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The Prevalence of Stuttering, Voice, and Speech-Sound Disorders in Primary School Students in Australia

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Communication disorders are potentially disabling conditions with widespread and lifelong implications. Communication disorders may affect social and emotional well-being, cognition, and behavior (Baker & Cantwell, 1987; Beitchman et al., 1986; Bryan, 2004; Felsenfeld, McGue, & Broen, 1995; Lewis, Freebairn, & Taylor, 2000a, 2000b). Communication disorders impact on academic achievement in the school years and affect vocational choices later in adulthood (Ruben, 2000). People with communication disorders are more likely to be unemployed or in a lower income bracket than are people without disorders (Ruben, 2000). The unemployment rate in people who are unable to speak intelligibly is an astonishing 75.6%; the cost of communication disorders to the U.S. "communication-dependent economy" is said to be between 2.5% and 3% of the Gross National Product (Ruben, 2000).

Communication disorder is an overarching term that encompasses a variety of different disorders (Ruscello, St. Louis, & Mason, 1991). Defining and describing communication disorders remains an inexact science because we lack clear and empirically derived definitions, cut-off points, and classification systems. This has resulted in a poorly developed evidence base on which to base the identification and management of communication disorders (Reilly, Douglas, & Oates, 2004). The current article presents data regarding the prevalence of three particular communication disorders: disorders of fluency

ABSTRACT: **Purpose:** The aims of this study were threefold: to report teachers' estimates of the prevalence of speech disorders (specifically, stuttering, voice, and speech-sound disorders); to consider correspondence between the prevalence of speech disorders and gender, grade level, and socioeconomic status; and to describe the level of support provided to schoolchildren with speech disorders.
Method: Students with speech disorders were identified from 10,425 students in Australia using a 4-stage process: training in the data collection process, teacher identification, confirmation by a speech-language pathologist, and consultation with district special needs advisors.
Results: The prevalence of students with speech disorders was estimated; specifically, 0.33% of students were identified as stuttering, 0.12% as having a voice disorder, and 1.06% as having a speech-sound disorder. There was a higher prevalence of speech disorders in males than in females. As grade level increased, the prevalence of speech disorders decreased. There was no significant difference in the pattern of prevalence across the three speech disorders and four socioeconomic groups; however, students who were identified with a speech disorder were more likely to be in the higher socioeconomic groups. Finally, there was a difference between the perceived and actual level of support that was provided to these students.
Conclusion: These prevalence figures are lower than those using initial identification by speech-language pathologists and similar to those using parent report.

KEY WORDS: epidemiology, stuttering, voice disorders, phonology, communication

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(stuttering), voice, and speech-sound production (articulation/phonology)—areas that are traditionally referred to as *speech disorders* (cf. Ukrainetz & Fresquez, 2003). For brevity, throughout this article, *speech disorders* will be used as an umbrella term, although each disorder will be referred to specifically. It is important to note that in the present article, the use of the term speech disorders does not include language disorders. The prevalence of language disorders is summarized in Law, Boyle, Harris, Harkness, and Nye (2000), with an excellent example of prevalence research provided by Tomblin et al. (1997). Teacher-reported prevalence of the broadest definition of communication disorders (including speech and language) is documented in McLeod and McKinnon (in press), using a different data set from the present investigation. Before reviewing the prevalence of speech disorders, it is first necessary to consider how prevalence is determined.

Determining Prevalence

A variety of different methods have been used to establish case status or the presence of communication disorders. To some extent, the methods are dependent on both the age of the individual and the setting. Both direct (face-to-face assessment including screening and diagnostic techniques) and parent or teacher report methods (e.g., Keating, Turrell, & Ozanne, 2001) have been used extensively. Parent report measures are commonly used in children of preschool age (e.g., Fenson et al., 1993; Wetherby & Prizant, 1996); teacher report measures are commonly used with school-aged children (e.g., Leske, 1981). The validity and reliability of some prospective parent report measures of early language delay have been established in young children of preschool age (Fenson et al., 1993; Wetherby & Prizant, 1996) but not in school-aged children. Prevalence rates also vary according to the method used; lower prevalence rates are typically derived from questionnaire or survey methods (including parent or teacher reports) (e.g., Leske, 1981) in comparison to direct screening techniques (e.g., Shriberg, Tomblin, & McSweeny, 1999). Even higher prevalence rates are reported in some studies that have included face-to-face clinical diagnosis, such as that used by Tuomi and Ivanoff (1977). In a recent systematic review, Law et al. (2000) concluded that underreporting of the prevalence of communication disorders was more likely when studies did not include both a screening and a follow-up assessment. Duff, Proctor, and Yairi (2004) concurred with this finding: They discovered a lower prevalence of voice disorders when using the report of teachers and parents as compared to assessment by a speech-language pathologist (SLP). In contrast, Clarizio (1992) found that teachers were more likely to overidentify the number of children with learning disabilities compared to identification by a multidisciplinary team.

