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Jasmyn Hall
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Date: 31/1/2014

Communication disorders and Indigenous Australians

A synthesis and critique of the available literature

Honours Research Thesis – SPE4106

Jasmyn Hall

Edith Cowan University

2013

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Abstract

Purpose: To synthesise and critique the available diverse literature related to communication disorders experienced by Indigenous Australians. This is in order to provide health professionals with a resource guide for evidence based decision making. The review has a specific focus on prevalence, assessment and effective treatment of communication disorders and explores these across the lifespan.

Method: A three phase systematic search process was adopted. A number of key databases, speech pathology journals and grey literature sources were searched to obtain articles relevant to the research aims. Two researchers independently rated articles for inclusion as well as methodological quality using the Kmet rating tool. Data synthesis was completed by categorising articles according to communication disorder type and methodology used.. Each article was then summarised for key findings relating to the research aims.

Results: A total of 85 articles rated highly relevant were included in the review. A total of 60% of the available literature was textual or grey literature and 40% was quantitative or qualitative studies. Methodological quality of the 34 quantitative and qualitative articles ranged from limited (13), adequate (2), good (5) to strong (14). The majority of articles focussed on hearing loss, language and early literacy. No articles were identified addressing voice or fluency disorders. Limited evidence was found for any of the areas addressed in the research aims.

Conclusion: High quality scientific literature surrounding Indigenous communication disorders is limited. The available sources of information favoured textual papers or 'grey' literature government sources. Very little published scientific quantitative or qualitative studies are available to address the issues of prevalence, assessment or treatment of specific communication disorders. Given the likelihood of the burden of communication disorders amongst this population, the lack of evidence is concerning. The complexities of conducting research within the Indigenous Australian population are acknowledged and whilst empirical scientific evidence is still lacking, the last five years has seen greater focus and commitment to improving the knowledge base with higher quality scientific research being conducted.

Key Words: Communication disorder; communication disability; Indigenous Australian; Aboriginal; Torres Strait Islander; speech-language pathology.

Indigenous Australians and Communication Disorders
A Synthesis and Critique of the Literature

An abundance of research literature exists that relates to prevalent health issues affecting Indigenous Australians. Chronic disease, infectious disease and other issues such as ear, eye and oral health are among the most researched areas (Derrick et al., 2012; Lowell, 2013). Scholarly articles and government documents are readily available to provide key information on the disproportionately high incidence of these conditions experienced by Indigenous Australians as well as the services available and recommended interventions to address these health issues (Australian Bureau of Statistics & Australian Institute of Health and Welfare, 2001; de Courten et al., 1998). However, this is not the case for the area of communication disorders.

It is estimated that one in seven Australians have a communication disorder (CD) (Speech Pathology Australia, 2012). Speech Pathology Australia (SPA) defines a CD as one or more areas of communication (speech, language, pragmatics, fluency or voice) being ineffective. The ability to communicate is an essential skill required for participation in modern society. Links between CD and poor educational achievement, social isolation, limited employment prospects, behavioural issues and incarceration are well documented in the general population (Conti-Ramsden, Durkin, Simkin, & Knox, 2009; Linares-Orama, 2005; McCormack, McLeod, McAllister, & Harrison, 2009; Toohill, McLeod, & McCormack, 2012) and it is also known that for Indigenous Australian children these future risks may be even greater (McTurk, Nutton, Lea, Robinson, & Carapetis, 2008). Although a small amount of literature on Indigenous Australians and CD exists, it is acknowledged that little empirical scientific evidence is available on the prevalence, assessment or intervention for this population (Davidson, Hill, & Nelson, 2013; Lowell, 2013; Wheldall, Beaman, & Langstaff, 2010).

Communication is defined as the activity of conveying information through the exchange of thoughts, information or messages. This meaningful exchange between two or more people can be performed using speech, writing, sign, gesture or facial expressions to convey a message. When someone is considered to have a CD, an impairment in the ability to receive, send, process or comprehend information exists (American Speech-Language-Hearing Association, 1993). The severity of CD can range from mild to severe, and can be developmental or acquired across the lifespan. CD may affect the areas of hearing, speech

and/or language. Individuals can display one or a combination of CD that can be a primary disability or secondary to another disability (American Speech-Language-Hearing Association, 1993).

A speech disorder is an impairment to an individual's articulation of speech sounds, their fluency or their voice (American Speech-Language-Hearing Association, 1993). This type of CD includes articulation disorders in which atypical speech sound production results in an individuals reduced intelligibility; fluency disorders such as stuttering which are an interruption to the flow of speaking; and voice disorders where individuals produce abnormal or reduced vocal quality. Any of these disorders involving speech production impact an individual's ability to communicate. CD involving language result in an impairment to comprehension and/or the use of the spoken or written symbols known as language. Language disorders can involve the form of language (phonology, morphology, syntax), the content of language (semantics) and the use of language (pragmatics) (American Speech-Language-Hearing Association, 1993). Cognitive CD are a result of congenital or acquired injuries such as stroke or traumatic brain injury. Any aspect of communication can be affected by a disruption to an individual's cognitive processes such as memory, attention, perception, organisation and executive functions (K. Smith et al., 2008).

In a 2011 briefing paper, SPA recommended to the Australian Government a national enquiry into the social and economic impact of CD, addressing the critical need for comprehensive data on CD in Australia. The briefing paper included a specific recommendation for a review of Indigenous Australians status in this regard because of the likelihood of heightened prevalence and impact within Australia's most disadvantaged population (Speech Pathology Australia, 2011). The current lack of data in this area suggests a lack of recognition of the problem and could contribute to a lack of government planning in terms of appropriate services and resources. The nature of CD makes recognition particularly problematic since a CD is largely an invisible and silent disability impacting an individual's ability to understand others, to speak out or be understood and to seek appropriate help. Hence people with CD are less likely or able to advocate for themselves. It is therefore critical to better understand CD experienced by Indigenous Australians if Australia is to close the gap and improve service delivery in this area.

According to the Australian Bureau of Statistics, the 2011 census count reported the Australian Indigenous population to be at 669,736 people (Australian Bureau of Statistics,

2011). Of these, 90 per cent were of Aboriginal origin, six per cent Torres Strait Islander and the remaining four per cent identifying as being both Aboriginal and Torres Strait Islander. The state of New South Wales has the largest resident population of Indigenous Australians, followed by Queensland, Western Australia and the Northern Territory. The most up to date information indicates that in 2006, 31% of Indigenous Australians lived in major cities of Australia, 22% lived in inner regional Australia, 23% lived in outer regional Australia, 8% lived in remote Australia and 16% lived in very remote Australia (Australian Bureau of Statistics, 2006). Approximately 56% of Australia's Indigenous population are aged between 0-24 years. It is estimated that 36% of Indigenous Australians are under 15 years of age, compared with 18% of non-Indigenous Australians and about 3% of Indigenous Australians were aged 65 years and over, compared with 14% of non-Indigenous Australians (Australian Bureau of Statistics, 2011). These figures indicate Australia's Indigenous population is much younger than the non-Indigenous Australian population. It was reported in the 2011 census that 83% of Indigenous Australians spoke English at home and it is probable that the majority speak a form of Aboriginal English (AE), meaning their language is on a continuum ranging from something very close to Standard Australian English (SAE) at one end and something representing more creole at the other end (Butcher, 2008). It was also reported that 11% spoke an Indigenous Australian language at home and 17% of those who spoke an Indigenous language at home reported to not speak English well or at all. The traditional Indigenous languages most commonly spoken at home were Arandic language varieties with 77% claiming to be proficient followed by Yolngu speakers with 68% claiming to be proficient (Australian Bureau of Statistics, 2011).

A growing debate in the CD literature regarding communication and Indigenous Australians is the issue of how non-Indigenous health and education professionals assessing language, communication development and function, recognise communication difference versus diagnosing a CD. Whilst it is estimated that 83% of Indigenous Australians speak English at home (Australian Bureau of Statistics, 2011) what is often not recognised is that many Indigenous Australians identifying as English speakers use a distinctly Aboriginal form of English that differs markedly from SAE (McKay, 2011; Toohill et al., 2012). AE differs from SAE on lexical, grammatical, phonological and pragmatic levels (Butcher, 2008; McKay, 2011; Pearce & Stockings, 2011; Toohill et al., 2012). It is these differences at all linguistic levels that lead researchers to question the appropriateness of standardised speech and language assessments for Indigenous Australian children (Pearce & Williams, 2013). Literature suggests a possible risk for over and under diagnosis of language impairment due

to the misattribution of the features of AE, resulting in inaccuracies in determining CD or difference (Gould, 2008b; Pearce & Williams, 2013). Speech Pathologists in Australia are beginning to argue for different approaches to assessment and intervention which are able to consider a child's home language, often AE (Davidson et al., 2013).

However, some researchers challenge the emphasis placed on communication 'difference'. They argue that the role of cultural and linguistic difference in the learning process has been exaggerated and too much emphasis is placed on a students' background and reasons for difficulty, rather than on 'what' and 'how' one should teach (Wheldall et al., 2010). Scientific evidence on the language and communication 'difference' of Indigenous students is rarely referenced or considered in the Indigenous literacy debate and it is also acknowledged that few scientific articles exist to support this 'difference' (Gould, 2008c; Wheldall et al., 2010). Nakata (2003) shared the belief that instead of being preoccupied with and blaming Indigenous cultural and linguistic differences as a 'convenient' justification for student failures, there should be a shift towards understanding the goals and processes of language and literacy learning and adapting, innovating and adjusting these for each individual student (Nakata, 2003). Clearly, debate in this area will continue.

Other potential factors that may contribute to communication disorders in Indigenous Australians include hearing disorders, maternal smoking, alcohol use during pregnancy and cardiovascular risks such as smoking, diabetes and hypertension. The high prevalence of otitis media (OM) and conductive hearing loss experienced by Indigenous Australian children (Davidson et al., 2013) is well documented within the literature. Prevalence has been reported to be amongst the highest in the world (Couzos & Murray, 2003), manifesting early in life and occurring even beyond adolescence (Couzos, Metcalf, & Murray, 2001; C. Williams & Jacobs, 2009). OM and hearing loss primarily impact language development which then adversely impacts educational outcomes, including literacy achievement (Couzos et al., 2001). This is a topic of increased discussion and research within the Indigenous Australian population, with evidence that inconsistent auditory signals contributes to impaired language development, speech discrimination and processing difficulties as well as delayed phonological development, all well-established precursors for literacy acquisition (Partington & Galloway, 2005; Walker & Wigglesworth, 2001; C. Williams & Jacobs, 2009).

One factor related to impaired early child neurodevelopment is maternal smoking (Wehby, Prater, McCarthy, Castilla, & Murray, 2011). Figures reported in the National

Perinatal Data Collection in 2007 revealed that 51% of Australia's Indigenous mothers' smoked during pregnancy, compared to 15% of non-Indigenous mothers' (Australian Institute of Health and Welfare, 2011b). Several studies demonstrate the adverse effects of smoking while pregnant to include impaired cognitive functioning, poor language development, delayed response to sound in utero (Key et al., 2007) and a lower ability to discriminate between sounds after birth, which is a vital skill for later language development (Wehby et al., 2011). Analysis of the 2008 National Aboriginal Torres Strait Islander Social Survey (NATSISS) also identified that 20% of Indigenous mothers' reported consuming alcohol during pregnancy (Australian Bureau of Statistics, 2009), a second factor related to impaired early child neurodevelopment.

Foetal alcohol spectrum disorder (FASD) is the umbrella term given to the adverse effects cause by prenatal exposure to alcohol (National Indigenous Drug and Alcohol Committee, 2012). The first report to identify prevalence of FASD estimated 2.76 per 1000 births for Indigenous Australian children and 0.02 for non-Indigenous Australian children (Bower, Silva, Henderson, Ryan, & Rudy, 2000). A prospective national study by Elliot et al. (2008) described the epidemiology of cases of FASD seen by 1,150 Australian paediatricians during 2001-2004. Of the 169 cases reported, 92 fulfilled the study criteria of FASD of which 65% were Indigenous children and 59.8% had speech and language disorders (Elliott, Payne, Morris, Haan, & Bower, 2008). Gould (2008) also discusses the misuse of FASD as a 'default position' for lack of educational progress and behavioural difficulties as a way to medicalise language difference as a biological deficit (Gould, 2008a).

The known greater prevalence of cardiovascular risk factors such as smoking, alcohol and substance abuse, diabetes and hypertension within the Indigenous Australian population are all potential risk factors for stroke (Thrift, Cadilhac, & Eades, 2011). These factors, together with the high rates of head injury (Bohanna et al., 2013) within the Indigenous Australian population may be potential risk factors contributing to acquired communication disorders. Acquired communication disorders are often the result of stroke or brain injury and can result in deficits to many areas of communication including speech, language, voice, fluency and cognition. For example, wider aphasia literature reports that approximately 30% of individuals having suffered a stroke are aphasic (Engelter et al., 2006). Although there are no direct studies investigating the links or impact of smoking or alcohol on Indigenous Australians with CD, the high prevalence of both factors as well as prior to, during and after pregnancy in this population is well documented as potential risk factors known to

significantly impact early child development (D'Aprano, Carapetis, & Andrews, 2011). Further investigation is warranted to establish the exact relationships between these factors and Indigenous Australians with a CD.

The current review represents an attempt to fill what appears to be a current void in available resources for health practitioners potentially dealing with Indigenous Australians with CD. The existing literature is extensively distributed throughout multiple sources, making access to relevant information for individuals and service providers challenging, time consuming and frustrating. The review enables a single point of reference for detailed information covering all CD, providing clinicians with a time-saving resource that will enable them to incorporate the evidence into their everyday clinical decision making. It synthesises and critiques the available literature pertaining to Indigenous Australians and CD. More specifically, the review aimed to bring the literature together for the broader health community through the future development of a review publication for the Australian Indigenous Health*Info*net. The ultimate aim was to provide a coherent and comprehensive review to enable health professionals to better understand CD experienced across the lifespan by Indigenous Australians and the services and/or interventions currently offered to support these individuals.

Specifically, the research questions to be addressed were:

1. What is the evidence related to the prevalence of CD in Indigenous Australians across the areas of language, speech, hearing, literacy, voice, fluency and cognition (as related to brain injury)?

2. What evidence is available for valid assessment and diagnosis of CD in Indigenous Australians in the above mentioned areas?

3. What evidence is available for effective treatments of CD in Indigenous Australians in the above mentioned areas?

4. What information is available on Indigenous Australians experiences of CD?

5. What is the level of quality of the available literature for prevalence, assessment and diagnosis, treatment and experiences for Indigenous Australians with CD?

Method

The review followed the standard systematic review guidelines approach as used by The Joanna Briggs Institute (The Joanna Briggs Institute, 2008). Due to the complex nature of the review and different evidence sources available, a mixed-methods systematic approach was used to capture and include a wide variety of study designs such as quantitative, qualitative, textual and 'grey' literature. The limitations of traditional forms of systematic reviews in utilising all available types of evidence are becoming increasingly obvious for policy-makers and practitioners working within health services (Dixon-Woods, Agarwal, Jones, Young, & Sutton, 2005). A mixed-methods approach that includes the diverse literature available therefore reduces the limitations of the study, demonstrates triangulation to enhance the confidence in the findings and provides more relevant research to increase the value that the review has towards knowledge transfer and exchange (Harden, 2010). Mixed-method systematic reviews preserve the integrity of the data thus facilitating a critical analysis of the literature to inform future policy, practice and clinical decision making (Harden, 2010).

Search Strategy

The search strategy utilised a three phase approach to source both published and unpublished literature, ensuring a thorough search process to reach saturation of the available literature. Literature published in English and from 1990 onwards was considered for inclusion. Consultation was initially sought with an experienced research librarian to assist with the online search strategy and to ensure location of all appropriate studies through strategic and truncated search methods within the most relevant databases and journals. Phase one of the search process used broad key word strings (Appendix A) to search the databases of CINAHL, SpeechBITE, Medline and ERIC to locate potentially relevant literature in peer-reviewed journals. All citations were reviewed for relevance based on predetermined inclusion criteria as documented below. Words contained within the title, abstract and index terms used to describe the article were also analysed to establish a list of further key word search terms and phrases for phase two of the search process (Appendix C). Phase two of the search process involved a comprehensive search using sensitive searches and indexing terms created from the list of key words and phrases generated in phase one. Additional databases and journals (Appendix B) specifically related to the field of speech language pathology were then searched to locate further relevant literature. Phase three involved searching reference

lists contained within all identified literature as well as hand searching through specified 'grey' literature sources (Appendix B) that included government reports and policy documents, conference proceedings or discussion papers. The most current document for any grey literature with yearly publications was sought, rather than including multiple years. An author search was also conducted on the names of any individuals that were identified as having made contributions to the literature on Indigenous Australian communication and a number of key authors currently conducting topic related research were contacted via email to source additional literature.

The studies that met the following criteria were included in the review:

- Studies that contained reference to communication disorders of a speech, language, voice, cognition, literacy, hearing and fluency nature.
- Studies that included participants who were Indigenous Australian adults and children. An Indigenous Australian was defined as an individual who identifies as either Aboriginal or Torres Strait Islander.
- Articles that discussed prevalence, diagnosis, treatment and personal experiences from Indigenous Australians with CD.
- Articles that were deemed highly relevant to the research aims as determined by two reviewers during a blind review process.
- Articles that were published from 1990 onwards and were in written in English.

A total of 3,766 abstracts were retrieved in the first stage of the search process. Of these, 3,695 abstracts were discarded as they did not meet the above mentioned inclusion criteria for reasons including non-Australian location, study population or disorders being investigated. This resulted in 70 peer-reviewed articles retrieved for full searching in phase one. Phase two resulted in an additional 46 peer reviewed articles and phase three resulted in an additional 85 articles (peer and non-peer reviewed) retrieved for full searching. A total of 201 possible articles were available for inclusion (Appendix E). Because of the complexity of variables involved in CD, it became apparent that several of the articles whilst mentioning CD, primarily focussed on aspects such as hearing loss or testing for hearing loss. In addition, while mentioning language development, many articles focussed on school readiness and attendance. Hence, further rating of the articles in terms of degrees of relevance to the

research aims was undertaken. Articles were deemed highly relevant if they specifically addressed CD in one or more of the research questions. Articles were deemed having some relevance if they mentioned CD but did not address a specific research question, and articles were deemed having no relevance if they were not specific to CD and did address a research question. Two reviewers independently rated all articles and compared ratings and a third reviewer was used to judge any disagreement. Of the 201 articles, 85 were deemed highly relevant, 65 deemed having some relevance and 51 deemed no relevance to the research aims. For the purposes of this review, 85 highly relevant articles were included.

Assessment of Methodological Quality

The overall goal of the review was to provide a comprehensive report of what was contained in the literature without excluding any important studies. At the outset, the researcher was aware of the limited nature of studies in this area, and the likelihood of a lack of what is considered to be high level evidence based research. The assessment of methodological quality was therefore not used to determine inclusion or exclusion of articles. However, once included, studies were rated for methodological quality using a number of rating tools. For quantitative and qualitative articles the Kmet tool (Kmet, Lee, & Cook, 2004) was used to assess quality and provide readers with a basis for clinical decision making. The Kmet tool was chosen as the most suitable instrument to rate the articles as it was deemed more relevant to the type of studies included in the review compared with other rating scales that are specifically designed to rate higher level evidence such as randomised control trials. Appraising the quality of evidence is an important task which is increasingly complex when considering multiple study designs. There is an abundance of reliable checklists that exist to rate specific study designs such as randomised control trials, however this is not the case for reviews that simultaneously assess a wide variety of evidence from diverse study designs (Kmet et al., 2004). Given the lack of empirically grounded tools for use with multiple study designs, the Kmet tool was developed to fill such gap and enable the evaluation of the quality of studies from multiple designs (Kmet et al., 2004). No other standard criteria for simultaneously assessing the quality of diverse study designs exists to date (Kmet et al., 2004), therefore it was decided that the Kmet rating tool was most appropriate for this review.

Two reviewers independently rated each article using the Kmet checklists, which comprised of 10 qualitative questions and 14 quantitative questions scored according to the

instruction and scoring manual (Kmet et al., 2004). For the four mixed-method studies (qualitative and quantitative) both Kmet checklists were used and scores were combined to rate the article. Discrepancies were resolved by reviewer discussion and consensus was reached. Once the final score for each article was decided, scores were represented as a percentage with the strength of methodological quality being categorised as, strong (>85%), good (70-85%), adequate (60-70%) and limited (<60%). Textual studies were rated using The Joanna Briggs Critical Appraisal Checklist for Narrative, Expert opinion and Text (The Joanna Briggs Institute, 2008). This seven point checklist is useful in determining the credibility of the source, the motives for the opinions examined and the global context for the consideration of alternate or complimentary views in order to determine validity (The Joanna Briggs Institute, 2008). .Grey literature was rated using the ACCODS (Authority, Accuracy, Coverage, Objectivity, Date and Significance) checklist which is designed to enable evaluation and critical appraisal of grey literature (Tyndall, 2008).

