NDIS Quality and Safeguards Commission

Evidence review

Health risks, service use, and outcomes in people with disability

December 2025

Research and evaluation

Contents

1.0 Abstract

People with disability are more likely to die earlier and from potentially avoidable causes compared to the general population. We undertook this systematic review to identify health risks that contribute to potentially avoidable deaths. Knowing these risks may make it possible to develop preventative strategies. This systematic review synthesises evidence of health risks, health service use, health outcomes, and causes of death among people with disability.

The review focused specifically on people with traumatic brain injuries (TBI), autism spectrum disorder (ASD), and intellectual disability (ID). We conducted a systematic search of peer-reviewed studies from 2000 to 2023 across multiple databases, identifying 68 studies that reported comparative health data between people with disability and the general population. We looked at different studies that considered differences between those groups and combined the results to work out overall rates and risks.

Findings showed that people with TBI, ASD, and ID experience significantly poorer health outcomes compared to the general population.

There was strong evidence that people with TBI had increased cardiovascular risk, and increased rates of self-harm-related deaths. People with TBI also had higher rates of poor endocrine, gastrointestinal and mental health.

People with ASD were more likely to be at risk of obesity and diabetes compared to the general community. They were also more likely to have poor gastrointestinal, mental and neurological health. People with ASD were also more likely to present to emergency departments (EDs) and to be hospitalised. They were also more at risk of premature deaths and to die by accident, injury or suicide.

People with ID were also more likely to be at risk of obesity and diabetes compared to the general community. People with ID were also more likely to visit EDs and more likely to die from a range of causes compared to the general community. People with ID were also at increased risk of poor health affecting the urinary and respiratory systems.

This review highlights health risks that are more common in people with TBI, ASD and ID. The findings are consistent with earlier reports on higher death rates among people with disability but provides much more detailed information on health risks, health service use, health outcomes and causes of death in this cohort. Therefore, these findings highlight the need for improved preventative healthcare, tailored interventions, and policy responses to address the differences in outcomes faced by people with disability.

2.0 Background

Globally, people with disability (PwD) have been shown to have an increased risk of death at younger ages (Kuper et al., 2024). Two previous reports commissioned by the NDIS Commission provided evidence on causes of deaths of Australian PwD (Australian Institute of Health and Welfare [AIHW], 2020; Salomon & Trollor, 2019). In 2019, the University of New South Wales (UNSW) National Centre of Excellence in Intellectual Disability Health undertook a scoping review on the causes of and contributors to deaths of PwD (Salomon & Trollor, 2019). The scoping review used publicly accessible reports to examine the deaths of 901 people primarily with intellectual disability living in residential care settings in Victoria, QLD and NSW. The most common underlying causes of death were respiratory diseases, nervous system diseases, circulatory diseases and cancer.

A second report by AIHW used linked disability services and mortality data to identify the most prevalent primary causes of death among Australian people receiving specialist disability support services between 2013 and 2018 (AIHW, 2020). The study population included 526,515 individuals and 9,062 deaths. This report identified that people using specialist disability services in Australia had a mortality rate 4.7 times higher than the general population, even when adjusting for differences in age and sex. In this analysis of the primary causes of death, the 4 most common underlying causes of death were perinatal and congenital conditions, spinal muscular atrophy, coronary heart disease, and suicide.

Additional analyses of these data by the NDIS Commission were also undertaken to identify all reported contributing causes and risk factors in the deaths of these 9,062 Australian PwD. This work also identified potentially avoidable contributing causes in people whose deaths had been attributed to their disability. The most common causes were: injuries to multiple body regions; crushing; asphyxiation; poisoning by drugs; aspiration pneumonia; influenza and pneumonia; coronary heart disease; and mental and behavioural disorders due to psychoactive substance use.

While these reports on the deaths of PwD provide information that can inform preventative strategies to reduce death, the lack of evidence on other health outcomes and risk factors associated with disability make it difficult to develop other preventative strategies (Commonwealth of Australia, 2021; Gréaux et al., 2023). Therefore, to identify earlier points in which preventative strategies may be more effective, we undertook this systematic review focusing on the health risks, health service use, health outcomes and causes of death.

This systematic review aggregates data from national and international studies that reported other measures of health risks and outcomes in PwD.

2.1 Objective of this systematic review

The purpose of this review is to consolidate previous research relating to the health risks faced by PwD to inform substantive and positive efforts to reduce these increased risks. We therefore have undertaken a systematic review of the literature from 2000 to 2023 to identify health risks and outcomes including health service use and causes of death in PwD.

2.2 Research questions

This research aimed to answer the following questions:

1. What are the prevalence rates of health outcomes and causes of death for PwD compared to people without disability?
2. What health risk factors are more prevalent in PwD compared to people without disability?
3. What health services are more frequently used by PwD compared to people without disability?

3.0 Methods

3.1 Search strategy

We carried out a systematic search for peer-reviewed academic literature in December 2023 through an OVID search platform of the following research databases: MEDLINE, PsychINFO, ERIC, Social Policy and Practice, and Social Work Abstracts.

We executed searches for all disability groups. However, the focus of this review was on the following disabilities:

- Traumatic brain injury (TBI)
- Autism spectrum disorder (ASD)
- Intellectual disability (ID)

The appendices include the detailed search strategy (section 10.0).

We also checked published systematic and narrative reviews to determine whether any additional studies not found in the database searches were cited.

3.2 Inclusion criteria

3.2.1 Types of study

Studies with at least 1,000 participants reporting health risks, health service use, health outcomes and causes of death in all disability groups were included, provided they were published between January 2000 and December 2023. As data were comparing rates to people who did not have a disability, we only included studies with a control comparator group (comparable community population).

The 1000-participant minimum was to minimise sampling biases while the 20-year reporting frame was to ensure the data was current. There were no limits on language, country or setting.

3.2.2 Participants

This review focused specifically on people with TBI, ASD, and ID. To conduct this review, we only included studies that also reported outcomes for a comparable community population as a control group.

