






Long-term effects of childhood speech and language disorders: A scoping review



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Background: Speech and language disorders in childhood have the potential to affect every aspect of a child's day-to-day life and can potentially have negative long-term impacts.

Aim: This scoping review seeks to collate the existing evidence to identify the long-term effects of childhood speech and language disorders.

Methods: A systematic search of speechBITE, ERIC (Education Resources Information Center), Linguistics and Language Behaviour Abstracts, PubMed, MEDLINE, PsycINFO, SocINDEX and the Cochrane Library was conducted. Peer-reviewed English language publications reporting on the long-term (2+-year) outcomes of individuals with a childhood history of speech or language disorders were included. Data were extracted and the study quality assessed using a modified Newcastle–Ottawa scale.

Results: Fifty-one studies met the inclusion criteria. These studies reported mixed results, the most common of which were suboptimal mental health, social and academic outcomes for persons with a history of speech or language disorders. We found an association between childhood speech or language disorders and psychiatric disability, behavioural problems, lower socio-economic status, relationship and living difficulties, and lower academic achievement compared to the general population.

Conclusion: Individuals with a history of childhood speech or language disorders may experience long-term difficulties in mental health, social well-being and academic outcomes.

Keywords: speech and language; mental health; behaviour; psychosocial; quality of life; scoping review.

Introduction

Speech and language disorders (SLDs) in childhood are a public health concern. Childhood SLDs are associated with effects on the day-to-day lives of individuals and can potentially have negative long-term personal development and opportunity effects (Arkkila et al. 2009; Beitchman, Brownlie & Bao 2014; Clegg 2006). Speech and language disorder communication difficulties can limit an individual's ability to participate in society and may lead to reduced social and emotional well-being. Speech and language disorders often result in economic effects for the individual and society (Community Affairs References Committee & Siewert 2014). The societal economic burden may be substantial if the individual progresses to criminal behaviours, needs increased mental health services, is unemployed and requires ongoing support, or needs support from adult literacy programmes (Gross 2006). Additionally, a disproportionate number of SLDs are experienced by socio-economically disadvantaged populations, which often means that economic barriers inhibit access to appropriate assistance services (Law et al. 2017; Maggi et al. 2010).

Internationally, the reporting of SLD prevalence varies. This variation is likely a result of the differences in identification methods, reporting requirements and diagnostic criteria between countries. In the United States (US), it has been reported that 8% of children aged 3–17 years have voice, speech, language or swallowing disorders (Black, Vahratian & Hoffman 2015). In the United Kingdom (UK), 6% of children are reported to have speech and language delays (Law et al. 2000), which is similar to the estimated 6% – 9% of children in South Africa (Nwosu 2015; Pascoe, Mahura & Le Roux 2018). In Australia, the prevalence of communication impairments ranges from < 1% to 21% amongst Australian children, depending on the reference source, with prevalence highest amongst younger children (McCormack et al. 2007).

To facilitate evidence-based intervention selection and conduct economic evaluations for these treatment options, an overview of the long-term outcomes from SLDs is first required. This review examines the long-term outcomes for individuals who have experienced childhood SLDs. The existing evidence focuses on singular outcome effects resulting from childhood SLDs (Baltaxe & Simmons 1975; Jackson et al. 2009; Kent & Vorperian 2013); this review aims to provide a concise overview of all of the potential long-term effects of having a childhood SLD. The results of this research can provide patients, carers and health professionals with an overview of the current evidence, an essential tool in the era of evidence-based practice (EBP). To gain a holistic picture of the impact of SLDs, all relevant information needs to be examined; this requires the inclusion of many studies that examine SLDs without differentiating between SLDs. Separating the two would likely exclude valuable studies conducted before the two terms were independently defined. This scoping review seeks to answer the question: what are the potential long-term effects of childhood SLDs that have been reported in the literature? To do this, it identifies and analyses the existing evidence base and provides an overview of the long-term impact of SLDs, to provide solid evidence to guide future research, influence public policy and guide clinical practice.

Methods

This scoping review followed the methods outlined by Levac, Colquhoun and O'Brien (2010), comprising five main stages: (1) identify the research question; (2) identify relevant studies; (3) select studies; (4) chart the data; and (5) collate, summarise and report the results. A scoping review is a method for mapping areas of research and presenting the results in an accessible format for knowledge users (Grudniewicz et al. 2016).

Identification of relevant studies

Search criteria

In 2017, speechBITE, ERIC, Linguistics and Language Behaviour Abstracts, PubMed, MEDLINE, PsycINFO, SocINDEX and the Cochrane Library were searched. The aim was to identify studies investigating the impact of childhood SLDs or SLD therapy on individual and social aspects during adolescence and adulthood. As there is variation in the historical and international reporting of SLDs, we have not separated speech disorders and language disorders for this scoping review, as is now current practice. The search strategy included the following terms:

- *speech* or *language* or *language development* or *language disorders* or *communication disorders*
- *impairment* or *problem* or *difficult** or *pathology* or *disorder*
- *long-term* or *follow-up*
- *psychology* or *psychosocial* or *behavio*r* or *mental health* or *emotional health*.

The terms were adapted as necessary for each database. As there were no previous reviews on the topic, the searches

were not time constrained. The final searches were conducted in August 2017. Reference lists of the included studies were searched for additional citations.

Selection criteria

We included only studies that reported primary data and were peer-reviewed academic journal items, PhD dissertations, research reports or full conference papers. Articles were excluded if they were not available in English, did not pertain to humans, specifically examined SLDs resulting from either biomedical conditions such as Down syndrome or neurogenic, neuromotor or neurosensory impairments such as aphasia (Efstratiadou et al. 2018).

Study selection

Titles and abstracts were screened by one researcher (J.V.) against the selection criteria and categorised for inclusion or exclusion. In case of uncertainty, a second researcher (D.L.) screened the title and abstract against the selection criteria. Disagreements were resolved by consensus or consultation with a third researcher (L.J.C. or A.C.S.).

