

The association between disability and all-cause mortality in low and middle-income countries: a systematic review and meta-analysis

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Abstract

Background: There are at least one billion people with disabilities globally. On average they have poorer health, yet worse healthcare access. We aimed to systematically review the association between disability and mortality in low- and middle-income countries (LMICs).

Methods: We searched MEDLINE, Global Health, PsycINFO and EMBASE from 1st January 1990 to 14th November 2022. We included any longitudinal epidemiological study in any language with a comparator group that measured the association between disability and all-cause mortality in people of any age. Two reviewers independently assessed study eligibility, extracted data, and assessed risk of bias. We used a random-effects meta-analysis to calculate the pooled hazard ratio (HR) for all-cause mortality by disability status. We then conducted meta-analyses separately for different impairment and age groups.

Findings: We identified 6146 unique articles, of which 70 studies (81 cohorts) were included in the systematic review, from 22 countries. There was variability in the methods used to assess and report disability, as well as mortality. The meta-analysis included 53 studies, representing 62 cohorts (comprising 267,415 people with disabilities). Pooled HRs for all-cause mortality were 2.06 (95%CI 1.80 - 2.34) for people with disabilities versus those without disabilities, with high heterogeneity between studies ($\tau^2=0.24$, $I^2=98\%$). This association varied by impairment type; from 1.32 (95%CI 1.13 – 1.55) for visual impairment to 3.39 (95%CI 0.90 – 12.76) for multiple impairments. The association was highest for children under 18 (4.46, 95%CI 3.01–6.59); and lower in people aged 15 – 49 (3.53, 95%CI 1.29–9.66); and older people over 60 years (1.97, 95%CI 1.63–2.38).

Conclusion: Disability increases the risk of all-cause mortality in LMICs, particularly in childhood. Interventions are needed to improve health of people with disabilities and reduce their risk of death.

Key messages

What is already known on this topic – Globally, people with different impairments have a higher risk of death than those without disabilities and many deaths will be avoidable.

What this study adds – People with disabilities in LMIC have two-fold higher mortality rates than those without disabilities. Disability is associated with a higher hazard of age-adjusted all-cause mortality across diverse LMIC settings and populations as well as impairment types. The risk of dying early is highest for children with disabilities.

How this study might affect research, practice or policy - Improved understanding of the association between disability and mortality will help to inform public health planning and policy, and the allocation of limited health-care resources to optimise healthy longevity for all populations worldwide. Without a focus on disability it may be difficult to reach SDG3 and other key global health targets.

Introduction

There are at least one billion people with disabilities globally, more than 80% of whom live in low and middle-income countries (LMICs) (1). People with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which, in interaction with various barriers, may hinder their full and effective participation in society on an equal basis with others (2). Implicit in this conceptualisation are different pathways linking disability to premature mortality. People with disabilities, by definition, have an impairment and underlying health condition, which may increase their risk of death. For instance, people blind from diabetic retinopathy will still experience diabetes, which is linked to stroke and cancer (3, 4). The impairment may also lead to further health conditions, linked to mortality (e.g. pressure sores or respiratory disease among people with physical impairment). Additionally, people with disabilities face a range of exclusions, so that they are more likely to live in marginalised and poor positions in society (5), which are linked to higher mortality (6). They also frequently face widespread difficulties and barriers in accessing healthcare, including inaccessible transport and facilities, poor skills of healthcare providers around disability, and high costs (7, 8). Consequently, people with disabilities have worse health than others in the population (9), are at higher risk of morbidity and mortality (1).

Many deaths will be avoidable. For instance, the confidential inquiry into premature deaths of people with intellectual disabilities in the UK estimated that 37% of deaths were avoidable from causes amenable to change by good quality healthcare (10). Data from the USA showed that people with disabilities were diagnosed with cancer at similar or earlier stages, but experienced higher rates of cancer-related mortality, implying health system failures in care (11). An improved understanding of the association between disability and mortality will help to inform public health planning and policy, and the allocation of limited health-care resources. Different systematic reviews have shown the relationship between specific impairment types (e.g. hearing (12), vision (13), intellectual (14, 15)) and mortality, but not disability overall. Furthermore, many of the studies included in these reviews are from High Income Settings, although 80% of people with disabilities live in LMICs. Age and impairment type are strong common risk factors for both disability and mortality (16, 17) and the association between disability and mortality may vary by these factors, yet this has not been explored to date. A comprehensive systematic review of disability and mortality in LMICs is therefore needed.

We undertook a systematic review and meta-analysis on the association between disability and age-adjusted all-cause mortality in all ages in LMIC. This systematic review and meta-analysis aimed to answer the following questions:

1. What is the extent, strength and quality of the published evidence of the association of disability and risk of all-cause mortality in LMIC?

2. To what degree does disability affect the risk of all-cause mortality, and does this risk vary based on age and impairment type in LMIC?

Methods

Search strategy and selection criteria

We developed a protocol for this systematic review and meta-analysis that was registered with Prospero (ref CRD42022302557) (18) and followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (supplementary file 1). We systematically searched MEDLINE, Global Health, PsycINFO and EMBASE from 1st January 1990 to 14th November 2022 to identify available evidence in any language on disability and mortality in LMIC, including estimation of mortality rates and all-cause mortality.

Disability was conceptualised as arising from a combination of impairment and contextual barriers, as described in the following definitions: (i) UN Convention on the Rights of Persons with Disabilities (2006) (2) - People with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder their full and effective participation in society on an equal basis with others; (ii) World Report on Disability (2011) (1) - [Disability is] an umbrella term for impairments, activity limitations and participation restrictions, denoting the negative aspects of the interaction between an individual (with a health condition) and that individual's contextual factors (environmental and personal factors). Search terms are outlined in supplementary file 2.

We included prospective and retrospective epidemiological studies (cohorts and randomised controlled trials) that measured the association of disability and all-cause mortality in any age. Conference abstracts were included if sufficient information was included for data extraction. There was no limitation of follow up period.

Inclusion criteria:

1. Disability as defined in line with the International Classification of Functioning, Disability and Health Model and the United Nations Convention on the Rights of Persons with Disabilities (19). It includes people with specific conditions deemed likely to result in disability (e.g., spina bifida, schizophrenia), specific impairments (e.g. visual, hearing, physical) as well as disability measured through functioning/activity limitations/self-report (e.g., Washington Group questions, activities of daily living).
2. People of any age and sex, and any type of disability
3. LMIC, as defined by World Bank July 2021

4. Studies with a comparator group or that compared effect of disability on mortality to population statistics in a country as a whole (e.g. Standardised Mortality Ratio – SMR)
5. The outcome was all-cause mortality after baseline assessment of disability

Studies where all participants had a specific systemic disease (e.g. diabetes) were excluded due to issues with generalisability. Certain measures of disability were not eligible, including: 1) mild functional impairment (e.g. visual acuity $\geq 20/40$, cognition as measured by MMSE ≥ 21 , Washington group questions that reported 'some difficulty' or less, only one functional limitation/ limitation in activities of daily life (ADL)), 2) depression alone, 3) frailty alone, 4) disability as a continuous measure. Studies including both dementia and Alzheimer's disease only had data extracted for dementia as Alzheimer's was classified as a disease. Studies were excluded if there was no comparator group of people without disabilities or if they reported cause-specific mortality only (e.g. congenital heart disease, covid-19).

The outcome was all-cause mortality after baseline assessment of disability. Mortality could be reported using different measures of effect size and we included all measures. We also included cause of death and death rate.

Data search and selection

The electronic search was conducted by TS. Results were screened and stored in Rayyan. Study selection was conducted independently by TS and HK. Each reviewer independently and systematically screened all titles and abstracts against the eligibility criteria. From these preliminary lists, the reviewers independently assessed the full text of each article for inclusion. The reason for exclusion was recorded and discrepancies discussed at each stage.

Data extraction

To chart the data, we developed an extraction tool in Excel to systematically record information from included studies. The extraction form was piloted on four included studies to inform the final version. Each included study was charted by one reviewer and checked by the second reviewer.

Extracted information included:

1. Publication characteristics: author, title, year of publication, setting/country
2. Study design: study design, sample size
3. Participant characteristics: age, sex, disability measure, and any other relevant descriptive data
4. Outcomes: Effect size for mortality outcomes (e.g. hazard ratio, cumulative incidence ratio, death rate, odds ratio) and cause of death.

We extracted the crude estimates, and when estimates were reported with more than one level of adjustment, we extracted two additional estimates: (1) Minimally adjusted – usually the age and sex-adjusted estimate; and (2) Maximally adjusted – the greatest number of additional covariates, to elucidate potential pathways of the association of disability and mortality. When data on multiple cohorts were presented in a single publication, each cohort was separately eligible for inclusion. Where results from a study evaluated the association of disability and mortality over different population categories (e.g. non frail and frail people with disabilities) a weighted average of the effect measure was calculated for the entire cohort.

