



Is childhood mild traumatic brain injury associated with adult criminal behaviour?

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What is a traumatic brain injury (TBI)?

- Injury to the head
 - Falls
 - Fights
 - Sports
 - MVA
- Terminology
 - Head Injury, Concussion
 - Brain Injury, Head Knock
- Deficits
 - Memory
 - Processing Speed
 - Attention
 - Social awareness
 - Emotion regulation
 - Planning
 - Insight
 - Fatigue

TBI and offending – Why is it important?

- Increases likelihood of criminal behaviour
- Effect on interventions
- Violence in prison
- Recidivism

Prison studies – Prevalence (see Durand et al. 2017 for review)

- Population rates of medically identified TBI 23-32%
 - Cassidy, Boyle, & Carroll, 2014
 - McKinlay et al., 2008
 - Feigin et al., 2013
- Prevalence among offender groups, 9-100%
- Average of 46%
- Co-morbidity
 - Mental health problems
 - Use of alcohol etc.

Prevalence of TBI – (Davis, Williams et al. 2012)

- Sample:
 - Incarcerated male youth offenders, 16-18 years of age
- Question:
 - Have you ever sustained “an injury to the head that caused you to be knocked out and/or dazed and confused for a time.”
 - How many times and duration of each period of LOC.
 - Severity was recorded using the length of LOC
 - Worst injury as an index for severity

Severity / Outcome

- Severity Index – ranged from no history of TBI to very severe injury with LOC of more than 60 minutes
 - 0 = no history;
 - 1 = Feeling dazed and confused but no LOC, minor concussion;
 - 2 = LOC <10 minutes, mild TBI; mild TBI;
 - 3 = LOC 10 to 30, complicated mild TBI;
 - 4 = LOC 30-60 mins moderate/severe TBI;
 - 5 = LOC >60 very severe TBI.
- Post concussion symptoms measured using a modified version of the Rivermead Post-concussion Symptoms Questionnaire (RPSQ)

Results

- 70% reported at least 1 TBI at some point in their lives
- 41% reported experiencing a TBI with loss of consciousness
- Increase in Post Concussive Symptoms with increase in TBI severity
- TBI severity related to alcohol use
- Problem:
 - Most studies examine males
 - Are females different?

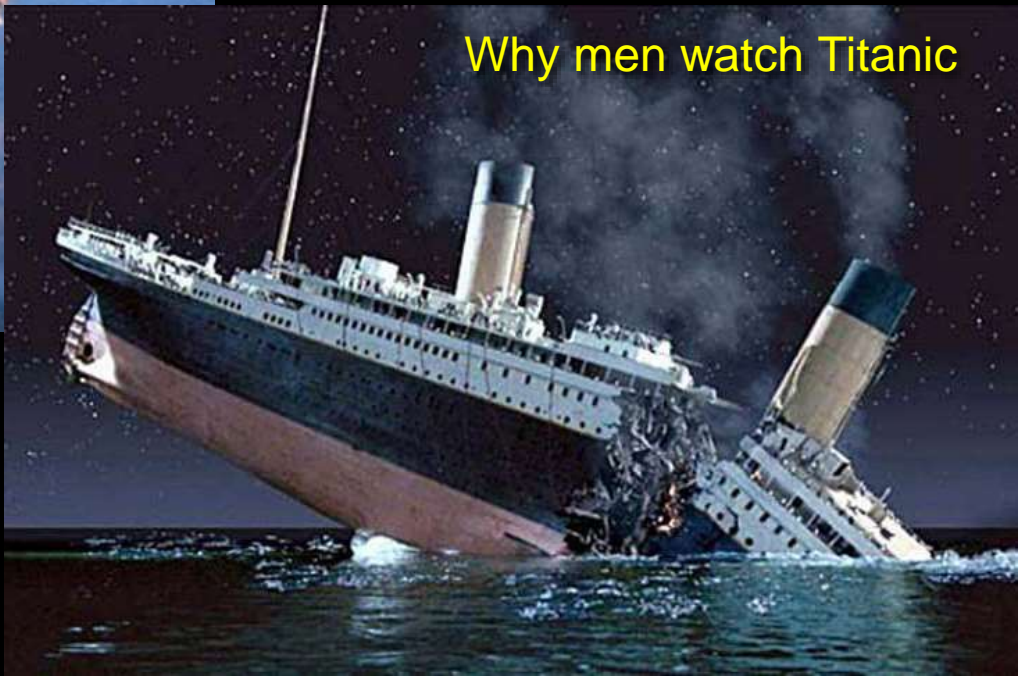
Females vs Males



Why women watch Titanic



Why men watch Titanic



Women in prison – (Woolhouse, McKinlay et al. 2016)

- Christchurch Women's Prison (New Zealand)
- Women approached (range 17 – 65 years)
- Severity
 - Minimum report of a history of TBI and 2 concussive symptoms
 - Mild TBI = LOC <30 minutes,
 - Moderate/severe TBI = LOC exceeding 30 minutes

Measures

- History of TBI
 - Obtained using the Ohio State University Identification Method Short form (OSU-TBI-ID)
- Depression
 - Depression Anxiety Stress Scale (DASS 21)
- Anxiety
 - (DASS 21)
- Stress
 - (DASS 21)

Results

- 95% reported a TBI history
 - Falls, MVA and Fights accounted for 75% of all injuries
- 83% reported multiple TBI's over lifetime
- Average age at first injury – 12 years 8 months (2–34 years)

Results continued

- 35% Depressive symptoms in clinical range
- 49% Anxiety in the clinical range
- 35% Stress in the clinical range

- Similar rates of depression, anxiety and stress as incarcerated males

TBI in other populations

- Incarcerated samples self-reported incidence on average 46%
- Samples with HIV over 74%
 - Jaff, O'Neill, Vandergoot, Gordon, & Small, 2000
- Samples with a history of mental illness over 72%
 - McHugo et al., 2016
 - Corrigan & Deuschle, 2009

Other factors?

- Strong association between TBI, offending and incarceration
- Influence of other factors?
 - Mental health problems
 - Sub-stance abuse
 - Drinking to excess/use illicit drugs may increase likelihood of TBIs
 - Those on drugs more likely to engage in criminal activity
 - Experience of incarceration may increase the likelihood of incurring a TBI
 - Increased risk of TBI as a result of assaults within the prison system itself.

Problems with studies

- Sample characteristic
 - Varied age groups, inclusion criteria, different terminology
- Representativeness of sample
- No information regarding timing of event
 - Before or after offending?
- Rely on self report
 - Not recalled, incorrectly recalled, false recall
- Accuracy of self-report not evaluated

Accuracy of self-report of life time history of TBI?



Accuracy of recall for early childhood TBI

- 0-5 years is a high incidence period for TBI
- How accurate are adults at recalling TBI that occurred early in life?
- How often do adults inaccurately recollect a TBI event?