Data Extraction

The process of sourcing and recording relevant results from the located literature sources followed processes outlined by The Joanna Briggs Institute (The Joanna Briggs Institute, 2008) and was completed using a standardised data extraction form on Microsoft Excel to ensure accurate and reliable data entry recordings for analysis (Appendix D). The same data extraction form was used consistently across all studies regardless of study design (quantitative, qualitative, textual or grey literature) in order to readily identify and summarise the data within one single document. The data extraction form recorded author, year of publication, area of disorder, population, number of participants, setting, geographical context, study design, data collection and analysis methods, results and main findings. Spread sheet software such as Microsoft Excel is a commonly used and inexpensive tool for data collection, summary and analysis when conducting systematic reviews (Elamin et al., 2009).

Data Synthesis

Studies were categorised according to CD type and methodology used i.e. quantitative, qualitative, textual and grey literature. Each article was then summarised for key findings relating to the research aims of prevalence, assessment, treatment and experiences. Due to the methodologies within the included articles, a meta-analysis was not possible or suitable for the review. Instead, this systematic review collated and extracted the data to present a summary of the results, literature quality and discussion of methodological issues.

Results

Of the 85 studies included in the review, 22 were quantitative studies, eight were qualitative studies, four were mixed-methods studies (quantitative and qualitative), 32 were textual articles (literature/systematic/narrative reviews, discussion papers or expert opinions) and 19 were unpublished grey literature documents (Appendix E). The articles retrieved were categorised according to the area of communication disorder. In total, six articles were specifically relevant to cognition, 20 articles were relevant to communication disorders in general, 24 articles were specifically relevant to hearing, 25 articles were specifically relevant to language, nine articles were specifically relevant to literacy and one article was specifically relevant to speech. There were no articles retrieved that related specifically to voice or fluency disorders.

A total of 12 articles were rated using the Kmet qualitative checklist (8 qualitative studies, 4 mixed methods studies) and a total of 26 articles were rated using the Kmet quantitative checklist (22 quantitative studies, 4 mixed methods studies). Of the 484 question items answered, a total of 311 were initially scored the same by both reviewers equalling an initial inter-rater reliability (by item) of 64%. The initial inter-rater reliability for the qualitative studies was 61% and for the quantitative studies initial inter-rater reliability was 65%. For the sample of qualitative articles, inter-rater reliability (by item) ranged from 42% to 75%. The overall scores assigned by the first reviewer ranged from 0.25 to 0.85 (M = 0.54, SD = 0.18). The overall scores assigned by the second reviewer ranged from 0.25 to 1.0 (M = 0.55, SD = 0.25). Both reviewers assigned the same score to four articles, and for all of the remaining articles discrepancies in the overall scores ranged from 0.05 to 0.35. Most discrepancies in the qualitative articles reflected differences in the assignment of ‘yes’ versus ‘partial’ to a number of questions.

For the sample of quantitative articles, inter-rater agreement (by item) ranged from 46% to 92%. The overall scores assigned by the first reviewer ranged from 0.27 to 0.95 (M = 0.68, SD = 0.18). The overall scores assigned by the second reviewer ranged from 0.28 to 1 (M = 0.73, SD = 0.24). Both reviewers assigned the same score for two articles, and for all of the remaining articles discrepancies in the overall scores ranged from 0.01 to 0.37. Most discrepancies reflected differences in the assignment of ‘yes’ versus ‘partial’ to a number of questions, as well as differences of opinion on how applicable certain questions were to specific study designs.

The methodological quality rating of the 34 qualitative and quantitative articles ranged from 20% to 100%. Of the 34 quantitative and qualitative articles, the methodological quality was rated limited for 13 articles, adequate for 2, good for five and strong for 14. Only 41% of the articles were rated as having strong methodological quality. Apart from one article, all studies rated strong were published within the last three years between 2010-2013. A summary of these (Table 1) is included and a comprehensive data extraction for all included articles is included in Appendix E. Details of both the quality rating and content of the studies (disorder area, participants and location) relating to the four research aims is outlined below.

Table 1. Summary of included quantitative and qualitative articles

First Author / Year	**Study Design**	**Disorder area and research aim addressed**	**Participant Details**	**Study Location**	**Methodological Quality Rating**
Dunn, 1999	Mixed - qualitative and quantitative	Literacy (Assessment & Treatment)	18 Indigenous preschool children	Warbrook, New South Wales	Limited quality (Score = 9/44)
Freeman, 2008	Mixed - qualitative and quantitative	Literacy (Treatment)	Indigenous children and their families 19 in experimental group and 15 in non-equivalent contrast group	Parramatta NSW	Limited quality (Score = 26/42)
Hewer, 2006	Mixed - qualitative and quantitative	Literacy (Treatment)	Aboriginal parents and Child health nurses (CHN's)	Geraldton, WA	Limited quality (Score = 18/34)

First Author / Year	Study Design	Disorder area and research aim addressed	Participant Details	Study Location	Methodological Quality Rating
Wolgemuth, 2011	Mixed - qualitative and quantitative	Literacy (Treatment)	Indigenous and non-Indigenous Grade 2 students Intervention Group – 67 Indigenous / 51 non-Indigenous Control Group – 29 Indigenous and 19 non-Indigenous	Northern Territory	Good quality (Score = 33/44)
Armstrong, 2012	Qualitative	Cognition (Experiences)	3 Indigenous adult males	Perth	Strong quality (Score = 20/20)
Gauld, 2011	Qualitative	Cognition (Treatment)	Between 5-50 Indigenous participants	Far North Queensland	Adequate quality (Score = 13/20)
Davidson, 2013	Qualitative	Communication (Treatment)	8 non-Indigenous speech pathology / occupational therapy students	Brisbane	Limited quality (Score =8/20)
Lowell, 1998	Qualitative	Communication (Assessment)	30 Indigenous school aged children	Northern Territory	Limited quality (Score = 9/20)
Lowell, 1993	Qualitative	Hearing (Assessment)	30 Indigenous school aged children	Northern Territory	Limited quality (Score = 10/20)
Lowell, 1995	Qualitative	Hearing (Assessment & Treatment)	30 Indigenous school aged children	Northern Territory	Limited quality (Score = 5/20)

First Author / Year	Study Design	Disorder area and research aim addressed	Participant Details	Study Location	Methodological Quality Rating
Warren, 2008	Qualitative	Language (Treatment)	28 Indigenous school aged children Classroom Year 6/7: 8 Aboriginal and 6 Torres Strait Island students aged 10-12 Classroom Year 3/4/5: 8 Aboriginal and 6 Torres Strait Island students – ages not specified	Northern Queensland	Limited quality (Score = 10/20)
Harper, 2012	Qualitative	Literacy (Treatment)	Indigenous and non-Indigenous students and their teachers – number of participants not disclosed	Northern Territory	Strong quality (Score = 18/20)
LoGiudice, 2006	Quantitative	Cognition (Assessment)	70 Indigenous participants (30 male / 40 female)	Kimberley Region	Strong quality (Score = 18/20)
McCormack, 2011	Quantitative	Communication (Prevalence & Assessment)	4,329 total participants Inclusive of 124 Indigenous children aged 4-5 years	Australia wide	Strong quality (Score = 20/20)
McDonald, 2012	Quantitative	Communication (Prevalence & Assessment)	134 Indigenous children Mean age 12.3months	Campbelltown NSW	Strong quality (Score = 22/22)
Aithal, 2008	Quantitative	Hearing (Assessment)	18 participants (11 Indigenous – 9 female / 2 male) (7 non-Indigenous – 3	Tiwi Islands	Good quality (Score = 16/20)

First Author / Year	Study Design	Disorder area and research aim addressed	Participant Details	Study Location	Methodological Quality Rating
			male / 4 female)		
Howard, 1991	Quantitative	Hearing (Assessment)	49 Indigenous school aged children	Darwin	Limited quality (Score = 7/22)
Massie, 2004	Quantitative	Hearing (Treatment)	64 Indigenous children 31 males, 33 females Ages 6;1 – 10;3	Cherbourg and Yarrabah, Queensland	Limited quality (Score = 11/20)
Walker, 2001	Quantitative	Hearing (Assessment)	19 Indigenous children Ages 5-6 years	Sydney	Good quality (Score = 18/22)
Yonovitz, 1995	Quantitative	Hearing (Assessment)	12 Aboriginal (6 male / 6 female aged from 6;5 – 13;2 yrs) 12 non-Aboriginal (6 male/6 female aged from 6;6 to 12;3 yrs)	Bathurst Island, Northern Territory	Good quality (Score = 16/20)
Yonovitz, 2000	Quantitative	Hearing (Treatment)	1,032 Indigenous students Ages 4 – 22yrs Average age 13.23 yrs 512 males 520 females	Northern Territory	Limited quality (Score = 12/22)
D'Aprano, 2010	Quantitative	Language (Prevalence & Assessment)	124 Indigenous children Ages 3-7 years	Northern Territory	Adequate quality (Score = 14/20)
Hodge, 2004	Quantitative	Language (Treatment)	31 Indigenous and non-Indigenous preschool aged children (14 Indigenous, 17 non-Indigenous)	Western Australia	Limited quality (Score = 15/28)

First Author / Year	Study Design	Disorder area and research aim addressed	Participant Details	Study Location	Methodological Quality Rating
Loakes, 2012	Quantitative	Language (Assessment)	80 Indigenous children Ages 4 – 12;8	Community 1 – Western Australia Community 2 & 3/4 - Northern Territory	Strong quality (Score = 18/20)
Meakins, 2013	Quantitative	Language (Assessment)	52 Indigenous adults and children Five age groups: 4-6 yrs, 7-8 yrs, 9-11 yrs, 12-15 yrs 20-30 yrs 37 females, 15 males	Kalkaringi	Strong quality (Score = 19/20)
Miller, 2013	Quantitative	Language (Assessment)	15 Indigenous preschool children Aged 4;5 yrs, 9 females, 6 males	Campbelltown NSW	Good quality (Score = 17/22)
Pearce, 2011	Quantitative	Language (Assessment)	6 Indigenous school aged children Ages 6;6 – 9;6 3 females , 3 males	North Queensland	Limited quality (Score 11/22)
Pearce, 2013	Quantitative	Language (Assessment)	19 Indigenous school aged children Ages 8;01 – 13;08	Townsville, QLD	Strong quality (Score = 19/22)
Williams, 2010	Quantitative	Language (Assessment)	10 Aboriginal (4 boys / 6 girls) 10 non-Aboriginal (5 boys / 5 boys) with a mean age of 6;3 years	Perth	Strong quality (Score = 20/22)

First Author / Year	Study Design	Disorder area and research aim addressed	Participant Details	Study Location	Methodological Quality Rating
Williams, 2012	Quantitative	Language (Assessment & Treatment)	128 speech pathologists from each state and territory working with Multilingual children. 21 out of 110 primary languages used by children on the SLP's caseloads were Australian Indigenous languages	Australia wide	Strong quality (Score 15/16)
Ehrich, 2010	Quantitative	Literacy (Treatment)	97 (63 Indigenous / 35 non-Indigenous) school aged children (54 male / 43 female)	Northern Territory	Strong quality (Score = 19/20)
Wheldell, 2010	Quantitative	Literacy (Treatment)	34 Indigenous and non – Indigenous participants. Average age 11;4. 14 Aboriginal students – 4 female / 10 male) 20 non-Aboriginal students – 8 female / 12 male)	Ashfield, NSW	Strong quality (Score = 19/22)

First Author / Year	Study Design	Disorder area and research aim addressed	Participant Details	Study Location	Methodological Quality Rating
Wolgemuth, 2013	Quantitative	Literacy (Treatment)	360 pre and 308 post-test Indigenous and non-Indigenous students ages 5;7-5;9 28% of sample Indigenous students	Northern Territory – Alice Springs, Darwin, Palmerston	Strong quality (Score = 23/24)
Toohill, 2012	Quantitative	Speech (Assessment)	15 Indigenous children Ages 3;11-5;0	Victoria and New South Wales	Strong quality (Score = 22/22)

Prevalence of Indigenous Australians with communication disorders

The majority of prevalence data available constituted part of the 'grey' literature i.e. results of government statistical documents. Apart from one study (Zubrick et al., 2004), no other articles were identified that discussed prevalence of a specific CD i.e. apraxia, instead problems with communication as a whole were often described. The Australian Bureau of Statistics (ABS) and the Australian Institute of Health and Welfare (AIHW) were two primary sources of such data. The ABS reports data related to Census or the National Aboriginal and Torres Strait Islander Social Survey (NATSISS) or other government initiatives such as the Australian Early Development Index (AEDI). In previous ABS statistical disability surveys such as the 1998 Australian Bureau of Statistics Survey of Disability, Ageing and Carers, detailed information about CD is provided, however Indigenous people are not identified. Inclusion of a disability item on the above mentioned NATSISS whilst enabling a basic profile of the prevalence of disability amongst Indigenous people, is only for ages 15 years and above. Provision for the Footprints in Time – Longitudinal Study of Indigenous Children (LSIC) was therefore established within the 2003-04 Federal Budget to pursue a developmental study that aimed to improve the understanding of, and policy response to, the diverse circumstances faced by Aboriginal and Torres Strait Islander children, their families and communities (Department of Families Housing Community Services and Indigenous Affairs, 2009).

Prevalence of hearing disorders such as OM, middle ear disease, conductive hearing loss and fluctuating hearing loss were well documented within the study sample both by qualitative and quantitative studies (Aithal, Yonovitz, & Aithal, 2008; P. S. Morris, 1998). However, the prevalence of Indigenous Australians with CD as a result of hearing problems is lacking as it is across the world for reasons including issues with research design, difficulties comparing Indigenous children with varying degrees and severity of hearing loss, methodological diversity and lack of information on sociodemographics (Aithal et al., 2008; Neinhuys, 1992; C. Williams & Jacobs, 2009).

Two peer reviewed quantitative studies were identified that measured early developmental progress of Indigenous Australian children (D'Aprano et al., 2011; McDonald, Comino, Knight, & Webster, 2012). Whilst both were not directly CD studies, they assessed areas specifically relevant to communication including hearing, expressive and receptive language, cognition, symbolic play and social skills.

Whilst research on the prevalence of cognitive CD resulting from TBI or stroke within Australia's Indigenous population was described in the literature as non-existent or lacking (Armstrong, Hersh, Hayward, Fraser, & Brown, 2012; Bohanna et al., 2013; Gauld, Smith, & Kendall, 2011), statistics indicated that head trauma accounts for 30% of injuries requiring hospitalisation for Indigenous Australians, compared to 18% in the non-Indigenous population (Bohanna et al., 2013). It could be presumed that the number of Indigenous Australians with cognitive CD is therefore significant, given that the wider literature reports up to 80% of people will have some form of resulting communication impairment from TBI (Sarno, 1980) and approximately 30% of people having strokes are aphasic (Armstrong et al., 2012).

Table 2. Prevalence of communication disorders reported within the literature

Study	**Prevalence reported**
AIHW, 2011	• In the 2008 NATSSIS, 41.6% of Indigenous Australians aged 15–64 years had severe or profound core activity limitations in sight, hearing and speech.
AIHW, 2011	• 66.1% of the 4,708 children receiving audiology service had at least one type of middle ear condition. • Otitis media with effusion was the most common middle ear condition (26.5%)

Study	**Prevalence reported**
Australian Early Development Index (AEDI), 2012	• 43.2 % of the 15,490 Indigenous children included in the survey were developmentally vulnerable on one or more of the AEDI domains. • 26.0% of Indigenous children were developmentally vulnerable on two or more of the AEDI domains. • Indigenous children were 3.8 times more likely to be developmentally vulnerable in the language and cognitive skills domain than non-Indigenous children (22.4% and 5.9%). • Indigenous children were 2.4 times more likely to be developmentally vulnerable in the communication and general knowledge domain than non-Indigenous children (19.9% and 8.4%).
Couzos, 2001	• Reported rates of hearing loss range from 5.7-80% and otitis media as high as 95%.
D'Aprano, 2011	• 100% of the 124 Indigenous children assessed scored below the age-specific cut-off on the Brigance developmental screening tool identifying children likely to have developmental disabilities, indicating uniformly poor performance on the language/ communication and academic items.
Footprints in Time: The Longitudinal Study of Indigenous Children – Wave 4, 2011	• 11% of children always needed assistance with communication. • 16.1% of children sometimes needed assistance with communication. • 18.4% of children vulnerable in language and cognitive skills. • 14.4% of children vulnerable in communication and general knowledge skills.
McDonald, 2012	• The mean general quotient score for the Aboriginal infants (97.0) was significantly lower than the Griffiths Mental Development Scales standard score (100.6) for hearing and language • The mean difference was -3.6 (95% CI: -5.3, -1.9).
Ministerial Advisory Committee, 2007	• 11.2% of Aboriginal students attending South Australian government schools verified as having a disability in communication/language.
Morris, 1999	• Rates of perforation ranged from 15.4-67% depending on location, rates of otitis media varied in different areas from 5-42%.
Zubrick, 2004	• 2,240 (10%) children were reported as having trouble saying certain sounds. • Stuttering was reported among 4.5% of children aged 4–17 years and was more common among males than females (6.4% vs. 2.6%).

Assessment and diagnosis of communication disorders in Indigenous Australians

Much discussion within the literature centred around the issue of the appropriateness of current assessment procedures, with many judging these to be suboptimal. It is evident from some of the earlier literature that a perception existed amongst speech pathologists that the availability of culturally appropriate standardised communication tests and assessment tools was lacking and the greatest impact of this being the inability to collect prevalence data (Baildon & Bourke, 2003; Gould, 2008c; Jackson, Lin, & Coffin, 2007; Lowell, 2013). Non-Indigenous speech pathologists using tests standardised on the non-Indigenous population to assess Australias Indigenous population with their vast range of linguistic diversity, differing cultural communication styles and world views is thought to result in misdiagnosis, both underrepresenting and over representing the true communicative abilities of Indigenous Australians (Cahir, 2011; Gould, 2008c; Miller, Webster, Knight, & Comino, 2013). However, anecdotal reports that standardised tests are inappropriate for Indigenous Australian children were not supported by scientific evidence until only recently. The first published scientific study of its kind investigated the performance of Indigenous Australian children on standardized language tests (Pearce & Williams, 2013). The researchers found a poor correlation between teacher ratings of language skills and language assessment results, with test scores negatively influenced by the features of AE (Pearce & Williams, 2013).

Whilst the lack of appropriate assessment tools and methods does not go unrecognised within the literature, some studies have also emerged which suggest that existing standardised tests may have a role in reliable assessment methods for Indigenous Australians when used together with culturally appropriate non-standardised methods such as spontaneous language sampling and recognition of AE features (Miller et al., 2013). A recent study by Miller, Webster, Knight & Comino (2013) in a small sample of urban Aboriginal pre-schoolers used the Clinical Evaluation of Language Fundamentals - Preschool Edition (CELF-P2) combined with a language sample obtained using culturally sound methods and analysed using recommendations made by Gould (2008). The authors reported the CELF-P2 was an appropriate tool for assessing the language development of the children in this way but strongly advised against using it alone to assess Indigenous Australian children (Miller et al., 2013).

Cahir (2011) reviewed the literature on culturally valid language assessments for Indigenous Australian children and suggested that caregiver report, teacher report,

contextualised language samples, dynamic assessment and using novel stimuli such as non-word repetition tasks are culturally safe and valid communication assessment options (Cahir, 2011). This is supported by Gould's (2008c) research that demonstrates non-standard assessment practices are valid communication assessments for Indigenous Australian children. Gould (2008c) reports it is imperative to consider the importance of context upon communication and ensure an understanding of how communication and culture are intricately linked. This was achieved by creating new assessments that reflected the communication system of the Indigenous child and the collection of naturalistic language samples (Gould, 2008c). Through meaningful and purposeful play based tasks that followed traditional Indigenous ways of communicating, the researcher was able to gather valid assessment data that was sensitive and specific enough to diagnose between language difference and language disorder (Gould, 2008c). Whilst non-standardised assessments do not allow comparison with norms, test results can be interpreted in collaboration with Indigenous educators/co-workers to ensure an accurate diagnosis (Gould, 2008c). Other appropriate communication assessments include the Revised Kimberly Early Language Scales (Philpott, 2003) which is an initial step towards developing a framework that is culturally appropriate and offers a culturally valid assessment protocol that is not limited to use by only speech pathologists. The quality of this assessment can be found in its approach to ensuring significant Indigenous input and importance given to interpreters and co-workers and the acknowledgement of traditional language stimulation and child rearing techniques.

The Footprints in Time: Longitudinal Study of Indigenous Children (LSIC) used the developmental and expressive vocabulary assessments 'Who Am I?' and the 'Renfrew Word Finding Vocabulary Test' for the wave two data collection in 2009 to assess processes that underlie the learning of early literacy and numeracy skills of Indigenous children aged 4;5-5;5 (Buckley, Underwood, & Purdie, 2009). The assessments were delivered by Aboriginal and Torres Strait Islander Research Administration Officers demonstrating culturally appropriate assessment methods and were scored by researchers at the Australian Council for Educational Research (Buckley et al., 2009). One factor the study examined was the effects of geographical isolation on language performance. Both assessments demonstrated statistically significant effects of the levels of isolation on test performance of the children. Children classified as no level of isolation scored statistically higher results than children living in geographical areas classified as low/moderate or high/extreme isolation (Buckley et al., 2009). Whilst this study is of government 'grey' literature design, the benefits and quality of this investigation lie in the attempts made to interpret the data in Indigenous contexts, with

assessment and data collection conducted by Indigenous interviewers. Limitations are evident however in the acknowledgement of the sample not being representative of the total Indigenous population and the sample consisting of Indigenous people living in a greater proportion of high or extreme isolation.