3.2.3 Data sources

All settings were included:

- Community settings: including GP practices, outpatient clinics and schools.
- Disability service settings: including any facility where people reside or spend a large proportion of the day in the care of disability support staff. Examples include group homes, as well as congregate and respite-care settings.
- Linked administrative data: including health, disability, electronic medical records, hospital, or mortality data.

3.3 Data synthesis and analysis

The review findings were organised for analysis by the types of disability (i.e. TBI, ASD, and ID) and types of health related domains (i.e. health risks, health service use, health outcomes and causes of death). Additional subgroups were provided for each of these categories of health outcomes. For example, health outcomes included cardiovascular, endocrine, gastrointestinal, and mental health subgroups; health service use included ED visits and hospitalisations; cause of death included premature death, accident or injury, and suicide subgroups.

Disagreements among the research team regarding data/study inclusion were resolved by consensus. Studies were identified using electronic databases and hand-searched references of published reviews.

Using a random effects model, the study data was then collated and analysed in RevMan 5.4.1 (Cochrane Collaboration). A meta-analysis was conducted to synthesise prevalence rates and risk ratios (RRs) across studies, calculating pooled percentage rates and 95% confidence intervals (95% CI) based on raw and unadjusted data. A pooled RR is a weighted average of the individual RRs from each study, providing an overall estimate of the relative risk across all studies in the analysis. An RR is a measure used to compare the probability of a certain event (such as a health outcome) occurring in one group with the probability of it occurring in another group. An RR of 1 indicates no difference between the two groups, an RR greater than 1 suggests a higher risk in the exposed group, and an RR less than 1 suggests a lower risk. A 95% confidence interval (CI) gives a range of values that is likely to contain the true RR 95% of the time; it reflects the precision of the estimate. A significant effect is one where the 95% CI does not include 1.

The results included in this review list the RRs determined to be reportable, based on the RRs and 95% CI (presented in the effect estimate columns). The indicative risk columns in the results section tables use one arrow to indicate a statistically significant RR of less than 2, and two arrows for a significant RR greater than 2. Only significant findings supported by three or more studies are summarised in the results summary table (Section 7.0) and discussed in the discussion section, as significant findings from fewer studies present limited data.

4.0 Results – traumatic brain injury

There were11 studies across 4 countries(Canada, Sweden, Taiwan and the USA) reporting relevant outcomes for people with TBI. The inclusion criteria typically relied on standardised diagnostic codes from the International Classification of Diseases (ICD) to identify cases of TBI, with one study using self-report measures (Ilie et al., 2015). The reporting of age ranges varied with some studies reporting specific age ranges, while others reported only mean or median age. In those that reported specific age ranges, participants were aged between 2 and 85 years of age. Total participant sample sizes ranged from 1,988 (Ilie et al., 2015) to 2,381,490 participants (Fazel et al., 2014).

4.1 Health risks

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Cardiovascular	6	740104	1.54 [1.31, 1.81]	**Moderate**
Hypertension	4	390109	1.19 [0.94, 1.52]	
Hyperlipidemia	3	341476	1.35 [0.98, 1.87]	
Tobacco smoking	2	8519	3.76 [1.20, 11.78]	**High**
Metabolic	1	6531	1.24 [0.88, 1.76]	
Obesity	1	6531	1.24 [0.88, 1.76]	

There was evidence across 6 studies that cardiovascular risks were 54% higher in people with TBI compared to the general population. The highest risk was for tobacco smoking, which was nearly 4 times higher than the general population across 2 studies.

4.2 Health service use

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Any hospitalisation within 5-year period	1	91218	1.96 [1.76, 2.18]	**Moderate**

People with TBI were nearly twice as likely to be hospitalised compared to the general population in the one study that reported health service use.

4.3 Health outcomes

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Cancer	1	161160	0.99 [0.92, 1.07]	
Cardiovascular	5	1040705	1.90 [1.53, 2.37]	Moderate
Atrial fibrillation	1	92796	1.49 [1.17, 1.90]	Moderate
Cardiovascular	3	216324	2.11 [0.92, 4.80]	
Cerebrovascular	1	161160	2.25 [2.14, 2.37]	High
Congestive heart failure	2	180316	1.83 [1.21, 2.75]	Moderate
Coronary artery	2	180316	1.78 [0.89, 3.59]	
Myocardial dysfunction	1	161160	1.48 [1.36, 1.61]	Moderate
Stroke	1	48633	2.41 [2.15, 2.70]	High
Endocrine	5	398640	1.49 [1.24, 1.78]	Moderate
Diabetes	5	398640	1.49 [1.24, 1.78]	Moderate
Gastrointestinal	3	460473	1.27 [1.16, 1.40]	Moderate
Chronic liver	2	211793	1.16 [1.01, 1.34]	Moderate
Liver cirrhosis	1	87520	1.45 [1.42, 1.49]	Moderate
Peptic ulcer	1	161160	1.32 [1.29, 1.36]	Moderate
Mental	7	8169946	2.18 [1.75, 2.72]	High
Anxiety	1	157995	1.49 [1.27, 1.74]	Moderate
Depression	4	2718223	1.80 [1.47, 2.20]	Moderate
Suicide attempts	2	245515	3.03 [1.31, 7.03]	High
Substance abuse	3	2390009	2.60 [1.79, 3.77]	High
Alcohol abuse	1	2381490	4.01 [3.90, 4.13]	High
Schizophrenia	1	20970	1.83 [1.21, 2.77]	Moderate
Bipolar disorder	2	249213	2.58 [1.96, 3.38]	High
Psychiatric disorder	1	6531	0.91 [0.64, 1.31]	
Musculoskeletal	1	161160	1.27 [1.17, 1.37]	Moderate
Rheumatologic	1	161160	1.27 [1.17, 1.37]	Moderate
Neurological	2	284919	4.48 [2.25, 8.90]	High
Neurological	1	6531	4.54 [3.21, 6.42]	High
Stroke – 3-month follow-up	1	92796	9.78 [8.38, 11.42]	High
Stroke – 1-yr follow-up	1	92796	4.34 [3.94, 4.78]	High