Risk of bias assessment

The full texts of all eligible studies were assessed independently by both reviewers against quality assessment criteria adapted from Lund et al (20). The studies were evaluated for methodological quality and appropriateness for inclusion, without consideration of their results, based on a set of pre-determined criteria (Table 1). Disagreements on risk of bias ratings were resolved through discussion.

Table 1: Risk of bias criteria and ratings

Assessment criteria

- Study design, sampling method is appropriate to the study question
- Adequate sample size, for example sample size calculations undertaken
- Response rate reported and acceptable (>70%)
- Disability/impairment measure is clearly defined and reliable
- Measure of death is clearly defined and reliable
- Potential confounders taken into account in analysis
- Confidence intervals are presented
- Groups being studied are comparable at baseline
- Losses to follow-up are presented and acceptable

Risk of bias

- | | |
|--------|--|
| Low | All or almost of the above criteria were fulfilled and those that were not fulfilled were thought unlikely to alter the conclusions of the study |
| Medium | Some of the above criteria were fulfilled, and those not fulfilled were thought unlikely to alter the conclusions of the study |
| High | Few or no criteria were fulfilled, and the conclusions of the study were thought likely or very likely to alter with their inclusion. |

Data Analysis

Meta-analyses were performed using a random-effects model to generate a pooled effect estimate, reported as the hazard ratio (HR) with 95% CIs for the association between disability and age-adjusted, all-cause mortality. Between-study heterogeneity was assessed with I^2 and τ^2 statistics. We included age-adjusted estimates of the effect of disability on mortality risk in the meta-analysis since age is a strong confounder for the association of mortality and disability. Where only multivariable adjusted estimates were available, these were used. Studies that did not adjust for age were therefore not included in the meta-analysis; studies that reported odds ratios were not included in the meta-analysis as the estimates could not be pooled with HRs. There is the potential for effect modification of the association by impairment type and age and therefore we undertook separate meta-analyses for different age groups (≤ 18 years, 15 years – 49 years and ≥ 60 years) and impairment types (cognitive, functioning, hearing, neurological, multiple, physical, psychosocial and visual). We assessed the risk of publication bias using Egger's test (threshold for significance $p < 0.05$) and by inspection of funnel plots. A meta-regression was performed to estimate the between study variance and to calculate uncertainty in the estimated overall effect size risk of bias. We performed all statistical analyses using RevMan 5.4.1 (Cochrane collaboration).

Patient and public involvement

Patients were not involved in this research.

Results

We identified 10,547 articles through electronic database searches. After removing 4,401 duplicate references, we screened the titles and abstracts of 6,146 articles. Of these, we identified 154 articles for full-text review. Eighty-four studies were excluded, leaving 70 studies that met the inclusion criteria (fig 1). Sixty-two cohorts from 53 studies were eligible for inclusion in the meta-analysis.

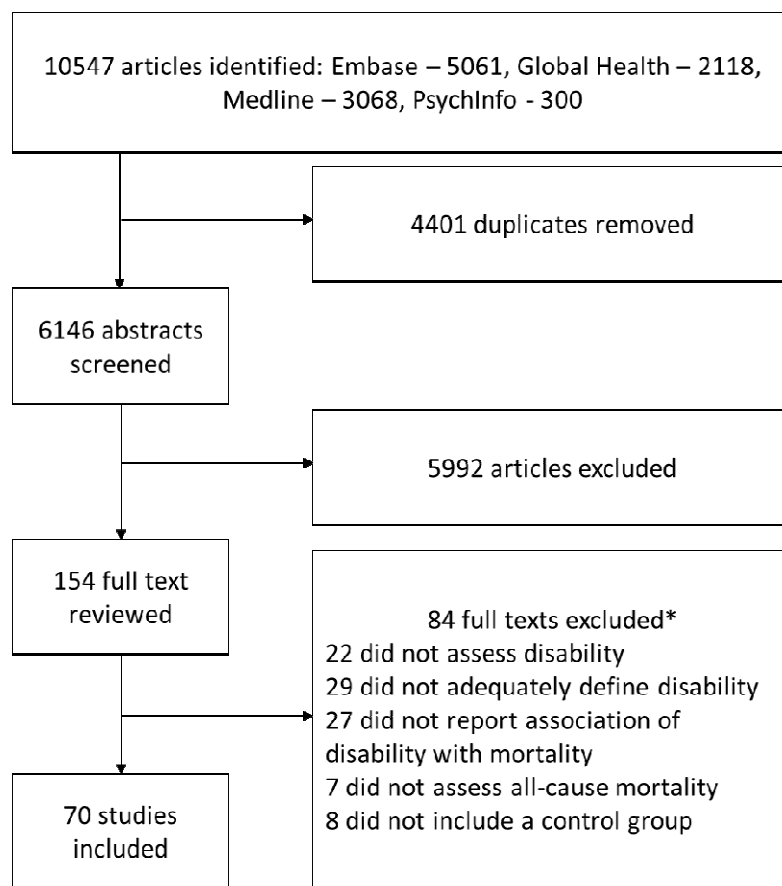


Figure 1: Study selection

*some studies were excluded for more than one reason

The characteristics of the studies are reported in table 2. Geographically, the largest number of studies were conducted in the Western Pacific Region (n=33, 44%; China n= 32, Hong Kong n = 1) followed by the Region of the Americas (n=22, 29%; Brazil n=15, Cuba n=1, Dominican republic n=1, Mexico n=2, Peru n=2, Venezuela n=1), and the Africa Region (n=17, 22%; Cameroon n=1, Congo n=1, Ethiopia n=2, Kenya n=2, Malawi n=2, Nigeria n=2, South Africa n=1, Tanzania n=2, Togo n=1, Uganda n=1, Zimbabwe n=1, Zambia n=1). There were no studies from the Eastern Mediterranean region. The South-East Asian region was only represented by India (n=3), and the European region by Turkey (n=1). There is an increase in the number of studies collecting data on disability and death since 2010. The duration of follow up in included studies ranged from 28 days to 17 years. Sample sizes ranged from 14 (people with neurological impairment in China) (21) to 749,720 (people with neurological impairment in Brazil)(22).

Table 2 Study characteristics

Variable	Category	No (%)
WHO Region*	African Region	17 (22)
	Region of the Americas	22 (29)
	South-East Asian Region	3 (4)
	European Region	1 (1)
	Eastern Mediterranean Region	0 (0)
	Western Pacific Region	33 (44)
Location	Population	55 (79)
	Hospital or clinic	15 (21)
Decade of publication	1990	3 (5)
	2000	5 (7)
	2010	31 (44)
	2020	31 (44)
Sample size	0 – 100	1 (2)
	101 – 1,000	17 (24)
	1,000 – 2,000	17 (24)
	>2,000	35 (50)
Population disability domain*	Cognitive impairment	14 (18)
	Functional	18 (23)
	Hearing	4 (5)
	Neurological	24 (31)
	Psychosocial	2 (3)
	Visual	12 (15)
	Multiple domains	4 (5)
Age group**	All ages	5 (5)
	Adults only (>18 years)	54 (50)
	Older adults only (>60 years)	37 (34)
	Children only (0-18 years)	4 (4)
	Specified age range from 15 years	4 (4)
	Not reported	3 (3)
Disability assessment*	Self-report	14 (19)
	Clinical	59 (79)
	Medical records	1 (1)
	Not reported	1 (1)
Death data source*	Death certificate	11 (14)
	Population register/ National death records	18 (23)
	Verbal autopsy/participant follow up	41 (53)
	Hospital records	2 (3)
	Not reported	5 (7)

*some studies included more than one domain

**studies including adults only and older adults are included in both categories

Studies used a wide variety of measures to assess disability (Table 3). Fifty-nine studies (62 cohorts) used clinical assessments and 14 studies (19 cohorts) used self-report to measure disability. The most commonly used assessment for visual impairment was visual acuity testing with a standardised chart (23), and the mini-mental state examination (MMSE) questionnaire (24) was most commonly used to determine cognitive impairment. The Katz Index of Independence in Activities of Daily Living (ADL) (25) was the tool used most to evaluate functioning.

Studies used various strategies to assess mortality, and were included regardless of the methods used because official death registries might not have been available or provided high-quality data in many LMIC (26). Most cohorts (n=41) were followed up by methods such as verbal autopsy, interviews with key informants, or both, with some studies (n=18) searching official vital records. Table 3 summarises the characteristics of included studies.