The assessment and detection of hearing loss was raised within the literature with health professionals and teachers in particular having difficulty identifying children whose communication difficulties may be a result of hearing disorders. Teachers are described in the literature as unaware of the impacts of hearing disorders on language and early literacy development, instead attributing communication deficits, inattention or poor listening behaviours to medical labels of intellectual disability, severe behaviour disorders and even foetal alcohol syndrome (Gould, 2008a; Lowell & Devlin, 1998). Increased prevalence, reoccurrence and fluctuating hearing loss experienced by Indigenous Australian children requires consistent and ongoing monitoring of hearing status. One assessment that speech pathologists, teachers and even parents could use to detect hearing loss is a simple speech reception game known as 'Blind Man' Simon Says' (Howard, 1992). This game also provides immediate meaningful feedback on how greatly communication is impacted when a child has hearing loss (Howard, 1992). Whilst results of the study demonstrated reliability in detecting children with hearing loss, overall methodological quality of the study design was rated limited for reasons including subject group selection, limited characteristics described for the participants, the use of basic analytic methods that reported results in insufficient detail and no attempts made to control for confounding variables.

In reference to Indigenous Australian adult CD, The Kimberley Indigenous Cognitive Assessment (KICA-Cog) was the first tool specifically developed to assess cognitive impairment and dementia in older Indigenous people in the Kimberley region of Australia (LoGiudice et al., 2006). The test assesses memory, comprehension, language abilities and some executive functions and was written in simple English to enable translation into Indigenous languages. The test demonstrated good inter-rater reliability and internal consistency and was able to successfully discriminate between Indigenous adults with and without cognitive impairment or dementia (LoGiudice et al., 2006). More recent research into the assessment of acquired brain injury in Indigenous Australians has seen the development and piloting of culturally appropriate instruments for assessing functioning and cognitive impairment, with the creation of a novel toolkit (untitled as yet) that is culturally acceptable for assessment of acquired brain injury in Aboriginal and Torres Strait Islander Australians

(Bohanna et al., 2013). Validation studies are currently being piloted in a number of rehabilitation sites before the instrument is able to be used reliably (Bohanna et al., 2013).

Effective treatment for Indigenous Australians with communication disorders

Treatment was identified as both direct therapy as well as wider initiatives that facilitated, provided education or assisted in improving the learning conditions for Indigenous Australians. Literature related to treatment available for Indigenous CD focusses primarily on programs for improving language and early literacy skills. The review found only one study related to intervention for Indigenous adults, a community based rehabilitation program for individuals with TBI (Gauld et al., 2011). No treatment approaches or therapies were found that specifically targeted speech, fluency, voice or cognitive CD for Indigenous Australians. Only one randomised control trial was identified from the treatment literature and this is discussed in detail below (Wolgemuth et al., 2013).

Language and early literacy

Therapy programs focussing on language and early literacy include the PA:EFL phonological awareness (PA) program for Indigenous students who have English as a foreign language and hearing disabilities (L. Yonovitz, Yonovitz, & Palmer, 2000). Explicit teaching of PA skills in a game format resulted in significant gains in literacy (L. Yonovitz et al., 2000). A longitudinal study by Dunn (1999) in an Aboriginal community in Warbrook, New South Wales studied the early literacy predictors of later reading success for Aboriginal students. The results led to the development of a culturally appropriate literacy program that was implemented as a core component of the pre-school curriculum (Dunn, 1999). Tasks included environmental print, letter identification, reading tasks, print concepts, comprehension exercises, free writing and small group story reading programs to improve early literacy (Dunn, 1999). Results of this mixed-methods approach study are to be interpreted with caution due to low methodological quality within the overall study design. Whilst acknowledging both qualitative and quantitative methods were used in this comprehensive five year longitudinal study, the study makes no connection to a theoretical framework or wider body of knowledge to guide its approach. The data collection and analysis methods used are poorly described and considered inappropriate for the study. Statistical methodology was not described in the article due to a provided reason of space. Only one of the outcome measures (Neale Analysis of Reading) used to track development was robust to measurement. The method of subject selection and subject characteristics were

insufficiently described with no indication of gender or the control of confounding variables such as hearing status or developmental delays as potential impacts on the overall results.

A study by Hodge & Downie (2004) evaluated the effectiveness of the 'Together we are heard' daily language group delivered to community preschool students in a low socioeconomic area of Perth. Small group daily language activities targeted discourse comprehension, vocabulary/semantic organisation, sequencing/narrative and metalinguistics in an attempt to improve early literacy. Of the 31 children who participated, 45% were Indigenous and aged between 4-5 years. Post test scores identified that there were no differences in the language skills and abilities of Indigenous and non-Indigenous children following the program, and significant improvements were evident for both groups (Hodge & Downie, 2004). Whilst gains in language were made by both groups, confounding variables were not controlled for, the study lacked a control group and participant numbers were deemed small with only four participants per group.

In 2001, the 'Bridging the Gap' project aimed to enhance early literacy skills of Indigenous kindergarten children through a shared-book home reading program (Freeman & Bochner, 2008). Each child was presented with a kit containing a tape-recorder and a number of other decorative items such as stickers and pencils to personalise their kit. The 20 week program entailed fortnightly visits where a new book, audio-recording and associated activities were provided. Aboriginal Education Assistants would model book reading strategies and provide parental support where required. Although children showed improvements in listening comprehension, phonemic awareness and receptive language with their mean reading ages higher than their chronological age at the end of the program, study limitations are evident in use of non-robust outcome measurements, no estimate of variance reported, a lack of control for confounding variables such as hearing loss and the use of a contrast group as opposed to a control group in the study design.

A program known as MULTILIT (Making Up Lost Time In Literacy) was delivered to a group of Aboriginal and non-Aboriginal low-progress readers attending the Schoolwise Program in New South Wales during 2004 (Wheldall et al., 2010). Students in Years five and six were at least two years behind in reading progress according to their chronological age for reading, as measured by the Neale Analysis of Reading Ability (Wheldall et al., 2010). The 20 week program covered an intensive and systematic approach to teaching five major components of effective literacy instruction – phonemic awareness, phonics, fluency,

vocabulary and comprehension. At the end of the program the whole group made significant gains on all literacy measures and Aboriginal student gains were just as great as those of the non-Aboriginal students. Wheldall et al. (2010) suggests that the study's findings support the view that Indigenous students do not necessarily need different instruction to non-Indigenous students and that non-categorical explicit teaching appeared to be effective for all students (Wheldall et al., 2010). This study was rated as strong in quality, with relatively large numbers of participants, strong methodological design and outcome measures that were robust to measurement. However, a limitation of this study was the lack of a control group.

The most recent literature investigates a web-based reading support tool known as ABRACADABRA that originated in Canada, designed to improve the early foundation literacy skills for at risk children (Wolgemuth et al., 2013; Wolgemuth et al., 2011). This free interactive computer program targets activities including alphabetics, fluency, comprehension and writing categories. A multisite randomised control trial comprising 28% Indigenous children in the Northern Territory revealed that all intervention group students made significant gains in phonological awareness and phoneme-grapheme knowledge above and beyond the control group (Wolgemuth et al., 2013). Findings demonstrated that the program accelerated early literacy growth of the Indigenous students, such that they were performing as well as their non-Indigenous peers in phonological awareness (Wolgemuth et al., 2013; Wolgemuth et al., 2011). Whilst the study acknowledged that the program had not been developed for an Indigenous Australian population, the developers made minor adjustments to the program to include Australian narrated stories and rhymes that matched Australian pronunciation. Children were untroubled by the foreign Canadian accent or characters they were unfamiliar with, with teacher reports that children were used to Northern American accents from television and it was a great learning opportunity for them to know about different animals around the world (Harper et al., 2012).

Other early literacy programs included those implemented by child health nurses (Hewer & Whyatt, 2006); collaborative speech pathology and teacher initiatives such as 'The Early Learning Project' in the first two and three years of compulsory schooling for Indigenous children (Winker, 2009); and interprofessional programs lead by speech pathology and occupational therapy students delivering specific whole class programs targeting gross and fine motor, sensory processing and communication skills within an urban Indigenous school in Brisbane (Davidson et al., 2013). Programs such as these however were rated as having limited methodological quality for reasons including lack of connection to

theoretical frameworks, insufficient detail in reporting of results, questionable study designs and collection methods that were not adequately described.

Hearing

Sound field amplification is another strategy that has proven a successful educational tool for the classroom that allows control of the acoustics of the classroom and amplifies the teachers' voice by 10-15 dB so children with hearing loss can hear better (Massie, Theodoros, Mcpherson, & Smaldino, 2004). When first introduced, FM-amplification systems were considered breakthrough technology for hearing-impaired Indigenous children, however there is no mandate for their use within the education system (Burrow, Galloway, & Weissofner, 2009; Massie et al., 2004). A number of positive outcomes were identified through the use of sound-field amplification during a study in Cherbourg, the closest rural Indigenous community to Brisbane (Massie et al., 2004). Results showed significant changes in communicative interactions in the trial classroom including an increase in communicative interactions, increase in child, teacher and peer verbal communication and an increase in initiation of communication by the children and without needing direct prompting (Massie et al., 2004). Classroom management strategies, combined with increasing student awareness of hearing problems and using a variety of therapy methods such as one-to-one or small groups was supported in the literature. Developing language skills that underlie written literacy such as phonological awareness and explicit teaching methods linking sounds to written language, text level skills and semantic 'world' knowledge were all also effective strategies often discussed throughout the literature (Burrow et al., 2009; Ford, 1993; Partington & Galloway, 2005).

Experiences of Indigenous Australians with communication disorders

Overall, the voices of Indigenous Australians with CD were minimally represented in the literature. Only three articles were found that highlight the experiences of Indigenous Australians with a CD. In one textual paper was the mention of an Aboriginal Yolngu male, a traditional elder within his community who had a stroke and was recovering in a The Darwin Rehabilitation Service. His stroke left him with global aphasia, and he became increasingly frustrated and angry because his niece and the Aboriginal Liaison Officer could not understand him. This highlighted the challenges of providing culturally appropriate rehabilitation for the elder when his only wish was to return to his community regardless of his current medical condition (Faux et al., 2009).

Other Indigenous insights include a recent qualitative study which reported on the experience of three Aboriginal men from the Perth metropolitan area who were living with aphasia (Armstrong et al., 2012). The authors aimed to explore how aphasia was constructed and dealt with in Aboriginal communities through listening to their stories. The study identified none of the men having long-term speech pathology intervention, nor did they wish for any, preferring to direct their own recovery through family connections and community participation (Armstrong et al., 2012). Whilst communication was valued by the men, aphasia was not perceived as a barrier to their social participation and their communication recovery was facilitated through different channels as opposed to traditional speech pathology intervention (Armstrong et al., 2012).

A number of personal stories of Indigenous Australian families with children who have disabilities are shared in the 'grey' literature Students with Disabilities report by the Ministerial Advisory Committee (Ministerial Advisory Committee: Students with Disabilities, 2003). Insightful stories and experiences are shared by Aboriginal families of students with disabilities including delayed language development, autism, intellectual disabilities, learning disabilities, foetal alcohol syndrome, cerebral palsy and muscular dystrophy (Ministerial Advisory Committee: Students with Disabilities, 2003). Families often expressed the want for their child to receive a good education, the frustrations and challenges of living remote and having limited service access, needing more information and wanting access to more therapy (Ministerial Advisory Committee: Students with Disabilities, 2003).

Discussion

In terms of the four research questions, it is evident from the literature reviewed that overall to date there is a confirmed lack of high quality empirical scientific quantitative and qualitative studies addressing prevalence, assessment and treatment of Indigenous CD within Australia. There is also limited literature on Indigenous peoples' experience of CD. There is a reliance on textual articles and 'grey' literature to provide information to clinicians in order to guide clinical practice and decision making. Significant complexities involved in obtaining such information are identified (Baildon & Bourke, 2003; Davidson et al., 2013; DiGiacomo et al., 2013; Dunn, 1999; Edis, 2002; Lowell, 2013; Pearce & Stockings, 2011) and these factors include limited access to participants, varying participation rates, difficulties in obtaining control groups, geographical challenges, environmental factors, diversity of

language groups, lack of Indigenous researchers, lack of culturally appropriate assessment tools, resources, infrastructure, time and cost (P. M. Morris, 1999; Williamson et al., 2010).

The implications of these factors contributed to much of the available literature being textual or 'grey' opposed to high quality scientific studies which prevents the profession of speech pathology being guided by evidence based practice when working with the Indigenous Australian population. However, a number of very useful and high quality studies, including longitudinal research, have been undertaken within only the last three years, contributing positive outcomes to service delivery for Indigenous Australians with CD. These initiatives include the collection of comprehensive prevalence and longitudinal developmental data (D'Aprano et al., 2011; Department of Families Housing Community Services and Indigenous Affairs, 2010; McDonald et al., 2012; Williamson et al., 2010); the investigation into appropriate assessment methods (Cahir, 2011; Miller et al., 2013; Pearce & Williams, 2013); RCTs and quasi-experimental studies for effective early literacy interventions (Wolgemuth et al., 2013; Wolgemuth et al., 2011) and the voices of Indigenous Australians with CD being listened to through culturally appropriate participatory action and narrative style research methods to guide assessment and intervention for cognitive CD (Armstrong et al., 2012; Bohanna et al., 2013; Gauld et al., 2011).

Whilst it was common for many studies to report a need for higher quality scientific research evidence, the realities and complexities of undertaking such research with Indigenous populations are often not explored in detail, warranting explanation and a greater depth of understanding by health professionals. Historical, environmental and lifestyle factors continue to influence access to participants and participation rates. It was commonly identified that participation rates often changed, declining throughout the course of the studies, for many reasons including transiency, children moving to new schools, absenteeism, lack of resources for testing or withdrawing of participant consent and this particularly impacts pre and post-test design studies (Wolgemuth et al., 2013; Wolgemuth et al., 2011; L. Yonovitz et al., 2000).

Another research challenge commonly referred to is the conceptualisation of disability within the Indigenous Australian population. This was often acknowledged not only as a barrier to service access and provision, but also to the ability to conduct valid scientific research. This might be better characterised by a mis-match between Indigenous and 'western' conceptualisations of disability. In western medicine, conceptualisation of disability still very

much focuses on the isolated structural impairment rather than incorporating the 'activity' and 'participation' aspects which are now recommended by the World Health Organisation in the International Classification of Functioning, Disability and Health, although the situation is changing. Ariotti (1999) on the other hand suggests that " service provision must be based on scrupulous attention to the way each individual and community defines disability and that disability, at least in the Anangu culture, is a dynamic construct and will vary according to local historical, cultural and linguistic factors" (Ariotti, 1999). Indigenous beliefs about health are known to traditionally focus more holistically on the 'illness' in the context of family and community as the following quote notes:

"Western medicine is primarily interested in the recognition and treatment of disease. Traditional medicine seeks to provide a meaningful explanation for illness and to respond to the personal, family and community issues surrounding illness. Traditional medicine explains not only the 'how' but also the 'why' of a sickness" (Pg 33) (Devanesen, 1985) cited in (Maher, 2002).

These differences create a tension between the kinds of research western medicine might see as appropriate as opposed to research that might emanate from a different conceptual framework in an Aboriginal context. The notion of disability in relation to communication and CD specifically is yet to be explored. It could be hypothesised the silent and invisible disability of CD complicates the above-mentioned mis-match even further and potentially hinders the ability to conduct valid research (DiGiacomo et al., 2013). In addition, western models of research often involve the use of control groups to support findings. Challenges in identifying control groups in Indigenous Australian CD studies are numerous. In the paediatric context for example, it is often difficult to find children within the community without hearing deficits in sufficient numbers to make a worthy sized control group (Freeman & Bochner, 2008; P. S. Morris, 1998; C. Williams & Jacobs, 2009).

The diverse sources of available literature combined with the extensive variety of methodologies used (i.e. linguistic, descriptive, narrative) resulted in difficulties in rating the overall methodological quality of the articles, findings supported by other systematic reviews into Indigenous disability (DiGiacomo et al., 2013). The Kmet tool, whilst accurate and reliable for both qualitative and quantitative research presented challenges due to the format of many of the identified articles. A number of studies failed to identify their specific qualitative research philosophy (e.g. ethnography) that underpinned the direction of the

research. Whilst these studies possibly may have used a variety of qualitative methods without adhering to a disclosed traditional scientific approach, the ramifications are that readers will potentially be unable to determine if all relevant criteria has been addressed. Challenges are then faced for researchers in reviewing and rating articles using proven quality scaled rating tools to evaluate the evidence for the wider research community, as many well defined objective scales are based on the principles of traditional scientific research. Earlier studies such as those in the 1990's or those more descriptive or linguistically based, although were deemed qualitative, had their age, lack of methodology and linguistic philosophy influence the style of the article and ultimately ended scoring lower than those that followed more formally accepted scientific methodological approaches in the health arena. Interestingly, the majority of the articles rated adequate or limited were the earliest published articles between 1991 – 2004, suggesting that research quality, adoption of scientific methodologies and reporting have improved over the last ten years.

A number of articles that addressed assessment and treatment included study designs that were deemed inappropriate, often did not consider or control for compounding variables such as hearing loss, developmental delays or differences in language and used sample sizes that were often questioned for appropriateness when comparing to the wider literature available on assessment and intervention. When rating the articles, these factors too impacted the overall score and methodological quality rating applied.

Current prevalence data available is based on collection methods including caregiver report, teacher checklist or self-reporting. Factors identified such as self-disclosure, misdiagnosis, differing conceptualisations of disability among the Indigenous population, Indigenous identification issues and resistance to disclose for fear of isolation or shame all have the potential to impact the reliability of prevalence data. Misdiagnosis and over diagnosis of CD by educational professionals due to cultural and linguistic communication differences was often discussed in the literature (Gould, 2008c; Lowell & Devlin, 1998). So too was the identified over representation of Indigenous children in special education classes (Gould, 2008a). Whilst these factors may question the reliability of developmental vulnerability figures reported, these beliefs were supported by very few scientific studies within the literature. The current data available does not provide health professionals with any true indication of CD prevalence within the Indigenous Australian population and demonstrates a true lack of recognition of the problem. Whilst two quantitative prevalence studies were identified, they focus on single geographical locations, are not CD specific, use

assessment tools with questionable cultural appropriateness, are not standardised on the Indigenous Australian population and were delivered by non-Indigenous professionals (D'Aprano et al., 2011; McDonald et al., 2012). Current extensive longitudinal research projects such as the LSIC (Department of Families Housing Community Services and Indigenous Affairs, 2009), the Gudaga study (McDonald et al., 2012) or the Study of Environment on Aboriginal Resilience and Child Health (SEARCH) (Williamson et al., 2010) may provide unique long-term prevalence resources through the inclusion of culturally appropriate communication assessment within the study designs.

Assessment methods, assessment tools and the diagnosis of CD for Indigenous Australians also lack supporting empirical scientific studies and rely upon a number of qualitative and textual articles to provide reference and guidance for clinicians during the assessment and diagnostic process. Supporting scientific evidence is also limited for the arguments of the cultural appropriateness of communication testing by non-Indigenous assessors, the use of standardised tests with Indigenous Australians and the debate over difference or disorder. There are strong arguments for not using language tests standardised on non-Indigenous children and utilising Indigenous concepts and vocabulary, however there are also arguments for incorporating use of these in combination with accommodations for AE and spontaneous language sampling. Anecdotal beliefs in this area are not yet supported by strong scientific evidence and while strong arguments are made through textual reports (i.e. expert opinions) and a few scientific studies, the majority are not guided by or based upon a body of scientific evidence. Only two very recent and small scale scientific studies discuss findings on the use of standardized tests. Whilst methodologically sound, these studies were conducted with small Indigenous populations limited to one geographical area and the findings provide conflicting evidence both for and against the use of standardised assessments with Indigenous Australians (Miller et al., 2013; Pearce & Williams, 2013). Whilst difference versus disorder is also widely discussed throughout the literature, only two articles to date provide a narrative summary and a qualitative study to support this argument (Gould, 2008a; Lowell & Devlin, 1998). While acknowledging the textual narrative is based on a comprehensive five year longitudinal study, language difference alone was not identified as the sole contributing factor to poor assessment performance, miscommunication and misdiagnosis of CD in both articles. Government educational policies such as the requirement to use specified testing materials, deliberate medicalization of language difference to attract extra funding and to place difficult students into special needs classes, lack of assessor knowledge between the features of AE and SAE, inabilities to detect the impact of hearing

loss during an assessment, quality of teachers and cross-cultural miscommunication also contributed to the misdiagnosis of the study population (Gould, 2008a; Lowell & Devlin, 1998). Further quality scientific research to explore the concept of difference versus disorder as well as the appropriateness of standardised tests is warranted to ensure accurate assessment and much needed prevalence data.

