GCS), Clinical evaluation, CT scan	GCS, CT scan	100%	1 (1.5%)	1 (1.5%)	Mild (50.8%) Moderate (43.1%) Severe (6.2%)	Fall: 52.3%, RTA (Road Traffic Accidents): 43.1%, Physical Assault: 3.1%	Mean age: 10.86±4.72 years	66.2%	33.9%
Choudhary et al., 2022[69]	Prospective study	India	New Delhi	154	154	2017 – 2018	2	Hospital records	Patients with mild traumatic brain injury presenting to the emergency department	Glasgow Coma Scale (GCS), clinical examination, CT scan if needed	Glasgow Coma Scale (GCS), CT scan	100%	1.3% (2 patients died)	1.3% (2 patients died)	NR	Road traffic accidents (50.6%), Fall from height (42.9%), Assault and sports injuries (6.4%)	19 to 38 years	74.7%	25.3%
Yaqoob et al., 2021[70]	Cross-sectional study	Pakistan	Karachi	5,546	5,546	2019	1	Autopsy records	Patients of all ages presenting with traumatic brain injury	Clinical evaluation, GCS score, CT scan	Glasgow Coma Scale (GCS), CT scan	100%	2.2% (123 deaths)	2.2% (123 deaths)	Mild (72.8%), Moderate (22.5%), Severe (4.7%)	Road Traffic Accidents (RTA): 39%, Accidental Fall: 32.2%, Other: 28.7%	Mean age 26.8 ± 3.7 years	73.1%	26.9%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Arfat et al., 2019[71]	Prospective study	India	Western Uttar Pradesh, India	500	500	2016 – 2018	3	Hospital records	Patients aged 2–70 years with acute head trauma	CT and MRI scan, clinical examination	MDCT (64-slice Siemens Somatom Sensation Scanner), MRI 1.5T	100%	NR	NR	NR	Road traffic accidents (62.1%), Fall from height (25.1%), Assault/hit by hard object (11.83%)	Mean age: 36 years	57.0%	43.0%
Mangal, 2017[72]	Prospective study	India	Southern Rajasthan, Udaipur	900	900	2015 – 2016	2	Hospital records	Patients diagnosed with traumatic brain injury (TBI) based on clinical or radiological findings	Glasgow Coma Scale (GCS), CT scan, clinical symptoms and signs	Glasgow Coma Scale (GCS), CT scan	100%	9% (81 patients)	9% (81 patients)	Mild (47.1%) Moderate (36.8%) Severe (16.0%)	Road traffic accidents (70%), Assault (14.67%), Falling from height (10.44%)	1 to > 60 years	64.9%	35.1%
Sharma et al., 2020[73]	Prospective study	India	Varanasi, Uttar Pradesh	2714	497	2015 – 2016	2	Hospital records	Pediatric patients (age < 18 years) with head injuries	Glasgow Coma Scale (GCS), CT scan, clinical examination	Glasgow Coma Scale (GCS), CT scan	18.3%	9.45%	9.4% (47 deaths)	Mild (51.5%) Moderate (36.4%) Severe (12.1%)	Road Traffic Accidents (RTA): 46.88%, Fall from height: 34.8%, Assault: 3%	0 to 18 years	71.8%	28.2%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Goel et al., 2004[74]	Prospective study	India	Lucknow, Uttar Pradesh	180	180	2000	1	Hospital records	Trauma patients admitted to the surgical department	TRISS, Injury Severity Score (ISS), Revised Trauma Score (RTS), Age, Glasgow Coma Scale (GCS)	TRISS, GCS, ISS, RTS	100%	31.4% (55 deaths)	NR	Blunt injuries (81.7%) Penetrating injuries (18.3%)	Accidental injuries (86.3%), Homicidal (12.6%), Suicidal (0.6%)	Mean age: 24.7 years	70.3%	29.7%
Pateria et al., 2020[75]	Retrospective study	India	Manipal, Karnataka	650	650	2017 – 2019	3	Police documents (forwarding letter, inquest report, dead body challan), Hospital records, Autopsy records	Patients with head injuries from road traffic accidents	Clinical examination, CT scans, Glasgow Coma Scale (GCS)	Glasgow Coma Scale (GCS), CT scan	100%	NR	NR	Minor (58.9%) Moderate (19.8%) Severe (21.2%)	Road traffic accidents (65.38%), 4-wheeler accidents (14.46%), Pedestrian injuries (15.38%)	Mean age 37.65 ± 16.30 years	77.3%	22.6%
Jha et al., 2010[76]	Prospective study	Nepal	Dharan, Eastern Nepal	124	77	2006 – 2007	2	Hospital records	Victims of fatal head injury from road	Clinical and autopsy examination	Autopsy findings, Glasgow Coma Scale (GCS)	62.1%	100% (all cases were fatalities)	100% (all cases were fatalities)	Fatal head injuries only	Pedestrian: 45%, Motorcyclist: 34%, Cyclists: 17%	NR	78.0%	22.0%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									traffic accidents										
Rao et al., 2015[77]	Retrospective study	India	Visakhapatnam, Andhra Pradesh	753	753	2014	1	Hospital records	Patients with head injuries attending the casualty and admitted to the Neurosurgery department	Glasgow Coma Scale (GCS), CT scan, clinical examination	Glasgow Coma Scale (GCS), CT scan	100%	159 deaths (21.1%)	159 deaths (21.1%)	Mild (56.3%) Moderate (20.18%) Severe (23.41%)	Road Traffic Accidents (72.77%), Falls (22.9%), Alcoholic injury (16.69%)	Mean age: 39.81 years	81.6%	18.4%
Chakraborty and Sarkar, 2017[78]	Retrospective study	India	Tripura, India	327	196	2011 – 2013	3	Hospital records	All autopsies of fatal road traffic accident victims during the study period	Autopsy findings and clinical evaluations	Autopsy, clinical examination, CT scans	59.9%	100% (196 cases)	100%	Fatal head injuries	Pedestrian (42.85%), Driver (29.08%), Occupant (28.06%)	0 to >60 years	79.1%	20.9%
Agrawal et al., 2012[79]	Retrospective study	India	Wardha, Maharashtra	1926	1926	2007 – 2009	3	Police, relatives, hospital, and post morte	All patients with traumatic brain injury (TBI) admitted to the	Clinical Assessment,CT scan and X-ray	Glasgow Coma Scale (GCS), CT scans, X - ray	100%	6.40%	2007: 8.9%,2008: 8.5%,2009: 4.9%	Mild (58%) Moderate (21.5%) Severe (15%)	Road traffic crashes: 903 (46.8%), Mechanism not available for 466 (29.4%) of patients,	0 to >70 years	70.8%	29.2%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
								m records	neurosurgery service of the hospital during the study period										
Avtar Malav et al., 2019[80]	Retrospective study	India	Rajasthan	800	800	2018 – 2019	2	Hospital records	All patients with traumatic head injuries admitted to the hospital during the study period	Clinical Assessment and CT scan	Glasgow Coma Scale (GCS), CT scan	100%	6.5% (50 patients)	6.5% (50 patients)	Mild (45%) Moderate (35%) Severe (20%)	Road Traffic Accidents (RTA): 60%, Fall from height: 25%, Assault: 10%	1 to > 50 years	65.0%	35.0%
Agrawal et al., 2008[81]	Retrospective study	Nepal	Dharan, Eastern Nepal	43	43	2005 – 2006	2	Hospital records	Children under 16 years with head injuries	GCS, CT scans, skull X-rays	GCS, CT scan, Skull X-ray	100%	3 patients (7%)	3 patients (7%)	Mild (65.1%) Moderate (27.9%) Severe (6.9%)	Fall: 65.1%, RTA (Road Traffic Accidents): 25.6%, Assault: 9.3%	Mean age: 7.67 years	60.5%	39.5%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Newall et al., 2020[13]	Retrospective study	Nepal	Kathmandu	167	167	2018 – 2019	2	Hospital records	Patients with traumatic brain injury (TBI) presenting to ANIAS	Identified using relevant ICD - 10 definitions in electronic patient records	Glasgow Coma Scale (GCS), CT scan	100%	6 deaths (3.6%)	6 deaths (3.6%)	Mild (84%) Moderate (10.8%) Severe (4.8%)	Road Traffic Accidents (RTA): 59%, Falls: 32%, Assault: 9%	Mean age: 32.1 ± 21.32 years	73.0%	27.0%
Das et al., 2023[82]	Prospective study	Bangladesh	Dhaka	14552	14552	2017 – 2019	3	Hospital records	All patients with head injury presenting at the emergency department	Glasgow Coma Scale (GCS), CT scan	GCS, CT scan, clinical examination	100%	8.64% (403 deaths)	8.6% (403 deaths)	Mild (60.0%) Moderate (25.0%) Severe (15.0%)	Road Traffic Accidents (RTA): 58.3%, Fall from height: 25%, Assault: 15.3%	Mean age: 29.9 years	72.0%	28.0%
Kamal et al., 2016[83]	Retrospective study	India	New Delhi	1527	1527	2010 – 2012	3	Hospital records	Patients with admission Glasgow Coma Scale (GCS) ≤ 12 in the emergency	Based on emergency department Glasgow Coma Scale (GCS) ≤ 12 for inclusion; further classified	Glasgow Coma Scale (GCS), CT scan	100%	34.58 %	34.6%	Moderate (16.1%) Severe (83.9%)	Road Traffic Accidents (RTA) (66.2%) Fall (25.3%) Assault (2.8%)	Mean age: 32.15 ± 16.76 years	86.6%	13.4%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									department	as severe (GCS 3 - 8) or moderate (GCS 9 - 12) post-resuscitation									
Shanmugaiah and Jayakumar, 2023[84]	Retrospective study	India	South India	310	310	2022	1	Hospital records	Patients with traumatic brain injury having basifrontal contusion confirmed by CT scan admitted during the study period	Based on CT scan findings of basifrontal contusion	Glasgow Coma Scale (GCS), CT scan	100%	74 deaths (24%)	74 deaths (24%)	Mild (45.0%) Moderate (35.0%) Severe (20.0%)	Road Traffic Accidents (RTA): 72%, Pedestrian hit by vehicle: 17%, Fall from height: 7%, Assault: 4%	<20 to >60 Years	80.6%	19.4%
Hassan et al., 2017[85]	Observational study	Pakistan	Khyber Pakhtunkhwa	1338	1338	2013 – 2014	2	Hospital records	All admitted patients with traumatic brain injury of	Clinical Assessment and CT scan	Glasgow Coma Scale (GCS), CT scan	100%	15% (201 patients died out of 1338 patients)	15% (201 patients died out of 1338 patients)	Mild (65%) Moderate (27%) Severe (8%)	Road Traffic Accidents (RTA): 45%, Fall from height: 34%, Firearm injury: 14%	Mean age: 40 ± 9.65 years	65.0%	35.0%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									either gender and all ages										
Anand et al., 2024[86]	Prospective observational study	India	South Malabar	107	107	NR	NR	Hospital records, telephone interviews, and hospital databases	TBI patients aged 18 years and older	Glasgow Coma Scale (GCS) and Full Outline of Unresponsiveness (FOUR) score assessments	GCS, FOUR score	100%	19.62 % (21 patients)	19.6% (21 patients)	GCS ≤5 and FOUR ≤4 associated with mortality	Road traffic accidents (RTA): 90%, Falls: 7.48%, Assaults: 1.47%	≥18 years	81.0%	19.0%
Bhaumik, 2018[87]	Prospective study	India	Southern Rajasthan	1000	1000	2014 – 2017	4	Hospital records	Patients with head injuries attending the casualty and admitted to the Neurosurgery department	Glasgow Coma Scale (GCS), CT scan, clinical examination	Glasgow Coma Scale (GCS), CT scan	100%	13.10 %	0.13	Mild (60.6%) Moderate (11.1%) Severe (28.3%)	Road Traffic Accidents (RTA): 47.4%, Fall from height: 31.9%, Assault: 14.3%	Mean age: 27.61 ± 4.89 years	74.3%	25.7%
Anand et al., 2020[88]	Prospective study	India	Haryana	200	200	2017 – 2018	2	Hospital records	Patients presenting with history of head injury and	Based on history of head injury and clinical findings; further evaluated with non -	Glasgow Coma Scale (GCS), CT scan	100%	NR	NR	Mild (89.0%) Moderate (6.0%) Severe (5.0%)	Assault: 58.5%, Road Traffic Accidents (RTA): 31%, Fall from height: 9.5%	Mean age: 35.95 years	78.0%	22.0%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									clinical findings	contrast CT head									
Singh et al., 2013[89]	Prospective study	India	Varanasi	1300	1300	2007 – 2009	3	Hospital records	All patients of head injury who came to the casualty during the study period	Based on presentation as a head injury case at the casualty; clinical status assessed with Glasgow Coma Scales (GCS)	Glasgow Coma Scale (GCS), CT scan	100%	13.00 %	13%	Mild (61%) Moderate (11%) Severe (28%)	Road Traffic Accidents (RTA): 47.07%, Fall from height: 32%, Assault: 7.84%	<1 to >60 years	74.0%	26.0%