It remains unknown whether different measures identify the same population of children with communication disorders. To date, the extent of overlap has not been explored and tested in an epidemiological study. Furthermore, no study has yet explored the relationship between a diagnostically determined communication disorder and functional communication outcomes as described by parent, teacher, and peer ratings. As a result of the varying definitions and cut-off points used for communication disorders, comparison across most studies is difficult. Existing prevalence data from longitudinal and cross-sectional studies suggest that some communication disorders (e.g., speech-sound disorders and stuttering) resolve with age; however, the degree to which residual errors may persist and fluency may fluctuate remains unknown.

The present investigation employed classroom teachers as the first point of identification of speech disorders followed by verification from a speech-language pathology report. There were a number of rationales for this. First, these data were collected by a school district that did not employ SLPs. The data reported in the present study were part of a larger study of teacher identification of children with a variety of special needs (including medical, sensory, and behavioral needs). Apart from this pragmatic reason, there were additional benefits of collecting prevalence data based on teacher report (see Clarizio, 1992, for a discussion). At a systemwide level, information about teachers' judgements of disorders is valuable because teachers provide influential data in the process of determining eligibility for special needs support and funding (Ysseldyke & Thurlow, 1984). On an individualistic level, teachers interact with their pupils for many hours every day; thus, judgments are made on numerous incidents of continuous assessment, potentially signifying high content validity. Furthermore, within classrooms, teachers interact with children possessing a wide range of abilities. The normal distribution of behaviors within a classroom can enable teachers to see the range of children's abilities and should promote reliable identification of students with difficulties. Teachers consider "a *global* judgement… about the child's teachability in class" (Clarizio, 1992, p. 29) and describe the impact of these disorders on the education of these children. In the present investigation, teachers were asked not only to identify children, but also to rate their perception of each student's support needs within their mainstream classrooms. Added to information about perception of needs was actual information about the extent of curriculum adaptations and the involvement of outside agencies to facilitate these students' education. Thus, a benefit of teacher identification of prevalence and the impact of speech disorders was that data were gathered to ascertain optimal educational support for these children.

Prevalence of Speech Disorders

Prevalence of stuttering. Research concerning the prevalence, onset, and natural history of stuttering is limited and difficult to interpret (for a review, see Packman & Onslow, 1998). Data regarding the prevalence of stuttering are derived from a limited number of studies. Some knowledge has been gained from retrospective parent report, often many years later (Yairi & Lewis, 1984). The majority of published studies have used self-selected or refereed samples of stutterers that almost certainly do not represent the population of children who begin to stutter. Stuttering is reported to begin in the third and fourth year for approximately 4% to 5% of children (Andrews, 1964; Yairi & Ambrose, 1999). Approximately 80% of children who begin stuttering recover without treatment, with 50% of these recovering within 1 year of onset (Andrews, 1964; Yairi & Ambrose, 1999). Mansson (2000) conducted a whole population survey of all 1,042 children born in a 2-year period (1990–1991) on the island of Bornholm in Denmark. The children were screened at 3 years of age, when 4.99% were determined to stutter. The known total incidence (assessed in subsequent follow-up studies over a 9-year period) was 5.19%, and a male–female ratio of 2.8:1 was reported. In an Australian telephone survey, Craig, Hancock, Tran, Craig, and Peters (2002) determined the prevalence of stuttering in the population to be 0.72%. Higher prevalence rates were reported for younger children (1.4%–1.44%); the lowest rate was reported for adolescents (0.53%). The incidence or risk of stuttering (obtained by combining prevalence data with reports of recovered stuttering) was estimated to be 2.8%

in children aged 2–5 years, 3.4% in children aged 6–10 years, and 2.1% in adults aged 21–50 years.

Prevalence of voice disorders. Oates (2004) reviewed the multiple methods used to describe voice disorders, including self-report; perceptual, acoustic, and physiological measurement; and direct laryngeal examination. A functional versus organic dichotomy for the classification of voice disorders is frequently used, although there is no universally agreed classification system. Oates emphasized that etiological and diagnostic confusions abound, and together these make the conduct of prevalence and natural history studies extremely difficult. Not surprisingly, there are little data on the prevalence of voice disorders in children. Aronson (1990) suggested that approximately 6% of children have voice disorders at any given moment in time. In one of the largest studies undertaken of the prevalence of voice disorders, Duff et al. (2004) studied rates of voice disorders in 2,445 preschool children (1,246 males and 1,199 females) aged between 2 and 6 years living in Illinois. Using three diagnostic indicators (i.e., teacher identification, parent identification, and investigator screening), voice disorders characterized by hoarseness were identified in 95 children, or 3.9% of the sample. No significant differences for age, gender, or race were identified.