Treatment of Indigenous communication disorders has recently seen investments in intervention studies for improving early literacy skills through high quality multisite randomised control trials (RCTs) and quasi-experimental studies (Wolgemuth et al., 2013; Wolgemuth et al., 2011). Whilst the complexities of conducting these studies are openly acknowledged throughout the articles, the researchers demonstrate to the wider speech pathology profession that high quality scientific evidence such as RCTs are achievable and are possible to conduct within the Indigenous Australian population.

If speech pathologists are to effectively assess and treat Indigenous Australians with CD, a comprehensive understanding of the perceptions, attitudes and experiences of these individuals is imperative. Their voices and those of their families/caregivers underpin service delivery and the future direction of research into prevalence, assessment and treatment. Without understanding their personal experiences of living with a CD, how they conceptualise their disability and their perceptions of and needs for intervention, speech pathology will continue to be guided by assumptions and expert opinions on what constitutes best practice for assessment and treatment of Indigenous Australians with CD. Once again, further research is needed in this area. Another point to note is that CD research to date focusses widely on the rural and remote populations, and whilst their needs are more complex due to significant cultural and linguistic differences, the majority of Indigenous Australians currently reside within city or inner regional areas of Australia, with only 8% living remote and 16% living very remote (Australian Bureau of Statistics, 2011; DiGiacomo et al., 2013).

Recent qualitative studies guided by theoretical principles and frameworks (Armstrong et al., 2012; Gauld et al., 2011) as well as high quality quantitative research (Wolgemuth et al., 2013; Wolgemuth et al., 2011) demonstrate that scientific approaches are possible when conducting research with Indigenous Australians. Frameworks such as participatory action research have enabled the collection of highly relevant qualitative findings through community consultation and Indigenous led research. This has enabled Indigenous Australians to respond in ways that are valued and to be involved in initiatives that are owned by them and their communities (Gauld et al., 2011). Strong scientific research

provides health professionals working with Indigenous Australians to be supported with evidenced based principles which they can apply in their clinical decision making. There is an urgent need to ensure that future research contributes to the goal of improving outcomes for Indigenous Australians with CD. The highest levels of scientific evidence available supports the wishes of Indigenous Australians (Bienenstock, 1993; National Aboriginal Health Strategy Evaluation Committee, 1994) who expressed the want and need for health research that is practical and leads to the reduction of disability or disease rather than the continuous description of excess morbidity, disadvantage and mortality (P. M. Morris, 1999).

Research methodologies are significant in this discussion. It is unlikely that high quality RCTs are going to be possible in many Indigenous contexts at this point. Nor may standardised assessment or treatment plans (based on non-Indigenous research) even be an appropriate approach to dealing with Indigenous individuals and families dealing with CD. There is an emerging literature into what might constitute appropriate Indigenous research methodologies including narrative enquiry and participatory action research as primary frameworks (Gauld et al., 2011; Kurtz, 2013). Research privileging Indigenous people's narratives, opinions and ways of collecting data, including the nature of the data collected, and led by Indigenous researchers to ensure authenticity are increasingly recommended (L. T. Smith, 1999; Wand & Eades, 2008). Quality ratings of Indigenous research in the future may well incorporate such emerging principles.

The low initial inter-rater reliability of the quality ratings was felt to be connected to the issues noted above. Given the nature of the articles requiring rating, a major challenge was identified in deciding what constituted an appropriate sample size. Given that the majority of studies had relatively small participants numbers (5-15), if comparing these to the wider non-Indigenous studies addressing similar questions, the sample sizes were not ideal. However, given the complexities in conducting research as already identified, this item on the checklist resulted in diverse opinions on what was deemed appropriate and contributed to lower than anticipated inter-rater reliability. A possible solution for future research adopting a similar ratings process would be to follow that of the Kmet testing phase whereby reviewers rate a small sample of articles first then discuss results prior to rating the whole sample as a means for improving inter-rater reliability and consistency with question item interpretation. It would have also been beneficial for reviewers to meet and discuss the ratings tool and Kmet definitions of each item and criteria for scoring prior to rating each article to ensure

understanding between both reviewers of the questions within each checklist and the relevance to the Indigenous Australian literature.

Study limitations and future research

The primary limitation of this study was the low initial inter-rater reliability of quality ratings. Further training of raters on the rating tool may have improved reliability. Future studies would be encouraged to further conceptualise the notion of 'quality' in Indigenous research prior to utilising rating scales. Clearly, much of the literature relates to expert opinion, although just over 40% of the qualitative/quantitative studies were rated highly overall.

Further research is warranted across all areas of prevalence, assessment, diagnosis and experiences relating to CD and Indigenous Australians. Firstly, this review identified no literature that specifically addressed fluency or voice disorders within the Indigenous population across all four main areas of research. Subsequent gaps in the literature were also evident in cognitive CD. Given the identified impact of hearing loss on speech sound development and only one identified article, further research in the area of speech disorders is also warranted. There is also an important need for more empirical scientific evidence on the effects of using tests standardised on the non-Indigenous Australian population with Indigenous Australian population. The belief among speech pathologists that standardised tests are not appropriate is only supported by one small scientific study. Further research needs to investigate effective and culturally appropriate assessment of CD across all levels of isolation and methods which can diagnose between difference and disorder. Finally, the experiences of Indigenous Australians with CD were identified as significantly underrepresented within the literature and research is warranted in this area. Such research can only be achieved through collaboration and partnership with Indigenous people and their communities together with speech pathologists, and stronger recognition of speech pathology in government health and education planning and decision making.

Conclusion

This review provides a comprehensive summary of the literature available from the last 23 years regarding prevalence, assessment and diagnosis, treatment and experiences of

Indigenous Australians with CD. Whilst a number of complexities exist in accurately obtaining data in these areas, the research focus and knowledge contributed to the area of Indigenous Australians and communication has significantly increased in quality within the last five years and has contributed in improving clinicians' knowledge base. The review identifies a general consensus on the lack of scientific prevalence data and diverse opinions on culturally appropriate and effective assessment and treatment options. A way forward for increasing the knowledge base for CD in Indigenous Australians can only be achieved through collaboration and partnership with Indigenous communities, families and through collaboration with rigorous research initiatives such as the LSIC or SEARCH (Department of Families Housing Community Services and Indigenous Affairs, 2009; Williamson et al., 2010) to access both a large and representative sample of Australias Indigenous population.

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Appendix

Appendix A. Initial key words used in search strategy

Subject	Keywords Searched
Communication	(Indigenous OR Aborig*) communication disorder, communication disability.
Speech	(Indigenous OR Aborig*) speech disorder, speech sound disorder, speech delay, articulat* disorder, phonolog* disorder.
Language	(Indigenous OR Aborig*) SLI, specific language impairment, expressive language delay OR disorder, receptive language delay OR disorder, language delay OR disorder.
Hearing	(Indigenous OR Aborig*) hearing impairment, otitis media, OM, middle ear disease.
Literacy	(Indigenous OR Aborig*) phonological awareness, PA, phonemic awareness.
Fluency	(Indigenous OR Aborig*) stutter*, fluency disorder.
Voice	(Indigenous OR Aborig*) voice disorder, voice quality, vocal cord nodules OR polyps.
Cognition	(Indigenous OR Aborig*) cognitive communication disorder, TBI, traumatic brain injury, dementia, stroke.

Appendix B. Additional databases and journals searched

Databases	PsychINFO PsychARTICLES Informit Cochrane Library Joanna Briggs Institute ProQuest
Journals	Journal of Clinical Practice in Speech-Language Pathology International Journal of Speech-Language Pathology Journal of Speech, Language and Hearing Research American Journal of Speech-Language Pathology Journal of Medical Speech-Language Pathology Canadian Journal of Speech-Language Pathology and Audiology Seminars in Speech and Language International Journal of Language and Communication Disorders New Zealand Journal of Speech-Language Therapy (Speech, Language and Hearing) Journal of Communication Disorders Journal of Childhood Communication Disorders Communication Disorders Quarterly

Grey Literature	Australian New Zealand Clinical Trials Registry Trove Australian Bureau of Statistics (ABS) Australian Institute of Health and Welfare (AIHW) Department of Education, Employment and Workplace Relations (DEEWR) Department of Health and Ageing (DHA) Indigenous.gov.au Closing the Gap Clearing House The Council of Australian Governments (COAG) Ministerial Council for Education, Early Childhood & Development and Youth Affairs Speech Pathology Australia Bibliographies and references listed in primary sources Australian Indigenous HealthInfoNet

Appendix C. Additional search strings/keywords used in Phase 2 searches

Subject	String Searches/Keywords for Phase 2 – Established from Phase 1 Search
Communication	Indigenous people*, Indigenous population*, Torres Strait Island*, TSI, Communication, communicative disorders, communication barriers, vulnerable populations, communication disorders, augmentative and alternative communication, AAC, communication problems, communication skills, prevalence, epidemiology, diagnosis, assessment, assessment tools, therapy, treatment.
Speech	Indigenous people*, Indigenous population*, Torres Strait Island*, TSI, Speech, speech disorders, articulation disorders, phonetics, apraxia*, dyspraxia, dysarthria, speech production, speech intelligibility, speech production measurement, spoken language impairment, speech perception, speech therapy, speech disorders classification system, SDCS, SSD, speech difficulties, phonological awareness, speech articulation, childhood apraxia of speech, CAS, speech sound acquisition, speech errors, sound errors, speech intervention, phonemic awareness, neurogenic speech disturbances, managing apraxia of speech, motor speech disorder*, speech patholog*, prevalence, epidemiology, diagnosis, assessment, assessment tools, therapy, treatment.
Language	Indigenous people*, Indigenous population*, Torres Strait Island*, TSI, language, language difference, speech and language assessment, language development, language intervention, language therapy, language impairments, language learning, standard Aboriginal English, SAE, Aboriginal English,

	TESOL, Aboriginal language, receptive language, expressive language, language processing, comprehension, language intervention program, spoken language disorder*, language patholog*, prevalence, epidemiology, diagnosis, assessment, assessment tools, therapy, treatment.
Hearing	Indigenous people*, indigenous population*, Torres Strait Island*, TSI, Otitis media with effusion, otitis media suppurative, hearing, hearing disorders, hearing loss conductive, conductive hearing loss, hearing disorders prevention and control, hearing loss, hearing loss prevention and control, otitis media etiology, otitis media complications, learning disorders and otitis media, learning disorders and hearing loss, auditory processing, CAPD, auditory processing disorder, prevalence, epidemiology, diagnosis, assessment, assessment tools, therapy, treatment.
Literacy	Indigenous people*, Indigenous population*, Torres Strait Island*, TSI, literacy, phonology, phonetics, spelling, reading, literacy development, reading disorders, reading comprehension, encoding, decoding, listening comprehension, pre-literacy, literacy skills, at risk readers, literacy difficult*, struggling readers, reading intervention, writing intervention, second language learning, english (second language), prevalence, epidemiology, diagnosis, assessment, assessment tools, therapy, treatment.
Fluency	Indigenous people*, Indigenous population*, Torres Strait Island*, TSI, Lidcombe Program, The Camperdown Program, stuttering treatment, early stuttering intervention, stuttering therapy, Westmead Program, syllable-timed speech, SpeechEasy, speech fluency, fluency, developmental stuttering, altered auditory feedback, clutter, cluttered speech, speech dysfluency, dysfluency, prevalence, epidemiology, diagnosis, assessment, assessment tools, therapy, treatment.
Voice	Indigenous people*, Indigenous population*, Torres Strait Island*, TSI, voice, voice disorder*, vocal quality, organic voice disorders, neurogenic voice disorders, functional voice disorders, voice production, phonation, pitch, resonance, dysarthria, flaccid dysarthria, unilateral upper motor neuron dysarthria, spastic dysarthria, hypokinetic dysarthria, hyperkinetic dysarthria, ataxic dysarthria, mixed dysarthria, voice screening, voice evaluation, voice management and therapy for adults and children, voice therapy, vocal polyp*, LSVT, Lee Silverman Voice Treatment, vocal hyperfunction, vocal fold

	disorders, phonatory disorder*, prevalence, epidemiology, diagnosis, assessment, assessment tools, therapy, treatment.
Cognition	Indigenous people*, Indigenous population*, Torres Strait Island*, TSI, Cognition, cognitive communication, cognitive disorder*, cognition disorders, brain injur*, aphasia, acquired aphasia, dysphasia, expressive aphasia, receptive aphasia, fluent aphasia, non-fluent aphasia, global aphasia, conduction aphasia, primary progressive aphasia, Wernicke's aphasia, Broca's aphasia, cognitive communication impairment, cognitive communication disorders resulting from brain injury, treatment of cognitive communication disorders, acquired brain injury, ABI, cognitive communication disorders resulting from right hemisphere damage, cognitive process*, pragmatic*, cognitive communication impairment, Alzheimer*, memory disorders, prevalence, epidemiology, diagnosis, assessment, assessment tools, therapy, treatment.

Appendix D. Description of included studies (alphabetical by area of disorder)

First Author / Year of Publication	Area of disorder & research aim addressed	Population	Number of Participants	Setting	Geographical Context	Intervention / Focus of Study	Study Design	Data Collection	Analysis Technique	Results	Summary of Findings / Themes	Methodological Quality Rating
Armstrong, 2012	Cognition (Experience)	Indigenous Australian adult males 47-63yrs old	3	Community	Perth	Experiences of living with aphasia. How aphasia was constructed and dealt with in Aboriginal communities. How Aboriginal people adjusted to aphasia long term.	Qualitative	Semi-structured interviews	Thematic		Although Aboriginal people with aphasia may not access traditional speech-language pathology services, they do attend "services" i.e. activities and groups that have social and recreational opportunities within a community supportive network. These different channels support and facilitate aphasia recovery. Aphasia therapy may be more productive through being embedded within other community initiatives rather than a separate service. Questions raised about the relevance of aphasia services in particular flexibility, relevance for very young people, family and community involvement and follow-up. Concerns about aphasia therapy and its fit within the holistic health views of Indigenous populations.	Strong quality (Score = 20/20)
Bohanna, 2013	Cognition (Assessment)	Indigenous Australians	75 45 Non-Indigenous 27 Aboriginal 3 Torres Strait Islander	Community	Northern Territory, Queensland, New South Wales	To develop best practice guidelines for the assessment of Indigenous Australians with acquired brain injury (ABI), to develop, trial and evaluate culturally appropriate assessments for functioning, cognitive impairment, care and support needs for Indigenous Australians with ABI and to develop a support framework for assessors.	Grey Literature	Semi structured interviews and focus groups (recorded and transcribed) Research yarning	Systematic synthesis using Nvivo 10 data extraction tool		Development of four-stage Planning and Assessment framework that describes the appropriate actions that DisabilityCare Australia Planners and/or Local Area Coordinators need to take during the assessment process when determining eligibility to DisabilityCare Australia. A novel instrument toolkit was developed, containing cognitive and functional assessments that are culturally acceptable for assessment of acquired brain injury in Aboriginal and Torres Strait Islander Australians. This instrument toolkit must be scientifically validated before DisabilityCare Planners and Local Area Co-ordinators can use it. Identification of training components and professional development required for assessors - cultural awareness and competency training and acquired brain injury training programmes and coursework required.	
Faux, 2009	Cognition (Experience)	Stroke survivors Reference to an Aboriginal Yolngu male	N/A	Post-acute stroke services – city, country and rural Australia.	Australia	Stroke infrastructure and rehabilitation services in Australia. Exposing inequities in service provision between city, country and remote settings. Complexities and difficulties in	Textual - Review				Complexities in providing culturally appropriate rehabilitation to Aboriginal clients. Communication difficulties due to limited interpreters, English being sometimes a third language, limited literacy skills and inability to write to	

First Author / Year of Publication	Area of disorder & research aim addressed	Population	Number of Participants	Setting	Geographical Context	Intervention / Focus of Study	Study Design	Data Collection	Analysis Technique	Results	Summary of Findings / Themes	Methodological Quality Rating
						treating indigenous stroke survivors. Australian audit of post-acute stroke services					communicate. Lack of understanding by Aboriginal people of what rehabilitation is and the necessity of other professional roles during rehabilitation such as speech therapy.	
Gauld, 2009	Cognition (Treatment)	Indigenous adults Service Providers Community Members Health and disability stakeholders	Not disclosed	Community	Cape York, Queensland	Perceptions of acquired brain injury (ABI) by members of two communities. Exploration of issues and most appropriate community based rehabilitation for ABI. Identification of ongoing needs and support required	Grey Literature – conference proceedings				Clear indication from community for more information and education on prevention of brain injury and how to support community members who have a brain injury. Need for better access to information and meaningful local resources on brain injury. Interest from the community on support and information on how they can link into and access brain injury rehabilitation.	
Gauld, 2011	Cognition (Treatment)	Aboriginal Australians	Varied between 5-50 participants	Remote community	Far North Queensland	Participatory action research (PAR) as a driver for exploring and translating the community based rehabilitation model within a mainstream brain injury rehabilitation service in Queensland, Australia.	Qualitative	Community meetings Focus groups, individual meetings Participatory action research	Bi-monthly reviews by community members and project team of progress, past action and planning for future action		Focus on community consultation, planning and review, and the development of a significant partnership has increased the cultural competency of the state community rehabilitation service. Success of this community-led and driven approach for working with Aboriginal communities in relation to ABI may offer opportunities for developing partnerships with communities to assist other diagnostic groups e.g. chronic illness, ear health.	Adequate quality (Score = 13/20)
LoGiudice, 2006	Cognition (Assessment)	Indigenous adults 40 females 30 males Mean age 72 yrs	70	Community	Kimberley Region	Development of a validated assessment tool to assess cognition in older Indigenous Australians. Evaluation of the Kimberley Cognitive Assessment (KICA-Cog)	Quantitative	Interview and functional cognitive assessment	Statistical analysis using SPSS Measures used include Pearson's χ2-test, Student's *t*-test, Cohen's κ, Cronbach's α, receiver-operator characteristic (ROC) curves, area under curve (AUC). Exploratory discriminant factor analysis was used to determine the	κ,-values intra-class correlations very good (κ,$\geq$ 0.6), Internal consistency measured by Cronbach's α was 0.87. AUC was calculated for comparison between normal and those with dementia; 0.95 [95% confidence interval (CI)=0.87 to 1.00] At a cut-off score of	KICA-Cog tests memory, comprehension, language abilities and limited executive functions. Assessment of executive function was limited due to assessment items not easily adaptable to traditional ways of thinking. Therefore, KICA-Cog ultimately assesses memory and language skills. Tool was accepted by participants and was able to successfully discriminate between those with and without cognitive impairment and dementia. The need for more sophisticated ways of assessment of executive function was identified in this community.	Strong quality (Score = 18/20)

First Author / Year of Publication	Area of disorder & research aim addressed	Population	Number of Participants	Setting	Geographical Context	Intervention / Focus of Study	Study Design	Data Collection	Analysis Technique	Results	Summary of Findings / Themes	Methodological Quality Rating
									ability of individual questionnaire items in differentiating people with and without dementia. Cronbach's α was set at 5% and all probability values reported were two-tailed	31/32 the sensitivity was 90.6% and specificity 92.6% for the diagnosis of dementia compared to no cognitive impairment. Three items of the KICA-Cog (pension week, recall and free recall, with discriminant factor coefficients of 0.34, 0.51 and 0.71, respectively) were able to successfully classify 85.7% of participants as having either dementia or no cognitive impairment.		
Aldred, 2002	Communication (Treatment)	Indigenous children < 5yrs old	83	Hospital health service	Queensland	Prevalence of speech and language impairment in this population is significantly higher than the wider Australian population however this is not reflected in the service provider's caseloads. Study investigated why Indigenous people were not accessing the speech pathology services.	Textual - review	Staff feedback	Not disclosed		Little evidence found to demonstrate the service was culturally appropriate although staff believed it was. Extra time involved to meet cultural needs was often put in the "too hard" basket with clients labelled as "difficult". Under-representation of Indigenous workers in the health workforce. General lack of understanding of their roles or who they were resulting in them not being utilised. Lack of knowledge of the culture and communication styles of Indigenous Australians also were barriers to accessing the service.	
Australian Government Department of Families, Housing, Community Services and Indigenous Affairs, 2008-2011	Communication (Prevalence)	Indigenous children and their caregivers Younger cohort ages 6-18months at first wave Older cohort ages 3;5 – 4;5 yrs at first wave	1,687 (Approx 150 participants in each site)	Community	Australia 11 sites across the country	Longitudinal study of Indigenous children aimed at improving the understanding of, and policy response to, the diverse circumstances faced by Aboriginal and Torres Strait Islander children, their families and communities.	Grey Literature	Primary carer and teacher interviews Questionnaires Progressive Achievement Test in Reading (PAT-R) Renfrew Vocabulary Test Who am I? developmental	Statistical		Collection of data since 2008 in waves (1-4) provides quantitative and qualitative data that can be used as insight into how an Indigenous child's early years affect their development. Relevance for speech pathology in areas of child development, language development, language spoken, social development. Wave 3 reports that 11% of caregivers reported their child always requires assistance with communication, 16.1% sometimes require assistance and 72.9% never requires assistance.	