Table 3: Summary of included cohorts

Primary author, year	Country (Study)	Sample size of people with disabilities	Female n% (participants with disabilities)	Comparator group sample size	Age	Setting	Baseline assessment period	Follow up duration	Disability assessment	Mortality assessment method
Cognitive										
An, 2018 (27)	China (Beijing longitudinal study of ageing)	193	151 (81.9%)	321	55+	Population	1992	8 years (median)	Clinical	Death certificate
Aprahamian, 2018 (28)	Brazil	296	201 (67.9%)	405	60+	Hospital	2014 - 2016	12 months (total)	Medical records and clinical	verbal autopsy
Ascencio, 2022a (29)	Peru	53	not reported	374	60+	Population	2013	46.5 months	clinical	national health database
Campos, 2020 (30)	Brazil (Bambui Health Aging Study)	21	12 (57.1%)	1134	60+	Population	1997	11 years (mean)	Clinical	population register
Cao, 2022 (31)	China (China health and retirement longitudinal study (CHARLS))	1348	not reported	2581	60+	population	2011-2012	not reported	clinical	participant follow up
Correa, 2021b (32)	Brazil (EpiFloripa Aging Cohort)	330	not reported	1061	60+	Population	2009-2010	4 years	Clinical	population register
Duan, 2020 (33)	China (Chinese Longitudinal Healthy Longevity Survey (CLHLS))	7573	not reported	15896	65+	Population	1998 (waves 2002 and 2008)	6 years	Clinical	verbal autopsy
Flaherty, 2011b (34)	China	not reported	not reported	not reported	90+	Population	not reported	4 years	Self report	not reported
Gao, 2014 (35)	China	400	297 (74.3%)	1600	65+	Population	2003 - 2005	7 years	Clinical	verbal autopsy
Han, 2021 (36)	China (CLHLS)	1882	not reported	6411	65+	Population	1998 (2011 - 2018 waves)	7 years	Clinical	death certificate and verbal autopsy

Hao, 2018 (37)	China (Longevity and Aging in Dujiangyan (PLAD))	523	397 (75.9%)	86	90+	Population	2005	4 years	Clinical	population register
Su, 2021 (38)	China (CLHLS)	252	Not reported	Not reported	60+	Population	2009 - 2010	10.8 years (median)	Clinical	verbal autopsy
Wu, Z 2020 (39)	China (CHARLS)	820	598 (72.9%)	4293	60+	Population	2011	4 years	Clinical	not reported
Xavier, 2010 (40)	Brazil (Epidemiologia do Idoso)	56	not reported	1,477	65+	Population	1991-1992	10 years	Clinical	verbal autopsy and death certificate
Functioning										
Bahat, 2015 (41)	Turkey	not reported	not reported	Not reported	60+	Hospital	1999 - 2010	40.4 months	Clinical	population register
Bento, 2021 (42)	Brazil (SABE study)	177	0 (0%)	686	60+ men	Population	2000	14 years max	Clinical	population register
Cabrero Castro, 2021 (43)	Mexico (MHAS)	1,614	not reported	10,661	50+	Population	2001	3 years	Clinical	verbal autopsy
Confortin, 2020 (44)	Brazil (EpiFloripa Aging Cohort)	536	1087 (64%)	457	60+	Population	2009-2010	4 years	Clinical	population register
Correa, 2021a (32)	Brazil (EpiFloripa Aging Cohort)	426	not reported	965	60+	Population	2009-2010	4 years	Self report and clinical	population register
Flaherty, 2011a (34)	China	not reported	not reported	not reported	90+	Population	not reported	4 years	Self report	not reported
Feng, 2010 (45)	China (CLHLS)	817	not reported	12640	65+	Population	1998 (2002 wave)	3 years	Self report and clinical	death certificate
Gbeasor-Komlanvi, 2020 (46)	Togo (Study of Hospitalised Older Adults)	144	not reported	189	50+	Hospital	2018-2019	3 months	Clinical	verbal autopsy
Gray, 2016 (47)	Tanzania	78	not reported	Not reported	70+	Population	2009-2010	3 years	Clinical	verbal autopsy
Hu, Z 2022 (48)	China (CHARLS)	1,630	962 (59%)	9,383	50+	population	2011	7 years	clinical	participant follow up
Kou, S 2022 (49)	China (CHARLS)	3,791	2,882 (76%)	33,382	60+	population	1998-2014	2-4 years	clinical	participant follow up

Lima-Costa, M 2011 (50)	Brazil (Bambui Cohort Study of Aging)	28	22 (78.6%)	1196	60+	Population	1997	8.8	Self report	population register
Lyu, YB 2017 (51)	China (CLHLS)	Not reported	Not reported		≥80	Population	2009	5 years	Clinical	verbal autopsy
Nascimento, 2018b (52)	Brazil (Bambui cohort study of aging)	IADL: 295	IADL: 211 (81.5%)	IADL: 746	60+	Population	1997	15 year	Clinical	verbal autopsy and death certificate
Nascimento, 2018c (52)	Brazil (Bambui cohort study of aging)	ADL: 121	BADL: 77 (63.6%)	1060	60+	Population	1997	15 year	Clinical	verbal autopsy and death certificate
Prynn, 2020 (53)	Malawi (Karonga Health and Demographic Surveillance Site (HDSS))	1,277	857 (67.1%)	15,471	15+	Population	2014-2015	29 months	Self report	verbal autopsy
Souza, 2021 (54)	Brazil (COMO VAI)	125	not reported	920	60+	Population	2014	2.5 years	Self report	death certificate and population register
Tang, 2014 (55)	China (Beijing longitudinal study of ageing)	74	not reported	1936	55+	Population	1992	17 years	Self report	verbal autopsy
Wu X, 2004 (56)	China (Beijing Multidimensional longitudinal study of aging)	481	Not reported	2377	55+	Population	2000	8 years	Self report	death certificate
Hearing										
Agrawal, 2011b (57)	India	210	not reported	1212	60+	Population	2008	median: 518 days (3 days - 567 days)	Clinical	population register
Ascencio, 2022b (29)	Peru	180	not reported	247	60+	population	2013	46.5 months	self report	national health database
Ojagbemi, 2017c (58)	Nigeria (Ibadan Study of Ageing)		not reported		65+	Population	2003-2004	5 years	Self report	verbal autopsy
Sun, 2020b (59)	China (CLHLS)	5277	3103 (58.8%)	18884	65+	Population	1998		Self report	not reported

Multiple										
Lelijveld, 2020 (60)	Malawi (Pronut cohort)	60	22 (36.7%)	878	6-15.9	Hospital	2006 - 2007	7 years	Self report	verbal autopsy
Paixao, 2022 (61)	Brazil	3308	1855 (53.2%)	11477907	children <3 years	hospital	2015 - 2018	3 years	clinical	national health database
Sun, 2020c (59)	China (CLHLS)	7774	5812 (74.8%)	18884	65+	Population	1998		Self report	not reported
Zheng, X 2015 (62)	China	21,574	not reported	national mortality rates	not reported	Population	2006	4 years	Not reported	not reported
Neurological										
Abuga, 2019 (63)	Kenya (Kilifi DHS)	306	139 (48.9%)	9912 survey controls 22873 age matched	children 6 - 9	Population	2001	14.7 years (median)	Clinical	verbal autopsy
Avelino, 2017 (64)	Brazil	549	126 (69%)	570	60+	Hospital	2009 - 2015	1 year max	Clinical	verbal autopsy
Bwakura-Dangarembizi, 2021 (65)	Zimbabwe and Zambia (HOPE-SAM)	30	not reported	619	<5 years	Hospital	2016 - 2018	1 year	Clinical	verbal autopsy
Hong, 2005 (66)	China (CLHLS)	161	not reported	3811	≥55	Population	2001	40 months	Clinical	Population register and verbal autopsy
Hu L, 2022 (67)	China	72,102	37493 (52%)	population	all ages	hospital	2011	8 years	clinical	death certificate
Jotheeswaran, 2010 (68)	India (10/66 Dementia Research Group)	54	33 (61%)	698	65+	Population	2004 - 2006	3 years	Clinical	verbal autopsy
Katzman, 1994 (69)	China	53	not reported	3,351	65+	Population	1987	5 years	Clinical	verbal autopsy
Leite, 2019 (70)	Brazil	434	not reported	Population of Sao Paulo	All	Hospital	2004 - 2014	4.8 years	Clinical	death certificate
Li, G 1991 (21)	China	14	not reported	1076	60+	Population	1986	3 years	Clinical	verbal autopsy