After the review of titles and abstracts, full-text review of the articles was conducted according to criteria. Mental health, social well-being and academic outcomes were defined as the three main outcomes. Studies were excluded when they did not report mental health, social or academic outcomes, had less than 2 years of follow-up, described self-reported SLDs or participants with an intelligence quotient (IQ) of < 80 (to rule out general intellectual disability). In the absence of clinical information that could guide the choice of follow-up period, 2 years was chosen to ensure that study follow-ups occurred after initial assessments, whilst also including as many relevant studies as possible. Studies were not excluded if they presented different results from the same data set. No limitations were placed on participant age at enrolment or for follow-up for the included studies.

Data extraction

The full text of articles that met the inclusion criteria was read, and data were extracted by one researcher (J.V.) using an abstraction form. Based on the recommendations of Levac et al. (2010), the data abstraction form was collectively and iteratively developed as the scope of the review was clarified. The data abstraction form was pilot-tested by two researchers (J.V. and D.L.) for five articles to ensure consistency and to test the form. The data extracted included the publication details, study design and aim, sample, years of follow-up, type of impairment, age at onset, specific outcomes reported and results on relevant outcomes.

Quality assessment

The quality of included studies was assessed to provide an understanding of the strength of evidence of each study and to inform the interpretation of the review conclusions. A modified Newcastle–Ottawa scale was used

to determine a quality rating for each study (Wells et al. 2000). This scale assesses the quality of non-randomised studies by allocating a score based on study group selection, group comparability and the method by which the exposure or outcome of interest is ascertained (Wells et al. 2000). The scale was also modified to remove a criterion not relevant to this review and to score one criterion using two rather than three points. The modified scale and its coding are shown in the Appendix 1. The quality was rated independently by two researchers (J.V. and D.L./L.J.C.) in an iterative manner, with a discussion of any discrepancies to reach consensus with adjudication from a third member of the research team (A.C.S.). Studies were categorised as a higher or lower quality based on their overall quality rating (QR) using a median split (6+ vs. < 6, respectively, on the 0–8 scale). Studies were not excluded based on quality rating.

Data analysis and synthesis

The study results were broadly categorised into mental health, social well-being and academic outcomes. Some outcomes such as loneliness (measured in relation to quality of life) could be categorised under multiple categories such as mental health or social well-being. Classification of subcategories was determined by consensus between researchers (J.V. and D.L.) and is shown in Figure 1. The results are presented to show an overall coherent picture of the included studies, considering their quality rating and results, including null findings. Synthesis of the findings was performed narratively.

The term ‘speech and language *disorder*’ (SLD) as opposed to ‘impairment’ is used in this review. However, for consistency

and accuracy throughout this article, the terminology used by the authors has been preserved where possible.

Review findings

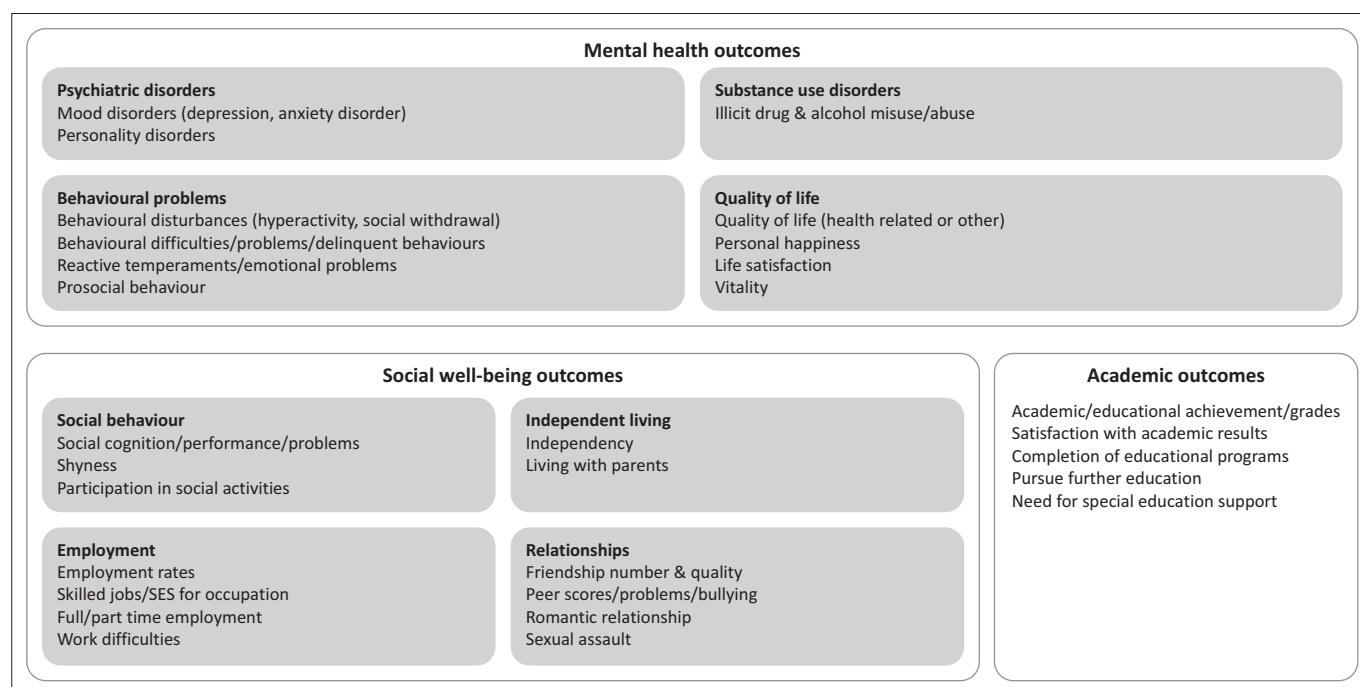
A total of 51 articles were included in the review. The results of the search and screening stages are shown in the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow chart (see Figure 2).