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								test Matrix Reasoning Test			Social, personal and cultural resilience of the parent or carer had a strong positive effect on a child's reading score, vocabulary had a large impact on reading scores and Being a girl and being older were also associated with significantly higher reading scores.	
Australian Institute of Health and Welfare, 2011	Communication (Prevalence)	Aboriginal and Torres Strait Islander people with disability	Not disclosed	Community	Australia	This report explores further the statistics from the ABS 2008 National Aboriginal and Torres Strait Islander Social Survey (NATSISS) on Indigenous rates of disability, providing more detailed information on Aboriginal and Torres Strait Islander people with severe or profound core activity limitation	Grey Literature	Australian Bureau of Statistics (ABS) National Aboriginal and Torres Strait Islander Social Survey Census data	Statistical - %		Among Indigenous Australians aged 15–64 years with severe or profound disability, 82% experience physical disability. Sight, hearing and speech disability is the next most common, at 42%.	
Australian Journal of Indigenous Education 1997	Communication (Assessment)	Aboriginal children	N/A	Community	Katherine	Breaking down language barriers in the area through working with an all-Aboriginal committee at the Katherine Regional Aboriginal Language Centre to develop culturally and linguistically appropriate assessment tools for Kriol speaking people of the region.	Textual - narrative				Modification of tests allowed for accurate assessment, insight and appreciation of the communication problems Aboriginal children were facing. One of the highest incidences of cleft palate in Australia. Interpreters enabled communication between parents and speech pathologists regarding children with cleft palate, operations required and therapy programs available.	
Baildon, 2003	Communication (Treatment)	Aboriginal adults and children as both inpatients and outpatients	N/A	Hospital	Northern Territory – Royal Darwin Hospital and East Arnhem Land	Insight into every day experiences of two Speech Pathologists working in the Northern Territory with an Aboriginal population, addressing challenges, barriers and issues.	Textual – expert opinion				Difficult to identify challenges, barriers or issues as they are often part of everyday work at the hospital. Identifies language and cultural barriers override all aspects of service provision, challenges with western medicine vs. traditional culture, dysphagia management, assessment issues and non-existent normative data on the population. Although the barriers and challenges are significant, the enriching clinician experiences are apparent.	
Davidson, 2013	Communication (Treatment)	Speech-Language Pathology and Occupational Therapy students working with Aboriginal and	8	School	Brisbane	Response and commentary on two key recommendations of the World Report on Disability in the context of a novel inter-professional service for ATSI children with communication and learning needs. Lessons learnt are	Qualitative	Online survey Informal feedback	Thematic		Lessons learnt from inter-professional student clinical placement creates a service delivery model that supports two key recommendations from the World Report on Disability – invest in specific programs and services for people with communication disabilities	Limited quality (Score = 8/20)

First Author / Year of Publication	Area of disorder & research aim addressed	Population	Number of Participants	Setting	Geographical Context	Intervention / Focus of Study	Study Design	Data Collection	Analysis Technique	Results	Summary of Findings / Themes	Methodological Quality Rating
		Torres Strait Islander children				explored.					and improve human resource. Location of service, more accessible and integrated services, approaches to therapy, relationship building and specific programs were successful in building a sustainable service for Indigenous children. Placements supported student need to learn and raise awareness of key factors when working with Indigenous children and families. Students become agents of change in Indigenous health outcomes.	
Edis, 2001	Communication (Treatment)	Aboriginal people	N/A	Community	Darwin	To recruit community disability workers from remote Aboriginal communities in Arnhem Land, implement training and establish suitable employment of the workers as a community based rehabilitation initiative. The aim was to also increase awareness of communication disorders, speech pathology services and develop skills of speech pathologists to work more effectively with Aboriginal people from remote communities.	Textual – conference proceedings				Outcomes of the project included employment training programs for community members as disability workers, increased awareness of disability within the community, creation of disability and speech pathology resources relevant for the local community, identification of unmet needs for community members with disabilities and subsequent successful funding applications to support their needs. Challenges included community control of the project not being decided by the community itself, issues of recruitment and training of community members due to literacy and cultural differences, logistics, working in isolated areas with limited resources and sustainability of the project due to lack of funding and support and unfilled speech pathology position.	
Edis, 2002	Communication (Treatment)	Indigenous Australians		Community	Remote Australia	Challenges of speech pathology service provision to Aboriginal people	Grey Literature – conference proceedings				Challenges include cultural and language differences, physical remoteness, lack of resources and limited evidence base in the field, speech pathology being low priority to Aboriginal people. Strategies to work more effectively include collaborative two-way partnerships with Aboriginal co-workers, intercultural competence, learning the language of the Aboriginal clients and being prepared to work in Aboriginal contexts.	
Gould, 2005	Communication	Aboriginal	34	Community	Brisbane	To describe the effective consultation within an Aboriginal community to create non-	Grey Literature – conference	Communication assessment using natural language	Consultation with Aboriginal English speaking		Consultation in an integral part of the diagnostic process. Aboriginal English members of the child's community are	

First Author / Year of Publication	Area of disorder & research aim addressed	Population	Number of Participants	Setting	Geographical Context	Intervention / Focus of Study	Study Design	Data Collection	Analysis Technique	Results	Summary of Findings / Themes	Methodological Quality Rating
	(Assessment)	children 3-5 years old (gender not specified)				standardized assessment tools that have been accurately able to identify communication differences as opposed to communication disorders	proceedings	sampling and activity-based assessment tasks	community members to identify communication differences and disorders within the child's assessment		able to identify accurately which children need speech pathology services and are able to provide valuable information about the language abilities of the children. Consultation therefore is essential in accurately determining whether an Aboriginal child has a communication disorder or difference. Effective consultation requires visiting professionals to Aboriginal communities to spend time on the ground getting to know people and learning their communicative practices.	
Gould, 2008	Communication (Assessment)	Indigenous Children (gender or age not specified)	47	Community	Queensland	Longitudinal research project examining the area of cross-cultural speech and language pathology assessment with Indigenous Australian children. Case study examples are provided in a detailed overview to show the values of non-standard testing.	Textual - review	Unstructured and semi-structured interviews Non-standard assessments Naturalistic language samples	Peer comparisons – converting raw data into Z scores. Longitudinal analysis of non-standard assessment results over a 5 year period		Non-standard assessment measures can provide a more effective and appropriate way of assessing the communication skills of Aboriginal English speaking children than what standard psychometric tests can. Misdiagnosis of intellectual impairment, literacy and developmental delays with the use of standard psychometric tests in the three case examples. Modifications to assessments need to consider – the importance of context upon communication, play-based tasks, tasks that have purpose, follow the Aboriginal ways of communicating, tasks that elicit the child's home language, tasks that value language, culture and the child, assessment tasks that achieve sensitivity and specificity, tasks that make provision of comparative information.	
Gould, 2009	Communication (Assessment)	Indigenous Australians		Community	Australia	The key to understanding how speech pathologists conceptualize communication lies in understanding how speech pathologists as a profession deal with the notion of what constitutes effective communication. This article discusses communication from a speech pathology perspective and the implications of considering communication as a purely biological phenomenon.	Textual - narrative				Narrow conceptualisation of communication following the traditional medical model becomes problematic in varied situations when speech pathologists have to describe an individual's communication system. Limitations of impairment focus and medical based approach to communication. Contextual factors on how an Aboriginal child performs as culture, withdrawal testing setting, emotional or psychological factors are often	

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											overlooked and a biological explanation is often only considered. This biological process does not always provide an adequate definition or reason for a communication breakdown.	
Jackson, 2007	Communication (Treatment)	Aboriginal Health or Education Specialists (AHEP's) Speech Pathologists (non-Aboriginal)	20 7	Country Health Service	Geraldton	To identify barriers and ways to enhance access to rural speech pathology services by Aboriginal children and their families	Textual – expert opinion	Semi-structured focus group interviews	Thematic	Four main themes identified	Limited knowledge in the Aboriginal community of speech pathology Cultural security of services – importance of working together. Preference for community based settings due to barriers accessing hospital based speech pathology. Clinical resources and other barriers – need for appropriate and culturally sensitive clinical and therapeutic resources. Other barriers include language development not being a priority, lack of telephone access and transient lifestyle.	
Lowell, 1998	Communication (Assessment)	Aboriginal school aged children (age/gender not specified)	30	School	Northern Territory	Investigating the impact of conductive hearing loss on children's communication and learning in the classroom.	Qualitative	Participant observation Informal assessment of language and auditory processing Parent and teacher interviews	Ethnographic		Communication difficulties between students and their Aboriginal teachers rarely occurred despite prevalence of hearing loss. Communication breakdown occurred frequently between students and non-Aboriginal teachers due to factors not related to hearing loss – such as misinterpretation of receptive language difficulties and cultural differences in listening behaviours. Confusion between communication difference or disorder easily occurring due to lack of understanding about cultural communication differences.	Limited quality (Score = 9/20)

First Author / Year of Publication	Area of disorder & research aim addressed	Population	Number of Participants	Setting	Geographical Context	Intervention / Focus of Study	Study Design	Data Collection	Analysis Technique	Results	Summary of Findings / Themes	Methodological Quality Rating
Lowell, 2013	Communication (Treatment)	Indigenous Australians		Community	Northern Territory	Barriers to equitable service provision for Indigenous Australians with communication disorders are explored and strategies to improve the provisions are discussed in response to the World Report on Disability.	Textual – review				Lack of prevalence data on Indigenous communication disorders and absence of appropriate assessment tools. Abundance of data on hearing and ear health and repeated mentions of impacts of hearing loss yet no mentions of speech-language pathology referral or follow up. Barriers to accessing services – inadequate levels of service, high staff turnover, difficulty recruiting staff, financial and geographical access to services, cultural and linguistic barriers, and very little cultural education for staff working with Indigenous clients. Addressing inequities – need for collaborative practice and shifting control back to the Indigenous people.	
McCormack, 2011	Communication (Prevalence & Assessment)	Children 51.1% boys 48.9% girls 2.8% Indigenous Aged 4-5 years	4,329 total (124 Indigenous participants)	Community and School	Australia	To understand the dimensions of childhood communication impairment by investigating speech and language impairment at age 4-5yrs and the impact of the impairment on five domains of Activities and Participation as determined by the ICF four years on at age 7-9yrs	Quantitative – 4 year comparable cohort longitudinal study	Computer assisted self-administered questionnaires Structured interviews Teacher questionnaire Standardised test	Statistical analysis using Pearson's $\chi 2$ and analysis of covariance (ANCOVA)	Almost twice the proportion of children in the CI group (19.1%) obtained scores outside the normal range on the Peabody Picture Vocabulary Test (PPVT–III) as did children in the non-CI group (10.6%) Effect sizes for communication impairment status were similar for parents and teachers ratings (n2s = .023 and .029, respectively) and were relatively large when compared with the effects of child and family covariates.	Significant association between communication impairment at 4–5 years of age and poorer scores on all 18 Activities and Participation outcomes at 7–9 years of age, even when accounting for the effects of other important child and family sociodemographic factors such as Indigenous status. Although effect sizes for communication impairment status were small (h2 < .04), they were comparable to the effect sizes for child and family demographic factors. Children in the communication impairment (CI) group reported poorer attitudes toward school than did their non-CI peers.	Strong quality (Score = 20/20)
McDonald, 2012	Communication (Prevalence & Assessment)	Aboriginal infants Mean age 12.3 months	134	Community	Campbelltown, New South Wales	To measure, describe and investigate potential predictors of early developmental progress in urban Aboriginal infants	Quantitative	Standardised assessment - Griffiths Mental Development Scales (GMDS)	Statistical	Scores for the Aboriginal infants for the GMDS were significantly lower than the standards (mean difference (MD) = -4.7, P < 0.001; 95% confidence interval (CI): -6.37, -2.96)	Urban Aboriginal infants are mostly developing within the normal range at 12 months, however significant differences in developmental progress in urban Aboriginal infants compared with the Griffiths standard norms was identified. Aboriginal infants performed less well on all domains except for gross motor	Strong quality (Score 22/22)

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											development. Great difference in performance was observed in the performance domain (cognition, symbolic play, puzzles) Mean difference in hearing and language domain was -3.6.	
Ministerial Advisory Committee: Students with Disabilities, 2003	Communication (Experience)	Aboriginal children with disabilities	14 Aboriginal families	Community	South Australia	To identify the major issues related to the education of Aboriginal students with disabilities	Grey Literature	Audiotaped stories of Aboriginal families with a child with a disability Consulting with professionals working in the area of Aboriginal education through a one day forum. Semi-structured interviews (in person or telephone) were conducted for key professionals who could not attend. Collation of statistics on the incidence of disability among Aboriginal and non-Aboriginal students	Transcription and summary of recordings to identify key themes		Broad range of key things relevant to communication disorder. These include: Disability related needs are seen as more important than the child's Aboriginality and need for cultural connection. Children are often placed in special classes where there are no other Aboriginal children and no expressions of Aboriginal culture. Rather than a professional's report describing what their child is unable to do and ending with a diagnosis, families often prefer an acknowledgement of what their child is able to do. Repeated contacts and discussions, with small inputs about practical matters, is more likely to result in the involvement of Aboriginal families in a process of change for their child. Many Aboriginal communities do not place a 'medical model' label on children who are slower at some things than their peers. They are less inclined to participate in strenuous intervention For a number of disabilities, the prevalence among Aboriginal and non-Aboriginal students is quite similar, except for communication and language. This category shows the greatest difference between the two populations, with 11.2 per cent of Aboriginal students compared with 4.7 per cent of non-Aboriginal students. Lack of culturally appropriate diagnostic tools available to diagnose communication and language disabilities has seen some professionals not wanting to diagnose Aboriginal students as having a disability, in order to avoid negative labelling. resulting in these students not receiving additional support to	

First Author / Year of Publication	Area of disorder & research aim addressed	Population	Number of Participants	Setting	Geographical Context	Intervention / Focus of Study	Study Design	Data Collection	Analysis Technique	Results	Summary of Findings / Themes	Methodological Quality Rating
											improve learning outcomes.	
Speech Pathology Australia, 2007	Communication (Assessment & Treatment)	Aboriginal people in rural and remote NT		Community	Northern Territory	The development of a shared resource for speech language pathologists (SLPs) working in the Northern Territory. The focus was to help SLPs to engage in culturally safe practices with Aboriginal people living in rural and remote areas of the Northern Territory	Grey Literature	Consultations with 14 SLPs working in the area who were experienced in delivering services to the Aboriginal people in rural and remote NT.			Good practice principles and frameworks in the NT are discussed along with cultural considerations and professional skills required working in the community. Ideas for clinical practice and speech pathology resources are discussed with future recommendations made for further resources and strategies as well as recommended future research. Research recommended includes the perspectives and understanding of Aboriginal people in the Northern Territory concerning communication and swallowing disorders and their treatment as well as the natural language development of Aboriginal children and the techniques used by Aboriginal people to stimulate and facilitate communication.	
Stewart, 2002	Communication (Assessment)	Aboriginal school aged children		School	Albury	To determine if Aboriginal children in a school were using an Aboriginal English dialect when talking in the classroom	Textual - narrative	Not disclosed	Not disclosed		Challenges in getting representative samples of language due to Aboriginal English (AE) spoken so lightly and unrecognisable by the researcher. Code switching to standard Australian English done so quickly that use of AE was only obvious to someone who is able to switch.	
Western Australian Aboriginal Child Health Survey: The Health of Aboriginal Children and Young People., 2004	Communication (Prevalence)	Aboriginal and Torres Strait Islander children and young people	5,289	Community	Western Australia	A survey to build the knowledge and to develop preventative strategies that promote and maintain the healthy development and the social, emotional, academic, and vocational well-being of Aboriginal and Torres Strait Islander children	Grey Literature	Carer survey	Statistical analysis	38% or carers indicated that their children knew a few words of an Aboriginal language. There were strong associations between level of remoteness and the proportion of children who spoke an Aboriginal language - 2 per cent of children in the Perth metropolitan area compared with over 60% in areas of extreme isolation. Just over one	Population data from this survey confirms that many of the key determinants of Aboriginal child health are outside the immediate influence of the health care system. Recurrent and discharging ear infections, which affected one in eight Aboriginal children, had a very significant impact on rates of hearing loss and of speech, language and learning problems. An estimated 2,240 or 10% of children were reported to have trouble saying certain sounds, this problem decreasing with increasing age. Amongst children aged 4 to 11 years, males were more likely to have difficulty saying certain sounds (17%	

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										quarter of participants (27%) were limited in one or more sensory functions (vision, hearing or speech) or experienced pain due to disability.	compared with 10% for females) and more likely to stutter (8% compared with 3% for females).	
Aithal, 2008	Hearing (Assessment)	Indigenous and non-Indigenous children 5 males 13 females Ages 10;3-17;1 Average age for each group 12;1-13;7	18 total (11 Indigenous – 9 female / 1 male, 7 non-Indigenous – 3 male / 4 female)	Community	Tiwi Islands	To consider the effects of hearing loss and native-language phonology on learning English by Australian Indigenous children.	Quantitative	Otoscopy and hearing sensitivity testing reaction time	Statistical analysis	Two factor ANOVA indicated no significant difference between features (F = 0.018, df = 6, 15, p > 0.05). Significant difference between the groups (F = 20.233, df = 2, 15, p < 0.05). Contrasts for each distinctive feature indicated all three groups were significantly different (df = 15, p < .05).	Discrimination of consonants was differentially affected by differences in language. Hearing loss further complicated difficulties that a child already had with English. Hearing loss also affected the discrimination of English consonants more than those in the native language. Phonological awareness programs with or without amplification need to part of reading programs from preschool with Indigenous children learning English as a 'school' language. Amplification alone does not suffice.	Good quality (Score = 16/20)
Australian Institute of Health and Welfare, 2011	Hearing (Prevalence)	Indigenous children 4 age groups 0-5 years 6-11 years 12-15 years 16+ years	4,708	Community	Northern Territory	Presentation of data collected from the Australian Government-funded follow-up ear and hearing health services delivered through the Child Health Check Initiative (CHCI) and then the Closing the Gap (CtG) in the Northern Territory from July 2007 to May 2011.	Grey Literature	Audiological assessment	Percentage %		Between August 2007 and May 2011, 7,421 audiology services and 3,840 ENT services were received by 4,708 and 2,670 children respectively. About 66% of children who received an ENT consultation or an audiological assessment were diagnosed with at least one type of middle ear condition. Among children who received an audiology service, 53% had some form of hearing loss and 33% had hearing impairment. 11% had hearing impairment at a hearing threshold of 35 dB HL or above. Without further intervention or rehabilitation, the speech and language development as well as the social and educational achievements of these children will be affected.	
Burrow, 2009	Hearing	Indigenous		Community	Australia	A review to complement the existing EarInfoNet review of the medical aspect of ear disease by	Textual - review	Literature search	Literature review		Educational and social implications of hearing loss influence development of language, communication, learning	

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	(Treatment)	people				providing a summary of the available literature that discusses the educational and other approaches to Indigenous hearing loss, drawing relevant information from various disciplines with a specific focus on conductive hearing loss resulting from otitis media.		(no specific details provided on collection process)			and social skills. Educational strategies that may enhance listening and learning include – identifying hearing problems, implementing classroom strategies, developing language skills that underlie written literacy, using a range of teaching methods, teaching children about hearing loss to raise their awareness.	
Coleman, 2011	Hearing (Treatment)	Indigenous children		Community	Remote Queensland	Shared partnership of three community organisations (Undoonoo Day Care, Child Services Skilled Planning and Deadly Ears QLD Health) to reduce the impact of otitis media in Indigenous communities	Textual – review				Shared vision of all children have the right to be healthy and engage in learning environments. Three community groups working in isolation became working in collaboration. Intersectoral sharing of knowledge, skills, resources and language strategies identified that enabled a consistent approach to early childhood education and language stimulation strategies. Reduction in overlap of information and repetition of information to staff and improved approaches to staff learning and development. Wider community delivery of the ear health promotion message and increase community awareness of hearing and speech.	
Couzos, 2001	Hearing (Prevalence)	Aboriginal and Torres Strait Islander populations		Community	Australia	To view the burden of ear disease in Aboriginal children through an international perspective in order to inform researchers and research bodies of the gaps in knowledge and where resources need to be directed in order to improve ear health. The review aimed to address primary health care prevention, diagnosis and management of otitis media.	Grey Literature	Searching of online database	Narrative		Experts have found between 6-80% of Aboriginal children have significant hearing loss. This range is so wide as it varies from community to community. Many studies prove that hearing loss caused by chronic otitis media in the first two years of life can seriously affect language development.	
DiGiacomo, 2013	Hearing (Prevalence, Assessment & Treatment)	Indigenous children		Community	Australia	To identify peer reviewed literature describing factors impacting on the prevention, recognition and access to support and management of disability in Indigenous Australian children	Textual - review	Literature search using a variety of online database sources	Narrative literature review	27 peer reviewed articles met inclusion criteria	Minimal data on Indigenous childhood and disability. Available research predominantly addresses physical health, health determinants and mental health and wellbeing. Indigenous and non-Indigenous interpretations of disability may impact on identification, diagnosis which is an important step towards early	

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											intervention to improve a child's social, language and communication development. Need for culturally appropriate screening instruments and psychometric tools, cultural training in the workforce.	
Ford, 1993	Hearing (Treatment)	Aboriginal children		School	Australia	Strategies for teaching Aboriginal children with hearing difficulties and special communication needs.	Textual - narrative				Importance of early identification and intervention so that Aboriginal children do not lose the ability to learn language competently. Teacher awareness of hearing loss and the effect it has on Aboriginal children as well as the implementation of suitable learning programs is essential.	
Howard, 1991	Hearing (Assessment)	Aboriginal school aged children (age and gender not disclosed)	49	School	Darwin	Identifying hearing loss through the use of a speech reception game called "Blind Man Simon Says"	Quantitative	Hearing screening Formal audiometric assessment Speech reception game Participant video observation	Behavioural analysis Statistical analysis	N = 26 children identified as having suspect hearing, N = 23 children identified as hearing not suspect. Formal audiometric assessment – N = 21 children confirmed hearing loss in one or both ears, N = 28 children confirmed no hearing loss.	Results suggest that the informal speech reception test is a simple and effective way for parents and teachers to identify which children may have a hearing loss. Particularly useful in absence of or lack of access to regular formal testing. This test enables communication difficulties of students with a hearing loss to be demonstrated in a way that is immediately meaningful as sometimes teachers and parents are unaware of the implications hearing loss has on communication and education.	Limited quality (Score = 7/22)
Lee, 2006	Hearing (Treatment)	Aboriginal children Aged 0-5		Community	Sydney	Implementation of a health promotion strategy collaboratively delivered by speech pathologists and Aboriginal workers called HEAR (Healthy Ears Activities Resources)	Textual – review				HEAR training increased participants' knowledge about glue ear. Increased referrals from the Aboriginal otitis media coordinator for hearing screening. Recognition of resources created within the community and requests from local agencies to present HEAR at community events. Increase request for use of HEAR resources from a wide range of Aboriginal service providers – schools, Aboriginal Early Childhood Education Units and health services. Increase in cultural awareness from non-Indigenous community.	