Method / Participants

- Christchurch Health and Development Study
- Birth cohort (originally 1265 individuals)
- History of TBI constructed via number of sources
 - Parent report, self-report validated by hospital records

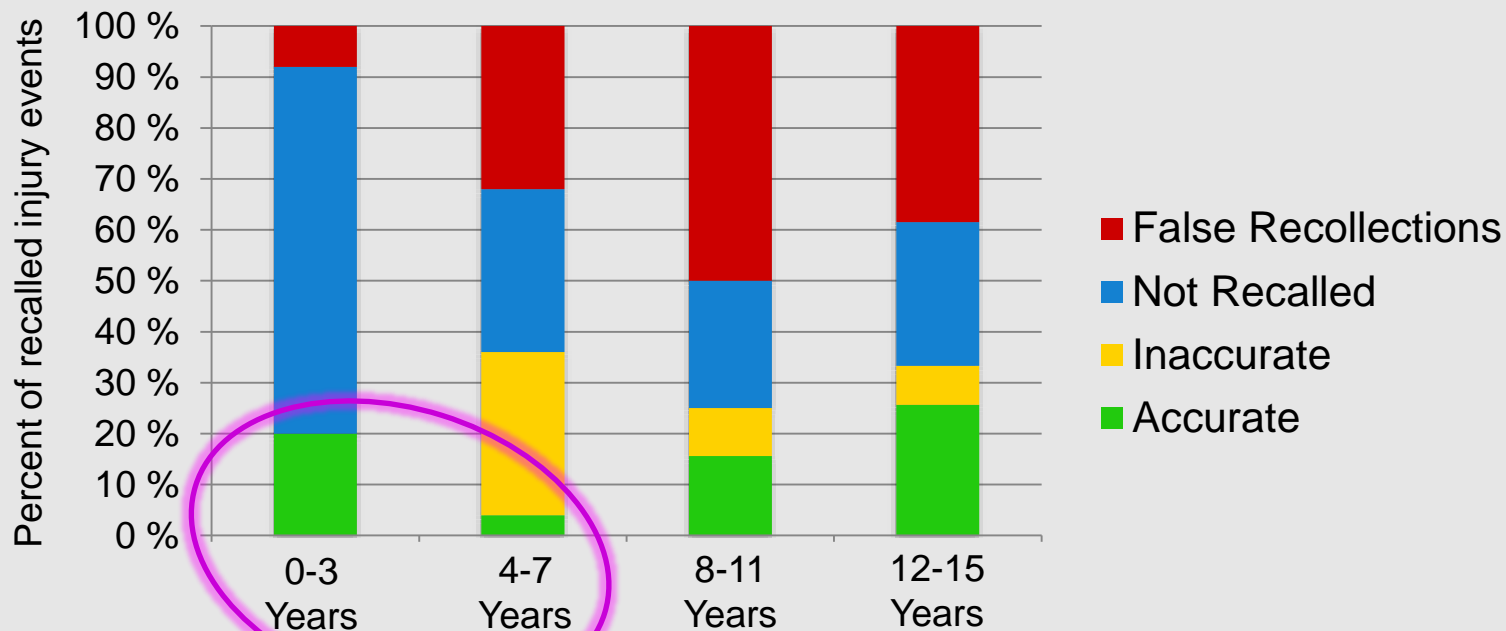
Method / Measures – (McKinlay et al. 2016)

- At 35 year follow-up participants were asked:
 - Recall all TBI events that had resulted in hospitalization including age at injury and details of the events
 - Ohio State University TBI identification method which required recall of injuries with a loss of consciousness

Results – TBI recalled for 0-14 years

- Cohort – 80 hospitalised TBI events documented first 15 years of life
- 76 TBI event recollections at 35 year follow-up
 - 21 (26%) corresponded with medical records
 - 14 (18%) corresponded with medical records but differed on age and/or altered consciousness
 - 45 (56%) medically recorded TBI events not recalled
 - 41 recollections had no corresponding medical records
 - I.E. 54% of the 76 TBI events recalled were false

Accuracy of the TBI event recall



Conclusions

- Limitations in retrospective self-report of life-time TBI events
- Recall better where a LOC had occurred
- Surprising number of recalls where TBI had not occurred

mTBI in Childhood – Adult Criminal Behaviour?

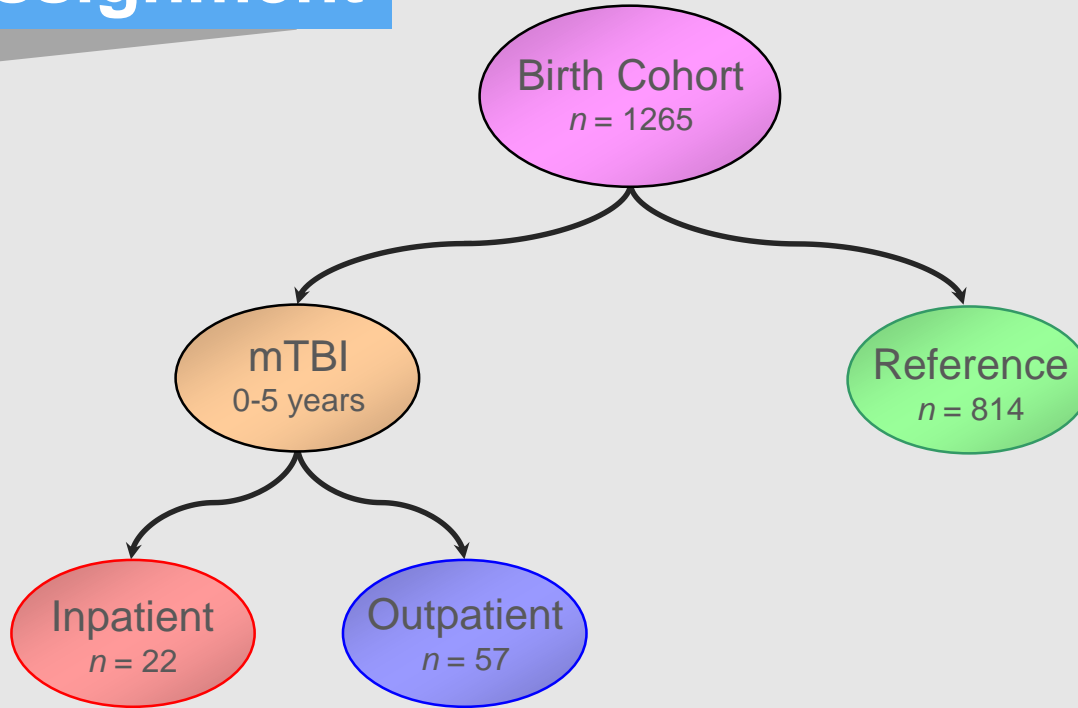


Fake News ?

Childhood TBI – Trajectory to adult offending

- Design: Longitudinal, birth cohort
 - Christchurch Health and Development Study, initiated in 1977
 - 97% of all births in the Christchurch region of New Zealand over a three month period
- Aim: Evaluate TBI effects in terms of:
 - Severity
 - Early childhood injury
 - Control for pre-injury factors

Group assignment



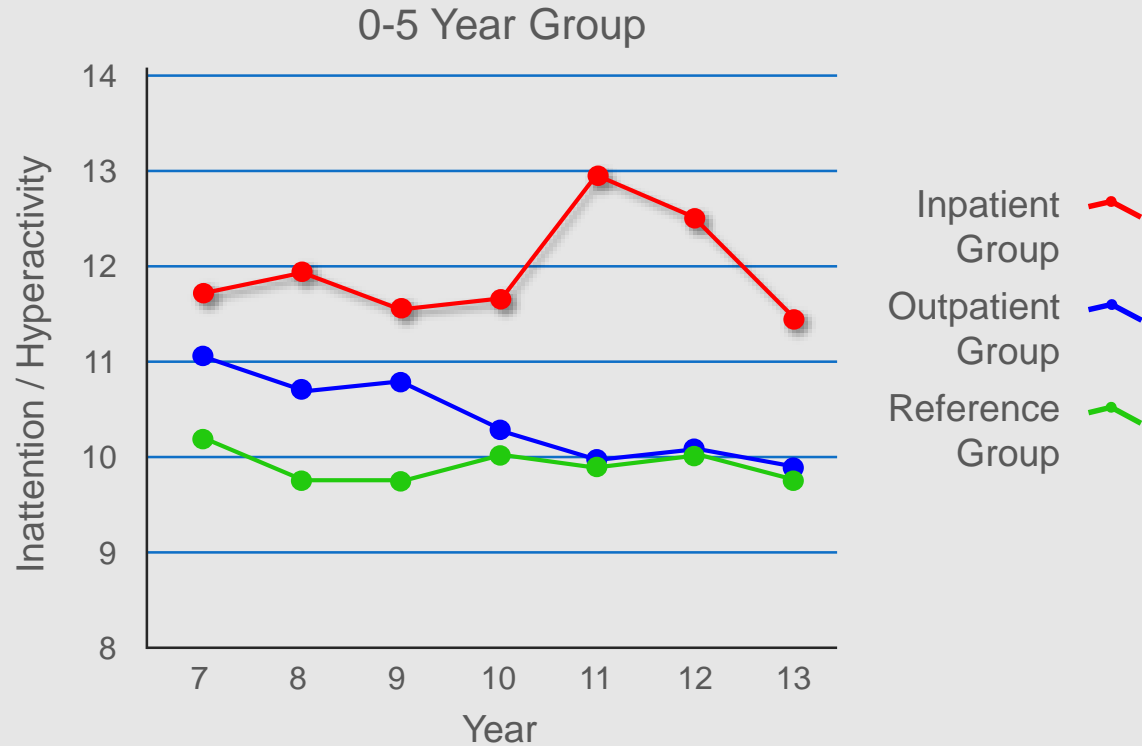
Requiring brief
hospital admission
 ≤ 2 days