Liu, T 2014 (71)	China (Second China National Sample Survey on Disability)	2,071	1149 (55.5%)		18+	Population	2006	4 years	Clinical	verbal autopsy
Melo, 2022 (22)	Brazil	749,720	378,609 (50.50%)	71,272,198	all ages	hospital	2000 - 2015	3 months - 15 years	clinical	national health database
Namaganda, 2020 (72)	Uganda	97	not reported	41319	2-17 years	Population	2005	54 months	Clinical	verbal autopsy
Niehaus, 2020 (73)	South Africa	subgroup of 60+; n=73 (from total of 981)	30 (41.1%)		60+	Hospital	1997-2005	12.1 years	Clinical	verbal autopsy
Nitrini, 2005 (74)	Brazil	113	80 (70.8%)	1280	65+	Population	1997	3 years	Clinical	population register
Ojagbemi, 2017a (58)	Nigeria (Ibadan Study of Ageing)	not reported	not reported		65+	Population	2003-2004	5 years	Clinical	verbal autopsy
Ojagbemi, 2016 (75)	Nigeria (Ibadan Study of Ageing)	255	not reported	1894	65+	Population	2003 - 2004	5 years	Clinical	verbal autopsy
Prince, 2012 (76)	Cuba, Dominican republic, Venezuela, Peru, Mexico, China (10/66 Dementia research group)	775	538 (69.4%)	11718	65+	Population	2003-2007	3-5 years	Clinical	verbal autopsy
Samba, 2016 (77)	Congo (EPIDEMCA-FU)	63	49 (77.8%)	791	65+	Population	2011 - 2012	2 years	Clinical	verbal autopsy
Teffer S, 2011 (78)	Ethiopia	307	55 (17.9%)	national mortality rates	15 - 49	Population	not reported	5 years	Clinical	verbal autopsy
Wang, 2019 (79)	China	132	not reported	Population	not reported	Hospital	2007	10 years	Clinical	not reported
Wen, H 2011 (80)	China	304	not reported	3581	55+	Population	1997	14 years	Clinical	verbal autopsy and certificate
Yung, 2022 (81)	Hong Kong	8826	4687 (53.10%)	population	18 - 39	hospital	2006 - 2012	5 years	clinical	national health database

Zhang, Y 2020 (82)	China	132	75 (56.8%)		not reported	Clinic	2007	10 years	Clinical	verbal autopsy
Zou, S 2022 (83)	China (China Kadoorie Biobank study)	3080	not reported	254733	30-79	population	2004-2008	10 years	self report	population register
Physical										
Nascimento, 2018a (52)	Brazil (Bambui cohort study of aging)	348	239 (68.7%)	765	60+	Population	1997	15 years	Clinical	verbal autopsy and death certificate
Nascimento, 2022 (84)	Brazil (SABE: (Health, Well-being and Aging Study)	255	not reported	1156	60+	population	2000	10 years	clinical	national health database
Psychosocial										
Fekadu, 2015 (85)	Ethiopia (Butajira cohort)	919	347 (37.8%)	national mortality rates (2009)	15 - 49	Population	1998 - 2001	11.3 years (median)	Clinical	verbal autopsy
Li, Y 2021 (86)	China	112576	53488 (47.5%)		15+	Hospital	2009-1014	5 years max	Clinical	population register
Visual										
Agrawal, 2011a (57)	India	134	not reported	128	60+	Population	2008	median: 518 days (3 days - 567 days)	Clinical	population register
Ascencio, 2022c (29)	Peru	321	not reported	106	60+	population	2013	46.5 months	self report	national health database
Cao, 2021 (87)	China	218	not reported	4,942	30+	Population	2006 - 2007	6 years	Clinical	verbal autopsy
Gu, 2013 (88)	China (CLHLS)	3,156	not reported	7,884	65+	Population	1998 (2002 - 2005 waves)	3 years	Clinical	death certificate and verbal autopsy
Khanna, 2013 (89)	India (Andhra Pradesh Eye Disease Study)	206	not reported	2991	30+	Population	1996	11	Clinical	verbal autopsy
Kuper, 2019 (90)	Kenya (Nakuru Posterior Segment Eye Disease Study)	341	159 (46.6%)	3,100	>50	Population	2007 - 2008	5.6 years	Clinical	verbal autopsy

Li Z, 2011 (91)	China (The Southern Harbin Eye Study)	Blind: 106 Moderate VI: 651	Blind: 74 (69.8%) Moderate VI: 408 (62.7%)	4,300	50-96	Population	2005-2006	4 years	Clinical	verbal autopsy
Ojagbemi, 2017b (58)	Nigeria (Ibadan Study of Ageing)	407	not reported	481	65+	Population	2003-2004	5 years	Self report	verbal autopsy
Pion, 2002 (92)	Cameroon	101	not reported	101	40+	Population	1991	10 years	Clinical	verbal autopsy
Sun, 2020a (59)	China (CLHLS)	5141	3344 (65%)	18884	65+	Population	1998		Self report	not reported
Taylor, 1991 (93)	Tanzania	47	27 (57.4%)	84	All ages	Population	1986	42 months	Clinical	verbal autopsy
Wang Z, 2022 (94)	China	3644	2,219 (60.90%)	12164	45+	population	2011	7 years	self report	participant follow up

All 70 studies (comprising 81 cohorts) calculated the association of mortality in participants with disabilities compared to those without disabilities (Table 4). There was high variability in effect estimates used for the association of disability and mortality, including HR (38 studies, 46 cohorts), OR (7 studies, 8 cohorts), RR (12 studies, 15 cohorts) and SMR (12 studies, 12 cohorts). Studies produced a combination of estimates; unadjusted (34 studies, 40 cohorts), age-sex adjusted (38 studies, 43 cohorts) and multivariable adjusted (40 studies, 47 cohorts). For risk of bias assessment (20), fifty-one (73%) studies (59 cohorts) received an assessment of low risk of bias across all nine domains. Six (9%) studies (8 cohorts) were assessed as having a high risk of bias, meaning that few criteria were fulfilled and the conclusions of the study are likely to alter with their inclusion.

Table 4: Association of disability with mortality

Primary author, publication year	Age (years)	Deaths disability (n)	Deaths control (n)	Analysis	Unadjusted Mortality rate ratio (95%CI)	Age sex adjusted ratio (95%CI)	Multivariable adjusted ratio (95%CI)	Risk of bias
Cognitive								
An, 2018	55+	130	156	Hazard ratio	3.73 (2.95-4.71)	2.77 (2.14-3.58)	2.14 (1.59 - 2.87)	Low
Aprahamian, 2018	60+	Not reported	Not reported	Hazard ratio			3.86 (2.32 - 6.44)	Low
Ascencio, 2022a	60+	18	not reported	hazard ratio	2.12 (1.28 - 3.51)			High
Campos, 2020	60+	17	538	Hazard ratio	2.5 (1.5-4.1)		1.7 (1.0-2.7)	Low
Cao, 2022	60+	not reported	not reported	Odds ratio		1.59 (1.29 - 1.96)	1.35 (1.08 - 1.69)	Low
Correa, 2021b	60+	Not reported	Not reported	Hazard ratio	0.89 (0.63 - 1.24)		0.82 (0.57 - 1.20)	Low
Duan, 2020	65+	3,523	3,360	Hazard ratio	3.25 (3.10–3.41)	1.65 (1.56 -1.74)	1.32 (1.25 - 1.41)	Low
Flaherty, 2011b	90+	Not reported	Not reported	Odds ratio			1.54 (1.18 - 2.00)	Moderate
Gao, 2014	65+	Not reported	Not reported	Hazard ratio	1.48 (1.13-1.93)			High
Han, 2021	65+	1,560	2,652	Hazard ratio	3.88 (3.58 - 4.20)		1.80 (1.64 - 1.96)	Low
Hao, 2018	90+	298	35	Hazard ratio	1.31 (0.88 - 1.94)		1.75 (1.18 - 2.58)	Low
Su, 2021	60+	Not reported	Not reported	Hazard ratio	11.56 (5.91-22.61)	3.83 (1.91-7.66)	2.29 (1.24-5.04)	Low
Wu, Z 2020	60+	81	353	Odds ratio		1.6 (1.2-2.1)	1.5 (1.1-2.0)	Low
Xavier, 2010	65+	44	930	Relative risk	2.69 (2.27 - 3.19)	2.03 (1.66-2.47)	1.64 (1.30 - 2.06)	Low
Functioning								
Bahat, 2015	60+	Not reported	108	Hazard ratio			1.22 (1.12-1.32)	Moderate