Study characteristics

All included studies used a cohort design and were largely ($n = 36$) published after the year 2000 (Table 1). Studies were predominantly conducted in the UK ($n = 21$), US ($n = 10$) and Canada ($n = 9$), on 27 unique cohorts. Most studies reported more than one outcome measure. In total 84 unique outcomes were reported across the 51 studies (Figure 1 and Table 2); 40 studies reported mental health outcomes, 27 reported social well-being outcomes, and 17 reported academic outcomes (Table 2). The age of participants at follow-up (7–39 years) and the length of follow-up (4–31 years) varied considerably. The quality rating of the reviewed studies ranged from 3 to 8 with a median of 6, out of a possible total of 8. Specific language impairments (SLIs) and developmental language disorders (DLDs) were the most common diagnoses reported within the studies (determined by use of this specific terminology).

Mental health outcomes

Four studies reported positive associations between childhood SLD and poor mental health (not otherwise specified) (Arkkila et al. 2009; Clegg et al. 2005; Law et al.



SES, socio-economic status.

FIGURE 1: Classification of mental health, social well-being and academic outcomes.

TABLE 1: Study characteristics (*n* = 51).

Characteristic	<i>n</i>
Publication year	
1971–1980	1
1981–1990	5
1991–2000	9
2001–2010	24
2011–2017	12
Sample	
Community sample	
Ottawa–Carleton sample	9
Bishop–Edmundson sample	2
Other	8
Clinical sample	7
Birth cohort sample	
1970 UK birth cohort	3
Danish children with language disorder	3
Other	3
School sample	
Conti-Ramsden Manchester language study	10
Templin investigation in kindergarten	2
Other	4
Years of follow-up	
< 10 years	24
≥ 10 years	27
Quality assessment rating†	
Median (range)	6 (3–8)
Country of publication	
United Kingdom	21
United States	10
Canada	9
Denmark	4
Other	7
Type of disorder studied	
DLD (4)/SLI (20)	24
Speech and language disorder	12
Specific (receptive) language disorder	5
Early language development	4
Language disorder	2
Speech disorder	2
Developmental language delay	1
Late talking	1
Age at outcome	
Childhood, 7–9 years	3
Early adolescence, 10–14 years	6
Adolescence, 15–19 years	22
Early adulthood, 20–29 years	7
Adulthood, 30–39 years	12
Mixed sample	1
Studies reporting outcomes	
Mental health	40
Social well-being	27
Academic outcomes	17

DLD, developmental language disorder; SLI, specific language impairment; UK, United Kingdom.

†, Scores range low to high, 0–8

2009; Schoon et al. 2010). Further outcomes relating to mental health were categorised into four areas: (1) psychiatric disorders, (2) behavioural problems, (3) substance use disorders and (4) quality of life.

Psychiatric disorders

Amongst the eight studies examining overall psychiatric disorders (including mood disorders or personality disorders), two reported no association (Howlin et al. 2000; Snowling et al. 2006) and six reported an association with childhood SLD (Baker & Cantwell 1987; Beitchman et al. 1996a, 1996b, 1999, 2001a; Whitehouse et al. 2009). Other studies examined psychiatric conditions individually (Table 1). When the subset of mood disorders (i.e. depression, bipolar disorder, anxiety disorder) was examined, two studies with comparable quality ratings reported disparate results. One reported an increased risk of mood disorders amongst participants with deteriorated vocabulary performance over follow-up (Armstrong et al. 2017), while the other reported no difference between SLD participants and their controls (Beitchman et al. 2014). In contrast, for the subset of personality disorders (long-term, extreme and inflexible patterns of thinking, behaviour and emotion), all three studies found more personality disorders in SLD participants than controls, and all three studies received high-quality ratings (Beitchman et al. 1999, 2001, Mouridsen & Hauschild 2009b). Eight out of 11 studies examining anxiety reported an association with childhood SLD. Three of these studies were led by Beitchman et al.; two reported higher anxiety problems in their cohort at age 19 years (Beitchman et al. 1999, 2001), while the third reported no difference at age 31 years (Beitchman et al. 2014). The difference could not be explained by dropout or change in language abilities over time. Beitchman et al. proposed that this may be a result of the demanding environment experienced by participants at 19 years of age resulting from their developmental stage, potential academic difficulties and SLD challenges (Beitchman et al. 2014).

There was mixed evidence that childhood SLD was associated with depression (Conti-Ramsden & Botting 2008b; Durkin, Conti-Ramsden & Simkin 2012; Lewis et al. 2016; Schoon et al. 2010; Wadman et al. 2011a). Of the five studies with similar quality ratings, three reported more depression in SLD participants than controls, whereas the other two studies reported no difference. Similarly, Lindsay et al. found that persons with a history of SLDs had lower self-esteem than their controls at age 16, but found no difference at age 17 (Lindsay, Dockrell & Palikara 2010).

Behavioural problems

Of the 15 studies that examined behavioural difficulties, 11 studies found a strong association between childhood SLD and behavioural difficulties. Baker and Cantwell (1987) and Yew and O’Kearney (2015) reported more hyperactive behaviour and reactive temperaments amongst participants with a history of SLDs. Similarly, Benasich, Curtiss and Tallal (1993) reported overall behavioural disturbances – hyperactivity in both male and female participants and social withdrawal in female participants.

TABLE 2: Study characteristics and mental health, social well-being and academic outcomes examined.