Khan et al., 2024[90]	Cross-sectional study	Bangladesh	Dhaka	280	280	2020 – 2021	2	Hospital records	TBI patients treated at Dhaka Medical College and Hospital; consented for participation	GCS scores, medical records, CT scan findings	Glasgow Coma Scale (GCS), CT scan	100%	3.2% (9 patients)	3.2% (9 patients)	Mild (35%) Moderate (35.7%) Severe (29.3%)	Road Traffic Accidents (RTA): 67.9% Falls: 18.2% Assaults: 13.9%	Below 18: 21.8% 18–35: 29.3% 36–50: 22.9% 51–65: 15.7% Above 65: 10.4%	76.1%	23.9%
Yattoo et al., 2009[91]	Prospective study	India	Srinagar, Kashmir	547	547	2004	1	Self - structured proforma	All age groups, both sexes admitted to the	GCS (Glasgow Coma Scale), Clinical Assessme	Glasgow Coma Scale (GCS), CT scan	100%	6.4% (35 deaths)	NR	Mild (25.5%) Moderate (21.2%	Road Traffic Accidents (RTA): 71.1%, Fall from height: 16.7%,	0 to 80 years	75.9%	24.1%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									Accident and Emergency department with TBI	nt and CT scan					) Severe (7.8%)	Assault: 8.3%			
Singh, 2014[92]	Prospective study	India	Chennai, Tamil Nadu	50	50	2007 – 2008	2	Hospital records	Fatal head injury cases admitted and died in the hospital, either in Intensive Care Unit or had neurosurgery	Based on fatal head injury cases as defined by The Royal College of Surgeons, U.K.	Autopsy, histopathological examination to confirm brain stem injury	100%	100% (50 deaths)	100% (74 patients)	Severe (100%)	Road Traffic Accidents (RTA): 86%, Homicidal injuries: 6%, Other: 8%	NR	94.0%	6.0%
Henriksson et al., 2020[93]	Retrospective study	Nepal	Kathmandu	577	577	2019	1	Hospital records	Patients with traumatic head injuries, including superficial injuries and concussions	GCS (Glasgow Coma Scale), clinical examination, CT scans	GCS, CT scan, clinical evaluation	100%	0.8% (4 patients)	0.8% (4 patients)	Mild (70.7%) Moderate (2.9%) Severe (1.2%) Unknown (25.1%)	Falls: 48.9%, Road traffic accidents: 18.2%, Violence/physical assault: 16.8%	NR	68.8%	31.2%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Sultana et al., 2021[94]	Retrospective study	Bangladesh	Rangpur	74	74	2014 – 2016	3	Hospital records	Victims of road traffic accidents who died due to head injury	Based on autopsy findings of fatal head injuries resulting from road traffic accidents	Autopsy to identify types of skull fractures and intracranial hemorrhages	100%	100% (74 patients)	100% (all cases are fatalities from RTA)	Severe (100%)	Road traffic accidents (100%)	0 to >70 years	87.8%	12.2%
Agrawal et al., 2009[95]	Retrospective study	Nepal	Dharan	334	334	2005	1	Data collection sheet filled for each patient	All patients with head injury admitted to the Department of Surgery	Based on admission to the Departmet nt of Surgery with a head injury; classified into mild, moderate, or severe using the Ommaya classification (based on the period of loss of consciousness and amnesia)	Glasgow Coma Scale (GCS)	100%	15 (4.5%)	15 (4.5%)	Mild (71.6%) Moderate (12.0%) Severe (16.5%)	Road Traffic Accidents (RTA): 43.4% Fall from height: 30.8% Assault: 19.2%	Mean age: 28.53 years	71.9%	28.1%
Kafle et al., 2019[96]	Prospective study	Nepal	Biratnagar	1056	1056	2016 – 2017	2	Hospital records	Patients aged ≥16 years with a diagno	Clinical examination, Glasgow Coma Scale (GCS), CT scans (when available)	Glasgow Coma Scale (GCS), Clinical monitoring, CT scan	100%	11.17 % (19 deaths)	11.1% (19 deaths)	Mild (16.0%) Moderate (80.8%) Severe (12.2%)	Road Traffic Accidents (RTA): 76% Fall: 18% Assault: 4%	Mean age: 38.7 years	77.7%	22.3%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									sis of TBI										
Malik and Chaliha, 2019[97]	Retrospective study	India	Guwahati	2474	1167	2009 – 2010	2	Hospital records	Patients aged 18 - 60 years, admitted to the ICU with head injury, after obtaining ethical approval and written informed consent	Diagnosis made by emergency physician or neurosurgeon; patients were identified based on admission to the ICU with a head injury diagnosis	Glasgow Coma Scale (GCS) and Kampala Trauma Score (KTS)	47.1%	14.20 %	14.2%	NR	Road traffic accidents (43.19%), Blunt force impact (41.1%), Railway accidents (6.87%)	NR	NR	NR
Khan et al., 2020[98]	Retrospective study	Pakistan	Peshawar	5047	5047	2019	1	Inquest reports, hospital records, police records, and information from	All patients with TBI who presented to the hospital during the study period and underw	Based on neurological examination including Glasgow Coma Scale (GCS) and CT scan results	Glasgow Coma Scale (GCS), CT scans	100%	100% (all cases were fatal as they were brought for autopsy)	NR	Mild (93.6%) Moderate (4.6%) Severe (2.1%)	Road Traffic Accidents (38.8%), Fall (32.7%), Other (28.4%)	Mean age: 25.9 ± 3.7 years	73.1%	26.9%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
								relatives	ent complete neurological examination										
Bansal et al., 2022[99]	Prospective cohort study	India	Multiple urban centers	7448	5042	2013 – 2015	3	Hospital records	Patients with isolated traumatic brain injury (iTBI)	ICD-10 codes for TBI, Abbreviated Injury Score (AIS)	Glasgow Coma Scale (GCS)	67.6%	24-h mortality: 5.9% 30-d mortality: 22.4%	24-h mortality: 5.9% 30-d mortality: 22.4%	Mild (45.8%) Moderate (21.4%) Severe (32.8%)	Road Traffic Accidents (47.4%) Falls (39.9%) Assault (5.7%)	Mean age: 33.6 ± 20.2 years	76.5%	23.5%
Kumar et al., 2019[100]	Retrospective study	India	Jabalpur, Madhya Pradesh	1173	932	2018 – 2019	2	Hospital records	All patients with head and spine injury admitted to the Department of Neurosurgery	Clinical diagnosis, medical records, and severity assessed via GCS and CT scans	Glasgow Coma Scale (GCS), CT scans	79.4%	NR	NR	Mild (92.2%) Moderate (6.3%) Severe (1.5%)	Road traffic accident: 74% Fall from height: 15.9% Assault: 7.5%	<10 to >70 years	78.0%	22.0%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Raja et al., 2001[101]	Retrospective cohort study	Pakistan	Multiple regions across Pakistan	260,000	260,000	1995 – 1999	5	Hospital records	Patients with moderate and severe head injuries, including those with skull fractures, CSF rhinorrhea, otorrhea, and neurological deficits	Clinical diagnosis, Glasgow Coma Scale (GCS), CT scans, and medical records	Glasgow Coma Scale (GCS), CT scan	100%	46,800 (18%)	46,800 (18%)	Mild (52%) Moderate (30%) Severe (18%)	Road Traffic Accidents (52.8%) Fall from Height (28%) Assault (14%)	< 10 years (24.0%) 11-15 years (16.1%) 16-20 years (17.1%) 21-30 years (25.2%) 31-40 years (7.0%) 41-50 years (5.9%) 51-60 years (2.8%) 61-70 years (1.1%) 71-80 years (0.8%)	75.0%	25.0%
Khan et al., 2011[102]	Retrospective study	India	Aligarh, Uttar Pradesh	2850	2850	2008 – 2009	2	Hospital records	1. All cases with a definite history of head injury 2. Cases registered in the casualty register with medico	Based on a definite history of head injury and clinical presentation along with diagnostic CT scan	CT scan	100%	NR	NR	NR	Road Traffic Accident (55.02%), Assault (22.67%), Fall from Height (12.67%)	15 to >65 years	85.6%	14.3%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									- legal case sheets prepared 3. Patients aged between 15 - 80 years										
Ahmed et al., 2009[103]	Retrospective study	India	New Delhi	2068	2068	2007 - 2009	3	Hospital records	All patients with head injury admitted to the department of neurosurgery	Patients with head injury admitted to the neurosurgery department; severity determined by Glasgow Coma Scale (GCS)	Glasgow Coma Scale (GCS)	100%	22% (454/ 2068 cases)	22% (454/2068 cases)	Minor 28.9% Moderate 18.3% Severe 52.7%	Road Traffic Accidents (64%), Assaults (26%), Other (10%)	Mean age: 24 years	71.5%	28.5%
Sharma et al., 2021[104]	Retrospective and prospective study	India	Ludhiana, Punjab	160	160	2016 – 2018	3	Hospital records	Patients ≥65 years of age, admitted with traumatic brain	Based on admission to the neurosurgery department with traumatic brain injury and positive CT findings	Glasgow Coma Scale (GCS)	100%	3.8% (6 patients)	3.8% (6 patients)	NR	Roadside accidents (61.6%), Falls (35.5%), Assault (1.4%)	Mean age: 71.08 years	75.6%	24.4%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									injury, undergoing conservative or operative management, and having positive CT findings										
D. Agrawal et al., 2016[105]	Retrospective study	India	New Delhi	2068	2068	2007 – 2009	3	Hospital records	All patients with head injury admitted to the department of neurosurgery during the study period	Based on admission to the neurosurgery department with head injury; severity determined by post - resuscitation Glasgow Coma Scale (GCS)	Glasgow Coma Scale (GCS)	100%	Overall in - hospital mortality: 22% Mortality within 48 hours of injury : 39%	Overall in - hospital mortality : 22% Mortality within 48 hours of injury: 39%	Severe (53.0%) Moderate (18.0%) Minor (29.0%)	Road traffic accidents (64%), Assault (26%), Other (10%)	Mean age: 24 years	71.5%	28.5%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Ahmed et al., 2023[106]	Observational study	Pakistan	Karachi	400	400	2017 – 2020	4	Hospital records	Motorbike riders with head injuries presenting to the neurosurgery department	Based on presentation to the neurosurgery department with head injury; severity classified by GCS score	Glasgow Coma Scale (GCS), CT scan	100%	16% (64 patients)	16% (64 patients)	Mild (56.0%) Moderate (28.5%) Severe (14.5%)	Motorbike accidents (100%)	15 to 65 years	100.0 %	0.0%
Nath et al., 2011[107]	Retrospective study	India	New Delhi	70	70	2008 – 2010	3	Hospital records	Patients with head injury admitted to the Department of Neurosurgery	Clinical diagnosis, CT scans, GCS scores, and hospital records	Glasgow Coma Scale (GCS), CT scans	100%	14% (10 patients)	14% (10 patients)	Mild: 10% Moderate: 40% Severe: 50%	Road traffic accidents (67%), Unknown cause (26%), Other (7%)	Mean age: 33.7 ± 14.6 years	97.0%	3.0%
Khan et al., 2023[108]	Cross-sectional study	Pakistan	Rawalpindi	58	58	2018 – 2019	2	Hospital records	Patients aged 18 - 60 years, admitted to the ICU with head injury, after obtaining ethical approval and written informed consent	Diagnosis made by emergency physician or neurosurgeon; patients were identified based on admission to the ICU with a head injury diagnosis	Glasgow Coma Scale (GCS) and Kampala Trauma Score (KTS)	100%	50% (29 patients)	50% (29 patients)	GCS >5: 82.7% GCS <5: 17.3% KTS mild or moderate: 82.7% KTS severe: 17.3%	Road traffic accidents (50%), Fall (19%), Assault (15.5%)	Mean age: 29.63 ± 3.46 years	84.5%	15.5%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Minai et al., 2013[109]	Retrospective study	Pakistan	Karachi	51	51	2009	1	Hospital records	All cases of mild, moderate, or severe brain injury requiring admission	Glasgow Coma Score (GCS) at admission	Glasgow Coma Score (GCS)	100%	46.2% (6 patients)	46.2% (6 patients)	NR	Road traffic accidents (96.1%), Penetrating injuries (3.9%)	Mean age: 37.3 ± 15.4 years	88.0%	12.0%