Not requiring
hospital admission

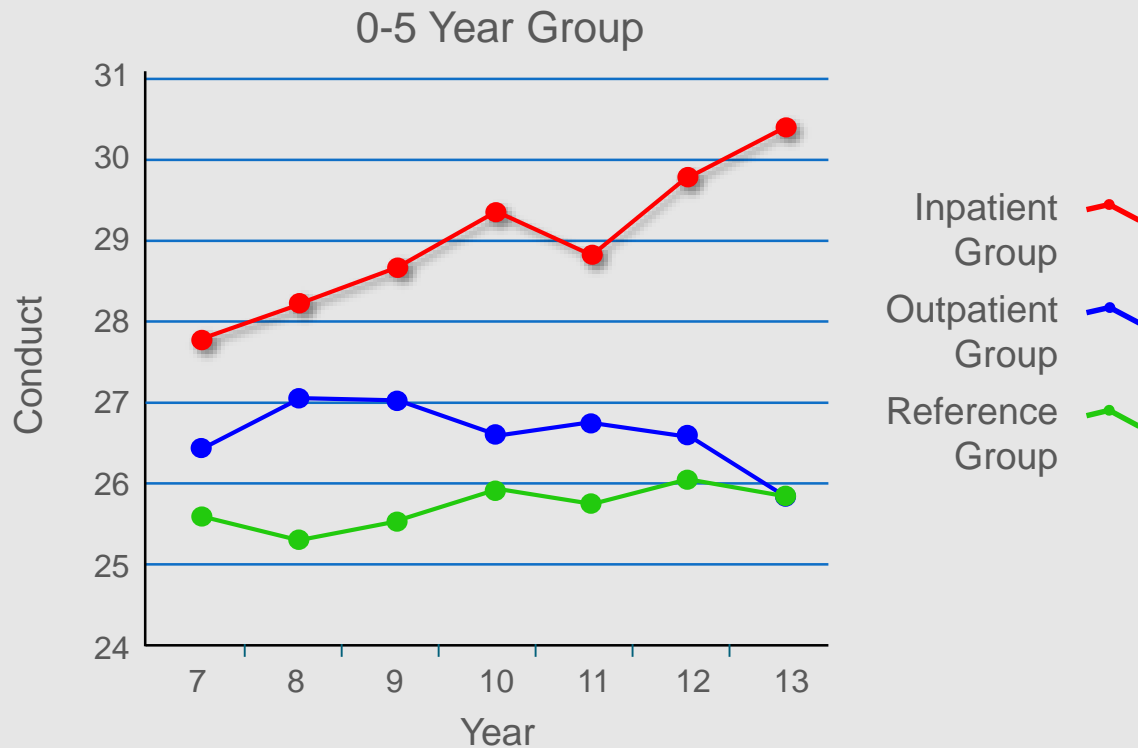
Inclusion – Exclusion criteria

- mTBI inclusions
 - Diagnosis of concussion
 - LOC \leq 20 minutes
 - PTA \leq 60 minutes (post traumatic amnesia)
- Exclusions
 - Skull fractures
 - Moderate or severe brain injury
 - Evidence of child abuse (pre or post injury)