First author and year	QR	N		Follow-up (years)	Age at outcome	Type(s) of SLD examined	Mental health outcomes		Social well-being outcome(s)	Academic outcome(s)
		With SLD	Control							
Aram 1984	3	20	–	10	Early adolescence	SLI and LD	Behavioural problems†	Impaired social behaviour†	Special education needs†	
Arkkila 2008	4	35	–	27	Adulthood	SLI	Lower HRQoL†	Lower employment†, independent living†	NR	
Arkkila 2009	4	67	235	8	Early adolescence	RSLI	General mental health†, lower HRQoL:‡	NR	NR	
Armstrong 2017	8	75	1839	16	Adulthood	SLI	Affective problems†, substance use disorders†	Lower employment†	Lower levels of attainment†	
Baker 1987	3	300	–	5	Childhood and adolescence	S/LI	Psychiatric disorders†, behavioural problems†	NR	NR	
Beitchman 1996 b	5	138	–	7	Early adolescence	S/LI	Psychiatric disorders†	NR	NR	
Beitchman 1996 a	5	91	111	7	Early adolescence	S/LI	Psychiatric disorders†, behavioural problems†	NR	NR	
Beitchman 1999	7	129	129	14	Adolescence	S/LI	Psychiatric disorders†, personality disorders†, anxiety†, substance use disorders	NR	NR	
Beitchman 2001	8	115	129	14	Adolescence	S/LI	Psychiatric disorders†, personality disorders†, anxiety†, substance use disorders	Lower SES rating for occupation†	NR	
Beitchman 2014	7	103	123	26	Adulthood	S/LI	Affective problems, anxiety, substance use disorders	NR	NR	
Benasich 1993	5	56	43	4	Childhood	SLI	Behavioural problems†	NR	NR	
Botting 2008	6	134	124	9	Adolescence	SLI	Less prosocial behaviour†	Impaired social behaviour†, lower friendship quality†, peer problems†	NR	
Brinton 2010	4	4	–	8	Adolescence	LI	Behavioural problems†, lower HRQoL:‡	Peer problems†	Lower grades/qualifications	
Brownlie 2004	8	76	92	14	Adolescence	S/LI	Delinquent behaviour†	NR	NR	
Brownlie 2007	8	33	59	20	Early adulthood	LI	General mental health†, anxiety†, behavioural problems†	Victim of assault†	NR	
Clegg 2005	6	17	1417	24	Adulthood	DLD	General mental health†, anxiety†, behavioural problems†	Lower SES rating for occupation†, fewer friendships†, peer problems†, fewer romantic relationships†, independent living†	NR	
Conitt-Ramsden 2008b	7	139	124	8	Adolescence	SLI	Anxiety†, depression†	NR	NR	
Conitt-Ramsden 2008a	7	120	118	9	Adolescence	SLI	NR	Independent living†	NR	
Conitt-Ramsden 2009	7	120	121	10	Adolescence	SLI	NR	NR	Lower levels of attainment, lower grades/qualifications†	
Durkin 2007	6	120	118	8	Adolescence	SLI	Behavioural problems†, less prosocial behaviour†, emotional problems†	Lower friendship quality†	Special education needs†	
Durkin 2009	7	120	121	8	Adolescence	SLI	NR	NR	Less likely to pursue further education, special education needs†	
Durkin 2012	6	26	85	9	Adolescence	SLI	Anxiety, depression	Lower employment, lower friendship quality†, independent living†	Lower levels of attainment†	
Elbro 2011	6	198	–	30	Adulthood	SLI and LI	NR	Lower employment†, lower SES rating for occupation†	Less likely to pursue further education†, special education needs†, less likely to complete education†	
Felsenfeld 1992	5	24	28	28	Adulthood	SD	Anxiety, behavioural problems	NR	NR	
Felsenfeld 1994	5	24	28	28	Adulthood	SD	NR	Lower employment, lower SES rating for occupation†	Lower levels of attainment†, lower grades/qualifications†	
Glogowska 2006	6	196	94	6	Childhood	S/LI	NR	Impaired social behaviour†	NR	
Hall 1978	6	18	18	18	Early adulthood	S/LI	NR	NR	Less likely to pursue further education†, less likely to complete education	