Bento, 2021	60+ men	25	38	Hazard ratio	2.5 (1.6-4.1)	2.33 (1.89 - 2.95)	1.96 (1.56 - 2.44)	Low
Cabrero Castro, 2021	50+	229	510	Hazard ratio	3.0 (2.6-3.4)			High
Confortin, 2020	60+	68	14	Hazard ratio	5.48 (2.31-12.99)		2.97 (1.10-8.04)	Low
Correa, 2021a	60+	Not reported	Not reported	Hazard ratio	1.32 (0.95 - 1.85)		0.96 (0.65 - 1.4)	Low
Flaherty, 2011a	90+	Not reported	Not reported	Odds ratio			1.41 (1.11 - 1.79)	Moderate
Feng, 2010	65+	Not reported	Not reported	Hazard ratio			1.9 (1.7-2.1)	Low
Gbeasor-Komlanvi, 2020	50+	Not reported	Not reported	Hazard ratio			2.49 (1.48 - 4.21)	Low
Gray, 2016	70+	Not reported	Not reported	Odds ratio	10.36 (7.35 - 14.60)		2.67 (1.36 - 5.23)	Low
Hu, Z 2022	50+	778	408	hazard ratio		2.06 (1.81 - 2.34)	1.63 (1.41 - 1.89)	Low
Kou, S 2022	60+	not reported	not reported	risk ratio	2.58 (2.52 - 2.65)	2.07 (2.02 - 2.13)	1.92 (1.86-1.97)	Low
Lima-Costa, M 2011	60+	Not reported	Not reported	Hazard ratio			3.4 (2.2-5.1)	Low
Lyu, YB 2017	≥80		571	Hazard ratio		1.37 (1.11 - 1.70)		Moderate
Nascimento, 2018b	60+	216	314	Hazard ratio	1.7 (1.6-1.9)	2.05 (1.70 - 2.48)		Moderate
Nascimento, 2018c	60+	90	494	Hazard ratio	1.6 (1.4-1.8)	1.92 (1.52 - 2.41)		Moderate
Prynn, 2020	15+	115	206	Hazard ratio		2.70 (1.91 - 3.82)	2.65 (1.84 to 3.8)	Low
Souza, 2021	60+	54	58	Risk ratio	8.9 (6.1-12.9)		3.1 (1.7-5.7)	Low
Tang, 2014	55+	58	1,010	Hazard ratio	1.5 (1.3-1.7)			Moderate
Wu X, 2004	55+	Not reported	Not reported	Odds Ratio		2.23 (1.53 - 3.23)		Moderate
Hearing								
Agrawal, 2011b	60+	28	72	Hazard ratio	2.4 (1.6-3.7).	1.32 (0.8-2.19)	1.22 (0.73-2.03)	Low

Ascencio, 2022b	60+	41	not reported	hazard ratio	1.43 (0.93 - 2.21)			high
Ojagbemi, 2017c	65+	Not reported	Not reported	Risk ratio			1.7 (0.8-2.2)	Low
Sun, 2020b	65+	4678	9128	Hazard ratio		1.4 (1.3-1.4)	1.3 (1.2-1.3)	Low
Multiple								
Lelijveld, 2020	6-15.9	42	Not reported	Risk ratio	3.03 (1.65 - 5.56)		6.99 (3.49 to 14.02)	Low
Paixao, 2022	children <3 years	398	120,629	Mortality rate ratio	14.3 (12.4 - 16.4)			Moderate
Sun, 2020c	65+	9478	9,128	Hazard ratio		1.8 (1.7-1.8)	1.5 (1.4-1.5)	Low
Zheng, X 2015	not reported	3,833		SMR		5.4 (5.2-5.5)		High
Neurological								
Abuga, 2019	children 6 - 9	11	92 survey 272 general population	Hazard ratio	3.83 (2.05-7.16)	4.24 (2.26-7.94)		Low
Avelino, 2017	60+	273	128	Hazard ratio	1.69 (1.02-2.80)		1.29 (0.72 - 2.30)	Low
Bwakura-Dangarembizi, 2021	<5 years	10	45	Hazard ratio	5.12 (2.58-10.16)		5.60 (2.72-11.50)	Low
Hong, 2005	≥55	69	266	Relative risk		1.63 (1.42 - 1.86)		Low
Hu L, 2022	all ages	11,766	not reported	SMR		10 - 39 years: 5.49 (5.34 - 5.36) 40 - 59 years: 4.01 (3.88 - 4.13) 60+ years: 4.85 (4.72 - 4.99) All ages: 4.75 (4.00 - 5.63)		Low

Jotheeswaran, 2010	65+	25	210	Hazard ratio	2.8 (1.8 -4.3)	2.3 (1.5 -3.7)	2.4 (1.2-4.8).	Low
Katzman, 1994a	65 - 74yr	41	676	Risk ratio			7.19 (3.6 - 14.4)	Low
Katzman, 1994b	75+	41	676	Risk ratio			3.49 (2.40 - 5.07)	Low
Leite, 2019	All	77	Not reported	SMR		2.88 (2.28-3.60)		Low
Li, G 1991	60+	8	40	relative risk	2.95 (not reported)			High
Liu, T 2014	18+	146	Not reported	SMR by gender		men = 10.17 (not reported) women = 12.42 (not reported)		Moderate
Melo, 2022	all ages	67,485	5,102,055	relative risk	Overall: 1.27 (1.27 - 1.28) male: 1.16 (1.32 - 1.35) female: 1.34 (1.32 - 1.35) 15 - 29 yrs:2.82 (2.76 - 2.88) 30 - 59yrs: 1.42 (1.41 - 1.44)			Low
Namaganda, 2020	2-17 years	15	169	Hazard ratio		2.90 (1.71-4.91)		Low
Niehaus, 2020	60+	23 (loss to follow up n=16)		Observed/ expected deaths		observed/ expected deaths = 1.77 (age adjusted)		Moderate
Nitrini, 2005	65+	58	163	Hazard ratio	5.16 (3.74–7.12)	3.92 (2.80-5.48)		Low
Ojagbemi, 2017a	65+	Not reported	Not reported	Relative risk ratio			3.5 (2.3-5.3)	Low

Ojagbemi, 2016	65+	137	698	Hazard ratio	1.8 (1.4-2.4)		1.5 (1.1-2.1)	Low
Prince, 2012	65+	470	1681	Hazard ratio		2.77 (2.47 -3.10)		Low
Samba, 2016	65+	Not reported	Not reported	Hazard ratio	3.9 (2.4-6.3)		2.5 (1.4-4.5)	Low
Teffera S, 2011	15 - 49	38	Not reported	SMR		5.98 (4.09-7.87)		Low
Wang, 2019	not reported	65	Not reported	SMR		1.2 (0.9-1.6)		Moderate
Wen, H 2011	55+	112	Not reported	SMR		0.91 (0.73-1.08)		Low
Yung, 2022	18 - 39	249	Not reported	SMR		1.23 (1.08 – 1.38)		Low
Zhang, Y 2020	Not reported	67	Not reported	SMR		1.23 (0.94–1.56)		Low
Zou, S 2022	30-79	97	not reported	hazard ratio			1.07 (0.87 - 1.30)	Low
Physical								
Nascimento, 2018a	60+	243	316	Hazard ratio	1.7 (1.5-1.9);	2.20 (1.85 - 2.63)		Moderate
Nascimento, 2022	60+	255	not reported	hazard ratio		2.35 (1.64 - 3.39)	1.80 (1.20 - 2.70)	Low
Psychosocial								
Fekadu, 2015	15 - 49	121	Not reported	SMR		2.14 (1.77–2.56)		low
Li, Y 2021	15+	2,579	Not reported	SMR		1.50 (1.42-1.58)		Low
Visual								
Agrawal, 2011a	60+	15	85	Hazard ratio	1.8 (1.0-3.1)	0.81 (0.45-1.47)	0.75 (0.41-1.38)	Low
Ascencio, 2022c	60+	62	not reported	hazard ratio	1.05 (0.62 - 1.77)			high
Cao, 2021	30+	61	349	Hazard ratio			0.98 (0.84 - 1.14)	Low

Gu, 2013	65+	Not reported	Not reported	Hazard ratio	Women 65-79: 2.8 (1.8-4.2); Women 80+: 1.4 (1.3-1.6); Men 65-79: 2.0 (1.2-3.2); Men 80+: 1.5 (1.4-1.7)			High
Khanna, 2013	30+	105	326	Hazard ratio	6.3 (5.0-7.8)		1.9 (1.5-2.5)	Low
Kuper, 2019	>50	100	309	Risk ratio		1.54 (1.22 - 1.93)	1.37 (1.10 - 1.71)	Low
Li Z, 2011	50-96	13	161	Odds ratio		3.4 (2.0-6.6)		Moderate
Ojagbemi, 2017b	65+	Not reported	Not reported	Risk ratio			1.7 (0.4-7.4)	Low
Pion, 2002	40+	38 (37.6%)	25 (24.8%)	Risk ratio		2.3 (1.10-4.83)	2.2 (1.20-4.05)	Moderate
Sun, 2020a	65+	4569	9128	Hazard ratio		1.3 (1.2-1.3)	1.2 (1.2-1.2)	Low
Taylor, 1991	All ages	12	7	Odds Ratio	3.0 (1.3-7.2)	3.33 (1.03-11.04)		Low
Wang Z, 2022	45+	not reported	not reported	Relative risk	1.29 (1.17 to 1.44)		1.22 (1.08 to 1.37)	Low

*SMR = standardised mortality ratio

Sixty-two cohorts from 53 studies were eligible for inclusion in the meta-analysis, comprising 267,415 participants with disabilities. The remaining studies identified in the systematic review were not included due to reporting measures of effect that could not be pooled with HRs (31, 34, 39, 47, 56, 73, 93, 95), and reporting of unadjusted measures of effect (21, 22, 29, 35, 43, 55, 61, 71, 88).