mTBI vs reference group - Inattention / Hyperactivity



mTBI vs reference group – Conduct



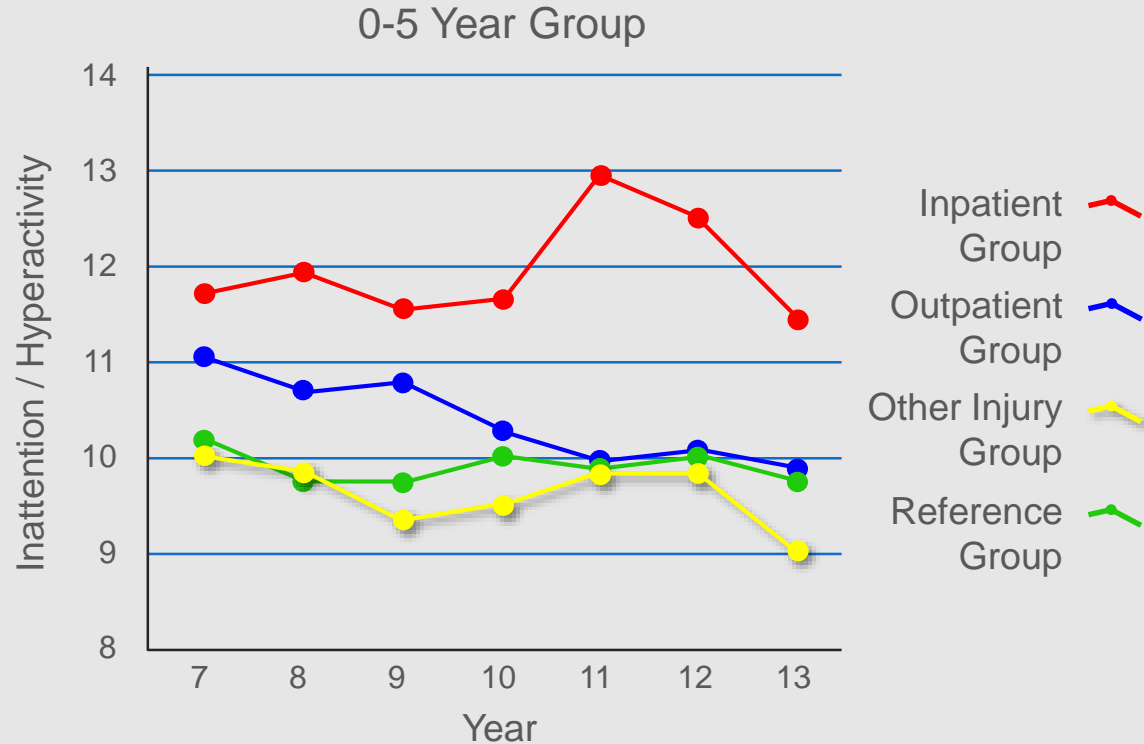


Statistical control for pre-injury child and family characteristics

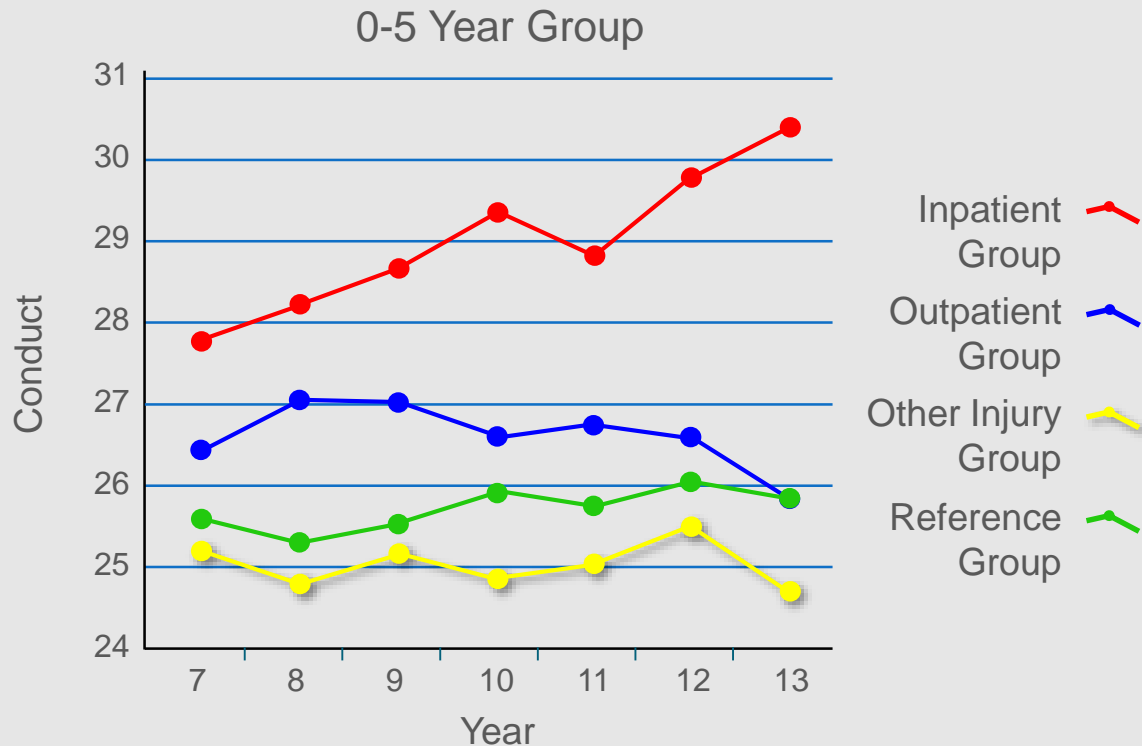


Maybe children who have increased behavioural problems have accidents?

mTBI vs reference group - Inattention / Hyperactivity



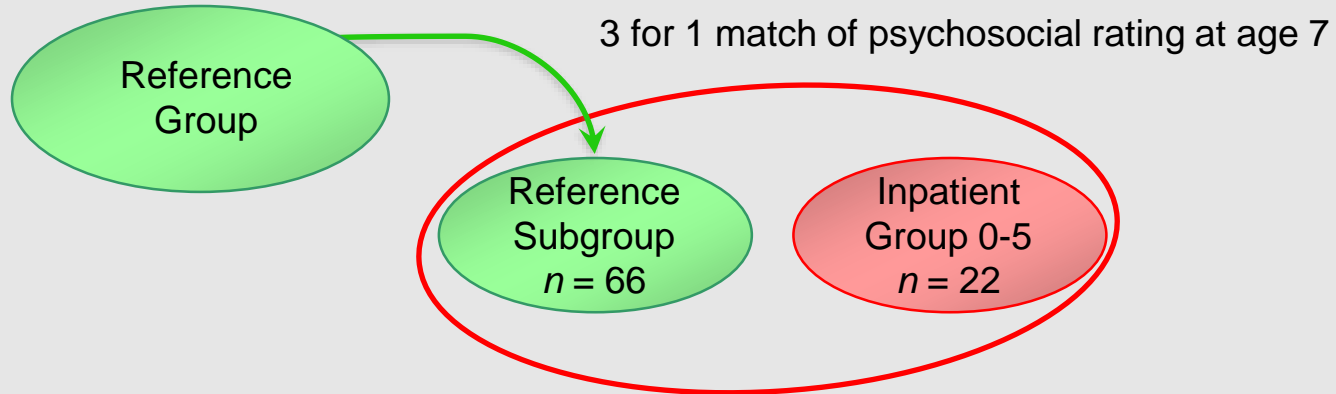
mTBI vs reference group – Conduct



Answers to frequently asked questions using descriptive data

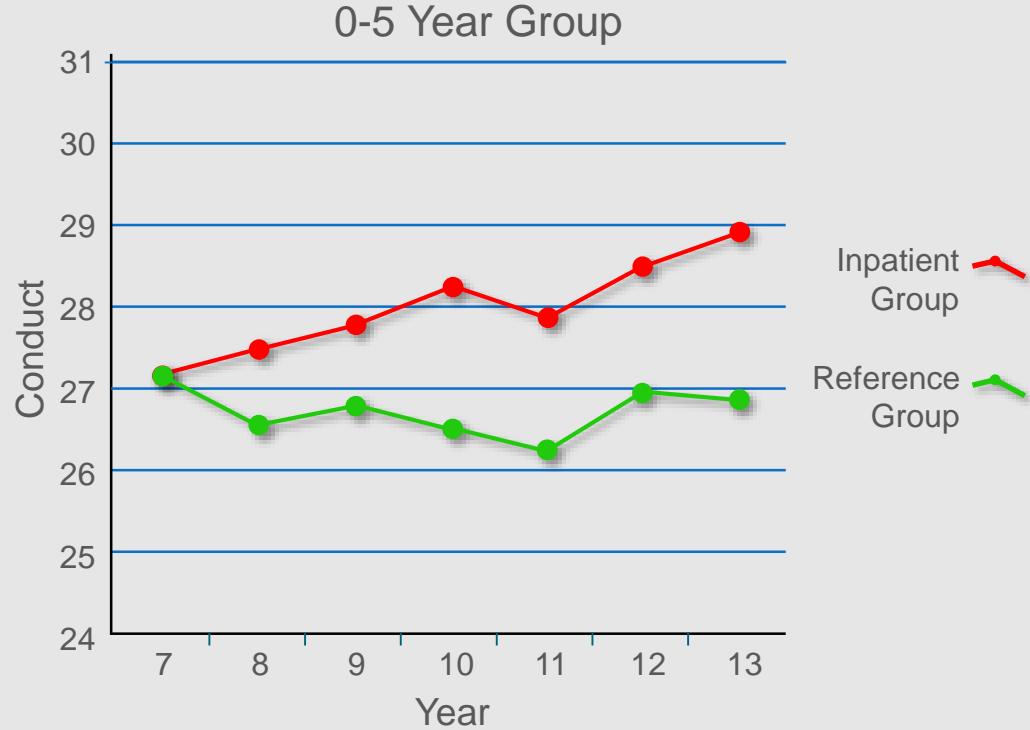
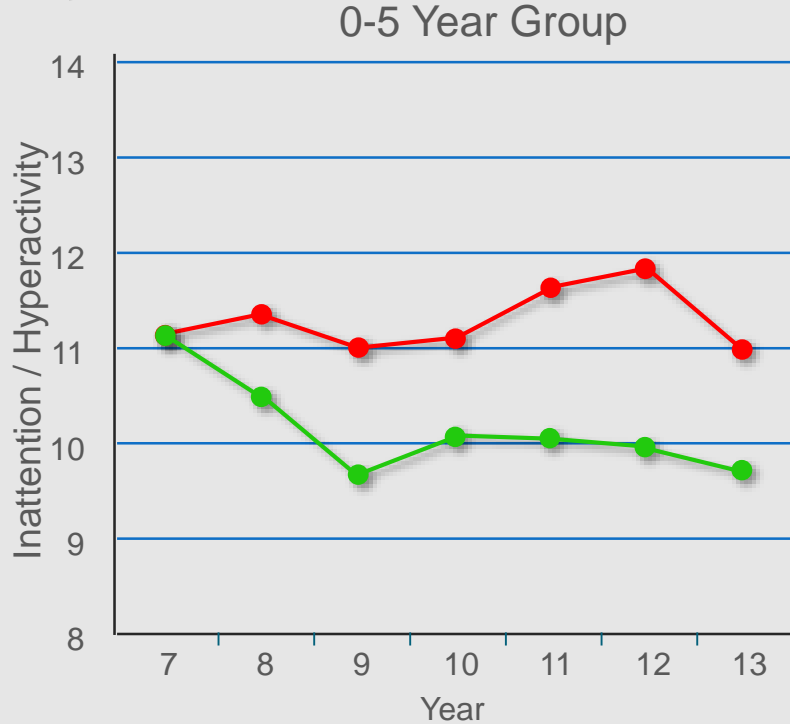
- Children who have accidents may have greater behavioural problems than other children
- There may be other variables that you were unable to control for

What if we matched behaviour at age 7 years?