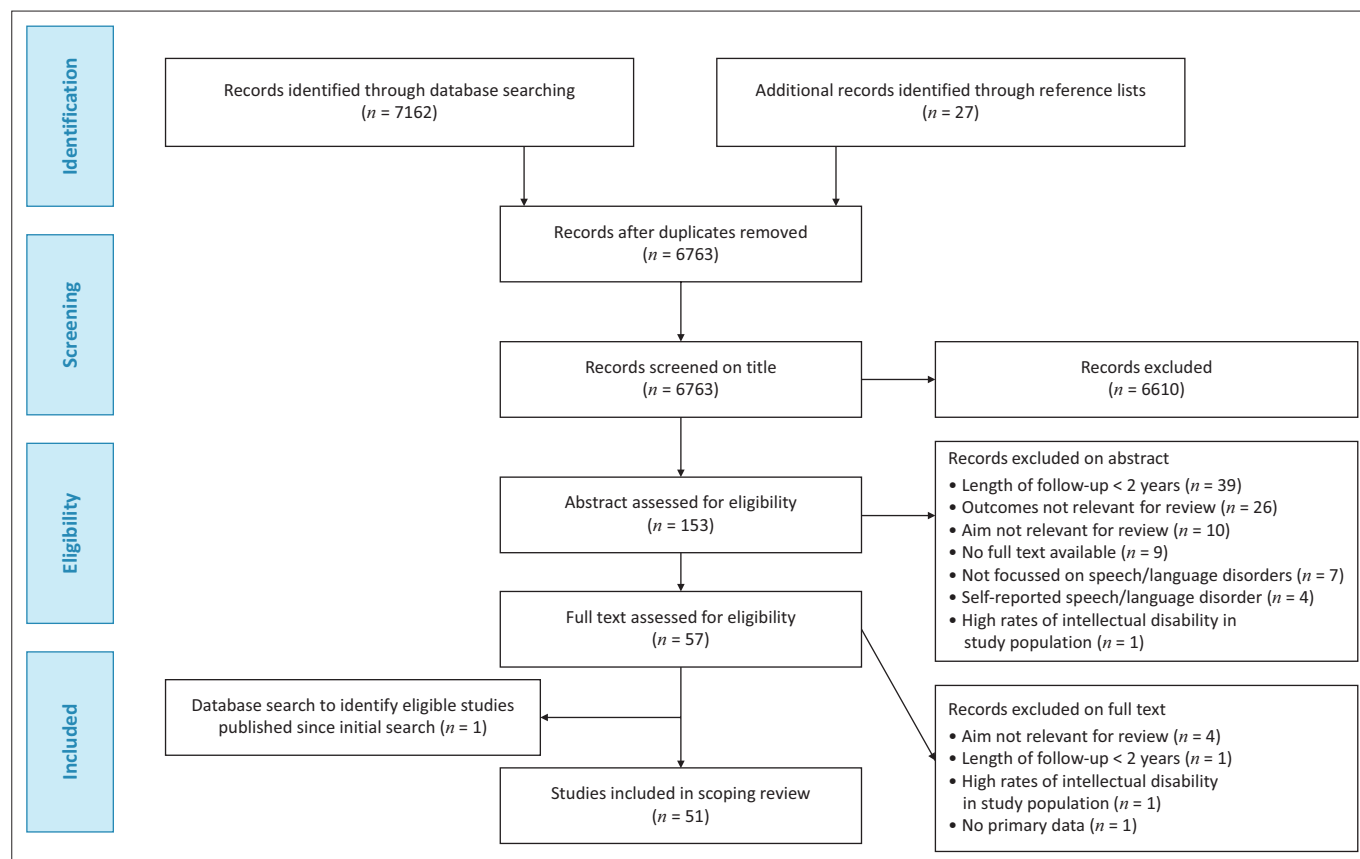
Table 2 continues on the next page →

TABLE 2 (Continues...): Study characteristics and mental health, social well-being and academic outcomes examined.

First author and year	QR	With SLD		Follow-up (years)	Age at outcome	Type(s) of SLD examined	Mental health outcomes	Social well-being outcome(s)	Academic outcome(s)
		N	Control						
Howlin 2000	6	20	-	16	Early adulthood	RSLI	Psychiatric disorders; behavioural problems	Impaired social behaviour†, lower employment, lower SES rating for occupation†, lower friendship quality‡, fewer romantic relationships‡, independent living†	Lower grades/qualifications†
Johnson 2010	8	112	132	20	Early adulthood	S/LI	Lower HRQoL	Lower employment, lower SES rating for occupation†	Less likely to complete education†
King 1982	3	50	-	15	Adolescence	S/LI	General mental health†	Impaired social behaviour, peer problems	Lower academic achievement†, lower grades/qualifications
Law 2009	7	406	8726	30	Adulthood	RSLI	General mental health†	Lower employment†	NR
Lewis 2016	6	148	83	> 5	Adolescence	S/LI	Anxiety†, depression	Impaired social behaviour†	NR
Lindsay 2010	3	54	-	8	Adolescence	SLI	Self-esteem‡	NR	NR
Mouridsen 2009 a	8	469	2345	30	Adulthood	DLD	Personality disorders†	NR	NR
Mouridsen 2009 b	6	469	2345	30	Adulthood	DLD	Delinquent behaviour	NR	NR
Mouridsen 2010	8	469	2345	30	Adulthood	DLD	Substance use disorders	NR	NR
Parsons 2011	4	Total 1230		30	Adulthood	RI	NR	Lower employment†	Lower levels of attainment†, less likely to complete education†
Records 1992	4	29	29	13	Early adulthood	SLI	Lower HRQoL	NR	NR
Schoon 2010	5	Total 6941		30	Adulthood	RSLI	General mental health†, depression†, lower HRQoL†	Lower employment‡, fewer romantic relationships†, independent living†	NR
Silva 1987	6	88	949	8	Early adolescence	DevLD	Behavioural problem†	NR	NR
Snowling 2001	7	55	49	12	Adolescence	SLI	NR	Lower employment†	Lower academic achievement†
Snowling 2006	7	55	49	11	Adolescence	SLI	Psychiatric disorders	NR	NR
St Clair 2011	4	103	n/a	9	Adolescence	SLI	Behavioural problems, emotional problems‡	Impaired social behaviour†	NR
Stattin 1993	6	122	n/a	14	Adolescence	ELD	Delinquent behaviour†	NR	NR
Stevenson 1985	3	535	n/a	5	Childhood	ELD	Anxiety†	NR	NR
Voci 2006	7	142	142	14	Adolescence	ELD	Anxiety†	NR	NR
Wadman 2011a	7	90	91	8 to 9	Adolescence	SLI	Anxiety†, depression†, Behavioural problems†	Peer problems†	NR
Wadman 2011b	6	90	91	10	Adolescence	SLI	Behavioural problems†, less prosocial behaviour†	Impaired social behaviour‡, fewer friendships, fewer romantic relationships†	NR
Whitehouse 2009	5	26	12	> 10	Early adulthood	SLI	Psychiatric disorders†	Impaired social behaviour†, lower SES rating for occupation†, fewer friendships‡, independent living†	Lower levels of attainment†
Whitehouse 2011	7	142	1280	12	Adolescence	LT	Behavioural problems	NR	NR
Yew 2015	6	439	2797	6	Early adolescence	ELD	Behavioural problems†, emotional problems†	Peer problems‡	NR

NR, not reported; DLD, developmental language disorder; DevLD, developmental language delay; ELD, early language development; HRQoL, health-related quality of life; LD, language disorder; LI, language impairment; LT, late talking; QR, quality rating; RI, reading impairment; RSLI, receptive specific language impairment; SLD, speech and language impairment; SD, speech disorder; SES, socio-economic status; SLD, speech and language disorder; SLI, specific language impairment. Outcomes without a symbol showed no association.