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Stroke – 5-yr follow-up	1	92796	2.10 [1.99, 2.23]	High
Urinary	2	209793	1.08 [0.76, 1.52]	
Chronic kidney	2	209793	1.08 [0.76, 1.52]	
Respiratory	3	216324	1.25 [0.99, 1.59]	
Respiratory	2	167691	1.52 [0.92, 2.51]	
COPD	1	48633	0.94 [0.88, 1.01]	
Other	1	6531	5.86 [4.22, 8.13]	High
Bleeding disorder	1	6531	5.86 [4.22, 8.13]	High

There was evidence from 5 studies that people with TBI were 90% more likely to experience poor cardiovascular health outcomes, specifically due to atrial fibrillation (+49%, one study), cerebrovascular health issues (+125%, one study), congestive heart failure (+83%, 2 studies), myocardial dysfunction (+48%, one study), and stroke (+141%, one study).

Other health outcomes found were endocrine issues (+49%, 5 studies), specifically diabetes (+49%, 5 studies), gastrointestinal issues (+27%, 3 studies), specifically, chronic liver issues (+16%, 2 studies), liver cirrhosis (+45%, one study) and peptic ulcers (+32%, one study).

Mental health outcomes were increased by 118% across 7 studies. This included depression (+80%, 4 studies) and substance abuse (+160%, 3 studies).

One study reported a 27% increased health risk of rheumatologic musculoskeletal issues, while 2 studies reported a 348% increased risk of neurological health issues, with one study reporting an 878% increase in stroke at 3-month follow-up, 334% risk at one-year follow-up, and 110% risk at 5-year follow-up.

One study also reported that people with TBI had a 354% increased risk of other neurological issues. Those with TBI also had an increased risk of other health issues like bleeding disorders (+486%, one study).

4.4 Cause of death

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Premature mortality	2	57164	2.77 [2.34, 3.29]	**High**
Accident or injury	3	2462437	1.86 [0.40, 8.64]	
Accidental injury exposure or poisoning	3	2449375	3.11 [0.38, 25.36]	
Assault	1	6531	1.35 [0.94, 1.95]	
Motor vehicle accidents	1	6531	0.52 [0.26, 1.02]	
Cancer	2	67885	1.81 [0.91, 3.61]	
Cardiovascular	1	67448	1.10 [1.01, 1.20]	**Moderate**
Heart failure	1	67448	1.10 [1.01, 1.20]	**Moderate**
Infection	1	6531	0.52 [0.26, 1.02]	
Endocrine	1	6531	0.98 [0.59, 1.63]	
Diabetes	1	6531	0.98 [0.59, 1.63]	
Renal or urinary	1	6531	0.61 [0.37, 1.00]	
Self-harm	3	2455469	2.82 [1.07, 7.48]	**High**
Intentional self-harm	2	73979	2.20 [0.17, 27.80]	
Suicide	1	2381490	2.11 [1.86, 2.39]	**High**

Evidence of the causes of death was limited, with most data coming from only one or 2 studies. Two studies found an increased risk of death due to premature mortality (+177%), one study reported an increased risk of death due to cardiovascular disease, specifically heart failure (+10%), and 3 studies reported an increased risk of death due to self-harm (+182%), including suicide (+111%, one study).

5.0 Results – Autism spectrum disorder

A total of 32 studies across 7 countries (Canada, Denmark, Finland, Sweden, Taiwan, the UK, and the USA) reporting relevant outcomes for people with ASD met the inclusion criteria for this review. The inclusion criteria for ASD reported in these studies included medical records reporting ASD diagnosis, being diagnosed using ICD codes, or parents reporting that a medical practitioner had reported their child with ASD.

Age ranges were not consistently reported across studies; some provided specific age ranges, while others only reported mean or median ages. Among the studies that did specify age ranges, the included populations varied widely, from infancy to 85 years. Total participant sample sizes ranged from 1,552 (Levy et al., 2019) to 39,524,849 (Guan & Li, 2017).

5.1 Health risks

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Cardiovascular	4	2731601	0.99 [0.26, 3.82]	
Hypertension	4	2731601	0.99 [0.26, 3.82]	
Metabolic	9	5873504	2.02 [1.75, 2.34]	**High**
Obesity	9	5550322	2.13 [1.78, 2.55]	**High**
Hyperlipidemia	2	323182	1.61 [1.06, 2.44]	**Moderate**

Evidence from 9 studies found that people with ASD were more than twice as likely to have metabolic health issues, including obesity (+113%, 9 studies) and hyperlipidemia (+61%, 2 studies).

5.2 Health service use

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
ED visit	4	52643413	1.61 [1.23, 2.12]	**Moderate**
Upper respiratory infection	1	55121	1.08 [0.95, 1.22]	
Viral infection	1	5521	0.92 [0.80, 1.06]	
Otitis media	1	55121	1.15 [0.99, 1.33]	
Vomiting	1	55121	0.99 [0.80, 1.24]	
Asthma	1	55121	0.75 [0.57, 0.97]	
Pneumonia	1	55121	0.97 [0.75, 1.26]	
Any ED visits (non-psychiatric)	2	478595	1.02 [0.94, 1.12]	
Falls	1	6412547	1.06 [1.04, 1.09]	**Moderate**