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Lowell, 1993	Hearing (Assessment)	Aboriginal school aged children (age/gender not specified)	30	School	Northern Territory	Preliminary findings of the investigation into the impact conductive hearing loss (CHL) has on classroom communication	Qualitative	Participant observation Informal assessment of language and auditory processing Parent and teacher interviews	Ethnographic		Classroom communication and academic outcomes of the Aboriginal children depend on the interaction of many factors including – intervention cannot just be based on currently hearing levels, effective compensatory strategies of Yolngu teachers and the children need to be considered when determining need for intervention, the actual difficulty not the "assumed" difficulty of each individual child needs to be accurately identified. Effects of CHL on early language development and the need for early intervention need to be more seriously considered when planning medical and educational management.	Limited quality (Score = 10/20)
Lowell, 1995	Hearing (Assessment & Treatment)	Aboriginal school aged children (age/gender not specified)	30	School	Northern Territory	Influence of conductive hearing loss on communication and learning in an Aboriginal school	Qualitative	Participant observation Informal assessment of language and auditory processing Parent and teacher interviews	Ethnographic		Unexpected findings include children who were progressing very in the classroom were found to have the worst hearing loss. These children had developed their own strategies to compensate for their difficulties such as visual and contextual clues. This was done so well that the teachers were not aware of the child's hearing loss. Children with fluctuating conductive hearing loss (CHL) were found to experience the greatest communication and learning difficulties and did not have strategies to compensate. Cultural differences in listening behaviour often misunderstood and confusion between communication difficulties and differences need to be carefully considered. Main cause of communication problems were not because of hearing loss, however were due to frequent communication breakdowns between Aboriginal students and non-Aboriginal teachers. Yolngu educators used many strategies that non-Aboriginal teachers (Balanda's) did not. These helped the children communicate and learn effectively. They are the ones who best understand the communication and learning needs of the children.	Limited quality (Score = 5/20)

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Massie, 2004	Hearing (Treatment)	Indigenous children 31 males 33 females Ages 6;1 – 10;3	64	School	Cherbourg and Yarrabah, Queensland	Investigation of the effects of sound field amplification intervention on the communication naturally occurring in the classrooms of Indigenous children.	Quantitative	Acoustic measurements Structured classroom observation Self-report protocols – before and after rating scale (SIFTER)	Comparison of observational data before and after amplification intervention Statistical analysis of SIFTER rating scale	Pure tone average hearing level was 20 dB pre-trials and 19 dB post-trials. 20% of children began trials with normal hearing levels, 67% began with slight hearing loss levels, 8% began with mild hearing loss and 5% began with moderate hearing loss.	Sound field amplification intervention reduced the effects of reduced speech perception and facilitated significantly more communication occurring between teacher, children and peers during the eight week trials. Currently no enforceable Australian standards on classroom acoustics. Structural modifications to classroom acoustics is a costly exercise, however sound field amplification may provide a cost effective and immediate solution to improving the listening environment within the classroom for Indigenous children.	Limited quality (Score = 11/20)
McCarthy, 2010	Hearing (Treatment)	Indigenous children	12	Community – rural and remote	Australia	Pilot project (RIDBC Teleschool) of using a telehealth model to provide ongoing intensive therapy support to families in Indigenous communities.	Textual - review				Demonstration of efficacy of using a telehealth model to provide continued intensive therapy to Indigenous families, regardless of the type of hearing loss, degree of hearing loss or age of the child. Despite significant levels of hearing loss and need for support, uptake by Indigenous communities was low. Needs had to be reviewed, as well as barriers to access in order to adapt the existing model of service delivery. Despite adaptations made to the service, the uptake of services was lower than expected and requires ongoing investigation.	
Ministerial Advisory Committee: Students with Disabilities, 2007	Hearing (Treatment)	Aboriginal students otitis media and conductive hearing loss		Community	South Australia	To examine programs or initiatives established in selected metropolitan and regional centres of South Australia to address the high prevalence of otitis media and conductive hearing loss in Aboriginal children.	Grey Literature	Comparative case studies Interviews with education, health and disability professionals Literature review			Study highlighted that although there was awareness of otitis media as a health problem for young Aboriginal children, there was little awareness by families and educators that otitis media could result in conductive hearing loss, with longer-term impact on educational outcomes. Educators understood the implications of hearing loss on children's development in the areas of language, communication and literacy. However, they were less aware of learning strategies to assist these children to access the curriculum. One concern that emerged from the study is that, although otitis media is	

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											considered an infant and maternal issue, current programs focussed on the provision of services to preschool and school age children, where at that age adverse effects on the development of speech and language may already have been impacted.	
Morris, 1998	Hearing (Prevalence, Assessment & Treatment)	Aboriginal children		Community	Australia	Systematic review to identify prevalence, aetiology, diagnosis, prognosis and therapy of otitis media in Australian Aboriginal children	Textual - review	Systematic literature search using a variety of online database sources	Systematic review	59 studies met inclusion criteria	Small number of studies were able to demonstrate that severe otitis media and consequent hearing loss affected speech and language skills. Impact on children who are learning English as a second language is likely to be even greater. Importance of early diagnosis and treatment. Lack of useful therapeutic studies is a concern and future research needs to concentrate on studies that examine the effectiveness of interventions, health seeking behaviours and compliance.	
Nienhuys, 1992	Hearing (Treatment)	Aboriginal infants		Community	Australia	To argue that Aboriginal infants are at increased risk for auditory and linguistic developmental problems due to significant middle ear disease and that this warrants early and aggressive treatment of infants.	Grey Literature – conference proceedings				Current treatment and educational management strategies for affected school-aged Aboriginal children is too late to treat conductive hearing loss (CHL) and subsequent auditory and language difficulties. Affects of CHL are described and include auditory processing difficulties, word identification and comprehension, acquisition of phonologic and metalinguistic skills and language learning delays. Treatment of otitis media with effusion in Aboriginal babies under 12months needs to be considered a paediatric emergency warranting aggressive treatment strategies to avoid likely future developmental and educational delays.	
Partington, 2005	Hearing (Treatment)	Indigenous students Preschool to Year 3 (5-8yrs)	80 teachers and teaching assistants Over 500 Indigenous students (exact number not	School	Western Australia	Outlines some of the key findings to date from a longitudinal study investigating effective teaching strategies to improve literacy and educational outcomes of Australian Indigenous students who have conductive hearing loss. Identification of teaching strategies and school environments that enhance	Textual - review	Interactive and iterative process involving teacher professional development and the collection of information on ear health, educational achievement pre	Document and data map analysis to identify common characteristics contributing to student achievement		Overview of characteristics of the learning environment that contributes to effective teaching with two major characteristics identified – teacher focus on language development and placing teaching in context. 1. Effective teachers focussed on explicit teaching of oral language skills such as phonological awareness,	

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			disclosed)			written literacy of Indigenous students aged 5-8years.		and post intervention, recording of lessons and teacher interviews.	Reflexivity		production and reception of sounds in all word positions. Effective teachers also focussed on vocabulary development, familiarity of parts of speech, sentence structure and expressive and receptive extended language skills. 2. Placing teaching in context – effective teachers were able to demonstrate responsiveness to students first language and home background by using strategies that linked the acquisition of literacy learning to specific cultural and linguistic needs of the students.	
Sargison, 2005	Hearing (Treatment)	Indigenous children		Hospital / Community	Brisbane, Queensland	To describe the development of the Ear Health Program's model of speech pathology service delivery, strategies adopted and ways to share the message of "healthy ears, good hearing, good talking, smart schooling, strong futures" in a meaningful and appropriate way.	Textual - narrative				Strategies identified include working alongside Indigenous colleagues to make the service more acceptable and effective, providing intervention in naturalistic settings, skilling and learning from co-workers, community development and transdisciplinary work. Establishing and providing a service to a large geographical area requires a step by step process to ensure successful implementation. Steps include information gathering, needs assessment, consulting the Indigenous community, establishing community links, introducing the service, health promotion, education and support. The last stage is effectively taking the service model out to the rest of the central zone and sharing the message to empower the Indigenous families so they play the key role in improving communication outcomes of their children.	
Scholes, 2010	Hearing (Treatment)	Indigenous children		Community	Queensland	Discussion of the Deadly Ears program and its aims in limiting the impact of otitis media on the communication development of Indigenous Australian children	Grey Literature – conference proceedings				Interagency framework that provides a cross-sector response to an endemic health problem in Queensland's Indigenous communities. The program works with communities to develop sustainable solutions, requiring a diverse team that includes Speech Pathologists who work together to reduce the impact of otitis media. This population-based approach explores ways to value-add and build local capacities within the community through focussing on professional development, resource development,	

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											health promotion, professional support and workforce development.	
The Board of Studies, 1994	Hearing (Assessment & Treatment)	Aboriginal children		Community / School	Australia	To help overcome the lack of awareness about otitis media (OM) by explaining what it is and by showing teachers and other school staff what role they can play in the shared responsibility for students who suffer from it	Grey Literature				Limited research has been conducted documenting the effects of otitis media and conductive hearing loss on Aboriginal children's language development. Conductive hearing loss creates a communication blockage and further alienates the Aboriginal child by exaggerating the impact of cultural differences of the classroom.	
Walker, 2001	Hearing (Assessment)	Aboriginal children 5-6 years old Similar ratio of boys and girls however numbers of each not disclosed	19	School	Sydney	Investigation of the differences in phonological awareness, reading and spelling skills of Aboriginal children with and without otitis media with effusion (OME) and conductive hearing loss (CHL).	Quantitative	Audiological assessment Educational assessment	Non-parametric statistical tests		Results support that OME and CHL during early years of education has detrimental consequences for phonological awareness skills and reading and spelling performance of Aboriginal children in Year 1. Correlational analysis supports that a relationship exists between phonological awareness, especially phoneme segmentation, and reading and spelling which has major implications for literacy levels.	Good quality (Score = 18/22)
Williams, 2009	Hearing (Assessment)	Indigenous children		Community	Australia	To present the view that Indigenous children who suffer otitis media are at increased risk of negative cognitive and educational outcomes.	Textual - review	Literature review Clinical experience of authors			Clear need for further research on the effects of otitis media on cognitive and educational outcomes – in particular prospective research that looks that measuring hearing levels as well as middle ear function. Despite lack of research evidence, it cannot be ignored that for some children otitis media has a negative impact on cognitive, language and educational development. For Indigenous children, these outcomes are more likely to be probable. Clear evidence to support that some patterns of otitis media do predict long-term negative outcomes on speech and language development, such as early onset, frequent infections and infections that last for a longer period,	
Yonovitz, 1995	Hearing	Aboriginal and non-Aboriginal	24	School	Bathurst Island, Northern	To use masking level difference (MLD) to determine if the consequences of early onset of	Quantitative	Audiological evaluation using otoscopy,	Statistical	All Aboriginal subjects were below 99% confidence	Summary of findings consistent with previous research indicating MLD is significantly reduced for those with a	Good quality

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	(Assessment)	children 12 Aboriginal (6 male / 6 female aged from 6;5 – 13;2 yrs) 12 non-Aboriginal (6 male/6 female aged from 6;6 to 12;3 yrs)			Territory	hearing loss in Aboriginal children 1) affects their central auditory processing of speech and tonal signals in noise and 2) affects the primary or native language differentially compared with a learned second language being English.		tympanometry and audiometry	analysis	interval. Mean MLD for non-Aboriginal children was 11.52 dB and for Aboriginal children mean MLD was 5.31 dB. ANOVA indicated significant effect for Aboriginal versus non-Aboriginal MLD ($F1,22 = 99.8$, $p < .001$)	history of otitis media with effusion in both pure tone and speech listening conditions and that MLD for pure tones is greater than for speech stimulus materials. No significant difference was found in MLD between pure tones and Tiwi speech signals for Aboriginal children although was the expected significant difference between pure tone and English speech conditions. Results from the study support that Aboriginal children with a history of otitis media with effusion have difficulty hearing in background noise especially when they are listening to English. Highlights need for further research to discover how literacy needs of Aboriginal children can best be developed in Aboriginal languages and what role central auditory processing plays.	(Score = 16/20)
Yonovitz, 2000	Hearing (Intervention	Indigenous students Ages 4 – 22yrs Average age 13.23 yrs 512 males 520 females	1032	School	Northern Territory	To demonstrate the link between ear disease, conductive hearing loss and low English literacy. To demonstrate that Indigenous students of any age can make significant progress in reading and spelling if provided with hearing support services such as a phonological awareness program for Indigenous students who are learning English as a foreign language (EFL)	Quantitative	Ear examination and hearing testing Norm referenced reading and spelling assessments pre and post testing Criterion referenced diagnostic phonological awareness testing and intervention	Statistical analysis	Phonological awareness testing – overall mean difference pre and post-test = 16.85 ($N = 340$, $t = 23.72$, $df = 339$, $p < .001$ Reading progress-mean difference pre and post-test = .82 ($N = 342$, $t = 19.71$, $df = 341$, $p < .001$) Significant ($p<.001$) correlations between norm referenced spelling and reading tests and criterion referenced test of phonological awareness. Phonological awareness % scores 19.58-62.71% pre-test and 26.47-81.92% post-test.	The PA-EFL program offers a criterion referenced and culturally sensitive means of charting the students' progress. Students demonstrated more than one years progress on phonological awareness. Students initially appeared to be using little to no phonics skills for reading and writing and resisted attempting writing any words they were not confident in spelling. By the end of the program teachers were commenting that students were becoming more confident and effective communication partner and that the listening experiences gave the students insight into the structures of spoken and written language. Indigenous Australian children who learn English as a 'school' language are disadvantaged by a number of factors including – delay of introducing English during the first five years or more of their life, high risk of middle ear infections and conductive hearing loss, cultural differences and poor living conditions.	Limited quality (Score = 12/22)

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										Mean reading age scores pre-test 6.06 – 8.47 yrs and 6.09 – 9.06 yrs post test	'Both-way' education is possible for Indigenous students and can be achieved through bilingual programs that immerse Indigenous children in spoken/ written English for portions of each day, using the same phonics spelling formulas and ensuring strong community commitment towards a culture of literacy in the home.	
Australian Council for Educational Research, 2009	Language (Assessment)	Indigenous children Ages 36-79 months	Between 505-587 (263-300 males, 242-287 females)	Community	Australia	Presentation of statistics gathered during language assessments delivered to wave two participants of the Footprints in Time – Longitudinal Study of Indigenous Children (LSIC)	Grey Literature	Who Am I? test Renfrew Word Finding Vocabulary Test	Statistical analysis	Reliability (Cronbach's Alpha)2 for the Who Am I? test items was .88. This compares favourably with the reliability reported for the Longitudinal Study of Australian Children (LSAC) cohort of children aged four years in 2003/4, which was .87 Statistically significant difference between children's performance on the Who Am I? according to their level of isolation $F(2, 503) = 5.40$, $p<0.01$ Statistically significant effect of level of isolation on performance in the Renfrew Word Finding Vocabulary Test, $F(2, 583) = 31.59$, $p<0.001$	The from both tests indicate that the LSIC Wave 2 cohort of children are following a similar pattern of development to children on whom both assessments were normed. Repeating these assessments (within the age parameters of the assessments) can provide a valuable picture of an Indigenous child's development over time. Statistics gathered can be used as initial normative data when using tests in a clinical setting with other Indigenous children.	
Australian Government, Department of Education, Employment and Workplace Relations – Australian Early Development Index (AEDI), 2012	Language (Assessment & Prevalence)	Indigenous children Non-Indigenous children First year of formal full-time schooling Average age 5;7	15, 490 274, 483	School / Community	Australia	Population measure of children's development as they enter school to help communities to know how their children are developing across five domains of physical health and wellbeing, social competence, emotional maturity, language and cognitive skills (school-based), communication skills and general knowledge. Provision of summary results from 2012 and comparative data	Grey Literature	Teacher completion of AEDI checklist for every child	Statistical - %	43.2% of Indigenous children were developmentally vulnerable in one or more of the 5 domains and 26% on two or more domains. These figures are more than two times higher than non-Indigenous	Significant decrease in vulnerability on one or more domains for Indigenous children from 2009 to 2012 (47.4% in 2009 compared to 43.2% in 2012). The largest improvement was identified in the language and cognitive development domain. The majority of Indigenous children are developmentally on track for each of the five AEDI domains.	

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						for the 2009 and 2012 collections				percentages (20.9% and 10% respectively) Greatest difference between Indigenous and non-Indigenous children was on the language and cognitive domain, with Indigenous children being 3.8 times more likely to be developmentally vulnerable than non-Indigenous (22.4% compared to 5.9%) Indigenous children are 2.4 times more likely to be developmentally vulnerable than non-Indigenous children in communication skills and general knowledge (19.9% compared to 8.4%)		
Butcher, 2008	Language (Assessment)	Aboriginal people		Community	Australia	To discuss the linguistic aspects of Australian Aboriginal English (AE) and how these differ to Standard Australian English (SAE)	Textual - review	Not disclosed			AE is a dialect of English with its own phonology, grammatical rules and lexicon and is just as efficient a medium of communication as any other language. Status and value of the dialect is still largely misunderstood in schools and all teaching and assessments continue to be done in SAE with little or no explicit or competent teaching of SAE as a second dialect. Many teachers still view AE as an uneducated form of SAE rather than a different dialect of English.	
Cahir, 2011	Language (Assessment)	Indigenous children		Community	Australia	To review the literature and provide some of the evidence available to speech pathologists working with Indigenous children regarding culturally safe and valid cross-cultural communication assessments. The focus is for the review to be used by speech pathologists as an introductory resource when	Textual - review	Not disclosed	Literature review		Assessment methods such as caregiver report, teacher report, contextualised language sample analysis, dynamic assessment, novel linguistic stimuli approach and the adaptation of standardised tests are considered as ways of gathering valid language assessments.	