Banzal et al., 2015[110]	Prospective study	India	Bhopal, Madhya Pradesh	282	282	2010	1	Hospital records	All dead bodies of fatal road traffic accidents brought to the Department of Forensic Medicine for autopsy	Based on autopsy findings and associated injuries in fatal road traffic accident victims	Autopsy findings and post-mortem examinations	100%	NR	NR	NR	Road traffic accidents (90%), multiple types of fractures	NR	91.5%	8.5%
Soni et al., 2016[111]	Prospective study	India	Indore, Madhya Pradesh	200	200	2014 – 2015	2	Structured questionnaires	Known cases with alleged history of death due to road traffic accident	Based on autopsy findings of road traffic accident victims	Scalp injuries, skull fractures, and intracranial hemorrhages	100%	100% (all fatalities were RTA related)	100% (all fatalities were RTA related)	NR	Road traffic accidents (100%)	<10 to 70 years	78.0%	22.0%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Fernandes et al., 2022[112]	Retrospective study	India	Goa	4350	1292	2015 – 2019	5	Hospital records	Emergency department records	Diagnosis based on clinical presentation, CT scans, GCS scores	Glasgow Coma Scale (GCS), CT scans, clinical examination	29.7%	NR	NR	Normal (71.2%) Mild (9.5%) Moderate (14.3%) Severe (5.0%)	Motor vehicle accidents (81.9%), Fall (9.7%), Assault (6.8%)	1 to 93 years	85.3%	14.7%
Patil and Vaz, 2010[113]	Retrospective and prospective study	India	Mumbai	189	189	2002 – 2004	3	Police inquest report, relatives, dead body challan, hospital records	All cases of head injury due to blunt trauma brought for medico legal autopsy during the study period	Medicolegal autopsy, police reports, hospital records	Medico-legal autopsy.	100%	100% (fatal cases)	100% (fatal cases)	NR	Accidental (91.5%), Homicidal (2.1%), Suicidal (1.1%), Others (5.3%)	Mean age: 36.9 years	88.4%	11.2%
Menon et al., 2008[114]	Retrospective study	India	Mangalore, Karnataka	682	682	1999 – 2003	5	Inquest reports accompanying the dead bodies, victims' attendants, and	Fatal head injury cases due to road traffic accidents autopsied during the study period	Based on autopsy findings of head injuries resulting from road traffic accidents	Autopsy findings	100%	100% (all cases are fatalities from RTA)	NR	NR	Vehicular accidents (100% of cases in this study)	0 to 90 years	84.6%	15.4%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
								postmortem examinations											
Punia et al., 2014[115]	Prospective study	India	Jaipur, Rajasthan	137	80	2013	1	Hospital records	Road traffic accident cases with fatal head injury autopsied	Based on autopsy findings of head injury in road traffic accident victims	Autopsy findings	58.3%	100% (fatal cases)	100% (fatal cases)	NR	Motorcyclists (40%), Light Motor Vehicles (35%), Pedestrians (25%)	0 to >60 years	82.5%	17.5%
Urfi et al., 2013[116]	Cross-sectional study	India	Aligarh, Uttar Pradesh	463	463	2010 – 2011	2	Hospital records	All road traffic accident victims aged 15-45 years with head injury admitted to the hospital	Clinical examination, CT scans, and medical records	Glasgow Coma Scale (GCS), CT scans, clinical findings	100%	NR	NR	NR	Road traffic accidents (100%)	15-44 years	81.2%	19.0%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
R K et al., 2014[117]	Retrospective study	India	Indore, Madhya Pradesh	129	81	2010 – 2012	3	Hospital records	Road traffic accident victims with fatal head injuries	Medico-legal autopsy, inquests, police reports, clinical records	Autopsy findings, clinical records, CT scans	62.7%	100% (fatal cases)	100% (fatal cases)	NR	Road traffic accidents (100%)	1 to 60 years	82.7%	17.3%
Sah et al., 2020[118]	Cross-sectional study	Nepal	Palpa	252	252	2019	1	Hospital records	Patients with head injuries (scalp injury, skull fracture, intracranial haemorrhage, and brain injury)	Based on presentation to the neurosurgery department with head injury; types of head injuries include scalp injury, skull fracture, intracranial haemorrhage, and brain injury	Radiological reports, Clinical Examination	100%	NR	NR	NR	Road traffic accidents (49.6%), Fall from height (42.9%), Physical assault (4.8%)	Mean age: 37.09 ± 17.59 years	66.7%	33.3%
Pate et al., 2017[119]	Cross-sectional study	India	Maharashtra	391	391	2012	1	Hospital records	Cases brought for post-mortem examination with history of road	Based on post-mortem findings of head injury	Post-Mortem Examination, External Injury Examination, Skull Fractures, Intracranial Hemorrhag	100%	100% (fatal head injuries)	100% (fatal head injuries)	NR	Road Traffic Accidents (52.43%), Fall from Height (18.93%), Railway Accidents (15.35%)	0 to >51 years	67.26 %	32.7%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									traffic accident, railway accident, accidental fall, or homicides with head injury		es								
Pate et al., 2017[120]	Retrospective study	Pakistan	South Punjab, Multan	1285	1285	2019 – 2021	3	Hospital records	Children aged up to 12 years with head injury	Glasgow Coma Scale (GCS)	Glasgow Coma Score (GCS)	100%	1.9% (25 children died)	1.9% (25 children died)	Mild (69.2%) Moderate (23.4%) Severe (7.3%)	Falls (58.9%), Road-traffic accidents (32.2%), Sports injuries (4.7%)	Mean age: 4.7 ± 2.5 years	64.0%	36.0%
Islam et al., 2020[121]	Prospective study	Bangladesh	Dhaka	675	675	2013 – 2017	5	Hospital records	Head injury patients with evidence of TBI	Clinically diagnosed by history, examination (including GCS), and immediate brain CT scan	Glasgow Coma Scale (GCS)	100%	7.40% (50 patients)	7.4% (50 patients)	Mild (45%) Moderate (37%) Severe (18%)	Road traffic accidents (50.05%), Physical assault (17.77%), Fall from height (15.33%)	Common age group was 21-30 years (43.7%)	66.5%	33.4%
Arora and Khajuria, 2016[122]	Retrospective study	India	Jammu & Kashmir	422	422	2013 – 2014	2	Hospital records	Cases of vehicular accidents who	Based on autopsy findings of cranio - cerebral injuries in	Post-Mortem Examination, External Injury Examinatio	100%	100% (fatal cases)	100% (fatal cases)	NR	Road traffic accidents (100%)	0 to >80 years	85.5%	14.5%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									died of cranio - cerebral damage, either brought dead or admitted and succumbed to injuries	vehicular accident victims	n, Intracranial Hemorrhages								
Hemalatha and Singh, 2013[123]	Prospective study	India	Chennai, Tamil Nadu	50	50	2007 – 2008	2	Hospital records	Fatal head injury cases with medico-legal autopsy	Medico-legal autopsy, CT scans, forensic analysis	Autopsy, brainstem injury identification, CT scans	100%	100% (fatal cases)	100% (fatal cases)	NR	Road Traffic Accidents (RTA): 86% Fall from Height: 12% Assault: 2%	Mean age: 53.5 years	94.0%	6.0%
Sharma et al., 2003[124]	Retrospective study	India	Chandigarh	632	367	1996 – 2001	6	Hospital records	Road Traffic Accident cases with fatal head injuries subject to medico-legal autopsy	Autopsy reports, clinical records, and police investigation records	Autopsy, CT scans, Glasgow Coma Scale (GCS)	58.1%	100% (fatal cases)	100% (fatal cases)	GCS 0 - 3: 35.9% GCS 4 - 5: 30.7% GCS 6 - 7: 9.2% GCS 8 - 9: 10.6% GCS 10 - 11: 7.3% GCS 12 - 15: 6%	Road traffic accidents (100%)	0 to >61 years	73.4%	26.6%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Tandle and Keoliy,2011[125]	Retrospective study	India	Maharashtra	187	138	Not specified	NR	Hospital records	Road traffic accident cases with head injury	Based on autopsy findings of head injury in road traffic accident victims	Post-Mortem Examination, External Injury Examination, Skull Fractures, Intracranial Hemorrhages	73.7%	100% (fatal cases)	100% (fatal cases)	NR	Road traffic accidents (100%)	0 to >70 years	87.0%	13.1%
Karmacharya and Acharya, 2015[126]	Prospective study	Nepal	Pokhara	287	287	2013 – 2014	2	Hospital records	Pediatric patients from birth to 15 years of age admitted to the hospital for head injury	Glasgow Coma Scale (GCS)	Glasgow Coma Scale (GCS)	100%	8 deaths (2.79 %)	8 deaths (2.7%)	Mild (75.9%) Moderate (20.9%) Severe (3.1%)	Falls (67.94%), Road Traffic Accidents (25.78%), Other causes (6.28%)	Mean age 7.64 years	68.3%	31.7%
Mukhida et al., 2006[127]	Retrospective study	Nepal	Kathmandu	416	399	2001 – 2004	4	Hospital records	Children aged 18 years or younger with acute neurological trauma admitted to the neurosurgical service or who died	Based on International Classification of Diseases (ICD)-9 diagnostic codes for head injuries	Glasgow Coma Scale (GCS)	95.9%	28.00 %	NR	Mild (57%) Moderate (26%) Severe (13%)	Falls (61%), Traffic accidents (30%), Other (9%)	<2 to 18 years	65.0%	35.0%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									before admission										
A. Ansari and Paneza, 1998[128]	Prospective study	Pakistan	Karachi and Quetta	100	100	1990 – 1993	4	Case report forms and medical records	Patients with penetrating intra - dural missile injuries to the brain	Glasgow Coma Score (GCS), CT scans, autopsy findings	GCS, CT scans, surgery, autopsy	100%	52% (52 patients died)	52% (52 patients died)	GCS < 5: 35% GCS 5 - 9: 21% GCS 10 - 12: 16% GCS 13 - 15: 28%	Penetrating injury (100%)	0 – 65 years	99.0%	1.0%
Ahmad et al., 2009[129]	Retrospective study	Bangladesh	Dhaka	100	78	2002 – 2003	2	Hospital records	Inquest reports accompanying the dead bodies, victims ' attendants, and postmortem examinations	RTA victims whose autopsies were conducted	Based on postmortem findings of head injuries related to RTA	78.0%	100% (all cases are fatalities from RTA)	100% (all cases are fatalities from RTA)	NR	Road traffic accidents (100%)	<10 to >60 years	64.0%	36.0%
Goswami et al., 2023[130]	Retrospective study	India	Ahmedabad	127	127	2019 – 2022	4	Hospital records	Adult patients (≥18 years) with acute TBI	Glasgow Coma Scale (GCS) and CT scan	Glasgow Coma Scale (GCS), CT scan findings	100%	32.3% (41 deaths)	32.3% (41 deaths)	Mild (12.6%) Moderate (22%) Severe (65.4%)	Road Traffic Accidents (84.3%), Falls (11%), Other (4.7%)	18 to ≥ 60 years	85.8%	14.2%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									who had a plain brain CT scan										
K. A. Khan et al., 2019[131]	Prospective study	India	Jaipur	1150	1150	2016 – 2017	2	Hospital records	Patients with TBI admitted to the trauma center	Glasgow Coma Scale (GCS) and CT scan	Glasgow Coma Scale (GCS), CT scan findings	100%	27.8% (116 deaths)	27.8% (116 deaths)	Mild (61.5%) Moderate (18.8%) Severe (19.6%)	Road Traffic Accidents (64.26%), Falls (24.61%), Assault (5.13%)	Mean age: 36 ± 15.8 years	84.6%	15.4%