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Poisoning	1	6412547	2.71 [2.54, 2.90]	High
Burns	1	6412547	1.22 [1.05, 1.43]	Moderate
Self-inflicted injury	1	6412547	2.40 [2.16, 2.66]	High
Psychosis	1	6412547	59.91 [47.86, 74.98]	High
Psychiatric ED	2	478595	3.90 [2.75, 5.53]	High
Motor vehicle accident	1	6412547	0.68 [0.63, 0.73]	
Struck	1	6412547	0.64 [0.62, 0.67]	
Suffocation	1	6412547	5.02 [3.98, 6.32]	High
Non-infectious gastroenteritis	1	55121	0.73 [0.53, 1.00]	
Hospitalisation	4	13929003	3.45 [1.30, 9.16]	High
Specialist visit (any)	1	80237	1.41 [1.37, 1.46]	Moderate
Inpatient hospitalisation	1	6412547	11.95 [11.40, 12.52]	High
Any hospitalisation	1	398358	1.81 [1.63, 2.01]	Moderate
Psychiatric hospitalisation	3	7037861	3.81 [1.00, 14.49]	
Mean ED costs	1	8061	40997.00 [38883.80, 43110.20]	High
Mean LOS hospital	1	7092	2.00 [1.12, 2.88]	High
Outpatient visits	2	87329	5.11 [1.46, 17.90]	High
Psychiatry outpatient visit	1	80237	2.83 [2.69, 2.98]	High
All outpatient visits	1	7092	10.21 [5.05, 20.62]	High
Specialist visits	2	2821074	2.11 [1.40, 3.21]	High
Paediatrician visit	1	398358	3.68 [3.34, 4.05]	High
Psychiatrist visit	1	398358	9.30 [8.81, 9.83]	High
Neurologist visit	1	398358	5.71 [5.09, 6.41]	High
Respirologist	1	398358	1.40 [0.84, 2.33]	
Gastroenterologist	1	398358	1.48 [1.14, 1.91]	Moderate
Surgical visit	1	398358	0.78 [0.72, 0.84]	
General Practitioner	2	430926	1.09 [0.91, 1.29]	

Across 4 studies, people with ASD were found to have a 61% increase in ED visits, specifically related to falls (+6%, one study), poisoning (+171%, one study), burns (+22%, one study), self-inflicted injury (+140%, one study), psychosis (+5891%, one study), psychiatric ED related visits (+290%, 2 studies), and suffocation (+402%, one study).

They were also over 3 times more likely to be hospitalised (4 studies) due to specialist visits (+41%, one study), inpatient hospitalisation (+1095%, one study), or any other type of hospitalisation (+81%, one study) compared to the general population.

Outpatient visits were also significantly increased (+411%, 2 studies).

Similarly, specialist visits were also increased (+111%, 2 studies) in people with ID.

5.3 Health outcomes

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Accident or injury	1	71476	0.88 [0.78, 1.00]	
Motor vehicle crashes	1	71476	0.88 [0.78, 1.00]	
Cancer	1	7092	0.42 [0.27, 0.67]	
Cardiovascular	2	8644	1.53 [0.42, 5.65]	
Cerebrovascular	1	7092	0.82 [0.72, 0.94]	
Cardiac	1	1552	3.13 [1.56, 6.28]	**High**
Endocrine	8	4740828	2.38 [1.76, 3.22]	**High**
Diabetes	8	4703126	2.21 [1.54, 3.18]	**High**
Thyroid	1	7092	2.33 [1.85, 2.92]	**High**
Gastrointestinal	3	3703374	1.20 [1.12, 1.29]	**Moderate**
Gastrointestinal disorder	2	8644	1.24 [1.04, 1.49]	**Moderate**
Bowel disorder	1	1847365	1.20 [1.09, 1.31]	**Moderate**
IBD	1	1847365	1.01 [0.61, 1.68]	
Infection	2	25914	1.38 [1.20, 1.58]	**Moderate**
Middle ear infections (grommet insertion)	1	11730	1.66 [1.21, 2.27]	**Moderate**
Infection	1	7092	1.24 [1.11, 1.38]	**Moderate**
Skin	1	7092	1.44 [1.29, 1.60]	**Moderate**
Mental	11	15108762	2.33 [1.77, 3.10]	**High**
Alcohol dependence	2	27955	0.22 [0.06, 0.79]	
OCD	1	32568	9.89 [7.39, 13.20]	**High**
Suicidality	1	6378	5.38 [4.31, 6.72]	**High**
Schizophrenia or other psychotic	4	3799929	4.36 [1.60, 11.90]	**High**
Anxiety	4	143042	2.71 [2.29, 3.20]	**High**

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Bipolar disorder	2	70771	2.94 [0.37, 23.42]	
Depression	5	2071004	1.80 [0.84, 3.81]	
Drug dependence	2	1912904	2.46 [2.24, 2.71]	High
Suicide attempts	1	6559266	1.72 [1.59, 1.87]	Moderate
Self-harm	2	431561	3.78 [2.18, 6.53]	High
Personality	1	7092	1.26 [0.89, 1.78]	
Substance-related disorder	1	23146	1.19 [1.00, 1.42]	
Non-affective psychosis	1	23146	6.35 [5.32, 7.57]	High
Musculoskeletal	1	7092	0.75 [0.65, 0.86]	
Musculoskeletal	1	7092	0.75 [0.65, 0.86]	
Neurological	7	3929111	6.73 [4.17, 10.89]	High
Epilepsy	7	3929111	6.73 [4.17, 10.89]	High
Oral health	2	83498	2.08 [1.66, 2.61]	High
Jaw and teeth disorders	2	45295	2.40 [1.12, 5.15]	High
Gingivitis	1	38203	1.74 [1.65, 1.84]	Moderate
Respiratory	5	560002	1.16 [0.95, 1.42]	
Asthma	4	552910	1.31 [1.12, 1.52]	Moderate
Respiratory	1	7092	0.79 [0.70, 0.89]	
Other	1	7092	4.69 [3.98, 5.53]	High
Hearing impairments	1	7092	4.69 [3.98, 5.53]	High
Chronic kidney disease	1	6542899	0.58 [0.47, 0.72]	