†, denotes association found; ‡, denotes some/mixed association found.



PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

FIGURE 2: PRISMA flow chart showing study selection.

Other studies showed overall difficulties in behaviour; studies that examined prosocial behaviour (empathic behaviour intended to help others with no expectation of reward) reported difficulties with this behaviour in later life for those with childhood SLDs (Botting & Conti-Ramsden 2008; Durkin & Conti-Ramsden 2007; Wadman et al. 2011b). Three studies examined delinquent behaviour; two (Brownlie et al. 2004; Stattin & Klackenberglarsson 1993) of them showed a strong association with SLDs, whilst the third found no evidence of association (Mouridsen & Hauschild 2009a). Emotional problems in participants with SLDs were reported by Durkin and Conti-Ramsden (2007), St Clair et al. (2011), Yew and O’Kearney (2015). The results from St Clair et al. also demonstrated a decrease in emotional problems over time; however, their ultimate prevalence in those with childhood SLDs remained higher than in the general population (St Clair et al. 2011). In contrast, four studies reported no association between childhood SLD and behaviour difficulties (Felsenfeld, Broen & Mcgue 1992; Howlin et al. 2000b; St Clair et al. 2011; Whitehouse, Robinson & Zubrick 2011).

Substance use disorders

Substance use disorders were investigated by five studies, with one study reporting that adults with deteriorated vocabulary performance had an increased risk for illicit and alcohol misuse or abuse (Armstrong et al. 2017). However,

four other studies found no difference in rates of substance use disorders between persons with a history of SLDs and their controls (Beitchman et al. 2014, 1999, 2001; Mouridsen & Hauschild 2010).

Health-related quality of life

Mixed results were reported about health-related quality of life (HRQoL). Studies such as that by Arkkila et al. reported no differences in overall HRQoL; however, the results indicated a lower vitality score for participants with a history of SLD (Arkkila et al. 2009). Three studies showed that SLDs had a great effect on HRQoL (Arkkila et al. 2008), assumedly because individuals with SLDs felt lonely (Brinton, Fujiki & Baldrige 2010), reported lower satisfaction with life and felt no control over life compared to the control groups (Schoon et al. 2010). In contrast, two studies reported no difference in quality of life (Johnson, Beitchman & Brownlie 2010), personal happiness or life satisfaction (Records, Tomblin & Freese 1992) between those with a history of SLDs and control groups.

Social well-being outcomes

Social behaviour

The majority of the studies that examined social behaviour reported lower social behaviour amongst persons with a history of SLDs compared to controls, although three studies found no discernible difference. These findings included

lower social cognition (Botting & Conti-Ramsden 2008) and social performance (Aram, Ekelman & Nation 1984) and significantly higher rates of social problems (Glogowska et al. 2006; Lewis et al. 2016). Dissimilar results were reported by Wadman et al., who found that although persons with a history of specific language impairment (SLI) were more likely to be shy, they had overall similar social behaviours to controls (Wadman et al. 2011b). This result was supported by two studies that reported similar participation in social activities amongst persons with SLD history compared to control groups (Aram et al. 1984, King, Jones & Lasky 1982), although these studies received lower quality ratings.

Employment

No consensus was found as to whether childhood SLDs were associated with lower employment rates in later life. It was clear, however, that when employed, the socio-economic status of persons with a history of SLDs was lower than that of control groups. Several studies showed that persons with a history of SLDs were more likely to be in less-skilled jobs than controls (Clegg et al. 2005; Elbro, Dalby & Maarbjerg 2011; Felsenfeld, Broen & McGue 1994; Howlin et al. 2000; Parsons et al. 2011; Whitehouse et al. 2009) and less likely to be employed in a full-time job (Arkkila et al. 2008; Armstrong et al. 2017; Beitchman et al. 2001; Snowling et al. 2001). Durkin et al. reported lower part-time employment for participants with a history of an SLD; however, the presence of autism spectrum disorder symptomatology was also found to be a significant predictor of employability in this study (Durkin et al. 2012). Participants with a history of SLDs were reported as unemployed for longer periods than controls in three studies (Clegg et al. 2005; Law et al. 2009; Parsons et al. 2011). Moreover, Clegg et al. and Howlin et al. reported that persons with a history of SLDs had more difficulties in the work environment and that behaviour-related problems were often referenced in reasons for dismissal (Clegg et al. 2005; Howlin et al. 2000). In contrast, other studies reported no substantial difference in employment rates (Felsenfeld et al. 1994; Johnson et al. 2010).

Relationships

There was no reported difference in the number of friendships for participants with SLDs and controls across studies; however, the overall quality of friendships was rated lower by SLD participants. All but one study (King et al. 1982) reported lower peer scores or more peer problems amongst persons with a history of SLDs compared to controls (Botting & Conti-Ramsden 2008; Brinton et al. 2010; Wadman et al. 2011b), although Yew et al. suggested that this was only true for girls (Yew & O'Kearney 2015). Persons with a history of SLDs were reported to experience more instances of bullying (Wadman et al. 2011a), have fewer acquaintances and be more awkward and limited in making contact (Clegg et al. 2005). When romantic relationships were examined, fewer participants with a history of SLDs were in romantic relationships compared to controls (Clegg et al.

2005; Schoon et al. 2010; Wadman et al. 2011b), although no difference was found for participants with a DLD history (Howlin et al. 2000). Additionally, Brownlie et al. (2007) found that language-impaired women were more likely than controls to have experienced sexual assault.

Independent living

All seven studies that examined independent living reported low independency or higher rates of living with parents for persons with a history of SLDs compared to control groups (Arkkila et al. 2008; Clegg 2006, Conti-Ramsden & Durkin 2008a; Durkin et al. 2012; Howlin et al. 2000; Schoon et al. 2010; Whitehouse et al. 2009).