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						investigating relevant assessment options for cultural valid research and clinical practice.					Although these different approaches can provide valid language assessment for Indigenous Australian populations it is recommended that the best resource for valid assessment is found in community consultation.	
D'Aprano, 2010	Language (Prevalence & Assessment)	Aboriginal children across three remote communities Ages 3-7 years	124	Community / School	Northern Territory	To examine how useful the Brigance developmental screening tool is in identifying Aboriginal children at risk of developmental disabilities and for providing guidelines for further diagnosis and intervention	Quantitative	Brigance screening tool	Results compared to age specific cut off scores	100% of children scored below the age-specific cut-off identifying children likely to have developmental disabilities. Median score on the 3 year old screen was 13, which is age equivalent of 2 years. Median score of the 4 year old screen was 32, which is age equivalent to 3years 1 month Those completing the Year 1 Screen (6yrs and above) had a median score of 25 which is age equivalent to 4yrs 7 months. 100% of children scored below the cut-off for their age. When scoring using the at-risk guidelines which focus on language and academic domains, 100% of children still scored below the cut-off.	Screening tool was not useful in differentiating children who had delays that would benefit from intervention programs from those with a high probability of disability that required diagnostic evaluation and specialised services. Test stimuli were not culturally appropriate and the method of delivery was not relevant or appropriate for the population. Clear need to improve and adapt a screening tool to guide a system for developmental surveillance within remote Aboriginal communities that is culturally and linguistically sound. Despite screening tools limitations, the uniformly poor test results cannot be denied and supports the need for quality language and early childhood educational services in order to prepare Aboriginal children for future school success.	Adequate quality (Score = 14/20)
Dinos, 2000	Language (Assessment)	Aboriginal children		School / Community	Australia	Review of current and specific literature on narrative from the perspectives of experts in Aboriginal communication styles and narrative as well as sociolinguistics. Personal author comments attempt to make links between the information and its relevance for speech pathologists	Textual - review	Not disclosed	Literature review		Culturally appropriate assessment of an Aboriginal child's narrative ability is important as it informs us about the child's language use and construction of oral tests. Prejudged ideas of narrative structure and storytelling should not be brought to the assessment, as this will affect the assessors' ability to observe and	

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						working with Aboriginal children.					identify a child's highly developed linguistic skills. Culturally specific texts need to be explicitly taught to the children at all linguistic and discourse levels to ensure the child's success. If it is our intention to teach Aboriginal children Western narrative structure, then we must provide explicit teaching, contextual information and plenty of opportunity for practice. For many Aboriginal children it is the difference in pragmatics and semantics that are the most common cause of communication breakdowns	
Gould, 2001	Language (Assessment & Treatment)	Aboriginal children		Community	Australia	To present observations regarding the crucial role that Aboriginal adults have to play in the delivery of speech pathology services to Aboriginal English speaking Aboriginal children	Textual – expert opinion				Aboriginal adults provide speech pathologists with perspectives on a child that are mostly unavailable to non-Indigenous adults. They play a significant role in the assessment of communicative abilities of Aboriginal children. When an Aboriginal adult is present, children are more communicative, display a greater range of language skills which allows the Aboriginal adult to tap into the sociolinguistic rules for communicating under which the children are operating. Including an Aboriginal adult in the assessment of an Aboriginal child greatly increases the speech pathologists capacity to make accurate diagnosis of the child's speech, language and communicative abilities.	
Gould, 2008	Language (Assessment)	Aboriginal children Ages 3-4 at first year of data collection Gender not specified	47	School / Community	Rural Australia (Location not disclosed)	Discussion of longitudinal study that examined how the type of language testing conducted by language professionals such as speech pathologists, educational psychologists or guidance officers constitutes a particular type of language policy. The article discusses how the implementation of these policies constructs the Aboriginal child being assessed in harmful ways.	Textual - narrative	Semi-structured interviews with school staff and parents Teacher questionnaire Student documentation from Education Department Videotaping	Standard scores and measures of standard deviation	Not disclosed	Implementation of language policies and language planning at the school has resulted in medicalising what is in fact a naturally occurring language situation. Individual children are being regarded as deficient in a number of different ways, with language and cultural differences being transformed in cognitive and language deficits. The cause of the children's deficits are being described as biological in nature and other explanations such as linguistic difference, cross-cultural miscommunication, inadequate	

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								natural interactions Non-standardized speech, language and phonological awareness assessments			teaching, hearing loss or health issues are overlooked due to the inherent power of the medical discourse. A more balanced assessment approach is necessary – one that considers language assessment theory and practice as well as medical models of communication development.	
Hodge, 2004	Language (Treatment)	Indigenous and non-Indigenous preschool children 20 males 11 females Ages 4-5 yrs	31 (28 participants full data collection, 3 incomplete data) (14 Indigenous, 17 non-Indigenous)	Preschool	Western Australia	To determine the effectiveness of an early group intervention program aimed at increasing children's oral language skills. The study also aimed to identify any significant differences between gender and ethnicity in order to guide future service provisions.	Quantitative	Preschool Language Assessment Inventory (PLAI) pre and post intervention	Statistical analysis using SPSS – descriptive statistics and t-tests	Blank Level 1 (t = -3.0; df = 25, P = 0.006) Blank Level 2 (t = -7.1; df = 25, P = 0.000) Blank Level 3 (t = -9.4; df = 25, P = 0.006) Blank Level 4 (t = -8.2; df = 25, P = 0.006) T-tests revealed no significant differences in the scores of the children at all four levels, regardless of their ethnicity or gender.	All children who participated in the language groups improved their scores on the PLAI, suggesting improved oral language skills regardless of the exact number of language groups they attended. This supports early intervention and its benefit on language and literacy acquisition. Pleasing outcome of the study was that there was no difference in the language skills and abilities of Indigenous and non-Indigenous children – significant improvements were made by both groups and shows that Indigenous children are just as capable of achieving strong language skills and performing comparably to their non-Indigenous peers.	Limited quality (Score = 15/28)
Kenny, 2011	Language (Prevalence & Assessment)	Aboriginal students in the first grade of primary school		School	Northern Territory	Issues surrounding the mapping of oral language development of Standard Australian English (SAE) in the early school years of remote and very remote Aboriginal education with current mandated documents and the creation of an emergent oral profile to chart the development of SAE oracy.	Textual - narrative				Current developmental profiles used in NT (T-9 Diagnostic Net and the Northern Territory Curriculum Framework NTCF) reflect mainstream education developmental profiles and do not include any early/emergent language behaviours or indicators for SAE ELS/EFL oracy from the remote Aboriginal context. The ESL section of the NTCF is based on developmental profiles of ESL learners from urban and rural contexts that have been immersed in mainstream culture. Consequently, teachers in remote/very remote areas cannot identify and chart the developmental progress of Aboriginal students within this crucial early stage of language development. Most children in remote/very remote NT arrive at school with little or no experience with English. Teachers	

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											recruited to these communities often have no recognised ESL training. The new profile that is under development will be a descriptive profile of these remote/very remote Aboriginal learners and will chart the entire developmental process from their first language to SAE.	
Kinton, 2000	Language (Assessment)	Aboriginal pre-school aged children Ages 3-5yrs 3 females 2 males	5	Preschool	New South Wales	To examine the pragmatic behaviours of Aboriginal children in different contexts and over time	Grey Literature – conference proceedings	Video and audio taped interactions recorded at the beginning, middle and end of the year	Ethnographic	Differences between peer and Aboriginal adult contexts $F(1,4) = 95.71$, $P < .05$. Significantly fewer inappropriate pragmatic behaviours recorded when children interacted with peers (mean = .96) than with Aboriginal adults (mean = 6.93) Differences found between peer and non-Aboriginal adults contexts $F(1,4) = 28.96$, $P < .05$. Significantly fewer inappropriate pragmatic behaviours recorded when children interacted with peers (mean=.96) than with non-Aboriginal adults (mean = 6.27) Significant linear trend $F(1,4) = 7.26$, $p < .05$ and significant quadratic trend $F(1,4) = 15.07$, $P < .05$.	Significantly less number of inappropriate pragmatic behaviours were recorded for the peer context than for both the Aboriginal and non-Aboriginal adult contexts. This may be due to familiarity of the children who lived close to each other or previously attended preschool or kindergarten together. In Aboriginal culture, children take time to become accustomed to an unfamiliar person, with relationships influencing communication exchange Aboriginal children's communication behaviour differs between contexts and over time. Inappropriate pragmatic behaviours observed will depend on whom they are interacting with and the relationship they have with their communication partner. These findings need to be considered when assessing their communicative strengths and weaknesses to ensure a true reflection of their communication and language skills is obtained	
Loakes, 2012	Language (Assessment)	Indigenous children	80	Community	Community 1 – Western Australia	To develop an assessment tool suitable for use in Indigenous communities, to pilot the tool in four closely related remote	Quantitative	Computer based receptive vocabulary assessment using	Statistical	Community 1 – 81.4% correct Community 2 –	Although limitations were noted, the test was successful in its implementation and giving an understanding of how well Indigenous	Strong quality (Score = 18/20)

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		Ages 4 – 12;8			Community 2 & 3/4 - Northern Territory	Indigenous Australian communities, to use the test to determine how well the Indigenous children understand aspects of their local Indigenous language and to determine the efficacy of the assessment tool.		pre-recorded audio files		67.3% correct Community ¾ - 77.4% correct Results suggest that age impacts how well the child recognised the test items (ANOVA; $F = 7.711$, $p = .001$). Two way ANOVA with both community and age group as dependent variables also show both factors as significant ($F = 3.165$, $p = .019$)	children in a remote multilingual community in Australia can identify individual lexical items in Walmajarri. Results may provide baseline normative data for researchers working on child language development in Indigenous Australia, and given the lack of normative data on this population it makes a much needed contribution to the literature. Limitations – validity issues with age of participants affecting responses, deductive reasoning was limiting and construct validity threatened for a few test items.	
Malcolm, 2011	Language (Assessment)	Indigenous children		School	Australia	Examination of linguistic and social contextual factors that underlie the English language assessment of Indigenous Australians.	Textual - review				Shortcomings of current assessment practices and acknowledgement that it is possible to develop more contextually realistic approaches to testing the Indigenous population through translating the language used in tests, replacing biased test items, using interpreters to administer tests and by using alternative assessment methodologies. A great deal more needs to be done to explore these alternatives to assessing the Indigenous population.	
Meakins, 2013	Language (Assessment)	Aboriginal adults children Five age groups: 4-6 yrs 7-8 yrs 9-11 yrs 12-15 yrs 20-30 yrs 37 females 15 males	52	Community	Kalkaringi	To test the relationship between language comprehension and child language input of Gurindji Kriol speaking Aboriginal children. Effects of age and the frequency of input on comprehension of Gurindji were also examined.	Quantitative	Comprehension test of 40 Gurindji vocabulary items (nouns)	Statistical analysis	All children are less likely to choose the correct picture on hearing a Gurindji word: 12-15yrs ($p < 0.01$) 9-11yrs ($p < 0.001$) 7-8yrs ($p < 0.001$) 4-6 yrs ($p < 0.001$) The correct picture is less likely to be chosen if the corresponding word is of medium ($p < 0.001$) or low frequency ($p < 0.001$)	Decline in Gurindji comprehension skills seen across two generations relative to the number of years that the children, teenagers and young adults have been exposed to the language. Adults had greater exposure to hearing Gurindji spoken as a child because a large number of Gurindji speakers were alive at the time when they were children. Age and exposure to the amount of Gurindji heard by children affects their comprehension of the language. Findings conclude that some input is not enough to have a high level of understanding of a language.	Strong quality (Score = 19/20)

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Miller, 2013	Language (Assessment)	Aboriginal preschool children Aged 4;5 yrs 9 females 6 males	15	Hospital	Campbelltown, New South Wales	To explore the language development of urban Aboriginal children prior to beginning school using a standardized language assessment and to compare the results of this assessment with non-standard language assessment methods that are recommended for use with Indigenous children.	Quantitative	Standardized (CELF-P2) and non-standardized language assessments Language samples – videotaped Paediatric health assessment	Grammatical analysis of language samples	10 children referred to audiologist – 5 of these children attended the hearing assessment and of these 3 were referred to an ENT for specialist follow-up Results of CELF-P2 indicated that 2 children had receptive/ expressive language impairment, 4 children had a receptive language impairment and 2 children had an expressive language impairment.	One of the first studies to investigate the impact of Aboriginal English has on standardized language assessments in urban areas of east coast Australia. Findings highlight the great variety in the linguistic strengths and weaknesses among a group of children from the same region of Sydney who share a similar cultural background. Language observed alludes to a non-standard dialect of English in the region and for urban Indigenous children speech pathologists should not make assumptions about the culture or language exposure, instead they need to take the time to elicit and analyse a language sample to supplement the results of standardized language assessments.	Good quality (Score = 17/22)
Pearce, 2011	Language (Assessment)	Aboriginal children Ages 6;6 – 9;6 yrs 3 females , 3 males	6	School	North Queensland	To identify the micro and macro structure characteristics of oral narratives produced by Aboriginal children in North Queensland and how these compare to norms derived from existing language sample analysis databases.	Quantitative	Audio recording of participant language samples	Transcription into computer software program Systematic Analysis of Language Transcripts (SALT), marking and coding as per SALT conventions. Comparison of results using SALT database normative data to calculate number of C-units (NCU), mean length of C-units in words (MLCU), number of different words (NDW), grammatical accuracy (GA) Reliability calculated using Krippendoff alpha values Statistical	Microstructure Analysis: - NCU: 3 participants within normal limits (WNL), 2 participants 1 standard deviation (SD) below SALT database mean and 1 participant 2 SD above mean. NDW: 2 participants WNL, 2 participants 1 SD below mean, 2 participants 2 SD below mean. MLCU: 1 participant WNL, 4 participants 1 SD below mean, 1 participant at least 2 SD below mean. Macrostructure Analysis: All except one participant scored WNL for the narrative scoring scheme (NSS). The	Aboriginal children who were identified by their teachers as progressing well at school did not consistently perform within normal limits on measures of oral narrative microstructure when compared to reference data from the U.S. Most children however performed within normal limits for narrative macrostructure. Using grammatical accuracy of Standard Australian English measure may underestimate the Aboriginal child's linguistic proficiency In macrostructure measures, most participants did well with the introduction, character development and conclusion components. These findings are consistent with the observation that people and place are of key importance in Aboriginal storytelling. More information is needed on the language development of Aboriginal, Torres Strait Islander and non-Indigenous children across the remote, rural and urban contexts, language groups and socioeconomic backgrounds. Until such normative data exists, clinicians need to collect and analyse language samples over	Limited quality (Score = 11/22)

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									analysis used to calculate standard deviation from reference data	remaining participant scored at least 2 SD below the reference database mean.	time to monitor progress in response to intervention.	
Pearce, 2013	Language (Assessment)	Indigenous children Ages 8;01 – 13;08 Gender not specified	19	School	Townsville, Queensland	To determine how Indigenous children attending the same school in a regional urban area performed on a set of standardized assessments – specifically how does their performance compare to that of Australian-English speaking children, do teacher judgements of the child's language ability match the ability of the children on a standardized test and will scoring which takes into account specific features of Aboriginal English lead to a significant change in standardized test scores.	Quantitative	Standardized language assessment (CELF-4Aus and Test of Non-verbal Intelligence) Teacher interview and rating of each child	Descriptive statistics Raw and standard scores	Standardised test: results indicate 3 children WNL, 6 children with mild-moderate language impairment (LI), 10 children with severe LI. Adjusted Scoring results indicate 7 children would be classified as WNL, 7 children mild-moderate LI and 5 children with severe LI. Poor alignment with teacher ratings compared to language diagnosis.	First documented study to look at the performance of Indigenous Australian children and their performance on a standardized language assessment. Adjusted scoring to give credit to Aboriginal English (AE) responses led to an increase in standardized test scores and improved alignment with teacher ratings. Supports belief that AE has a negative impact on standardized assessment scores when comparisons are made against Standard Australian English. Study shows that there is considerable potential for misdiagnosis of language impairment using standardized assessments with Indigenous Australian children. Contrastive scoring for grammatical elements known to be characteristic of AE may reduce the number of misdiagnosed Indigenous children with language impairment.	Strong quality (Score 19/22)
Philpott, 2003	Language (Assessment)	Aboriginal children and families		Community	Kimberly region, Western Australia	To establish a document that will provide a framework on Aboriginal communication development and stimulation for speech pathologists and other health and education workers. The Revised Kimberly Early Language Scales (RKELS) aimed to be an initial step towards developing frameworks that are culturally appropriate when working with Aboriginal people.	Grey Literature				The first framework speech pathologists had that acknowledged cultural differences in communication acquisition and communication stimulation of Aboriginal people in remote Australia. Findings strongly support the importance of improving our understanding of Aboriginal children's communicative, social and cultural environment. Such knowledge is essential to assist non-Aboriginal people to differentiate between communication difference and communication deficit, and to ensure that children who are, in fact, experiencing language-learning difficulties are accurately identified and receive appropriate support.	

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Warren, 2008	Language (Treatment)	Indigenous Australian students Classroom Year 6/7: 8 Aboriginal and 6 Torres Strait Island students aged 10-12 yrs Classroom Year 3/4/5: 8 Aboriginal and 6 Torres Strait Island students – ages not specified	28	School	Northern Queensland	To explore the role of oral language and representations in negotiating mathematical understanding	Qualitative	Open ended teacher interviews (pre-interview) Video observations of classroom lessons Reflective teacher interview (post-interview)	Epistemological		Highlights the need for explicit links between home environment to school environment to support students learning. Importance of recognising that Indigenous Australian classrooms are bilingual, and the child's home language, while sounding like English is in fact different from Standard Australian English and in the child's home language there is a lack of vocabulary commonly used to describe mathematical situations. Importance of the type of classroom discourse and choice of representations and language used to explore mathematical concepts because oral communication is dominant in the lives of these students and their experiences with print and other literacies is limited.	Limited quality (Score = 10/20)
Wigglesworth, 2011	Language (Assessment)	Indigenous children Year 3		School	Northern Territory	To review the National Assessment Program – Literacy and Numeracy (NAPLAN) Year 3 literacy component (reading and language conventions) to support the argument that testing needs to be very carefully monitored for appropriateness for the assessment of children living in remote Indigenous communities because the tests are standardised on groups of English language speaking children.	Textual - review	Sample materials available from the NAPLAN website of 2008 sample test questions and additional sample questions from the Australian Curriculum Assessment and Reporting Authority (ACARA) website in 2011 under the heading of minimum standards			Content of some sample tests relies on cultural knowledge that Indigenous children cannot be expected to have. Although NAPLAN testing is suitable for most groups of Australian Standard English speakers, it is linguistically and culturally unsuitable for Indigenous children, especially those living in remote communities. Action needs to be taken to so results truly reflect whether students are meeting normal EFL/ESL benchmarks for stages of acquiring English so that Indigenous students are not just seen as simply having poor English literacy skills.	
Williams, 2000	Language (Assessment)	Aboriginal people		Community	Australia	To summarise the literature available on the major characteristics of Aboriginal English and the features which may be evident in the speech and language used by Aboriginal people and to discuss the implications of English words used with Aboriginal meanings	Textual - review	Not disclosed	Literature review		A number of differences are highlighted in reference to phonology, prosody, syntax, discourse, semantics and pragmatics. Implications for the speech pathologist working with the Aboriginal population highlight the importance of distinguishing between language characteristics attributable to language difference from those attributable to disorder.	