Compared to the general population, health outcomes were significantly worse among people with ASD, with data across multiple studies finding poor outcomes in various areas: endocrine issues (+138%, 8 studies), including diabetes (+121%, 8 studies) and thyroid issues (+133%, one study); gastrointestinal issues (+20%, 3 studies) including gastrointestinal disorders (+24%, 2 studies) and bowel disorders (+20%, one study); infections (+38%, 2 studies) including middle ear infections (+66%, one study), any infection (+24%, 1 study) and skin infections (+44%, 1 study); mental health issues (+133%, 11 studies) including OCD (+889%, 1 study), suicidality (+438%, 1 study), schizophrenia and other psychotic issues (+336%, 4 studies), anxiety (+171%, 4 studies), drug dependence (+146%, 2 studies), suicide attempts (+72%, 1 study), self-harm (278%, 2 studies), and non-affective psychosis (+535%, 1 study); neurological issues (+573%, 7 studies), specifically epilepsy (+573%, 7 studies); oral health (+108%, 2 studies) including jaw and teeth disorders (+140%, 2 studies), and gingivitis (+174%, 1 study); and other health outcomes (+369%, 1 study), specifically, hearing impairments (+369%, one study).

5.4 Cause of death

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Premature Mortality	3	2859491	2.22 [1.30, 3.79]	**High**
Accident or injury	3	160821849	6.22 [1.47, 26.43]	**High**
Accidental injury exposure or poisoning	1	23146	1.76 [0.92, 3.39]	
Asphyxiation	1	39524849	13.49 [10.88, 16.74]	**High**
Drowning	1	39524849	40.00 [32.04, 49.93]	**High**
Suffocation	1	39524849	31.92 [26.14, 38.97]	**High**
External causes	1	2699307	1.74 [1.21, 2.50]	**Moderate**
Other injuries	1	39524849	1.05 [0.90, 1.23]	
Cancer	1	2699307	1.93 [1.56, 2.38]	**Moderate**
Cardiovascular	1	2699307	1.75 [1.50, 2.05]	**Moderate**
Circulatory	1	2699307	1.75 [1.50, 2.05]	**Moderate**
Endocrine	1	2699307	3.95 [2.50, 6.25]	**High**
Endocrine	1	2699307	3.95 [2.50, 6.25]	**High**
Gastrointestinal	1	2699307	3.63 [2.47, 5.33]	**High**
Infection	1	2699307	2.01 [0.83, 4.87]	
Infectious or parasitic	1	2699307	2.01 [0.83, 4.87]	
Mental	1	2699307	3.20 [2.22, 4.60]	**High**
Mental or behavioural	1	2699307	3.20 [2.22, 4.60]	**High**
Neurological	1	2699307	8.29 [6.40, 10.74]	**High**
Urinary	1	2699307	4.67 [2.62, 8.34]	**High**
Genitourinary system	1	2699307	4.67 [2.62, 8.34]	**High**
Respiratory	1	2699307	3.28 [2.44, 4.42]	**High**
Respiratory	1	2699307	3.28 [2.44, 4.42]	**High**
Suicide	3	9281719	3.10 [1.05, 9.10]	**High**

Across causes of death, 3 studies reported that people with ASD had a 122% increased risk of dying prematurely, and a 522% (3 studies) reported increased risk of dying due to accident or injury either due to asphyxiation (+1249%, one study), drowning (+3900%, one study), suffocation (+3092%, one study) or external causes (+74%, one study).

There was also an increased risk of death due to cancer (+93%, one study), cardiovascular issues (+75%, one study), specifically circulatory issues (+93%, one study), endocrine issues (+295%, one

study), gastrointestinal issues (+263%, one study), mental health issues (+220%, one study), specifically mental or behavioural issues (+220%, one study), neurological issues (+729%, one study), urinary issues (+367%, one study) specifically genitourinary system issues (+367%, one study), respiratory issues (+328%, one study).

Additionally, 3 studies indicated suicide to be 210% more prevalent among people with ASD than the general population.

6.0 Results – intellectual disability

There were 30 studies across 9 countries (Netherlands, UK, Canada, USA, Australia, Sweden, Poland, Spain, Scotland) reporting health outcomes for people with ID that were included in this review.

The inclusion criteria for ID reported in these studies included medical records reporting an ID diagnosis, being diagnosed using ICD codes, or parents reporting that a medical practitioner had diagnosed their child with ID.

As with the other disabilities reported above, age ranges were not consistently reported across studies, with ages ranging from infant to over the age of 85 years. Total participant sample sizes ranged from 1,136 (Wyszyńska et al., 2017) to 32,760,741 (Landes et al., 2019).

6.1 Health risks

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Cardiovascular	10	4551018	0.72 [0.47, 1.12]	
Hyperlipidemia	1	7539	0.61 [0.52, 0.71]	
Hypertension	5	4543479	0.75 [0.44, 1.28]	
Metabolic	9	4410200	1.74 [1.41, 2.16]	Moderate
Obesity	9	4410200	1.74 [1.41, 2.16]	Moderate

Across the 9 studies, there was a 74% increased risk of metabolic issues among a population of people with ID, specifically obesity.

6.2 Health service use

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
ED visits	4	73096014	2.22 [1.86, 2.66]	High
Any ED visits	2	4706860	2.46 [2.20, 2.75]	High
Burns	1	6402313	1.46 [1.12, 1.90]	Moderate
Falls	1	6402313	0.77 [0.72, 0.82]	
Motor vehicle accident	1	6402313	0.57 [0.49, 0.66]	
Poisoning	1	6402313	2.34 [2.04, 2.67]	High
Self-inflicted injury	1	6402313	4.10 [3.54, 4.76]	High
Six-year all-cause ED visit	1	1991164	1.19 [1.18, 1.20]	Moderate
Struck	1	6402313	0.40 [0.36, 0.44]	