Academic outcomes

Overall, academic achievement was lower for participants with an SLD when compared to controls (Durkin et al. 2012; King et al. 1982; Snowling et al. 2001). This finding was supported by the results of studies that examined specific academic outcomes such as the need for special education support or the likelihood of completing education programmes. Although one study (King et al. 1982) was rated lower in quality, most studies showed that SLD individuals were more likely to need special education support and less likely to complete their education programmes (Aram et al. 1984; Armstrong et al. 2017; Durkin & Conti-Ramsden 2007; Elbro et al. 2011; Howlin et al. 2000; Parsons et al. 2011; Whitehouse et al. 2009). More specifically, Johnson et al. (2010) reported lower educational attainment amongst young adults with a history of a language impairment when compared to those without impairments or early speech-only impairment. Although some studies reported reduced academic outcomes, students with an SLD tended to be satisfied with their academic results (Durkin et al. 2009); some were even more satisfied than their peers (Felsenfeld et al. 1994). One study found that participants with SLDs received 'acceptable' grades; however, this study lacked a control group for comparison and was a small sample (Brinton et al. 2010). Hall and Tomblin (1978) did not find consistent differences in academic outcomes between cases with a language disorder and articulation disorder controls. Similarly, King et al. (1982) reported no difference in academic achievement between groups with and without SLDs. Conti-Ramsden et al. and Durkin et al. also suggest that participants with a history of SLDs appear to have more opportunities now than in the 1990s (Conti-Ramsden et al. 2009; Durkin et al. 2009).

Implications and recommendations

This scoping review is the first comprehensive attempt to summarise the data available on the potential long-term effects of SLDs reported in the literature. These results have implications for individuals living with SLDs, their families and the clinicians advising them. Although the results varied, across the 51 studies that met the inclusion criteria, the most common results reported were suboptimal mental health,

social well-being and academic outcomes for persons with a history of SLDs. Most studies ($n = 40$) reported mental health outcomes, while fewer studies ($n = 17$) explored academic outcomes. However, these findings are limited to only those reported by the authors in the studies reviewed. The average quality rating of the included studies did not seem to differ across these three domains. Studies published before 1990 were given lower quality ratings, predominantly because of the lack of reporting control groups and lower population representation in the samples. The differences in associations between SLDs and outcomes identified in the studies are likely a result of study-related factors, and therefore, clinical implications should be drawn based on study quality and applicability. Thirty-nine studies included more than 60 participants with SLDs, 41 included comparison groups, and 17 studies had a follow-up of 10 years or greater. Within the studies, different assessment tools were used to determine SLD, and terminology defining SLDs was non-uniform between studies. Because of the varied quality of the studies reviewed and the lack of terminology defining disorders, it was not possible to compare the severity of the SLDs described between studies; however, future reviews should seek to do so. Despite the international diagnostic variation, the evidence that childhood SLDs can have long-term impacts on mental health, social well-being and academic outcomes was strong.

Long-term outcomes

Having a childhood diagnosis of an SLD appears to be associated with mental health outcomes, with evidence most consistently indicating associations with personality disorders and behavioural problems. This is important for treating professionals to be aware of, as they are well positioned to refer patients to ancillary support services for early intervention. This review found a high association between SLDs and behavioural disorders; however, the authors were unclear whether this relationship was incidental or causative (Lindsay, Dockrell & Strand 2007; Weinberg et al. 1998). It should be noted that other factors may have been responsible for these effects, including social, cognitive and genetic risk factors (Lau et al. 2007). Multilingual countries like South Africa face unique SLD diagnosis and treatment challenges (Jordaan & Yelland 2003). More research aimed at these constructs will provide a better understanding of these problems in individuals with SLDs and how treating professionals can support them (Kathard & Pillay 2013; Whitehouse et al. 2009). Additionally, studies reported the added difficulty of diagnosing SLDs in individuals with existing childhood behavioural or psychiatric disorders (Sundheim & Voeller 2004). This phenomenon may have resulted in under- or overestimation of the occurrence of SLDs and therefore their impact within the studies. No association was found between childhood SLDs and substance use disorder. However, difficulties that are often comorbid with SLDs, such as self-regulation difficulties, hyperactivity and school-based difficulties, are seen to be potential precursors of substance use disorder (Weinberg et al. 1998).

Evidence for the impact of SLDs on relationships and employment varied. Evidence suggests that persons with a history of SLDs are more likely to be employed in unskilled or manual labour than their peers. In today's knowledge economy, which increasingly relies on knowledge over physical capital and labour (Brinkley 2006), workers who are unable to communicate clearly may be disadvantaged. This effect coupled with the decline in jobs in the manual sector and associated lower incomes may enhance the socio-economic impacts of SLDs for individuals. This enhanced effect could potentially lead to exacerbation of their condition through reduced access to health services because of financial barriers (Ruben 2000). This could create a cycle of disadvantage and accentuate the impact of the social gradient on health from a young age (Law, Reilly & Snow 2013), further disadvantaging vulnerable populations such as those with SLDs.

Similar to employment, evidence suggests that individuals with a history of SLDs are likely to experience overall lower academic achievement compared to their peers (King et al. 1982; Snowling et al. 2001). However, researchers also noted that individuals with SLDs may be as or more satisfied with their results than their peers (Felsenfeld et al. 1994; Records et al. 1992). These findings may reflect the fact that students with SLDs have to work harder than non-SLD peers for desired results and thus feel more satisfied with the academic outcomes they achieve (Records et al. 1992; Western & Tomaszewski 2016). Regardless of the cause of this discrepancy, the finding that SLDs are associated with lower academic achievement has important implications for early diagnosis and intervention services.