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Williams, 2008	Language (Treatment)	Indigenous children with otitis media-induced language delay		Community	Australia	To discuss otitis media and subsequent language delays and whether to intervene or not	Textual - review				Research suggests that conductive hearing loss (CHL) caused by otitis media (OM) may have an affect on language development. Due to increased severity and frequency of OM and subsequent CHL in Australian Indigenous populations, these children are at higher risk of developmental delays in language compared to the wider Australian population.	
Williams, 2010	Language (Assessment)	Aboriginal and non-Aboriginal children in their first year of schooling 10 Aboriginal (4 boys / 6 girls) with a mean age of 6;2 years 10 non-Aboriginal (5 boys / 5 boys) with a mean age of 6;3 years	20	School	Perth, Western Australia	To determine whether there are differences between phonological awareness and early spelling skills of Aboriginal and non-Aboriginal school children	Quantitative	Standardized test – Queensland University Inventory of Literacy (QUIL) Non-standardized spelling test	Non-parametric Mann-Whitney test Standard effect size (d) Spelling sensitivity scoring procedure (SSS) – descriptive analysis	Mean scores for both groups fell within normal range for all subtests of the QUIL however non-Aboriginal children scored higher scores for all subtests and above the mean on four subtests. Greatest difference between the groups were on tasks relating most closely to early literacy. Significant differences between the groups in non-word reading and spelling and phoneme segmentation with Aboriginal children performing poorly on these subtests. Large effect sizes between the groups on four measures of phonological awareness – non-word spelling and reading, syllable identification and phoneme segmentation. Aboriginal children spelled an average of 11.7% words correctly, non-	Urban Aboriginal children who participated in the study performed well below the level of low SES non-Aboriginal children on measures of phonemic awareness and early literacy. Findings clearly support the need to provide early educational experiences to close the literacy gap for Aboriginal children. Findings do not identify the factors which contribute to the problem. Future research needs to concentrate on identifying factors that are associated with success of Aboriginal children rather than continuing to focus on failure.	Strong quality (Score = 21/22)

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										Aboriginal spelled an average of 22.5% correctly.		
Williams, 2012	Language (Assessment & Treatment)	Speech pathologists from each state and territory in Australia N = 125 female N = 3 male Multilingual children – including 21 out of 110 primary languages used by children on the SLP's caseloads being Australian Indigenous languages	128	Community	Australia	To examine Australian speech language pathologists (SLP's) perspectives and experiences of multilingualism, including their assessment and intervention practices and service delivery methods when working with children who spoke languages other than English	Quantitative	Participant questionnaire	Percentage %		Majority of SLP's were monolingual. Results clearly support that the provision of SLP services to multilingual children rarely would involve a SLP who was able to use the child's first language. Results support an encouraging trend of using both languages in service provision for multilingual children. Lack of standardized tests for multilingual speakers and difficulties with access to interpreters support findings that most SLP's conducted assessments by themselves without interpreters using informal procedures in English. Limited resources to discriminate between speech and language difference vs. disorder. 75% of participants reported they did not feel they had adequate training in working with multilingual children.	Strong quality (Score = 15/16)
Winkler, 2009	Language (Treatment)	Indigenous primary school aged children		School	Melbourne	Discussion of an innovative project called The Early Learning Project being run in three government primary schools in Northern Melbourne who all have a significant number of Indigenous students.	Textual - review	Standardised language assessment			Project team are trying to write an adapted checklist for teachers to use to look at the behaviours of students in the areas of speaking, listening, reading and writing as the assessment used does not reflect the child's home language. The project focusses on teacher professional development, so they can understand and look at individual students strengths and difficulties and work with them. Teachers have been encouraged to shift their thinking from reading and writing being isolated skills to language, play, listening, speaking, reading and writing all being integrated.	
Dunn, 1999	Literacy (Assessment & Treatment)	Aboriginal children Age and gender	18	Pre-school	Warbrook, New South Wales	Five and a half year longitudinal research project that aimed to determine the early literacy predictors of later reading success	Mixed - qualitative and quantitative	Literacy tasks which examined story knowledge, print knowledge, book-handling knowledge and	Rasch analysis Pearson	Correlations between preschool/kindergarten and the mid-primary tasks show significant	Combined results of all tasks demonstrate that as a group the children's literacy knowledge was severely limited in comparison with their age group. However, results show that after formal literacy instruction the	Limited quality (Score = 9/44)

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		not specified				for Aboriginal students.		reading and writing knowledge mapped at 5 different times – middle and end of preschool, beginning / middle / end of Kindergarten and lastly when the children were in Grade 4.	Correlations Ethnographic analysis of case study material	relationships between literacy competencies at the end of the preschool year and four years later. Case studies indicate that family literacy issues in early childhood including cultural and social issues affect literacy development.	literacy skills increased demonstrating that Aboriginal children do respond to literacy instruction. Tasks used in preschool to measure emergent literacy appear to predict children's literacy competency in later childhood. Schools have not yet implemented effective methods of teaching so that Aboriginal children may become literate as readily as do non-Aboriginal children.	
Ehrich, 2010	Literacy (Treatment) Transition to Grade 3 – ages not specified	Indigenous and non-Indigenous school children	97 (63 Indigenous / 35 non-Indigenous) (54 male / 43 female)	School	Northern Territory	To study the relationship between attendance and the acquisition of early literacy skills of Indigenous and non-Indigenous children.	Quantitative	Standardized assessment pre and post-test – Group Reading Assessment and Diagnostic Evaluation (GRADE levels P, K, 1)	Statistical analysis – paired samples *t*-test with Bonferroni adjustments Bivariate correlations	Level P – *ps* < .001 with medium to large effect sizes, all *d*s > .73. Level K – performance significantly better at post-test in terms of total scores, $p < .001$ with a medium effect size, $d = .57$. Level 1 – performance significantly better at post-test in terms of all measures, *p*s < .002, all effect sizes were large, *d*s > .94. Pattern of results indicated school attendance was positively and strongly correlated to gains in phonological awareness, early literacy skills and overall improvement at GRADE level K. No correlations were found at level P or 1. Significant Indigeneity main effect, overall Indigenous students	Significant positive correlation found between gain sin early literacy skills and school attendance. Findings suggest that in terms of acquisition of early literacy skills, participation in classroom activities may be critical. Performance was poorer for Indigenous students as compared to non-Indigenous students. In particular, Indigenous children's performance on phonological awareness tasks was particularly weak. Study also found also found that Indigenous children attended literacy classes less frequently than non-Indigenous children. Attendance was strongly and positively related to gains in performance on phonological awareness processing tasks. Teachers need to explicitly focus on the development of Indigenous children's phonological awareness and early literacy skills.	Strong quality (Score = 19/20

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										attended less teaching sessions $F(1, 83) = 30.1$, $MSE = 921$, $p < .001$ Indigenous students' gains in phonological awareness and overall (total scores) were significantly less than the non-Indigenous students, $F(1, 21) = 23.5$, $MSE = 414$, $p < .001$, and $F(1, 20) = 12.8$, $MSE = 617$, $p < .003$, respectively		
Freeman, 2008	Literacy (Treatment)	Indigenous children and their families Experimental group mean age = 5;3 Control Group – Year 2 (exact age or gender specified)	19 in experimental group 15 in non-equivalent contrast group	School	Parramatta, New South Wales	To enhance the early literacy skills of Indigenous kindergarten children through a home shared-book reading program that was designed to foster child-family interactions with books at home and to bridge the gap between children's literacy experiences at home and the schools reading curriculum.	Mixed - quantitative and qualitative	Standardised assessments pre and post-test– Peabody Picture Vocabulary Test-Revised (PPVT-R) and the Waddington Diagnostic Reading Test (WDRT) Non-standardized assessments Structured interviews with parents and children	Pre and post-test means, standard deviations and mean percentage scores	Slight reduction in the gap between their age-equivalent test scores and chronological age over the intervention period.	Children who reportedly had lots of books at home achieved higher listening comprehension scores at the pre-test than children who said they didn't have many books at home. Greatest change in listening comprehension was achieved by children who did not have many books at home. Receptive language skills of many of the children remained below the level expected for their age. By the end of the intervention, 75% of the children's WDRT reading ages were at or above their chronological age. Overall the results suggest that the project had a positive impact on children's experiences with books at home, on child-parent interactions, on home-school links and on the children's early literacy skills, their self-esteem and attitude towards school.	Limited quality (Score = 26/42)
Harper, 2012	Literacy	Indigenous and non-Indigenous students		School	Northern Territory	To explore how effective the web-based early literacy instruction tool ABRACADABRA (ABRA) is if	Qualitative	Classroom observations Open ended field	Thematic		Study revealed a nuanced picture of the challenges faced within Indigenous education and northern Australian	Strong quality

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	(Treatment)					it were implemented with minimal support or with the level of support typically offered in the NT for other literacy programs.		notes Semi-structured interviews with principals, teachers assistant teachers, tutors and students			schooling in general. With or without using computer based instruction, students in the case study schools were deemed difficult to teach, and teachers reported that they spent a significant amount of teaching time socialising Indigenous children in areas that non-Indigenous children already have (e.g. self-care, school behaviour). In this type of environment, an enormous amount of effort to prioritise any one intervention is challenging, let alone an early literacy program in which teachers are under equipped and struggling to implement. Evident that teachers needed regular support and time to help them become familiar with the ABRA activities and how to link the program into other forms of learning.to support early literacy development	(Score = 18/20)
Hewer, 2006	Literacy (Treatment)	Aboriginal and non-Aboriginal peoples Child health nurses (CHN's)	8	Community	Geraldton and Midwest, Western Australia	The potential influence of child health nurses and early literacy programs on the family literacy environment and the improvements required to address training and cultural needs.	Mixed - quantitative and qualitative	Semi-structured interviews of CHN's	% analysis to calculate reach of the program	68% of non-Aboriginal children and 31% of Aboriginal children attended 7-9month health check. 21% of records noted delivery of the early literacy package	The early literacy program was partially effective at achieving its aims of supplying parents and infants with a book package to encourage reading. Barrier to successful implementation was significantly lower attendance rate by the Aboriginal population at the 7-9 month check-up. Alternative methods of health promotion were needed to reach the Aboriginal population, therefore the program was offered to children presenting to triage at the local Aboriginal Health Organisation. CHN's reported that the training associated with the program was informal and inadequate.	Limited quality (Score = 18/34)
Sharifian, 2008	Literacy (Treatment)	Aboriginal students		School	Australia	In response to a survey by Zubrick *et al* (2006), issues surrounding the use of Australian Aboriginal English (AE) in the classroom is discussed and the author presents an argument about the factors that need to be examined in any discussion of the school role of students home talk.	Textual – review				Teachers can help Aboriginal students by bringing knowledge of their first dialect into conscious focus and by comparing the features of AE to the features of the second dialect they are learning – Standard Australian English (SAE) Training for teachers should include raising the awareness of the students home dialect. Teachers would be able to facilitate students learning of SAE if	

First Author / Year of Publication	Area of disorder & research aim addressed	Population	Number of Participants	Setting	Geographical Context	Intervention / Focus of Study	Study Design	Data Collection	Analysis Technique	Results	Summary of Findings / Themes	Methodological Quality Rating
											they knew which areas of the dialect are different to AE. Schools should acknowledge and highlight the children's home language and develop their awareness of when their dialect and SAE are used for different purposes, rather than just urging them to not speak AE at school at all. Educators often do not acknowledge AE as a dialect of English and simply describe the differences they see in the speech of Aboriginal children as laziness, bad grammar or a lack of grammar. Some even refer to speech pathology or psychology because of these differences.	
Wheldell, 2010	Literacy (Treatment)	Aboriginal and non-Aboriginal children Years 5 and 6 – mean age 11;4	34 (14 Aboriginal students – 4 female / 10 male) (20 non-Aboriginal students – 8 female / 12 male)	School	Ashfield, New South Wales	To test the efficacy for Aboriginal students of an intensive, evidence-based literacy program for low progress readers called MULTILIT (Making Up Lost Time In Literacy).	Quantitative	Standardised tests pre and post intervention	Statistical analysis of raw scores	Total sample (*N*=34) made major and highly statistically significant gains on all 6 measures ($p <$ .0001). Effect sizes for gains classified as large (> .8, ranging from .91-1.49) On all measures except for nonword reading, there was no statistical significance between Aboriginal and non-Aboriginal children ($p >$ .05) pre or post-test. *t*-test analysis show that there were no significant difference between the mean gains for the Aboriginal and non-Aboriginal students on any of the measures.	All available evidence points to the fact that overall, the Aboriginal students gains were just as great as the non-Aboriginal students, supporting that the Schoolwise MULTILIT program was beneficial for all low progress readers irrespective of their cultural backgrounds. Recommended that adapted materials and approaches be used in order to meet the educational needs of Aboriginal students. The study provides new information suggesting that students from Aboriginal backgrounds do not need different instruction from non-Aboriginal students, just effective non-categorical instruction.	Strong quality (Score = 19/22)
Wolgemuth, 2011	Literacy (Treatment)	Indigenous and non-Indigenous students in Kindergarten to	242 – pretested 185 – post	School	Northern Territory	To determine whether the early literacy program ABRACADABRA (ABRA) improves Indigenous student literacy as compared to non-Indigenous and Indigenous	Mixed - quantitative and qualitative	Telephone based focus groups – teachers Pre and post	Thematic analysis of focus groups	Factorial ANCOVA tests revealed when controlling for pre-test score, ABRA students had significantly greater	Evidence that ABRA instruction improves both Indigenous and non-Indigenous students phonological awareness compared to regular literacy instruction in the NT. These findings are promising given that phonological	Good quality (Score = 33/44)

First Author / Year of Publication	Area of disorder & research aim addressed	Population	Number of Participants	Setting	Geographical Context	Intervention / Focus of Study	Study Design	Data Collection	Analysis Technique	Results	Summary of Findings / Themes	Methodological Quality Rating
		Year 2. Ages and gender not specified	tested Intervention Group – 67 Indigenous / 51 non-Indigenous Control Group – 29 Indigenous and 19 non-Indigenous *19 student results from control class excluded from analysis due to contaminated data			control groups and whether the quality of literacy instruction and student attendance impacts ABRA's effectiveness.		assessment of literacy using Group Reading Assessment and Diagnostic Evaluation (GRADE) level K and the Performance Indicators in Primary Schools Baseline Assessment (PIPS-BLA)	Rasch analysis Factorial analysis of research questions using ANCOVAs	post-test ability that the control students on the GRADE K phonological awareness (F 1,165 = 25.96, p<.001, η2=.14). Interaction between Indigenous status and intervention was not significant for any of the analyses, indicating that ABRA is more effective that regular literacy instruction in improving both Indigenous and non-Indigenous phonological awareness. Significant main effect of Indigenous status for all outcome measures except for PIPS-BLA phonics.	awareness is an excellent predictor of literacy outcomes at the end of primary school education. ABRA teachers appeared better prepared than control teachers to explicitly teach their students how to recognise and manipulate word sounds, with 3 out of 6 teachers indicating a lack of experience in teaching literacy, especially phonological awareness. Less clear evidence for ABRA affecting outcomes of early reading skills, phoneme-grapheme knowledge and phonics ability.	
Wolgemuth, 2013	Literacy (Treatment)	Indigenous and non-Indigenous children Ages 5;7-5;9 Gender not specified	360 (pre-test) Data analysis performed only on 145 students in the control group, 163 in the treatment groups = 308 total post test Students were lost to follow-up, withdrew consent, did not have consent or left the school 28% of total sample was Indigenous	School	Northern Territory – Alice Springs, Darwin, Palmerston	Multisite randomized control trial of the literacy software ABRACADABRA (ABRA) to determine whether using the software improves students' phonological awareness, word reading and other early literacy scores. The study also aimed to explore the relative impacts of ABRA on Indigenous students.	Quantitative	Pre and post assessment of literacy using Group Reading Assessment and Diagnostic Evaluation (GRADE) level K and the Performance Indicators in Primary Schools Baseline Assessment (PIPS-BLA) APFOR – ABRA Program Fidelity Observation Record CLOS-R – Classroom Literacy Observation Survey	Statistical analysis – ANCOVA and logistic regression analyses, Rasch analysis	ABRA group significantly outperformed students in the control group on the GRADE K post-test phonological awareness subscale (F1,305 =10.56, p = .002) Medium effect size for this difference (d = .37). Difference between the two groups on GRADE K word reading was not significant (F1,305 = 2.53, p = .11, d = .18). Treatment by Indigenous status interaction was significant for the GRADE K phonological	Overall, students in the ABRA treatment group made improvements above and beyond the improvements made by the control group. For Indigenous students, results suggest that ABRA may have been effective especially in the areas of phonological awareness, phoneme-grapheme correspondence and early literacy skills. Promising findings was that ABRA accelerated the early literacy growth of these Indigenous students to a point where they started performing as well as their non-Indigenous peers in phonological awareness. ABRA had less impact on word reading, however similar to research in Canada, the impact on word reading in the NT may be evident beyond the timeframe of the study. Indigenous students who had less	Strong quality (Score = 23/24)

First Author / Year of Publication	Area of disorder & research aim addressed	Population	Number of Participants	Setting	Geographical Context	Intervention / Focus of Study	Study Design	Data Collection	Analysis Technique	Results	Summary of Findings / Themes	Methodological Quality Rating
										awareness (F1,290 = 4.77, p = .03) Indigenous students in the treatment group (*Madj* = 1.44, SE = .20) had adjusted post test scores almost three times the size of Indigenous students' in the control group (*Madj* = .49, SE = .18) and larger than those of non-Indigenous students' in the treatment group (*Madj* = .91, SE = .11).	exposure to ABRA lessons had higher standard score gains per hour of intervention than non-Indigenous students, further supporting ABRA as an accelerant for this population in phonological awareness and early literacy skills.	
Toohill, 2012	Speech (Assessment)	Indigenous Australian children Ages 3;11-5;0	15 8 males 7 females	School/ Community	Victoria and New South Wales	To investigate the effect of dialectal difference on the identification and the rating of severity of speech impairment in Indigenous Australian preschool children	Quantitative	Standardized speech assessment – Diagnostic Evaluation of Articulation and Phonology (DEAP)	Computer software – Profile of Phonology (PROPH+) to perform phonological analyses SPSS statistical analysis	14/15 children (93.3%) were identified on the DEAP as having a speech impairment. When the data was re-analysed using AAE features, 13 Indigenous children (86.7%) were identified with speech impairment. Paired samples t-test identified the difference between AusE and AAE per cent phonemes correct (PPC) scores for Indigenous Australian children was significantly different at $p <$ 0.000. Mean difference between SAE and AE per cent consonants correct (PCC) scores was 9.26% (SD = 2.90, range = 5.1–14.8) that was statistically significant ($p <$ 0.000).	Some of the Aboriginal English (AE) features in the study were consistent with typical development or errors common to children with speech impairment. The challenge exists with determining the developmental appropriateness of these for Indigenous children due to the lack of data on phoneme acquisition of this population. Future research looking at the typical acquisition of phonemes for children learning multiple dialects is needed, so that accurate identification of true speech errors can be made. Modifications to the analysis of speech assessments for Indigenous Australian children are a step in ensuring culturally appropriate practices are used for accurately identifying and managing speech impairment within this population.	Strong quality (Score = 22/22)

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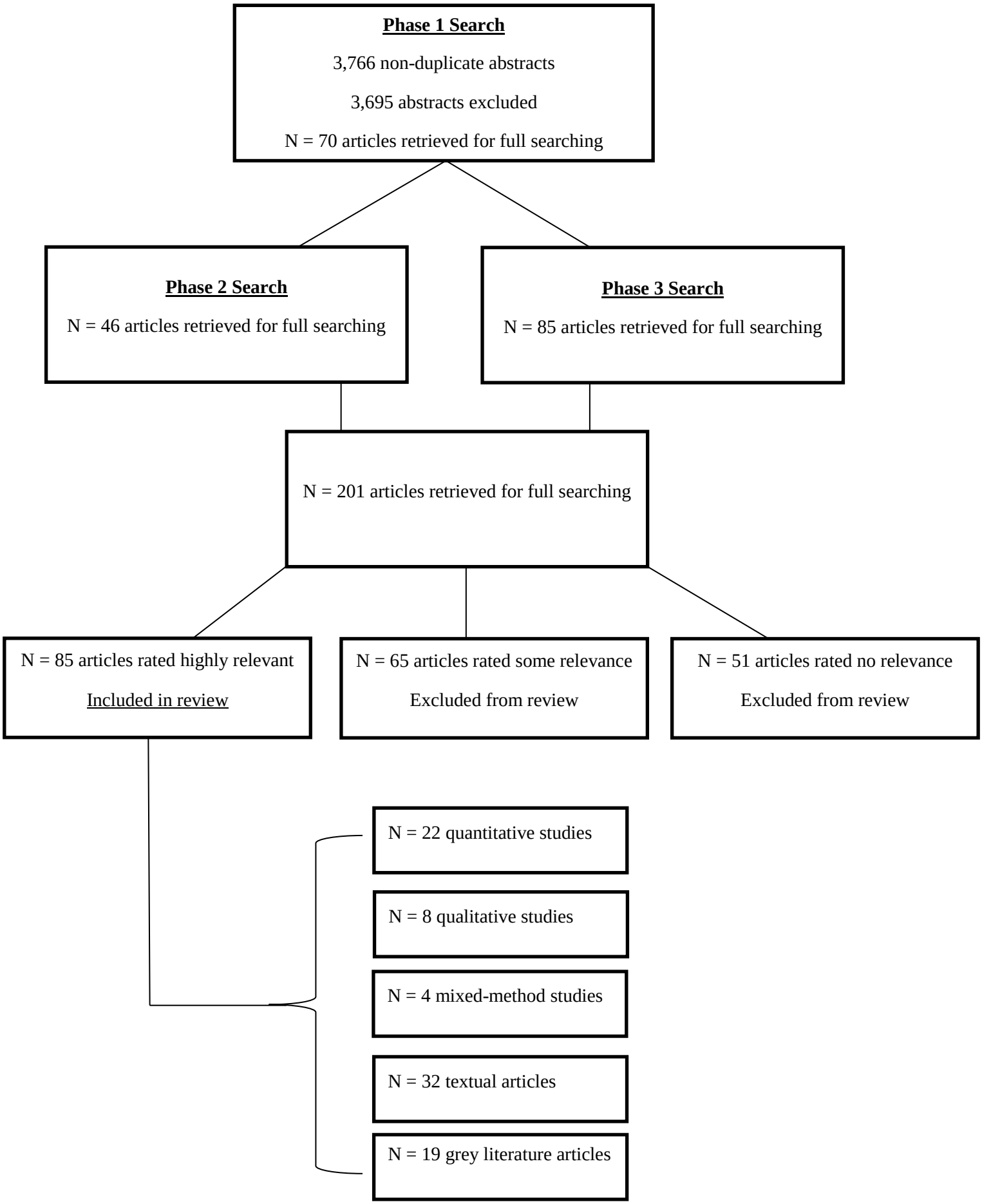
										Mean difference between SAE per cent vowels correct (PVC) and AE PVC was 2.41% (SD = 2.35%, range = 0–7) that was statistically significant ($p <$ 0.001).		

Appendix E. Flowchart of article selection process



Appendix F. List of Abbreviations

ABS – Australian Bureau of Statistics

ACCODS Checklist – Authority, Accuracy, Coverage, Objectivity, Date, Significance

AE – Aboriginal English

AEDI – Australian Early Development Index

AIHW – Australian Institute of Health and Welfare

CD – Communication disorder

CELF – P2 – Clinical Evaluation of Language Fundamentals Preschool 2nd Edition

FASD – Foetal Alcohol Spectrum Disorder

LSIC – Longitudinal Study of Indigenous Children

NATSISS – National Aboriginal Torres Strait Islander Social Survey

OM – Otitis media

PA – Phonological awareness

RCT – Randomised control trial

SAE – Standard Australian English

SEARCH – Study of Environment on Aboriginal Resilience and Child Health

SPA – Speech Pathology Australia

TBI – Traumatic brain injury