The pooled maximally adjusted HR for mortality in people with disabilities compared with those without disabilities was 2.06 (95%CI 1.80 - 2.34) and heterogeneity between studies was high ($\tau^2=0.24$, $I^2=98\%$) suggesting differing effects across studies (Supplementary file 3). This association varied by impairment type; 1.91 (95%CI: 1.61 – 2.26) for cognitive impairment, 1.95 (1.67 – 2.27) for functional impairment, 1.40 (95%CI 1.30 – 1.51) for hearing impairment, 2.39 (95%CI 1.86 – 3.07) for neurological impairment, 3.39 (0.90 – 12.76) for multiple impairments, 1.77 (95%CI 1.25 – 2.51) for psychosocial impairment and 1.32 (95%CI 1.13 – 1.55) for visual impairment (Figure 2).

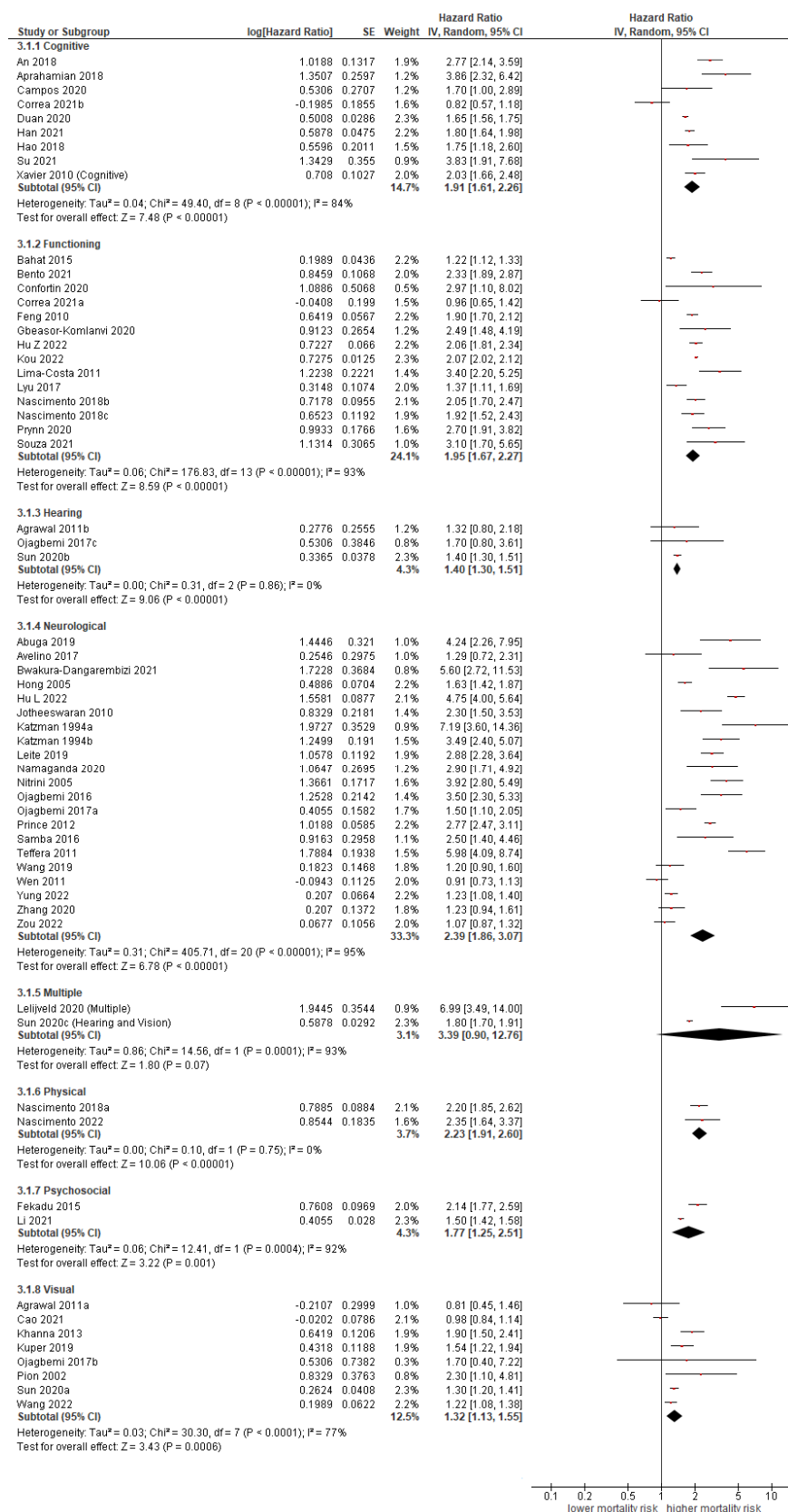


Figure 2: Association of impairment type with all-cause mortality

Four studies compared the hazard for mortality among children with disabilities versus children without disabilities. Pooled HRs for all-cause mortality was 4.46 (95%CI 3.01–6.59) for children under 18 with disabilities versus those without disabilities, with low heterogeneity between studies ($\tau^2=0.05$, $I^2=34\%$) that suggests a consistent effect across studies (Figure 3). Two studies compared the hazard for mortality in participants with disabilities aged 15 – 49 versus those without disabilities, with a HR for mortality of 3.53 (95%CI 1.29–9.66, $\tau^2=0.50$, $I^2=96\%$). Twenty-seven studies (35 cohorts) compared the hazard for mortality in participants over the age of 60 with disabilities to those without disabilities; the adjusted HR for mortality was 1.97 (95%CI 1.63–2.38, $\tau^2=0.28$, $I^2=99\%$).

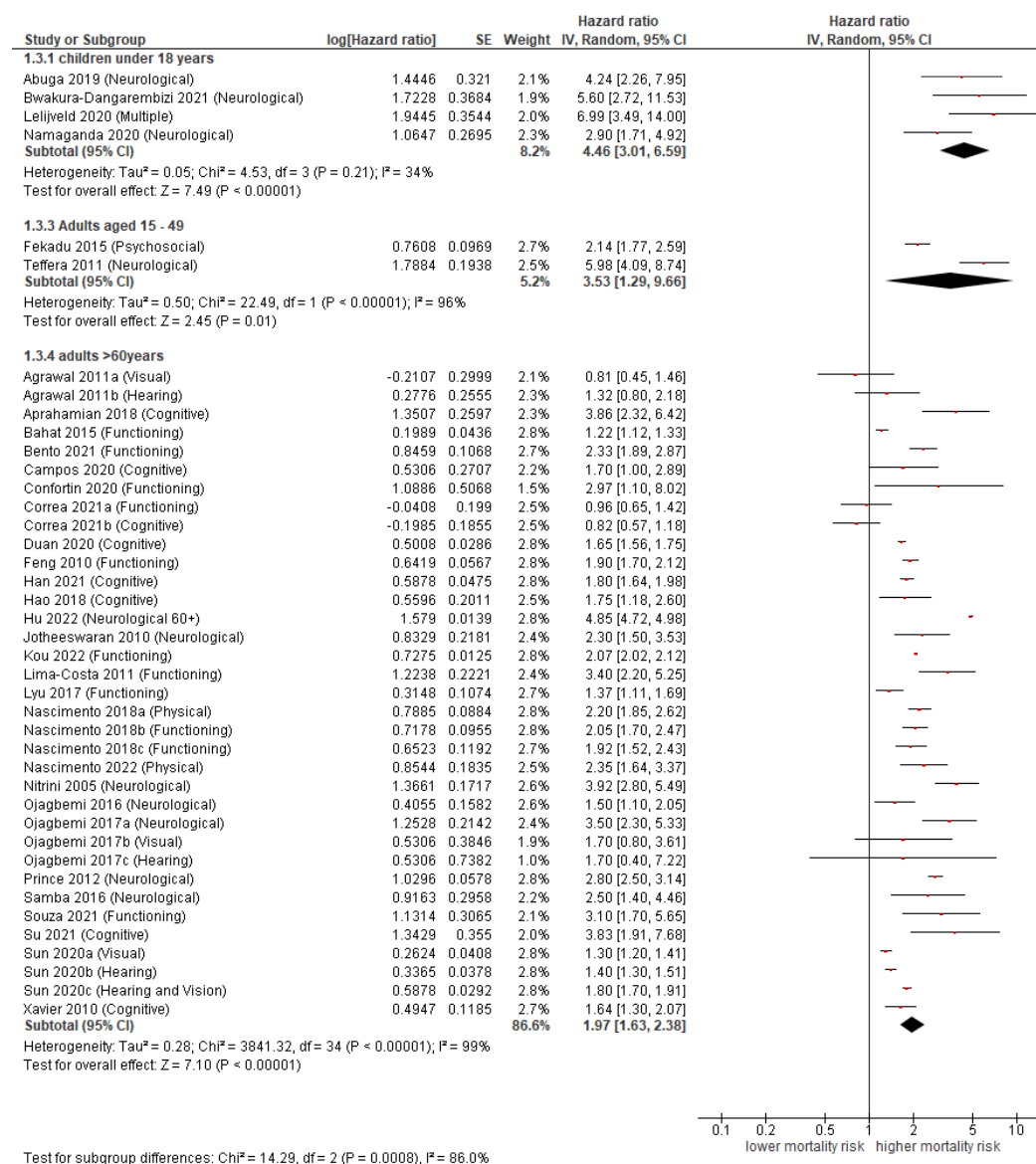


Figure 3: Random effects meta-analysis by age group

Meta-regression analysis of studies comparing all-cause mortality between the participants with disabilities and those without revealed that the association between disability and mortality was not influenced by risk of bias (Chi^2 3.03, $p=0.22$). Funnel plots were reviewed for studies comparing all-cause mortality in participants with disabilities with participants who did not have a disability, and no evidence of publication bias was identified (Supplementary file 4).