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Suffocation	1	6402313	8.99 [6.51, 12.39]	High
Thirty-day repeat ED visit	2	4818318	1.66 [1.63, 1.70]	Moderate
Abdominal pain	1	2827154	2.67 [2.55, 2.80]	High
Chest pain	1	2827154	1.90 [1.80, 2.01]	Moderate
Urinary Tract Infection (UTIs)	1	2827154	2.78 [2.63, 2.93]	High
Hospitalisation	2	12375805	5.57 [1.09, 28.47]	High
Any inpatient hospitalisation	1	6402313	38.54 [36.97, 40.16]	High
Delayed discharge	1	1991164	6.76 [6.36, 7.17]	High
Six-year all cause hospital admission	1	1991164	1.41 [1.39, 1.44]	Moderate
Thirty-day readmission (all causes)	1	1991164	2.63 [2.50, 2.76]	High
Medication-related hospitalisation	1	11987788	2.29 [2.13, 2.45]	High
Psychotropic medication adverse events	1	5993894	2.34 [2.10, 2.59]	High
Physical medication adverse events	1	5993894	2.25 [2.05, 2.47]	High

Four studies indicated that people with ID were more than twice as likely to visit the emergency department compared to the general population. These visits were due to: any ED visits (+146%, 2 studies), burns (+46%, one study), poisoning (+134%, one study), self-inflicted injury (+310%, one study), 6-year all-cause ED visit (+19%, one study), suffocation (+799%, one study), 30-day repeat ED visit (+66%, 2 studies), abdominal pain (+167%, one study), chest pain (+90%, one study), and UTIs (+178%, one study).

Across 2 studies, people with ID were found have a 457% increased risk of hospitalisation service use, specifically due to: inpatient hospitalisation (3754%, one study), delayed discharge (576%, one study), 6-year all cause hospital admission (41%, one study), and 30-day readmission (all causes) (163%, one study).

One study also found that medication-related hospitalisation was increased by 129% among people with ID compared to the general population, specifically due to psychotropic medication adverse events (+134%, one study) and physical medication adverse events (+125%, one study).

6.3 Health outcomes

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Cancer	2	1070720	0.75 [0.42, 1.33]	
Cardiovascular	3	4177218	1.50 [0.80, 2.80]	
Cerebrovascular	1	1333	1.30 [0.81, 2.09]	
Coronary heart	1	765393	0.76 [0.52, 1.12]	
Heart failure	2	2645099	2.87 [2.85, 2.88]	High
Stroke	1	765393	0.92 [0.54, 1.57]	
Endocrine	9	9572846	1.56 [1.36, 1.79]	Moderate
Diabetes	8	8799929	1.52 [1.30, 1.77]	Moderate
Hypothyroidism	1	765393	1.87 [1.37, 2.55]	Moderate
Thyroid	1	7524	1.75 [1.44, 2.13]	Moderate
Gastrointestinal	3	12437	2.20 [0.86, 5.63]	
Constipation	1	7558	3.53 [2.93, 4.25]	High
Other GI	2	3277	1.05 [0.87, 1.28]	
Liver	1	1602	6.71 [0.88, 50.88]	
Mental	2	853029	5.63 [3.79, 8.37]	High
Anxiety	1	43818	5.73 [5.01, 6.54]	High
Depression	1	43818	3.76 [3.09, 4.58]	High
Psychosis	1	765393	8.46 [6.55, 10.91]	High
Musculoskeletal	1	7477	1.12 [0.83, 1.51]	
Osteoporosis	1	7477	1.12 [0.83, 1.51]	
Neurological	2	1532321	2.73 [0.04, 185.46]	
Dementia	1	765393	0.50 [0.13, 2.01]	
Epilepsy	1	765393	34.35 [30.49, 38.70]	High
Migraine/headache	1	1535	1.11 [0.82, 1.49]	
Urinary	3	7320110	2.51 [1.05, 6.04]	High
Chronic kidney	2	7312546	1.73 [1.26, 2.38]	Moderate
Urinary incontinence	1	7564	5.99 [4.88, 7.35]	High
Respiratory	5	3527657	1.66 [1.29, 2.13]	Moderate
Asthma	4	882558	1.71 [1.55, 1.88]	Moderate
COPD	2	2645099	1.22 [0.29, 5.05]	

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Other	1	1619	1.66 [0.92, 2.99]	
Eczema	1	1619	1.66 [0.92, 2.99]	

Across the 9 studies, people with ID were found to have a 56% increased risk of having endocrine issues, specifically, diabetes (+52%, 8 studies), hypothyroidism (+87%, 1 study) and thyroid issues (+75%, 1 study).

Additionally, 2 studies found that people with ID had a 463% increased risk of mental health outcomes, including anxiety (+473%, one study), depression (+276%, one study), and psychosis (+746%, one study) compared to the general population.

They also had a 151% (across 3 studies) increased risk of having urinary issues, including chronic kidney issues (+73%, 2 studies), and urinary incontinence (+499%, one study) and a 66% (across 5 studies) increased risk of respiratory issues, including asthma (+71%, 4 studies).

6.4 Cause of death

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Premature mortality	1	1991164	4.26 [4.07, 4.46]	▲▲
Accident or injury	7	44443817	1.33 [0.35, 5.07]	
Accidental injury exposure or poisoning	3	348733	1.58 [0.36, 6.93]	
Aspiration of solids or liquids	1	32760741	12.30 [11.79, 12.83]	▲▲
External causes	5	11334343	0.71 [0.41, 1.24]	
Cancer	7	44353233	0.60 [0.43, 0.83]	
Circulatory	8	77501031	1.15 [0.90, 1.47]	
Cerebrovascular	2	32889736	1.19 [0.31, 4.63]	
Circulatory	7	11721559	1.23 [0.83, 1.81]	
Ischaemic heart	2	32889736	0.96 [0.42, 2.22]	
Gastrointestinal	6	11639742	1.66 [1.07, 2.58]	▲
Endocrine	6	44271416	1.54 [1.07, 2.21]	▲
Infection	5	43966089	2.12 [1.23, 3.66]	▲▲
Infectious or parasitic	5	43966089	2.12 [1.23, 3.66]	▲▲
Urinary	7	44400483	2.37 [1.52, 3.70]	▲▲
Mental	5	11510675	2.03 [1.08, 3.80]	▲▲