Regmi et al., 2024[132]	Cross-sectional study	Nepal	Kathmandu	144	144	2018 – 2019	2	Hospital records	All TBI patients referred to the Neurosurgery Department	Clinically diagnosed as TBI, graded in the ED based on the Glasgow Coma Scale (GCS)	Glasgow Coma Scale (GCS)	100%	NR	NR	Mild (55.5%), Moderate (24.3%), Severe (20.1%)	Falls (82.64%), Motor Vehicle Accidents (14.58%), Physical Assault (2.78%)	0 to >60 years	69.4%	30.5%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Ram et al., 2019[133]	Prospective study	India	Andhra Pradesh	447	447	2017	1	Hospital records	Adults aged >18 years of age admitted with TBI to the primary referring hospital; included subjects with polytrauma and transfers from both in-network and non-network hospitals	Patient admitted with TBI to the hospital	Glasgow Coma Scale (GCS)	100%	25.30 %	25.3%	Mild (38%) Moderate (30%) Severe (32%)	Road traffic accident (48.1%), Fall (46.5%), Assault (2.5%)	Mean age: 41.2±15.2	81.2%	18.8%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Kar et al., 2023[134]	Retrospective study	India	Lucknow, Uttar Pradesh	72	72	2018 – 2022	5	Hospital records	All patients presenting with traumatic brain injury (TBI)	Glasgow Coma Scale (GCS), clinical assessment, CT scans	GCS, CT scans, clinical diagnosis	100%	43.06 % (31 deaths out of 72 patients)	43.1% (31 deaths out of 72 patients)	NR	Road Traffic Accidents (83.33%), Fall from height (11.11%), Assault (5.56%)	Mean age: 40.07 ± 18.31	81.9%	18.1%
Agrawal et al., 2015[135]	Retrospective and prospective study	India	New Delhi	1525	1525	2010 – 2013	4	Hospital records	Severe traumatic brain injury (GCS ≤ 8) at admission and motor response of M5 or lower on the GCS at discharge	Severe traumatic brain injury defined as GCS ≤ 8 at admission	Glasgow Coma Scale (GCS)	100%	52.9% (54 deaths)	52.9% (54 deaths)	M5 (19.3%) M4 (26.5%) M3 (35.5%) M2 (26.5%) M1 (5.4%)	Road Traffic Accidents (80%), Fall from height (15%), Assault (5%)	Mean age: 33.9 years	83.7%	16.3%
Kumar et al., 2025[136]	Retrospective study	India	Uttar Pradesh	654	654	2016 – 2020	5	Hospital records	Patients aged ≥ 60 years with head injuries due to road traffic accidents, falls, assault,	Glasgow Coma Scale (GCS), clinical and radiological examination	GCS, CT scan, clinical assessment	100%	25.2% (165 patients died)	25.2% (165 patients died)	Mild (25.8%) Moderate (33.2%) Severe (41%)	Road traffic accidents (68.5%), Fall from height (19.7%), Assault (7.5%)	Mean age: 66.16 ± 6.55 years	76.1%	23.9%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									and other causes, with a minimum follow-up of 6 months										
Churiwala et al., 2022[137]	Retrospective study	India	Mumbai	275	275	Not specified	NR	Medico-legal post-mortem records from the Police Mortuary	Acute TBI and traumatic intracranial hematoma on initial CT brain within 48 h of trauma, admitted under emergency trauma care ICU, and did not require neurosurgical operation within 48 h of	CT scan, clinical assessment, Glasgow Coma Scale (GCS)	GCS, CT scans, clinical findings	100%	19.27% (53 deaths)	19.2% (53 deaths)	Mild (70.18%) Moderate (17.81%) Severe (12%)	Road Traffic Accidents (61.45%), Falls (30.18%), Assault (6.18%)	Mean age: 42.38 years	74.5%	25.5%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									trauma										
Paudel et al., 2020[138]	Cross-sectional study	Nepal	Kathmandu	113	113	2019	1	Patient records, clinical examinations, and CT scan results	Patients with acute head trauma presenting to the Emergency department within 24 hours of injury	Glasgow Coma Scale (GCS), CT scan, clinical assessment	GCS, CT scans, clinical findings	100%	NR	NR	Mild (59.3%) Moderate (23.9%) Severe (16.8%)	Road traffic accidents (51%), Falls (37%), Physical assault (12%)	Mean age: 35.53 years (males), 32.1 years (females)	64.6%	35.4%
Kannan et al., 1999[139]	Retrospective study	India	Chandigarh	171	171	1995 – 1997	3	Patient's visitors/relatives, ambulance drivers, accompanying perso	Patients with severe closed head injury	Based on Glasgow coma scale (8 or less for severe closed head injury in Group A)	Glasgow Coma Scale (GCS)	100%	46.80 %	46.8%	Severe (51.1%) Moderate (32.2%) Mild (16.7%)	NR	Mean age: 28.9 ± 15.5 years	84.8%	15.2%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
								ns, emergency admission tickets, and doctors on duty											
Jain et al., 2020[140]	Prospective study	India	Madhya Pradesh	102	102	2015 – 2017	3	Hospital records	Road traffic accident victims with head injuries undergoing medico-legal autopsy	Medico-legal autopsy, inquest report, and clinical details	Autopsy findings, clinical history, inquest report, CT scans	100%	100% (all cases were fatal as they were brought for autopsy)	100% (all cases were fatal as they were brought for autopsy)	NR	Road traffic accidents (100%)	11 to ≥71 years	85.3%	14.7%
Satapathy et al., 2016[141]	Retrospective study	India	Odisha	147	147	2012 – 2013	2	Hospital records	Children <15 years with TBI reporting to the neurosurgical emergency department, excluding those with polytrauma	Glasgow Coma Scale (GCS), CT scans, clinical assessment	GCS, CT scans, neurological assessments	100%	7.48% (11 deaths)	7.4% (11 deaths)	Mild (56.47 %) Moderate (29.25 %) Severe (14.28 %)	Road Traffic Accidents (RTA) (55.1%), Falls (37.41%), Assault (7.48%)	<5 to 15 years	69.0%	31.0%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Pusdekar et al., 2018[142]	Observational study	India	Maharashtra	50	50	1 year and 6 months They didn't mentioned the year of the study	1.6	Hospital records	Cases of head injury referred for surgery during the study period	Trauma to the head resulting in transient or permanent alteration of consciousness; classified into mild, moderate, and severe based on Glasgow Coma Scale (GCS)	Glasgow Coma Scale (GCS), CT scan	100%	17 (34%)	17 (34%)	Mild (36%) Moderate (42%) Severe (22%)	Road traffic accidents (76%), Falls (14%), Assault (10%)	NR	83.7%	16.3%
Dade et al., 2019[143]	Prospective study	India	Andhra Pradesh	187	187	2015 – 2017	3	Hospital records	Patients aged 15 - 60 years with normal premorbid personality, admitted with traumatic brain injury (isolated or as part of polytrauma)	Clinical evaluation, particularly using the Glasgow Coma Scale (GCS). The patients were also assessed for any cognitive, neuropsychological, or behavioral disorders using the Mini-	Glasgow Coma Scale (GCS); MINI PLUS (English version 5.0.0) for assessment of cognitive and neurobehavioural disorders	100%	NR	NR	Mild (71.1%) Moderate (15.5%) Severe (13.4%)	Road traffic accidents (83.4%), Falls (10.2%), Assault (2.1%)	Mean age: 46.68 years	87.7%	12.3%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
										International Neuropsychiatric Interview Plus (M.I.N.I. PLUS) tool									
Patil et al., 2024[144]	Retrospective study	India	Maharashtra	100	100	2017 – 2019	3	Hospital records	Patients of all age groups with head trauma that occurred within 24 hours and were treated as in-patients	Head trauma cases with positive CT scan findings	Glasgow Coma Scale (GCS)	100%	NR	NR	NR	Road traffic accidents (68%), Other injuries (32%)	0 to >61 years	70.0%	30.0%
Iyer and Patel, 2020[145]	Prospective observational study	India	Mumbai	300	300	2014 – 2016	3	Hospital records	Children below 12 years of age (including neonates) with a history of isolated	Head injury determined by medical history and diagnosis	Glasgow Coma Scale (GCS), CT scan	100%	7% (21 patients)	7% (21 patients)	Mild (55.3%) Moderate (36.6%) Severe (8.0%)	Fall from height (73%), Road traffic accidents (17%), Other causes (10%)	Mean age: 5.02 years	60.7%	39.3%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
									head injury										
Deotale et al., 2020[146]	Retrospective study	India	Mumbai	944	944	2019	1	Inpatient data and structured interviews	All admitted patients of exclusive head injury with age more than 12 years	Clinical records, GCS score, CT scans	GCS, CT scans, clinical examination	100%	111 (11.8%)	111 (11.8%)	Mild (81.1%) Moderate (10.7%) Severe (8.1%)	Road Traffic Accidents (79.2%), Accidental Fall (17.8%), Assault (2.8%)	<25 to >55 years	83.2%	16.8%
Tabish et al., 2006[147]	Prospective study	India	Kashmir	1500	1500	2003	1	Hospital records	Children below 15 years admitted to the hospital with a diagnosis of head injury	Clinical assessment, CT scans, Glasgow Coma Scale (GCS)	GCS, CT scans, clinical assessment	100%	NR	NR	NR	Falls (68%), Road Traffic Accidents (26%), Assault (3%)	1 to 15 years	60.2%	39.8%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Yattoo and Tabish, 2008[148]	Retrospective and prospective study	India	Kashmir	3861	547	1996 – 2004	9	Hospital records	Head injury patients admitted to the emergency department; TBI death data from medical records (1996-2004)	Glasgow Coma Scale (GCS), CT scans, clinical examination	GCS, CT scans, clinical history	8.4%	7.17%	7.1%	Based on GCS: 15 (80.2%) 13 - 14 (9.9%) 8 - 12 (5.3%) <8 (4.6%)	Road traffic accidents (44.4%), Falls from height (32.2%), Assault (18.8%)	0 to 80 years	74.9%	25.1%
A. Agrawal et al., 2016a[149]	Prospective study	India	Andhra Pradesh	337	337	2013 – 2015	3	Hospital records	Patients admitted with traumatic brain injury (TBI) at the hospital	GCS, clinical examination, CT scan	GCS, CT scan, clinical assessment	100%	7.12% (24 patients)	7.1% (24 patients)	NR	NR	1 to 90 years	76.0%	24.0%
Pareek and Sodhi, 2020[150]	Retrospective study	India	Bikaner, Rajasthan	100	100	Not specified	NR	Hospital records	Head injury patients presenting to the trauma center and admitted to the neurosurgery ward	Head injury cases admitted to the neurosurgery ward	Glasgow Coma Scale (GCS)	100%	NR	NR	NR	Road traffic accidents (89%), Fall (4%), Assault (7%)	0 to >60 years	88.0%	12.0%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Mr, 2024[151]	Prospective study	Bangladesh	Rangpur	360	360	2022 – 2024	3	Hospital records	Patients with traumatic brain injury (TBI) admitted through emergency and casualty departments	Glasgow Coma Scale (GCS), CT scan, clinical assessment	GCS, CT scans, clinical history, neurological assessment	100%	NR	NR	Mild (58.6%), Moderate (23.3%), Severe (18.0%)	Road traffic accidents (52.78%), Assault and violence (17.5%), Fall from height (16.67%)	1 to >75 years	75.8%	24.2%
Rahman et al., 2023[152]	Cross-sectional study	Pakistan	Southern Punjab, Multan	450	450	2016 – 2016	1	Hospital records	Patients diagnosed with traumatic brain injury (TBI) in emergency or neurosurgical departments	GCS, CT scans, clinical examination	GCS, CT scans, clinical assessment	100%	NR	NR	Mild (51.6%) Moderate (29.6%) Severe (10.7%) Not recorded (8.2%)	Road Traffic Incident (RTI) (93.2%)	Mean age: 28.9 ± 14.1 years	84.2%	15.2%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Umerani et al., 2014[153]	Prospective study	Pakistan	Karachi	1378	1378	2009 – 2011	3	Hospital records	Patients presenting with head injury at emergency department	Clinical assessment, Glasgow Coma Scale (GCS), CT scan	GCS, CT scans, clinical examination	100%	NR	NR	Mild (64.8%) Moderate (27.7%) Severe (7.5%)	Road Traffic Accidents (RTA): 62.6% Fall: 31.7% Assault: 5.5%	Mean age: 29.2 years	76.7%	23.3%
Shrestha et al., 2023[154]	Cross-sectional study	Nepal	Chitwan	350	140	2019 – 2020	2	Hospital records	Patients with traumatic brain injury admitted to the neurosurgical unit and underwent two or more CT scans	Clinical assessment, GCS, CT scan	GCS, CT scan, clinical examination	40.0%	NR	NR	NR	Road traffic accidents (63.57%), Falls (30.71%), Physical assault (4.29%)	NR	70.0%	25.0%