Discussion

Review of findings

There is limited knowledge about all-cause mortality for people with disability in general, and within LMIC settings specifically. This systematic review and meta-analysis synthesizes the available data from 22 countries and 5 WHO regions on the association between disability and the risk of mortality in LMICs. We found an increased risk of early death for people with disabilities across impairment types and in all ages. The association varied by impairment type as it was strongest for people with multiple impairments, followed by those with neurological impairment. The risk of early death is greatest for children with disabilities and remains increased for adults aged 15 – 49 as well as adults over 60 years of age. All 17 heterogeneous studies that were identified in the systematic review and that were not included in the meta-analysis reported an association between disability and increased mortality.

There was little evidence that the quality of the studies or publication bias impacted on the results. Whilst the quality of the included studies was generally high, this review highlighted that there is variability in the methods used to assess and report disability, as well as mortality. Studies predominantly used clinical diagnosis followed by self-report to evaluate disability status and verbal autopsy and population registers to establish death.

Consistency with other reviews

Our results are consistent with meta-analyses of specific impairments and mortality. Globally, Ehrlich et al (13) found that people with visual impairment have a higher risk of early death compared to those with normal vision and the magnitude of the effect increased with severity of impairment. O'Leary et al (15) established that people with intellectual impairments are missing 20 years of life experience globally, and that age of death is lower for people with more severe intellectual disabilities and for people with additional comorbidities such as epilepsy, genetic syndromes and functional impairments. Abuga et al (96) identified that the risk of early death is increased in children with neurological impairments and adults with child onset neurological impairments compared with the general population (median SMR was 2.9 (range 2.0–11.6)), with few studies eligible for inclusion from LMIC.

Limitations and strengths

This systematic review and meta-analysis has limitations that need to be taken into account. Whilst we placed no restrictions on language, the electronic searches were conducted in the English language, and some literature may have been missed. Data was missing from the Eastern Mediterranean region, with only four studies representing the South-East Asia and European regions. Therefore, included studies may not be representative of all LMIC. Nevertheless, 62 cohorts from 22 countries were included in the meta-analysis. Included studies demonstrate a significant association between disability and all-cause mortality in both multivariable adjusted and age-adjusted pooled effect estimates. We included multivariable adjusted studies where the age-adjusted estimates were unavailable. These studies adjusted for other important factors that could explain the association between disability and mortality, such as socio-economic status and comorbidities, which are common risk factors for disability and mortality (3-6). They may therefore have over-adjusted the statistical models and included variables that lie on the causal pathway between disability and mortality. This adjustment could have biased study results toward no effect. Underreporting of disability in studies using self-report is a potential concern, as it may lead to misclassification and bias of the association towards the null. There were also inconsistencies in the assessment of mortality, disability and adjustments made in the analyses, which make comparisons difficult and may explain the high heterogeneity in the meta-analyses.

This study has several key strengths. We included studies from regions in the world that are not represented in any other meta-analyses for disability and mortality. We also included a risk of bias assessment for the included studies. The quality of included studies was generally high and nearly three quarters of studies were estimated to have a low risk of bias across all domains. There was no evidence from the meta-regression analyses that the estimated association was affected by risk of bias.

Implications for research, policy and practice

Our findings that all people with disabilities are at risk of early death in LMIC have important implications for research, policy and practice. Consistent methods of measurement and disaggregation of results by disability are imperative to monitor progress toward the SDGs with respect to disability. Our study highlights the need for widespread adoption of standard definitions and protocols to promote comparability across cohorts. There was notably more information on conditions, such as schizophrenia and dementia, which are frequently recorded in medical records, while other groups (e.g. physical impairment, hearing impairment) were lacking. Attention is therefore needed on how to record disability and impairment type more consistently in medical records to allow use of this resource to measure mortality trends. Research is also needed to develop and test interventions to reduce mortality among people with disabilities, which may include health system

strengthening (e.g. healthcare worker training on disability), improving affordability of care for people with disabilities (e.g. provision of health insurance) and tackling the social determinants of poor health in this group.

A key implication of our review is that it will be difficult to reach SDG3, in particular targets related to reducing mortality (e.g. SDG3.2 - “end all preventable deaths under five years of age”), if the one billion people with disabilities globally continue to experience higher mortality. The global community must therefore design disability-inclusive health systems to promote health, wellbeing and rehabilitation for people with disabilities. These systems must “expect, accept and connect” people with disabilities, meaning that they are able to reach accessible services, experience positive attitudes from healthcare workers, and are connected to further services that they need (97). Services for people with disabilities should be included in national health systems at all levels to maximise access and targeted healthcare improvements required for people with disabilities are available when needed (e.g. health promotion programs that focus on lifestyle behaviours and wellness (98)). Reasonable accommodation must be made within provision of quality health care. For example, for people with intellectual impairment, inclusion of anticipatory care in the form of health checks has been shown to improve the management of long-term conditions and quality of life, in addition to having greater clinical and cost-effectiveness when compared with standard care (99, 100).

Conclusion

Disability increases the risk of all-cause mortality in LMICs, particularly in childhood. Interventions are needed to improve health of people with disabilities and reduce their risk of death. Without a focus on disability, it may be difficult to reach SDG3 and other key global health targets.

Contributors: TS and HK conceived the study, developed the research protocol and all data collection instruments and co-led data collection. TS led analysis. TS wrote the first draft of the manuscript with substantial input from HK. Both authors approved of the final version for publication.

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Disclaimer The views expressed in this publication are those of the author(s) and not necessarily those of the NIHR, NHS, the UK Department of Health and Social Care or FCDO.

Competing interests The authors declare no competing interests

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available

Supplementary file 1: Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	P1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	P2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	P3
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	P4
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	P4-5
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	P4
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	P4 and Supplement 2
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	P5
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	P5
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	P5-6
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	P6
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	P6
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	P6
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	P7

Section and Topic	Item #	Checklist item	Location where item is reported
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	P7
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	P7
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	P7
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	P7
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	P7
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	P7
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	P7
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	P8
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	P8
Study characteristics	17	Cite each included study and present its characteristics.	P11 - 16
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	P17-20
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	P17-20
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	P22 and P23
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	P21 and 22
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	P22
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	P22
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	P22-23
Certainty of	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	P22-23

Section and Topic	Item #	Checklist item	Location where item is reported
evidence			
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	P23
	23b	Discuss any limitations of the evidence included in the review.	P24
	23c	Discuss any limitations of the review processes used.	P24
	23d	Discuss implications of the results for practice, policy, and future research.	P24 - 25
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	P4
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	P4
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	n/a
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	P25
Competing interests	26	Declare any competing interests of review authors.	P25
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	P25