- For each inpatient group child:
 - Gender matched with 3 children from the reference group
 - Identical combined mother and teacher scores
 - Randomly selected
- Separately for attention and conduct

Combined mother & teacher ratings of inattention / hyperactivity and conduct matched at age 7 years

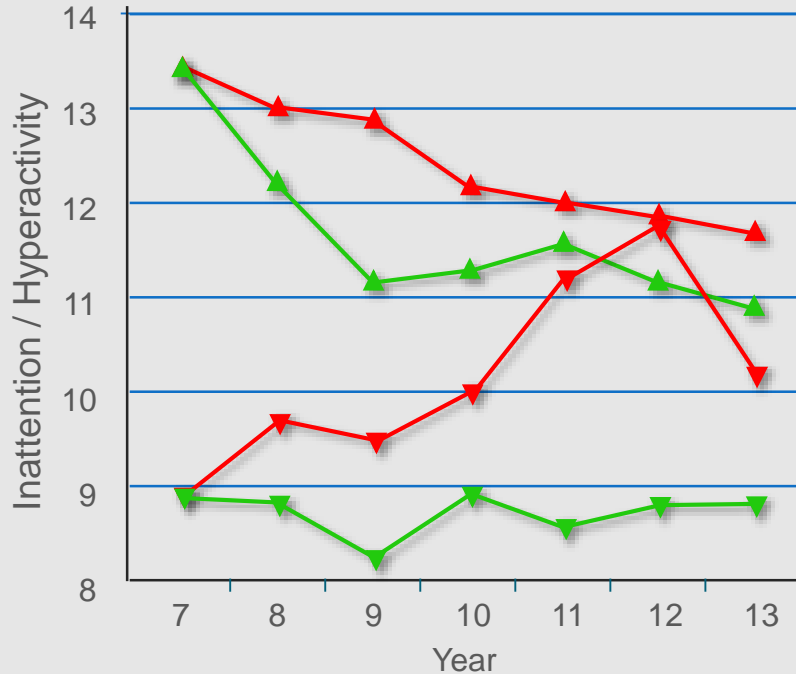


Answers to frequently asked questions – descriptive data

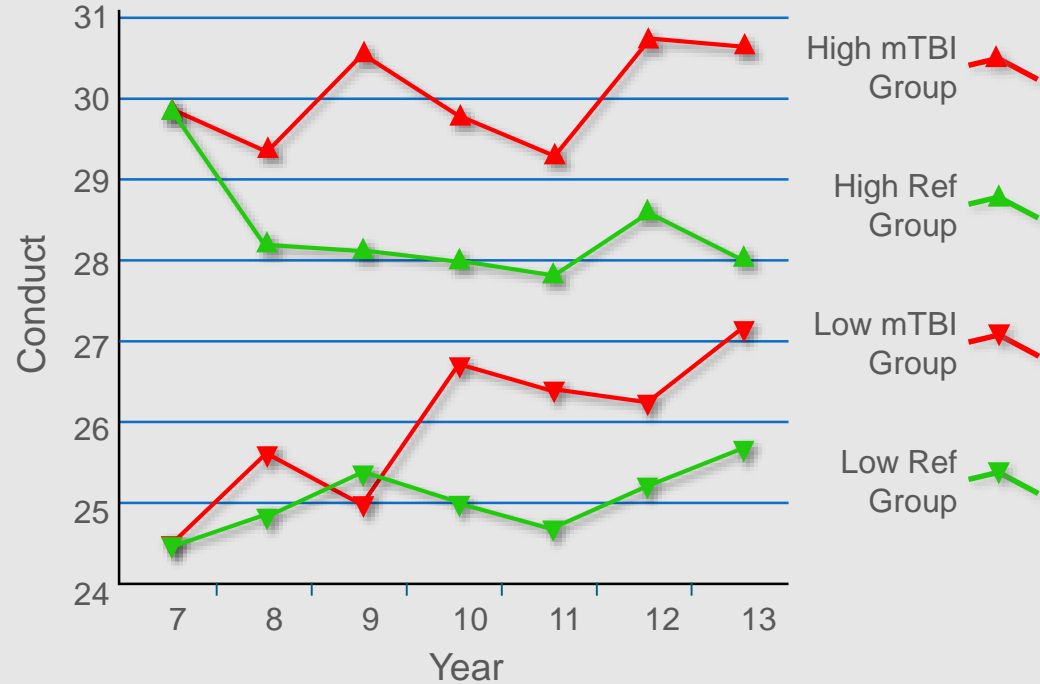
- Children who have accidents may have greater behavioural problems than other children
- There may be other variables that you were unable to control for
- One or two very high scoring children in the Mild TBI group may have biased the findings

Combined ratings of inattention / hyperactivity and conduct matched at age 7 years, median split