Author., year	Study type/design/ methods	Country	Region	Sample Size (N)	Number of TBI cases	Study period	Study duration (Year)	Data source	Inclusion criteria	TBI definition/ Case ascertainment	TBI measurement method	Prevalence	Mortality	Case fatality rate	Type of severity	Mechanism of TBI injury (up to 3 most frequent in %)	Age (Mean±SD)/ Age Range	Male	Female
Ashraf et al., 2022[155]	Prospective study	Pakistan	Lahore	112	112	2021	1	Hospital records	Patients with TBI caused by motorcycle - associated RTA, who were motorbike drivers younger than 18 years	Based on medical diagnosis in the hospital; patients with head injury referred for neurosurgery evaluation	Glasgow Coma Scale (GCS)	100%	13.40 %	13.4%	Mild (47.3%) Moderate (29.5%) Severe (23.2%)	Motorcycle-to-motorcycle (38.4%), Motorcycle-to-vehicle (24.1%), Motorcycle slip (19.6%)	Mean age: 14.7 ± 2.07 years	98.2%	1.8%
Ahmed et al., 2024[156]	Retrospective study	Pakistan	Lahore	2126	2126	2020	1	Hospital records	Patients with traumatic brain injury (TBI) presenting to the hospital from January to August 2020	Clinical assessment, GCS, CT scan	GCS, CT scans, clinical examination	100%	275 (12.1 %)	275 (12.1%)	Mild (37%) Moderate (29.4%) Severe (20%)	Road Traffic Accidents (51.1%), Falls (20.7%), Assault (4%)	Mean age: 28.85 ± 19.65 years	78.0%	21.4%