Clinical implications

There is a consensus supporting diagnosis and intervention before formal schooling to improve SLD, and thus to avoid the child experiencing academic failure (Buschmann et al. 2009; Nippold 2012). Interventions that are frequent, intense and systematic, that promote engagement and attention of children within a supportive and positive environment, and that are tailored to focus on normal classroom language needs have been shown to facilitate positive outcomes for children with SLDs (Hartshorne 2009b; Nippold 2012). This evidence highlights the important role of speech pathologists in identifying and intervening early for children with SLD.

Earlier intervention could avert or reduce substantial and ongoing costs to the individual and society as a whole. Research from the UK reports that the annual benefit of speech pathology intervention for just three disorders (aphasia following stroke, SLD and autism) is £765 million (Royal College of Speech & Language Therapists 2017). For example, 30 half-hour speech-language therapy sessions cost approximately £671.00 per patient, yet provide £4455.00 benefit per individual in terms of increased educational attainment and earnings (Royal College of Speech & Language Therapists 2017). Research from the US and the UK reports significantly higher societal costs associated

with individuals with SLDs. These costs are related to employment support, increased educational needs, welfare benefits, social service costs (resulting from behavioural and emotional development effects), mental health services, challenges communicating within the justice or health system and juvenile delinquency (Hartshorne 2009a; Speech Pathology Australia 2014). The healthcare and out-of-pocket costs for children with SLDs was higher in the age groups 4–5 years, 6–7 years and 10–11 years than for children without SLDs (Cronin et al. 2017). Therefore, appropriate early intervention by professionals such as speech pathologists could yield substantial economic and social cost savings, although further research needs to be conducted to quantify these savings.

Limitations

Differences in terminology, definitions and methods to assess outcomes across the included studies were a barrier for comparability and led to limitations within this review. In particular, many terms and different criteria were used to describe participants' SLDs, underlining the importance of the consistent terminology proposed by Bishop et al. (2016). As this review was intended to provide an overview of outcome effects, the results were not reported by disorder type. The studies reported results from individuals with different combinations and severity of SLDs, and this diversity presents difficulty in generalising the findings. Given the complex nature of SLDs, the exclusion of studies that reported SLDs resulting from biomedical conditions may have excluded relevant studies, as the interplay of biomedical and non-biomedical factors affecting SLDs is complex. However, this review provides an excellent collective representation of the effects of childhood SLDs in later life, which is relevant for developing health policy and fuelling advocacy. Additionally, studies were not excluded if they reported new results or results from different time points in the same data. While this has the potential to confound some of the results, as there was no meta-analysis of results it was not deemed inappropriate. Because of lack of terminology within the literature, some eligible studies may not have been captured during the initial searches; however, all search terms, inclusion and exclusion criteria and methods have been outlined clearly to improve reproducibility. The studies included spanned a large range of ages because of variations in their enrolment ages and follow-up periods. This variation may affect the generalisability of results to all age groups; however, this is why the scoping review method was used. Additionally, as the literature searches were conducted in 2017 and the analysis and synthesis of results took an extended period, future research could examine more recent literature and use this review as a foundation.

In this scoping review, a quality assessment tool was used to group studies and potentially explain diverging findings, increasing the quality of the investigation. Despite receiving criticism for rating validity and inter-rater reliability (Hartling et al. 2013; Lo, Mertz & Loeb 2014), the Newcastle–Ottawa scale has been used extensively (Abdel-Latif et al. 2007; Aziz et al. 2006; Margulis et al. 2014; Prins & Van der Wurff 2009). It has also been endorsed by the Cochrane Collaboration for

use in assessing the study quality of observational studies and has been reported as a convenient and adaptable tool (Margulis et al. 2014). To minimise these potential shortcomings, two researchers independently rated the quality of each eligible study, with the third researcher adjudicating the differences until consensus was reached.

Conclusion

This review of 51 cohort studies provides evidence that individuals who have childhood SLDs may experience a higher incidence of mental health difficulties, reduced social well-being and reduced academic achievement compared to their peers. The results also indicate that childhood SLDs are complex, and their effects can persist into adolescence and adulthood, potentially causing significant negative effects for the individual, society and the healthcare system, supporting the importance of early intervention and improvements in access. Further research examining the long-term effects of childhood SLDs is required to conclusively determine the impact of SLDs on each of these domains.

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Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this review article.

Authors' contribution

All authors contributed equally to this work.

Ethical consideration

This article followed all ethical standards for research without direct contact with human or animal subjects.

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Data availability statement

Data sharing is not applicable to this article, as no new data were created or analysed in this study.

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Appendix 1

TABLE 1-A1: Modified Newcastle–Ottawa scale for assessing the quality of included studies.

Domain	Indicator and item	Scoring
Selection bias	Representativeness in the intervention cohort:	
	• Truly or somewhat representative of the average speech and language-impaired child in the community	1
	• Selected group of participants or no description of the derivation of the cohort	0
	Selection of non-impaired cohort:	
	• Drawn from the same community as the impaired cohort	1
	• Drawn from a different source or no description of the derivation of the non-impaired cohort	0
Ascertainment of impairment:	• Diagnosed by speech and language pathologist or validated assessment by researcher	1
	• Self-report, other or no description	0
	Comparability	Comparability of cohorts on the basis of the design or analysis:
	• Study controls for one of the following factors: socio-economic status, maternal education, literacy and language, gender and non-verbal IQ	1
	• Study controls for more than one or any additional factors	1
Outcome	Assessment of outcome:	
	• Assessment by validated instruments, semi-structured interviews or record linkage	1
	• Self-report, other or no description	0
	Adequacy of follow-up period:	
	• Follow-up period, 10+ years	1
	• Follow-up period, < 10 years	0
	Adequacy of follow-up of cohorts:	
• ≤30% of participants lost to follow-up or description of those lost suggesting no difference from those followed	1	
• <30% of participants lost to follow-up, description of those lost suggesting difference from those followed, or no information	0	

IQ, intelligence quotient.