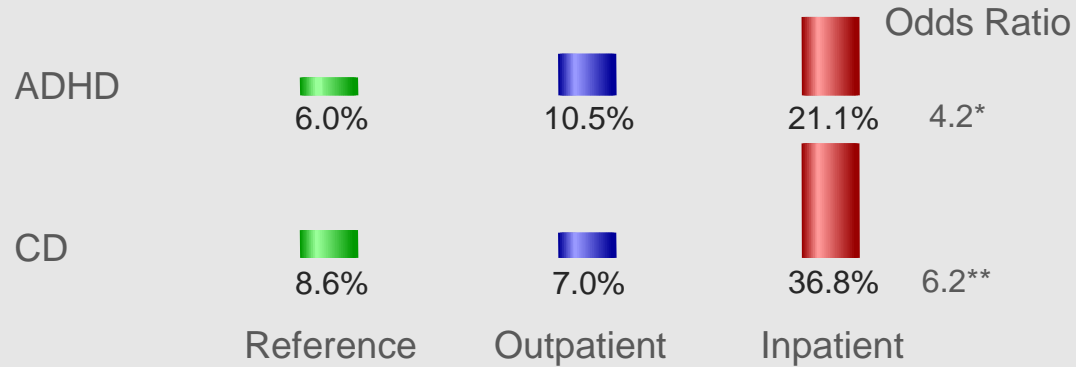
0-5 Year Group



0-5 Year Group



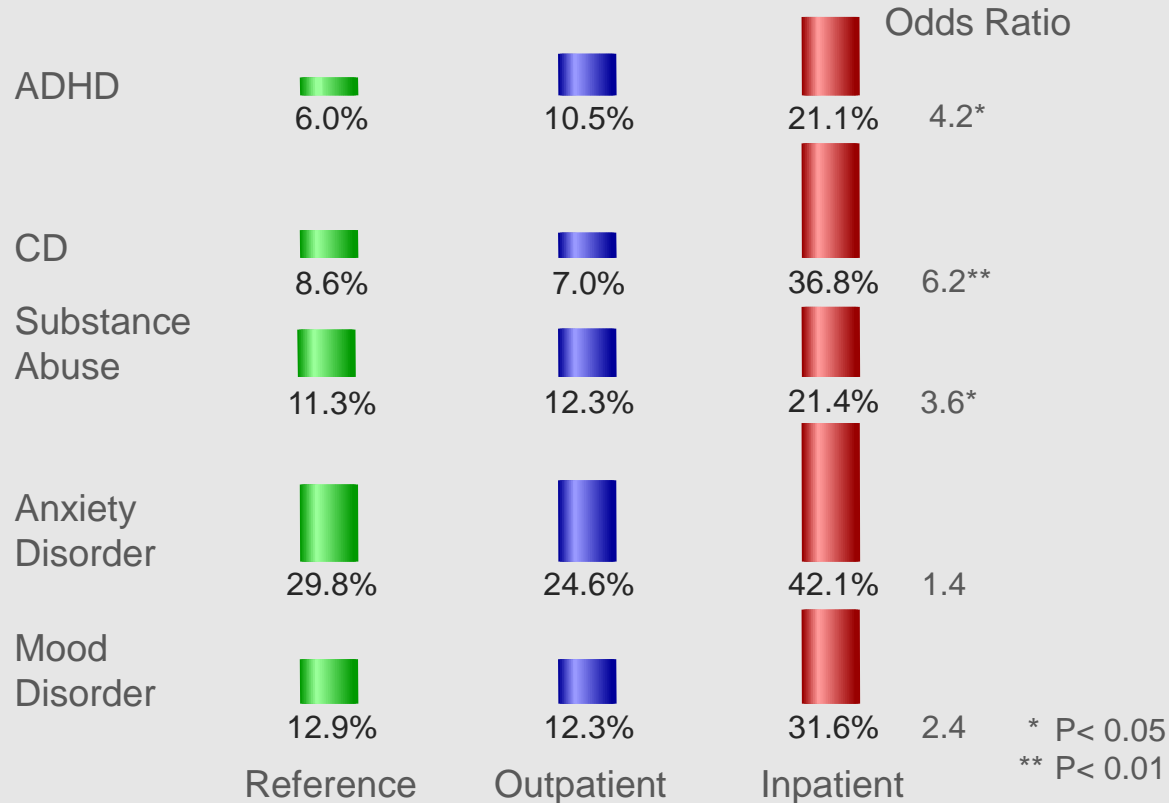
Psychiatric symptoms at ages 14-16 years based on DSM-III-R