Table 1. Characteristics of the included studies

Country Variation

The revies included studies from Bangladesh, India, Nepal, Pakistan and Sri Lanka. Studies from three more countries in South Asia, Afghanistan, Bhutan, and Maldives, were not part of this research. Though they were under consideration for inclusion, no articles from these countries met predetermined inclusion criteria. These countries thus did not represent in this final list of included studies for review.

Sample Size

The extensive range in sample size (from 10 up to 260,000) indicates heterogeneity in research scope on a large scale.

Study period

A total of 126 out of 130 studies in this research reported the duration for which data were collected. The average duration study periods were about 2.66 years. The study periods ranged from 1 to 22 years, showing variation in observation periods. Most studies focused on a relatively brief observation period. With regard to frequency, 1–3 year durations were most common. Among them 42 studies reported 2 years, 29 studies reported 1 year and remaining 29 studies had 3-year duration. These three durations contributed more than 78% of studies with valid duration data and demonstrate a strong tendency towards short-term investigations. Conversely, extended-term studies were rare. Only 11 studies reached 4 years, 9 studies reached 5 years, 2 studies reached 6 years and only 2 studies extended to 9 and 22 years, constituting an unusual instance of lengthy surveillance.

Data sources

Data for most came from hospital records, including medical histories, patient records, and treatment charts. Autopsy records and reports came into play to evaluate fatal cases in many

instances. Police records in the form of inquest reports and dead body challans added to the clinical data. Structured questionnaires, self-structured proformas, clinical examination, and CT scan reports were among other data sources. Telephone interviewing was also included by some studies.