Outcome of Subgroup	Studies	Participants	Effect Estimate	Indicative Risk
Musculoskeletal	3	45420	1.27 [0.84, 1.92]	
Neurological	7	44511527	3.56 [1.44, 8.77]	▲▲
Nervous system	6	11624283	5.05 [2.50, 10.23]	▲▲
Dementia	2	3288724	1.12 [0.37, 3.39]	
Respiratory	8	44611223	2.82 [1.42, 5.58]	▲▲
Respiratory	8	44482228	2.54 [1.25, 5.14]	▲▲
Bronchopneumonia	1	128995	6.47 [5.01, 8.37]	▲▲
Other	6	44218843	6.94 [2.99,16.18]	▲▲
Blood or immune system	2	36947	1.49 [0.87, 2.54]	
Skin and subcutaneous	2	43406	2.37 [0.18, 30.69]	
Symptoms signs and abnormal findings	2	43334	1.22 [0.75, 1.98]	
Unknown or unspecified	1	32760741	3.56 [3.36, 3.78]	▲▲

Compared to the general population, multiple studies reported issues with ID leading to death, including, gastrointestinal system issues (+66%, 6 studies), endocrine issues (+54%, 6 studies), infection (+112%, 5 studies), urinary issues (+137%, 7 studies), mental health issues (+103%, 5 studies), neurological issues (+256%, 7 studies) including nervous system issues (+405%, 6 studies), respiratory issues (+182%, 8 studies) including bronchopneumonia (+547%, one study), and 6 studies reporting other issues (+594%).

7.0 Summary

	Traumatic Brain Injury		Autism Spectrum Disorders		Intellectual Disability	
Health risks	Cardiovascular	1.54	Metabolic	2.02	Metabolic	1.74
Health service use			ED visits	1.61	ED visits	2.22
			Hospitalisation	3.45		
Health outcomes	Cardiovascular	1.90	Endocrine	2.38	Endocrine	1.56
	Endocrine	1.49	Gastrointestinal	1.20	Urinary	2.51
	Gastrointestinal	1.27	Mental	2.33	Respiratory	1.66
	Mental	2.18	Neurological	6.73		
Cause of death	Self-harm	2.82	Premature mortality	2.22	Gastrointestinal	1.66
			Accident or injury	6.22	Endocrine	1.54
			Suicide	3.10	Infection	2.12
					Urinary	2.37
					Mental	2.03
					Neurological	3.56
					Respiratory	2.82

This table shows the health risks, health outcomes, health service use and causes of death where there was a significantly increased risk among PwD across 3 or more studies. The pooled RR is shown for each of these outcomes by each of the disabilities – TBI, ASD and ID.

8.0 Discussion

8.1. Summary of findings and comparisons with other reviews

This review used a systematic review and meta-analysis approach to provide pooled estimates of health risks, health service use, health outcomes, and causes of death for people with TBI, ASD, and ID. The following sections summarise those major health conditions for which there was strong evidence of an increased risk in people with TBI, ASD and ID. It is important to note that there may be other risks to the health of people with these disabilities but, due to a lack of data, these may not yet be identified as an increased risk.

8.1.1. Increased risk in people with traumatic brain injury (TBI)

In this review, people with TBI have been shown to have multiple co-morbidities, including cardiovascular, endocrine, gastrointestinal, and mental health outcomes. Self-harm was also a major cause of death in people with TBI. In addition, we found that cardiovascular risk factors were increased in people with TBI.

The finding of high rates of cardiovascular risk may be partly explained by the systematic review and meta-analysis by Turner et al. (2021) which showed that TBI is an independent risk factor for stroke, regardless of TBI severity or type.

8.1.2. Autism spectrum disorders (ASD)

We found that metabolic risk (i.e. obesity) was doubled in people with ASD. A significantly higher prevalence of obesity was also observed in many of the studies identified in a systematic review and meta-analysis investigating the relationship between ASD and obesity (Zheng et al., 2017).

Health service use including overall ED visits and hospitalisations was increased in people with ASD. A systematic review by Gilmore et al. (2022) found that most studies reported adults with ASD were more likely to visit the ED and be hospitalised, as well as to be more likely to attend outpatient mental health, preventive services, and primary care.

There was considerable evidence of poor health outcomes in people with ASD. There was particularly strong evidence across multiple studies that certain disorders were markedly increased in people with ASD. These were: endocrine disorders (i.e. diabetes); gastrointestinal disorders; mental disorders (i.e. schizophrenia or other psychotic disorders, and anxiety); and neurological disorders (i.e. epilepsy). Epilepsy is a common co-morbidity of ASD (Besag 2017; Lee et al., 2015). There is also evidence of a high comorbidity between ASD and psychosis (Ribolsi et al., 2022).

There was strong evidence to show that people with ASD were more likely to die prematurely compared to the general population and had much higher rates of deaths due to accidents, injury and suicide. These causes of death were similar to the Forsyth et al. (2023) systematic review, which found the most common causes of death in people with ASD were external causes, which included suicides, accidents, asphyxiation, and drowning.

8.1.3. Intellectual disability

There was very strong evidence that people with ID had higher rates of metabolic risk of obesity and ED visits compared to the general population.

There was also strong evidence that a range of causes of death of people were more likely in people with ID compared to the general population. These included gastrointestinal, endocrine, infection, urinary, mental, neurological and respiratory causes. A systematic review and meta-analysis also found that respiratory-associated deaths were markedly higher in people with ID (Truesdale et al., 2020).