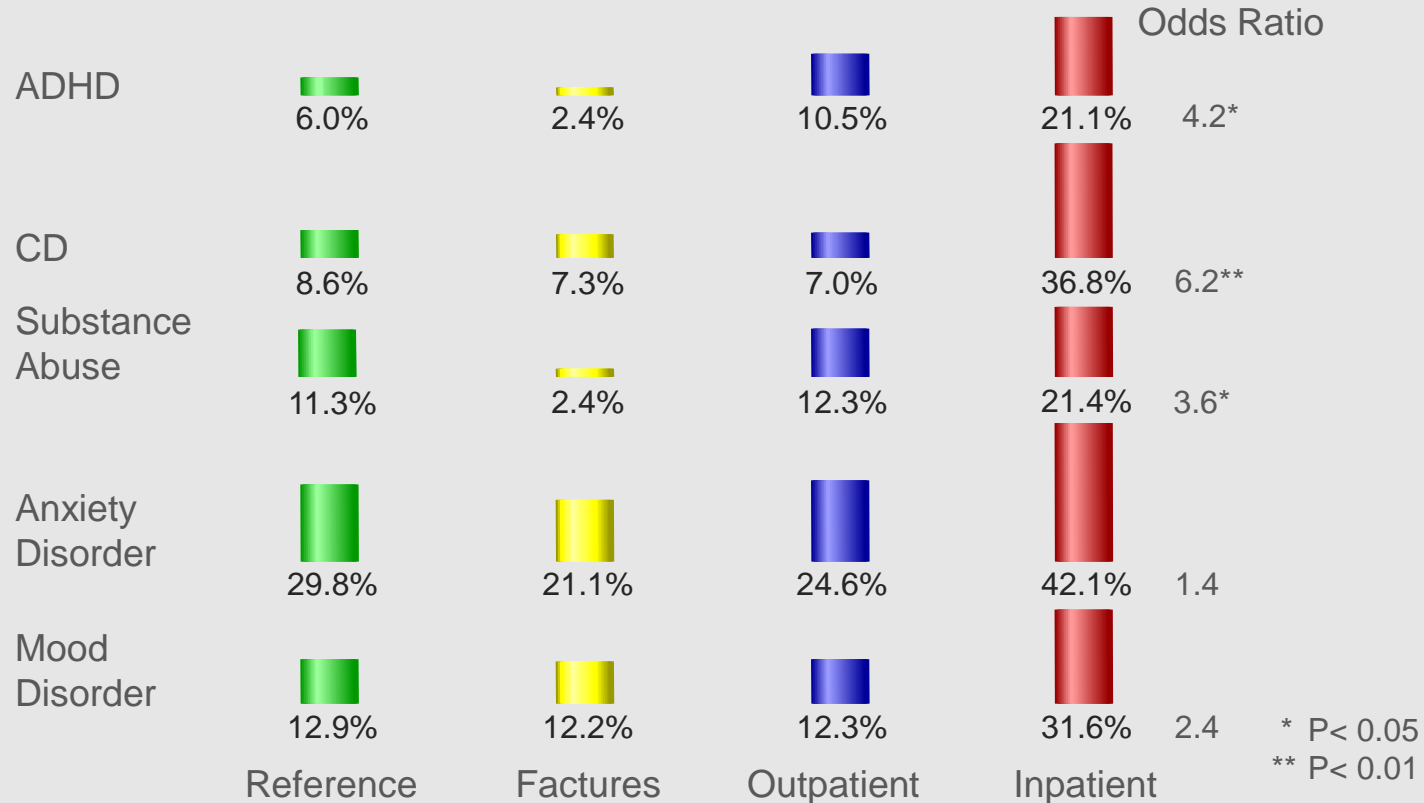
* P < 0.05

** P < 0.01

Psychiatric symptoms at ages 14-16 years based on DSM-III-R

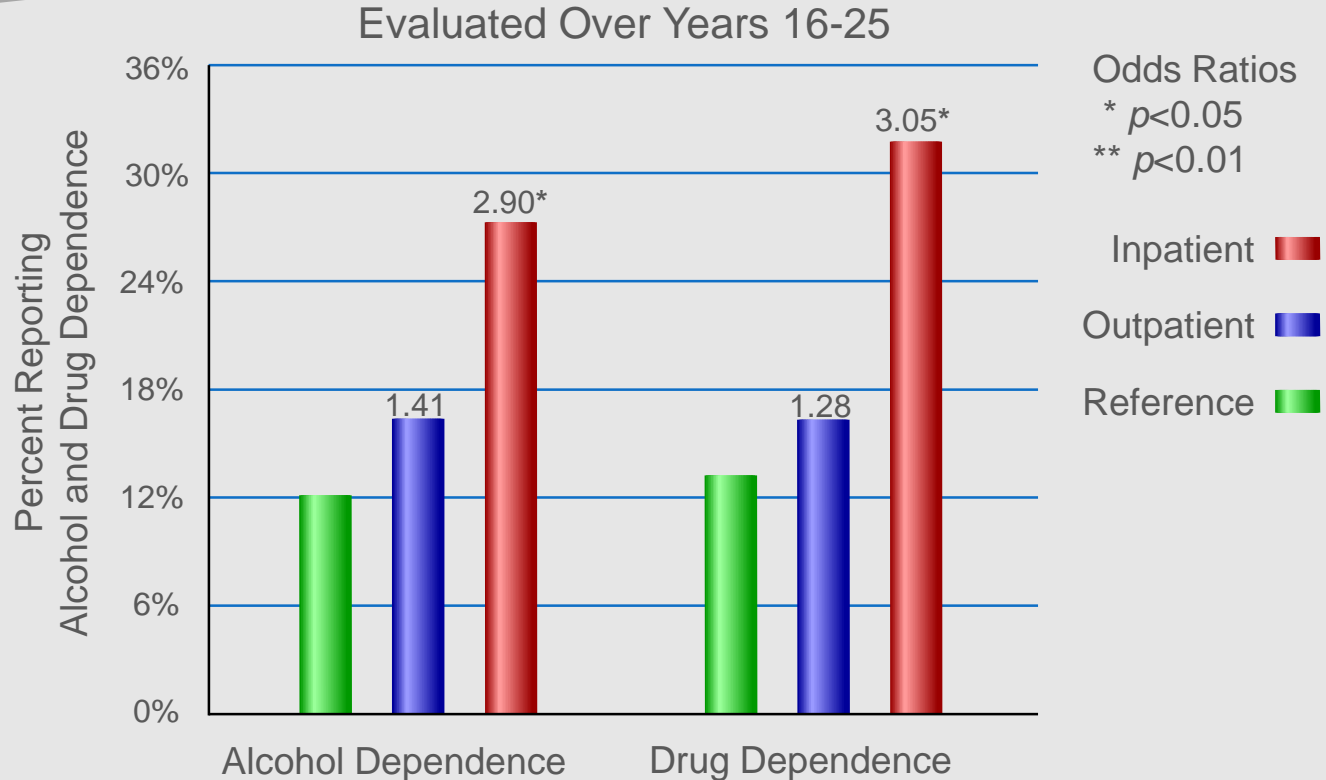


Psychiatric symptoms at ages 14-16 years based on DSM-III-R



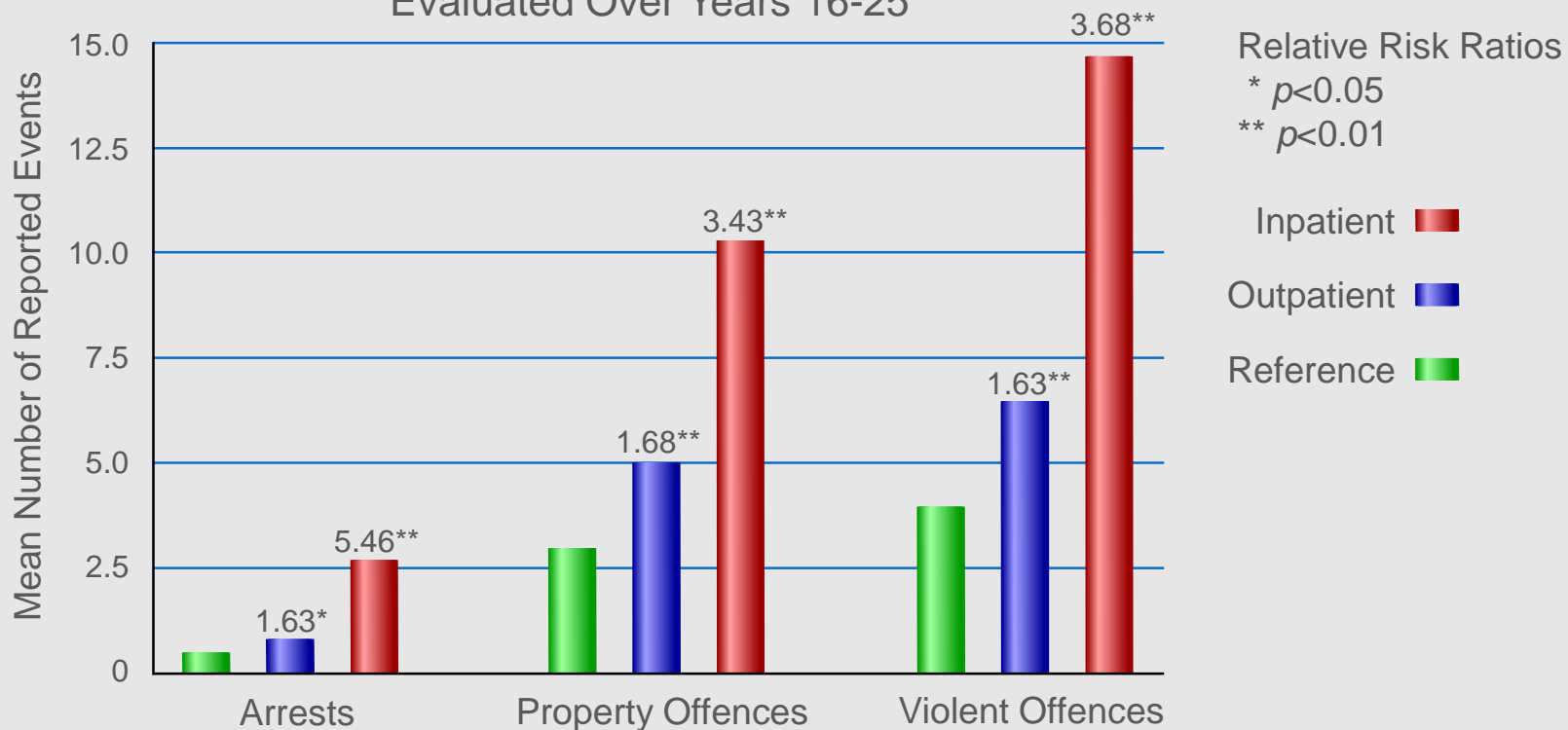


Association between TBI and Reported Alcohol and Drug Dependence



Association between Reported Arrests, and Property and Violent Offences

Evaluated Over Years 16-25



Summary and Conclusions

- Controlled for family factors
- All TBI events were identified
- All injuries occurred prior to first criminal activity
- Still evidence that early TBI is associated with criminal activity

Adult Offending Following Childhood TBI – Another Cohort



Participants

- Participants were recruited via an audit of neurosurgical and A&E files at Christchurch Hospital, New Zealand
- General inclusion
 - Injury event 0-16 years of age
 - Over 18 years of age on admission into the study
 - Minimum of 5 years post-injury

Inclusion Criteria

Other Injury Control (N = 43)	Mild TBI (N = 58)	Moderate /Severe TBI (N = 62)
No history of TBI	Clinical diagnosis of mTBI	Skull fracture or lesion
Fracture during childhood	LOC < 20min	PTA > 1 hour
	PTA < 1 hour	Cerebral haemorrhage
	No evidence of skull fracture	LOC > 20 mins
	No evidence of lesion	Clinical diagnosis of moderate /severe TBI