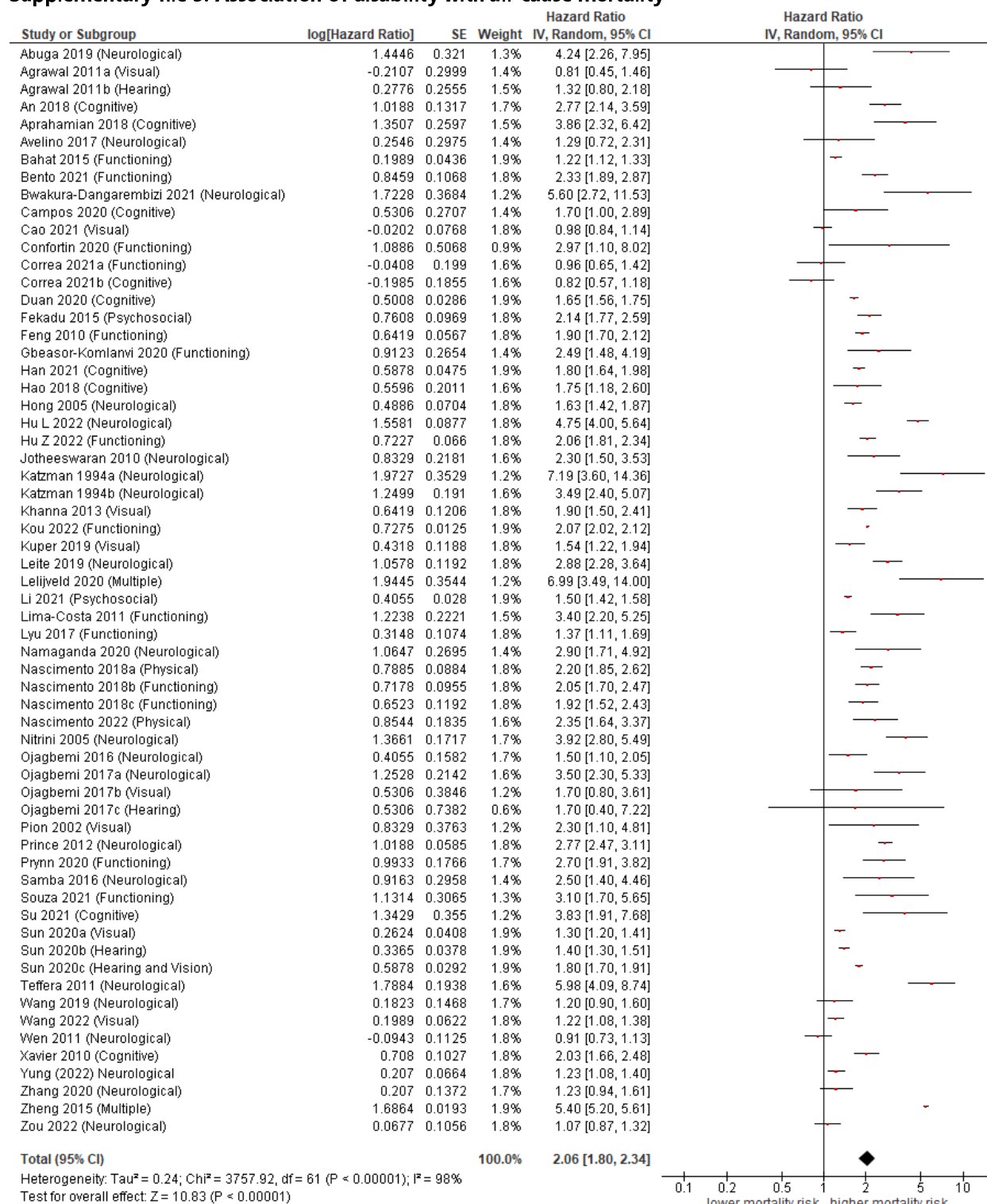
Supplementary file 2: Search term example

EMBASE search strategy (14.11.2022)

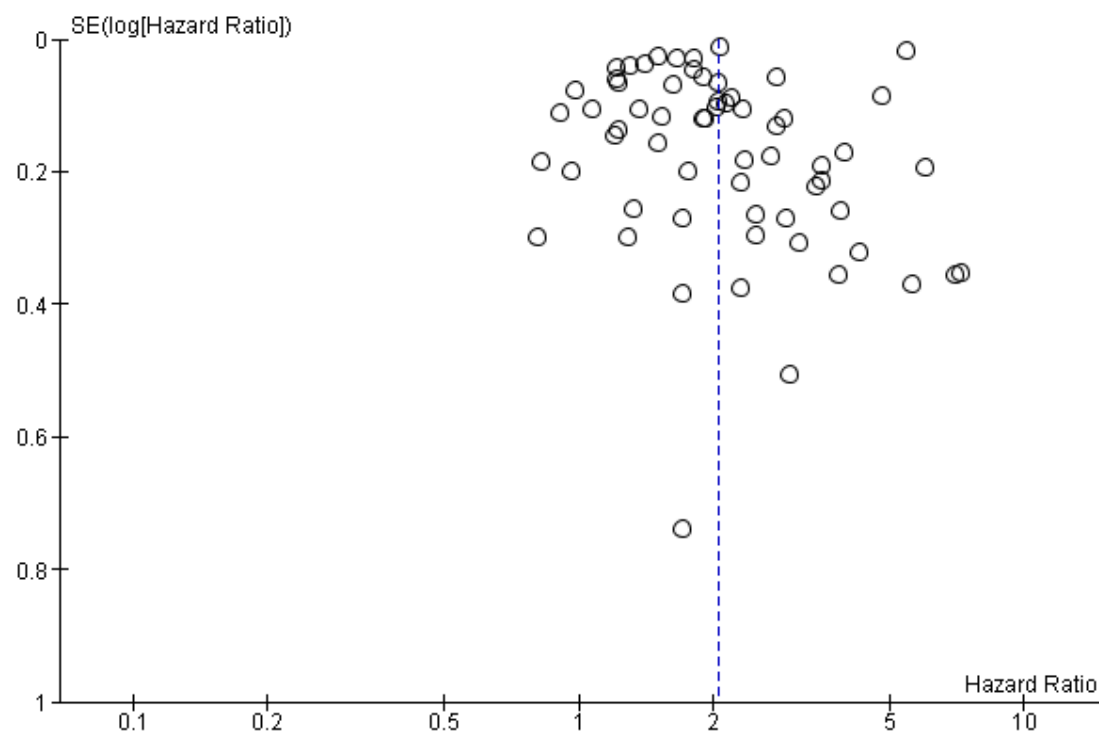
#		Searches	Results
1	LMIC	Embase expert search with World Bank LMIC from June 2019	1,982,116
2	Disability	((person* with disabilit* or people with disabilit* or (disable* or Disabilit* or Handicap*)) adj2 (person* or people or individ* or patient* or subject* or adult* or elderly)).ti,ab	39,154
3		(Physical* adj2 (impair* or deficienc* or disable* or disabili* or handicap*)).ti,ab.	23,216
4		(Cerebral pals* or Spina bifida or Muscular dystroph* or Osteogenesis imperfecta or Musculoskeletal abnormalit* or Musculo-skeletal abnormalit* or Muscular abnormalit* or Skeletal abnormalit* or Limb abnormalit* or Amputation* or Clubfoot or Poliomyeliti* or Paraplegi* or Paralys* or Paralyz* or Hemiplegi* or wheelchair user* or wheel chair user*).ti,ab.	297,217
5		((Hearing or Acoustic or Ear\$3) adj2 (loss* or impair* or deficienc* or disable* or disabili* or handicap*)).ti,ab.	98,955
6		((Visual* or Vision or Eye\$3) adj2 (loss* or impair* or deficienc* or disable* or disabili* or handicap*)).ti,ab	72,364
7		(Deaf* or Blind*).ti,ab.	520,496
8		exp Hearing impairment/ or exp vision disorders/ or exp Deafness/ or exp Blindness/	388,253
9		(Schizophreni* or Psychosis or Psychoses or Psychotic Disorder* or Schizoaffective Disorder* or Schizophreniform Disorder* or Dementia* or Alzheimer*).ti,ab.	557,897
10		exp Schizophrenia/	206,296
11		exp Dementia/ or exp Alzheimer disease/	400,715
12		((Intellectual* or Mental* or Psychological* or Developmental) adj2 (impair* or retard* or deficienc* or disable* or disabili* or handicap* or ill?6)).ti,ab	104,985
13		(communication or language or speech or learning) adj2 disorder*).ti,ab.	14,280
14		exp Disabled Children/	10,005

15		exp Learning Disorders/	39,920
16		exp Mentally Disabled Persons/	1,343
17		((genetic or hereditary or inherited or congenital) adj2 (disease* or ill* or syndrome or defect* or disorder* or condition* or malformation or anomal* or abnormalit*)).ti,ab	306,393
18		(elderly or older adult*).ti,ab.	489,760
19		Or /2 – 18 [ALL DISABILITY TERMS]	2,720,549
20	Mortality	Exp Mortality/	1,272,321
21		Death/	324,521
22		Death Certificate	9,978
23		Mortality.tw.	1,298,152
24		Death\$.tw.	1,352,807
25		(Fatality or fatalities).tw	42,777
26		Or/ 20 – 25 [ALL MORTALITY TERMS]	2,742,787
27	Study type	Cohort analysis/	781,100
28		Longitudinal study/	165,118
29		(Cohort\$ or longitudinal).tw	1,510,634
30		Cross-sectional study/	447,938
31		questionnaire/	787,233
32		Health survey/ or health care survey/	231,915
33		(Survey or surveys).tw	907,884
34		Or/ 27 – 33 [SPECIFIC STUDY DESIGNS]	3,368,663
35		1 AND 19 AND 26 AND 34	5,134
36		Limit to >1990, humans	5,061

Supplementary file 3: Association of disability with all-cause mortality



Supplementary file 4: Funnel plot for studies assessing all-cause mortality in people with disabilities



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