Inclusion Criteria

This study illustrates considerable heterogeneity among the studies, mirroring diversity in patient selection for TBI cases based on age, injury severity, clinical setting, and injury mechanism. Although some studies confined themselves to moderate to severe TBI alone, others included mild head injury cases as well as cases from all severities. Inclusion criteria differed by age groups as well, with some studies focusing on pediatric populations (<18 years), while others targeted adult and older populations (>60 years). These age-based subgroup distinctions help elucidate how age plays a role in susceptibility to as well as recovery from TBI and are important when interpreting age-specific risk factors and outcome patterns. Furthermore, numerous studies select based on clinical admission category, such as those admitted to ICUs or neurosurgical departments. Mechanisms involving road traffic accidents (RTAs) and falls were readily listed as inclusion criteria. These are common injury mechanisms in South Asia. The time since injury was another inclusion criterion with considerable heterogeneity. While most studies included acute TBI cases within 24 to 48 hours post-injury, others included patients with a more prolonged duration of injury from any hour to days post-injury and even included surgical cases. Such broad variation in inclusion could affect generalizability and comparability among studies.

TBI definition/ Case ascertainment

The severity of TBI was assessed primarily through Glasgow Coma Scale (GCS) and supplemented regularly by CT scans, X-rays, and MRI scans. Clinical examination and autopsies

were included as part of many studies to determine injuries such as skull fractures and intracranial hemorrhages. Furthermore, tools including Glasgow Outcome Scale (GOS), Kampala Trauma Score (KTS), TRISS, and FOUR score were used to quantify severity and outcome.

Methodological quality

Based on the MORE checklist, all included studies described their aims clearly (99.2%) and used proper study designs (100%), while ethical approval and conflict of interest were reported well (91.5% and 84.6%, respectively). Funding information reporting was poor (96.2%), while sampling exhibited significant flaws with 98.5% receiving minor flaws ratings. Definitions for cases and classifications for TBI severities were good (>93%), but management of bias was a critical flaw and 99.2% exhibited major flaws. Data sources and subject flow were reported well (97.7%). Reliability of estimates and reporting of mortality were less good with more than 60.8% and 24.5% exhibiting flaws, respectively.

	Ok n (%)	**Minor flaws n (%)**	**Major flaws n (%)**	**Poor reporting n (%)**
General descriptive elements				
Aim of study	129 (99.2)	1 (0.8)	0	0
Funding of study	5 (3.8)	0	0	125 (96.2)
Conflict of interest	110 (84.6)	0	0	20 (15.4)
Ethical approval	119 (91.5)	0	0	11 (8.5)
Study design	130 (100)	0	0	0

▯ Sampling	2 (1.5)	128 (98.5)	0	0
Definition of cases				
▯ Validation	125 (96.2)	5 (3.8)	0	0
▯ Severity of TBI	122 (93.8)	6 (4.6)	2 (1.5)	0
Address bias	0 (0)	1 (0.8)	129 (99.2)	0
Subject flow	129 (99.2)	1 (0.8)	0	0
Reporting methods				
▯ Source of data	127 (97.7)	3 (2.3)	0	0
▯ Reliability of estimates	51 (39.2)	79 (60.8)	0	0
Reporting of estimates				
▯ Incidence	116 (89.2)	4 (3.1)	2 (1.5)	8 (6.2)
▯ Mortality	98 (75.4)	15 (11.5)	5 (3.8)	12 (9.2)

Table 2. Summary results of quality assessment of included studies using Methodological Evaluation of Observational Research checklist (MORE) checklist

Prevalence

In this systematic review, 130 selected articles presented different prevalence rates for traumatic brain injury (TBI). While most study reported 100% prevalence on the selected study population, each representing uniform occurrence among the study populations, others reported prevalence rates ranging from 8.4% to 95.9%.

Mortality and case fatality rates

A total of 101 studies reported mortality rates. Mortality in studies included in this study varied significantly, as expected given differences in study design, target populations, and case severity being studied. Total 29 studies did not report mortality data.

Type of severity

The severity distribution of traumatic brain injuries (TBI) across the studies shows considerable variation. A total 95 studies reported severity data with detailed categorizations. The most frequent distribution shows a focus on mild, moderate, and severe injuries, with varying proportions in different studies.

Mechanism of TBI Injury

The injury mechanism for TBI is dominated strongly by road traffic accidents (RTAs) as the predominant source of injury in South Asia. There were 12 studies, and they reported 100% of cases attributed to RTAs,[33,45,94,111,116,117,122,124,125,129,140,157] confirming road traffic injury's high burden in the region. Aside from RTAs, some studies included fall from height as a major source of injury. Violence or assault as a factor was reported by some studies but less commonly included.

Age and sex

The average age of participants in studies included in this systematic review is highly variable and indicates diverse populations under investigation. The age in studies ranges from pediatric populations with average ages as low as 4.7 years to elderly populations with average ages as high as 71.08 years. The majority of studies target younger populations with ages in their 20s and 30s as indicated by commonest average age values of 24 and 28.9 years. Nevertheless, a few studies target adolescents and children with average ages of 15 and 4.7 years as an indication that pediatric TBI is their focus. The gender split throughout the studies is dominated by male

223 participants, and most studies report 70% and above male participants. For instance, 78% is the
224 most frequent male proportion, and most studies reveal male proportions ranging from 65% to
225 88%. Female proportions tend to be a smaller percentage and usually 22% or below.

226

227 ## Discussion

228 This systematic review fully explored the epidemiology of traumatic brain injury (TBI) in South
229 Asia. Despite significant methodological limitations in the primary studies, suggests that TBI is a
230 major public health concernin the region as indicated by high rates of prevalence among young
231 adults. Road traffic accidents (RTAs) were found to be the primary source of TBI in countries in
232 South Asia as a whole, including Bangladesh, India, and Nepal which recorded especially high
233 rates involving traffic injuries leading to TBI. Mortality differed, however, the burden of TBI as
234 indicated by case fatality and disability over a prolonged period after injury was high. Our
235 systematic review further highlighted that severity ranges of TBI in the region were mostly found
236 to be mild to moderate while a large number of cases also presented with severe injuries.

237 This systematic review indicated that TBI was a considerable public health problem in South
238 Asia with variable prevalence rates among countries. The prevalence of TBI within the region
239 was significantly high, particularly among countries with inadequate infrastructure and poor road
240 safety policies.[158] The rapid urbanization and motorization in South Asia further fueled the cases
241 of TBI and road traffic accidents (RTAs) were predominant causes in most studies.[155] TBI is
242 more common in other regions, such as United States. In a systematic meta-analysis including a

general adult population, about 18.2% (95% CI 14.4-22.7%) adults reported a lifetime history of TBI with loss of consciousness.[159]

The case and mortality rates due to TBI in South Asia were very high. There was wide variation in these rates in the systematic review, with severe cases of TBI being a major driving factor for mortality. Traumatic brain injury is also a major cause of death and disability worldwide despite accurate worldwide mortality rates being highly variable according to geographical region, healthcare system, and reporting policies. Mortality due to TBI is calculated in a systemic review to be 20-30% worldwide.[160] The crude mortality rates in Europe ranged from 9 to 28.1 per 100,000 population per year.[161] A study discovered that TBI now stands as the leading cause of mortality in instances of polytrauma as evidence indicates a change in patterns among trauma-related deaths.[162] They reported 66% (70/106) among all trauma-related mortality.[162]

In terms of their severity, most cases of TBI among South Asians were mild or moderate but a large percentage also included severe injuries. The distribution according to severity differed among countries and regions and an area might record a greater percentage of severe injuries. This inconsistency might have been due to variations in case ascertainment approaches that involved use of Glasgow Coma Scale (GCS) scores and high-tech imaging modalities such as CT and MRI scans. The injury severity in TBI was found to be directly associated with outcome, and the results indicated more severe injury in most instances leading to an extended duration of stay in the hospital, higher healthcare expenditure, and prolonged disabilities.

The major mode of TBI throughout South Asia was road traffic accidents (RTAs), followed by falls and assaults. RTAs specifically contributed to more than half of the cases with motorcycles being the leading vehicle implicated in TBI. These study results coincide with other studies. A

meta-analysis LMICs reported 39% pediatric TBI cases due to RTAs.[19] In Ethiopia, 21% of TBI cases were due to RTAs.[163] A bibliometric study involving research on TBI indicated RTAs as the most common source of TBI over falls among older populations in line with the evidence.[160] The predominance of RTAs in South Asia was driven by inadequate road infrastructure,[164-166] poor protective precautions such as helmet.[167]

TBI affected all ages but varied significantly depending on age and sex. This systematic review found high incidences among young adults and especially males that align with results in previous studies. One study found that young adults and especially men and older people are high-risk groups for TBI.[168] In line with a systematic review and meta-analysis involving all major studies up to 2023, males account for about 74.3% of all cases of TBI and create a male-to-female ratio close to 3:1.[169] One meta-analysis found that prevalence among genders differed and that males recorded a higher percentage at 20.8%.[159] Several studies have discovered age as a major factor in determining TBI outcome. In a recent systematic review and meta-analysis, age is a major determinant with an average age gap of 8.72 years among patients.[170]

This review utilized multiple databases to ensure comprehensive coverage of studies from various countries from the region of South Asia. It also had specific research aims centred on important TBI epidemiologic outcomes so a meaningful synthesis could be achieved. This review utilized the PRISMA approach and also employed a rigorous data extraction method for ensuring methodological quality. By considering different study designs like cross-sectional, cohort, and case-control studies, it captured data from a variety of settings from South Asia. The application of the MORE checklist for assessing study quality assured even more rigor and ensured the incorporation of accurate studies.