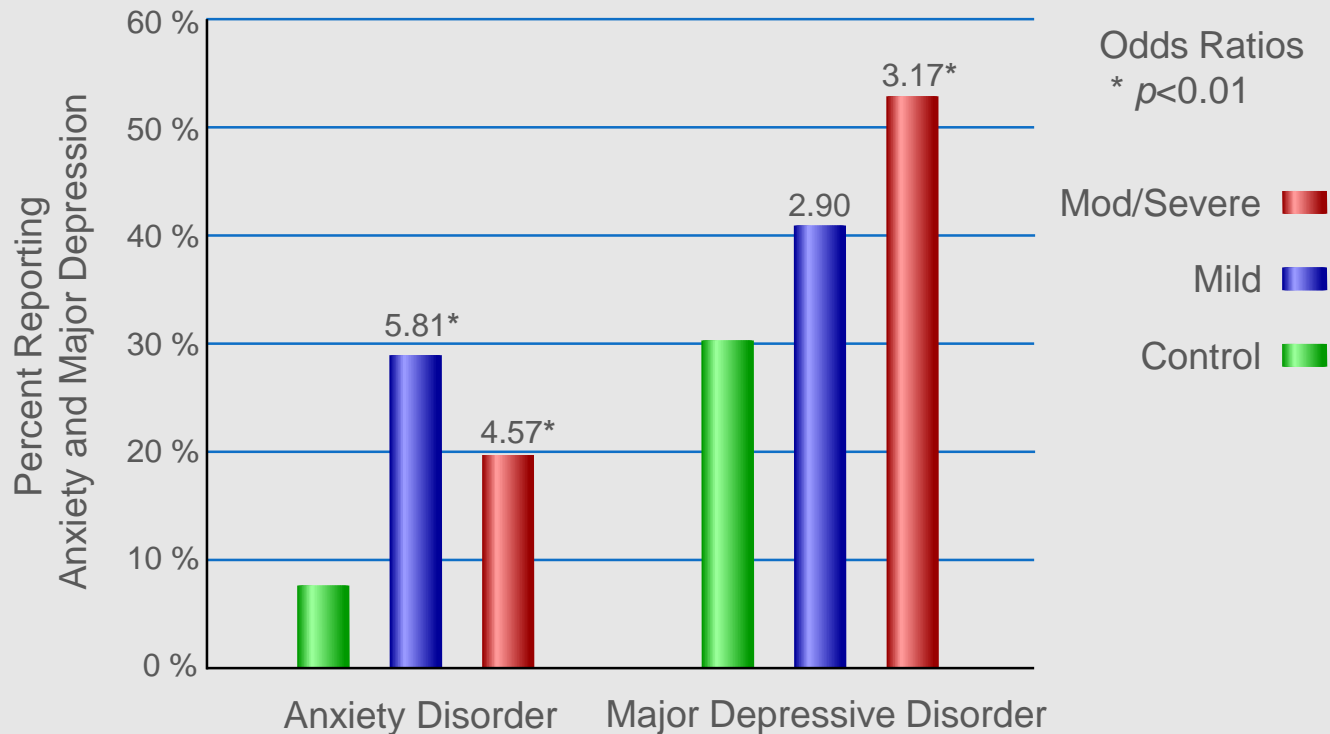
Measures

- Demographic characteristics
 - Current age
 - Sex
 - Age at injury
 - Time since injury
- Offending history

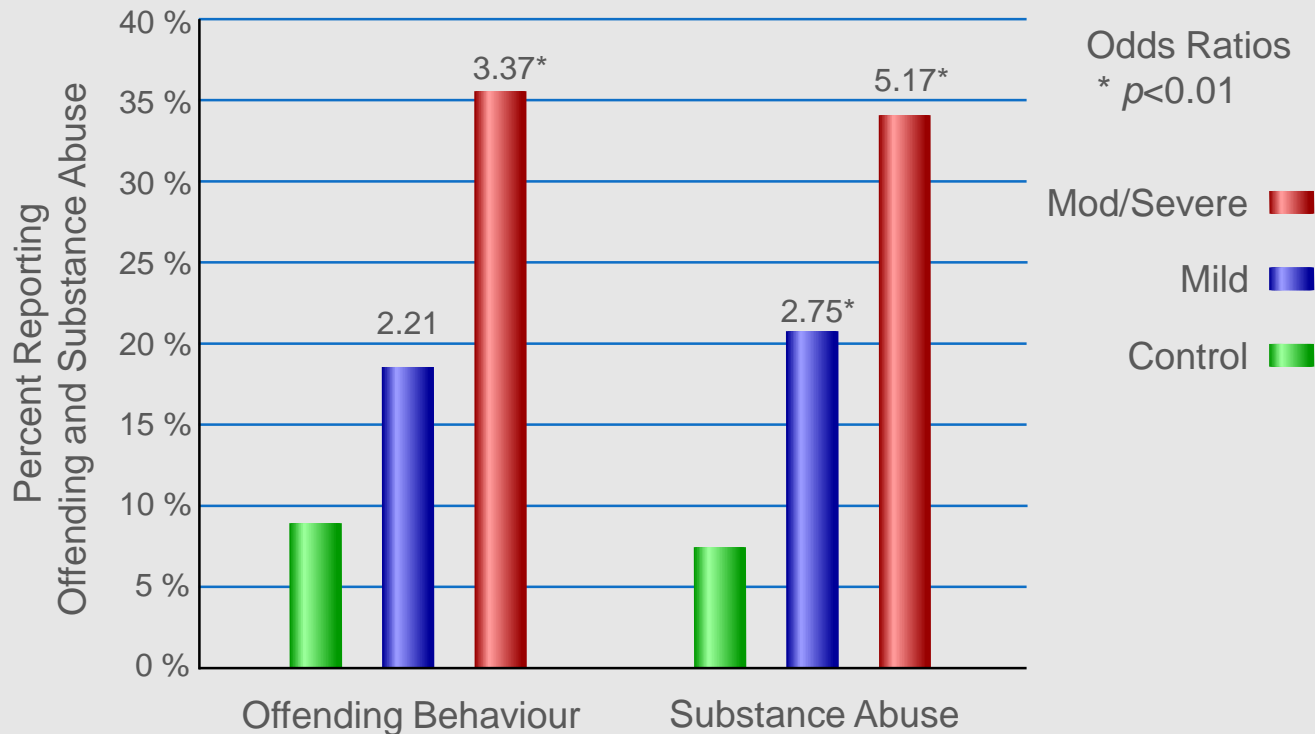
Results – General Characteristics

	Other Injury Control mean (SD)	Mild TBI mean (SD)	Mod/Severe TBI mean (SD)
Estimated IQ (NART)	103.1 (8)	101.4 (9)	99.2 (11)
Age at Injury	10.5 (4)	7.1 (4)* p>.01	10.9 (5)
Age	21.8 (4)	22.3 (3)	23.5 (4)
Sex	23F / 20M	27F / 31M	21F / 41M

Mental Health



Offending / Substance Abuse



Conclusions

- TBI in childhood is associated with psychosocial and offending behaviour
- Young people who experience a more severe injury are at most risk
- Are these negative outcomes inevitable?

Case study

- Jane (15yr) – car surfing,
- GCS 13, LOC 40 min (mild/moderate)
 - Fractured leg
- Assessed acutely (WISC)
 - Recommended evaluate in 2 years
- Expelled from school
 - Aggression
 - Difficulty with Concentration / Attention
- Mental health system
- Stole a car – Court



World Wide Problem

- Recommendations were generated from children's special interest group meetings of the International Brain Injury Association
- Delegates participating in the workshops were representative of nations from around the world
 - Turin, Italy, 2001
 - Stockholm, Sweden, 2003
 - Melbourne, Australia, 2005
 - Lisbon, Portugal, 2008
 - Through meetings of the IPBIS since 2009 - 2015
 - The Netherlands
 - New Zealand
 - Australia
 - UK
 - Finland
 - Germany
 - South Africa
 - USA
 - Canada
 - Sweden
 - Norway
 - Brazil
 - Italy

TBI often Lost in system

- Service provision – often lost in transition from hospital to post acute care (school's often unaware)
- Long term nature of TBI overlooked, total impact might not be apparent until years following injury
- Rehabilitation needs of children are not static. Attention to transition stages

Preschool – Primary school - High school - Work

Steps Forward

- 1. Early and appropriate intervention
- 2. Long-term follow-up / support
- 3. Identify on presentation (with corroborating evidence)
- 4. Training for prison staff
- 5. Interventions tailored
- 6. Health care solutions on release