8.2. Implications for disability and health practice and policy

Most studies identified in this review reported negative health outcomes, and a higher rate of deaths and health service use. Therefore, there is a great deal of strong evidence to show that, people with TBI, ASD and ID are susceptible to physical and mental health complications which present a risk of avoidable deaths. Several studies suggested strategies to mitigate health risks and prevent deaths. These included early detection, risk education for parents and health professionals, and tailored treatments. The findings of this review further emphasise the need for better prevention and tailored management of health conditions to reduce these risks in PwD.

Optimal disease management cannot be achieved without early detection. The under-identification implied by this review suggests inadequate inclusion of PwD in screening and preventative health programs and highlights the urgent need for this to be improved. For instance, evidence-based screening and/or assessment tools such as the Comprehensive Health Assessment Program (Australian Government, 2023).

The findings of this review can provide guideposts to help address poorer health outcomes in PwD. While the findings are consistent with earlier reports on higher death rates among people with disability, they provide much more detailed information on health risks, health service use, health outcomes and causes of death in people with TBI, ASD and ID. Therefore, these analyses can inform more rigorous, relevant recommendations around policy and practice.

The review highlights the need for continued research and interventions targeting health inequalities for PwD. Addressing these gaps, standardising research methods, and focusing on preventative and inclusive healthcare can all help in reducing risks for this population. Ultimately, the findings from this review reinforce the importance of a coordinated, evidence-driven approach to improving health outcomes and ensuring equitable access to care for all PwD. Such efforts will enhance the quality of life of PwD.

8.3. Limitations and future considerations

There was a very high degree of variability between reviewed studies which limits our confidence in the estimated RRs. The variability can be attributed to differences in population characteristics, such as age, gender, definition and severity of disability, as well as discrepancies in outcome definitions and methodological approaches. However, the number of studies that consistently indicate an apparent increase in risk in PwD implies a high level of confidence that these reflect real increases in risk.

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10.0 Appendix

Search strategies

Search Group	Search terms
Traumatic Brain Injury	1. exp Brain injuries/ 2. (Brain adj (injur* or damage)).tw,kf. 3. 1 or 2
Autism Spectrum	1. (asperger* or autis*).tw,kf. 2. exp Autism/ 3. 1 or 2
Developmental Delay	1. (development* adj delay*).tw,kf. 2. (development$ adj (deficit$ or deficient or disabled or disabilit$ or disorder$ or handicap$ or impair$ or retard$)).tw,kf. 3. 1 or 2
Intellectual Disability	1. exp intellectual disability/ or Mental retardation/ or Intellectual Disability/ or Learning Disabilities/ or Down Syndrome/ or Fetal Alcohol Spectrum Disorders/ or Prader-Willi Syndrome/ 2. ((intellectual$ or cognitiv$ or learning) adj3 (challenged or deficit$ or deficient or disabled or disabilit$ or disorder$ or handicap$ or impair$ or retard$)).tw,kf. 3. ("cri du chat" or "de lange syndrome" or "down$ syndrome" or adrenoleukodystroph$ or "coffin lowry" or "fragile x$" or FRAXE or FXS or "glycogen storage disease" or "lesch nyhan" or menkes or mucopolysaccharidosis or "pyruvate dehydrogenase complex deficiency" or "rett syndrome" or "prader willi" or "rubinstein taybi" or "trisomy 13" or "wagr syndrome" or "williams syndrome").tw,kf. 4. 1 or 2 or 3
Neurological	1. (neurological adj2 (condition$ or disorder$ or disabilit$ or handicap$ or impair$)).tw,kf. 2. Multiple Sclerosis/ 3. "multiple sclerosis".tw,kf. 4. 1 or 2 or 3
Physical	1. Spinal Cord Injuries/ or (spinal adj injur*).tw,kf. 2. (diplegia or diplaegia or hemiplegia or hemiplaegia or monoplegia or monoplaegia or paraplegia or paraplaegia or quadriplegia or quadriplaegia or tetraplegia or tetraplaegia).tw,kf. 3. 1 or 2 4. amput*.tw,kf. 5. (physical* adj2 (handicap* or retard* or difficult* or impair* or delay* or disorder* or condition*)).tw,kf. 6. Muscular Dystrophies/ or (muscular adj dystroph*).tw,kf. 7. "cerebral pals*".tw,kf. 8. 3 or 4 or 5 or 6 or 7

Search Group	Search terms
Psychosocial disability	1. Mentally Disabled Persons/ or Mental disorders/ 2. ((psychiatric or mental*) adj2 (illness* or ill or condition* or diagnoses or diagnosis or disorder* or impair*)).tw,kf. 3. (psychosocial adj (condition$ or disorder$ or disabilit$ or handicap$ or impair$)).tw,kf. 4. (schizo* or psychosis or bi*polar or (manic* adj depress*)).tw,kf. 5. 1 or 2 or 3 or 4
Sensory Speech	1. Deaf-Blind Disorders/ or (deaf adj blind).tw,kf. 2. Visually Impaired Persons/ or Blindness/ or Vision Disorders/ 3. ((vis* adj (disorder$ or disabilit$ or handicap$ or impair$)) or blindness).tw,kf. 4. 2 or 3 5. ((hearing adj (disorder$ or disabilit$ or handicap$ or impair$)) or deaf).tw,kf. 6. (speech adj2 (condition$ or disorder$ or disabilit$ or handicap$ or impair$)).tw,kf. 7. 5 or 6 8. ((speech or sound) adj disorder*).tw,kf. 9. (stutter* or stammer* or (childhood* adj fluency adj disorder*)).tw,kf. 10. (language adj disorder).tw,kf. 11. 8 or 9 or 10 12. 1 or 4 or 7 or 11
Specific Learning ADHD	1. (ADHD or ADDH or attention deficit$ or hyperactiv$ or hyper-activ$ or impulsivity).tw,kf. 2. exp Attention Deficit Disorder/ 3. 1 or 2 4. (dyslexia or dyscalculia or dysgraphia).tw,kf. or Dyslexia/ or Dyscalculia/ or Dysgraphia/ 5. 3 or 4