Major limitations of the present systematic review were the considerable heterogeneity in included studies in relation to study design, data sources, case definitions, TBI measurement method which hampered quantitative synthesis. Dissimilarities in the report of TBI outcomes like prevalence, mortality, severity, and mechanism of TBI injury also hampered comparison. The quality of the studies varied methodologically in relation to sampling and case and data reliability biases. Longitudinal follow-up data were missing from most studies, hence limited the estimation of outcomes like disability or recovery.

TBI in South Asia presented as a severe public health concern with high prevalence, high mortality, and variable severity and was most commonly due to road traffic accidents. This research results highlighted greater need for better infrastructure for trauma care, preventive efforts towards road safety, and recognition towards high-risk groups including young adults, children and older adults. Priority policy interventions towards strengthening road safety, increasing numbers of trauma care facilities, and enhancing data collection were necessary to reduce the burden of TBI in the region. Future studies should incorporate standardized approaches to collecting data on TBI and longitudinal studies to further understand late consequences and outcomes for survivors of TBI.

Contributors

SH and SCP conceptualized the study. SH, SCP, RH, and MEH performed title, abstract, and full-text screening. FS and KMYA conducted data extraction, and MMM and JAI verified the extracted data. SH, RH, FS, KMYA, MMM, and JAI synthesized the results. SH, RH, MMM and JAI assessed the risk of bias. SH drafted the manuscript, and SCP critically reviewed it for

intellectual content. All authors read and approved the final manuscript, jointly decided to submit the paper, and agreed to be accountable for all aspects of the work.

Data sharing statement

The findings of this study are based entirely on data from previously published studies, all of which are publicly accessible and referenced within this manuscript. No new primary data were collected or analyzed in this systematic review. Additional information or detailed data extraction materials used in this review can be provided upon reasonable request to the corresponding author.

Declaration of interests

All authors declare no competing interests.

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Appendix

S1 Appendix: Search String

S2 Appendix: Methodological Evaluation of Observational Research (MORE) Checklist for Quality Assessment of Included Studies

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Appendices

S1 Appendix: Search String

("Trauma" OR "head injury" OR "head injuries" OR "brain injury" OR "brain injuries" OR "traumatic brain injury" OR "TBI" OR "craniocerebral injuries" OR "craniocerebral injury" OR "head trauma" OR "brain trauma" OR "cranial trauma" OR "brain laceration" OR "brain contusion")

AND

("epidemiology" OR "prevalence" OR "Proportion" OR "incidence" OR "mortality" OR "case fatality" OR "severity" OR "risk factor" OR "mechanism" OR "outcomes" OR "morbidity" OR "impact")

AND

("South Asia" OR Bangladesh OR India OR Pakistan OR Afghanistan OR Sri Lanka OR Nepal OR Bhutan OR Maldives)

AND

("hospital" OR "trauma center" OR "emergency" OR "fatalities" OR "hospitalized" OR "inpatient") AND ("retrospective study" OR "prospective study" OR "cross-sectional" OR "cohort study" OR "case-control" OR "descriptive study")

849 Appendix 2: Methodological Evaluation of Observational Research (MORE) Checklist for
850 Quality assessment of Included Studies
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Type	Criteria		Conditions	Assessment
General descriptive	Aim of study		a) Included incidence/prevalence estimation with clear target population b) Included incidence/prevalence estimation without clear target population c) Aim of study was not stated d) Unclear due to poor reporting	a) OK b) Minor flaw c) Major flaw d) Poor reporting
	Funding of study		a) Reported b) Not reported	a) OK b) Poor reporting
	Conflict of interest		a) Reported b) Not reported	a) OK b) Poor reporting
	Ethical approval		a) Reported b) Not reported	a) OK b) Poor reporting
	Study design		a) Reported b) Not reported	a) OK b) Poor reporting
External validity	Sampling	Sampling frame	a) Not applicable for study design b) Sampling within nationally representative registries or databases c) Medical records d) Insurance claims e) Outpatients contacts f) Unclear due to poor reporting	a) NA b) OK c) Minor flaw d) Minor flaw e) Major flaw f) Poor reporting

Type	Criteria		Conditions	Assessment
	Definition of cases	Validation	a) Criteria of TBI were stated according to the guidelines b) TBI were defined by ICD codes c) Criteria of TBI were not stated according to the guidelines d) Criteria of TBI were not stated e) Unclear due to poor reporting	a) OK b) OK c) Minor flaw d) Major flaw e) Poor reporting
		Severity of TBI	a) Stated in the study with scales b) Stated in the study without scales c) Not stated in the study d) Unclear due to poor reporting	a) OK b) Minor flaw c) Major flaw d) poor reporting
	Address bias	Sampling bias is addressed in the analysis (can by mentioned in recommendations)	a) Not applicable for study design b) Weighting of the estimates by probability of selection c) Weighting of the estimates by non-response adjustment within sampling subgroups d) Post-stratification by age e) Post-stratification by sex f) Mentioned, but not addressed in analysis g) Not mentioned and not addressed in analysis h) Unclear due to poor reporting	a) NA b) OK c) OK d) OK e) OK f) Minor flaw g) Major flaw h) Poor reporting
		Subject flow	a) Not applicable for study design b) Number of enrolled stated clearly c) Number of enrolled not stated clearly d) Number of enrolled not stated e) Unclear due to poor reporting	a) NA b) OK c) Minor flaw d) Major flaw e) Poor reporting

Type	Criteria		Conditions	Assessment
Internal validity	Reporting of methods	Source of data	a) Objectively measured with diagnostic methods for the purpose of the study (independent on health care) b) Measured by interviewers for the study c) Obtained during clinical examination for the purpose of the study d) Obtained from registries or administrative databases (collected for epidemiologic evalua- tion independent of health care) e) Obtained from medical records (mining of the data collected for health care purposes) f) Obtained from administrative database (mining of the data collected for health care purposes) g) Source of data is not stated in the study h) Unclear due to oor re ortin	a) OK b) OK c) OK d) OK e) Minor flaw f) Minor flaw g) Major flaw h) Poor reporting
		Reliability of the estimates	a) Methods of data analysis (nominators/denominators) are stated clearly b) Methods of data analysis (nominators/denominators) are stated, but not clearly c) Methods of data analysis (nominators/denominators) are not stated d) Unclear due to poor reporting	a) OK b) Minor flaw c) Major flaw d) Poor reporting

Type	Criteria		Conditions	Assessment
	Reporting of estimates	Incidence	a) Incidence type (cumulative incidenc, incidencerate) stated and counted clearly b) Incidence type (cumulative incidenc, incidencerate) stated and counted not clearly c) Incidence type (cumulative incidenc, incidencerate) not stated and not counted d) Unclear due to poor reporting	a) OK b) Minor flaw c) Major flaw d) Poor reporting
			a) Precision of estimation (error, 95% CI) reported in all b) Precision of estimation (error, 95% CI) reported not in all c) Precision of estimation (error, 95% Cl) omitted d) Unclear due to poor reporting	a) OK b) Minor flaw c) Major flaw d) Poor reporting
			a) Age adjusted incidence in total sample b) Crude incidence in total sample c) The incidence is not stated as age adjusted or crude d) Unclear due to poor reporting	a) OK b) Minor flaw c) Major flaw d) Poor reporting
			a) Age adjusted incidences in all population subgroups b) Age adjusted incidences not in all population subgroups c) Crude incidences in subgroups d) Incidences are not stated as age adjusted or crude e) Unclear due to poor reporting	a) OK b) Minor flaw c) Minor flaw d) Major flaw e) Poor reporting

Type	Criteria		Conditions	Assessment
		Mortality	a) Mortality in all population is counted from all population b) Mortality in all population is counted not clearly c) Mortality in all population is counted as case fatality rate (only from the cases not from all population) d) Unclear due to poor reporting	a) OK b) Minor flaw c) Major flaw d) Poor reporting
			a) Precision of estimation (error, 95% CI) reported in all b) Precision of estimation (error, 95% CI) reported not in all c) Precision of estimation (error, 95% Cl) omitted d) Unclear due to poor reporting	a) OK b) Minor flaw c) Major flaw d) Poor reporting
			a) Age adjusted mortality in total sample b) Crude mortality in total sample c) The mortality is not stated as age adjusted or crude d) Unclear due to poor reporting	a) OK b) Minor flaw c) Major flaw d) Poor reporting
			a) Age adjusted mortalities in all population subgroups b) Age adjusted mortalities not in all population subgroups c) Crude mortalities in subgroups d) Mortalities are not stated as age adjusted or crude e) Unclear due to poor reporting	a) OK b) Minor flaw c) Minor flaw d) Major flaw e) Poor reporting

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