Some data are emerging regarding the prevalence of particular types of voice disorders in children. For example, Akif Kilic, Okur, Yildirim, and Guzelsoy (2004) determined that the prevalence of vocal nodules among 617 school-aged children in Turkey was 30.4% (13.3% minimal lesions, 14.3% immature nodules, 2.6% mature nodules, and 0.2% vocal polyps). Powell, Filter, and Williams (1989) conducted a mass screening of 847 children aged 6–10 years in rural schools in the United States. Of these, 203 children were identified to have a voice disorder. Follow-up testing was conducted 1 and 4 years later, and 39.9% and 38% were found to have persisting voice disorders. Milutinovic (1994) compared 362 children aged 12–13 years living in rural and urban areas of Serbia. Many more children living in urban areas (43.67%) were reported to have voice problems as compared to children living in rural areas (3.92%).

Prevalence of speech-sound disorders. There is wide variation in the reported prevalence rates of speech-sound disorders. Law et al. (2000) indicated that there was more variability in the prevalence rates for speech-sound disorders compared to language delay. Among the studies reviewed for this article, prevalence estimates ranged from 6.4% (Beitchman et al., 1986) to 43.9% (Dudley & Delage, 1980). These data were derived from a variety of different types of studies, and there are numerous reasons to explain this variation.

- A range of designs, both cross-sectional and longitudinal, were employed (e.g., Beitchman et al., 1986; Calnan & Richardson, 1976; Campbell et al., 2003; Peckham, 1973).
- Varying age cohorts were studied. Higher prevalence rates were reported for younger ages (e.g., 15.6% of 3-year-olds; Campbell et al., 2003); lower prevalence rates were reported in older children (e.g., 3.8% of 6-year-olds; Shriberg et al., 1999). Some studies included a range of ages (e.g., Dudley & Delage, 1980; Hull, Mielke, Timmons, & Willeford, 1971; Keating et al., 2001); others focused on single-age cohorts (e.g., Beitchman et al., 1986; Campbell et al., 2003; Qvarnström, Laine, & Jaroma, 1991; Shriberg et al., 1999).
- Some samples were not representative of the entire population and some were clinic-referred samples (e.g., Aithal, 1985; Bax & Hart, 1976; Broomfield & Dodd, 2004; Stewart, Hester, & Taylor, 1986).
- Varying definitions, classification systems, and measures were used (e.g., Beitchman et al., 1986; Campbell et al., 2003). Studies were conducted in different countries (including Australia [e.g., Harasty & Reed, 1994; Kirkpatrick & Ward, 1984], Britian [e.g., Broomfield & Dodd, 2004], Canada [e.g., Beitchman et al., 1986], and the United States [e.g., Shriberg et al., 1999]), where there may be differential categorization of dialectal variants and speech-sound errors (such as /f/ for *th*).

Unfortunately, few epidemiological studies of the prevalence of speech-sound disorders have been conducted on samples that are representative of the population. Cross-sectional longitudinal data concerning a wide age range (0–14 years) are available from the "1995 Australian Health Survey," which was conducted on 12,388 children (Keating et al., 2001). On the basis of parent report, the overall prevalence rate reported for this survey was 1.7%. Rates varied across ages and according to gender, with a peak prevalence being 7.4% for boys at 5 years and 1.9% for girls at 4 years.

Comorbidity. High rates of comorbidity have been reported in children with communication disorders, particularly speech-sound and language disorders (Beitchman et al., 1986; Harasty & Reed, 1994; Keating et al., 2001). Speech-sound disorders are reported to be more likely to resolve, whereas coexisting speech-sound and language disorders are pervasive and are also reported to be associated with poorer academic outcomes (Bishop & Adams, 1990; Johnson et al., 1999; Lewis, O'Donnell, Freebairn, & Taylor, 1998). Arndt and Healy (2001) surveyed SLPs about children on their caseloads who stuttered. Forty-four percent of the children were reported to have at least one communication disorder additional to stuttering. However, more recently, Nippold (2004) highlighted that this was possible because SLPs were more likely to recommend children who stuttered and had an additional disorder for treatment. Nippold suggested that caseload surveys may overestimate the rate of additional disorders in children who stutter and that more rigorous methods are needed to accurately report the rate of co-existing disorders (Nippold, 2001).

Context of the Current Study

Support for students with communication disorders in Australian schools. The role of SLPs in assisting students with communication disorders in schools has been widely documented (Justice & Fey, 2004; McCartney, 2004; Prelock, 2000; Rahilly, 2003; Roseberry-McKibbin, O'Hanlon, & Brice, 2004; Roulstone, Owen, & French, 2005; Smith & Prelock, 2002; Sunderland, 2004; Terry & Kelman, 2004; Wolf Nelson, 2002). However, within Australia, school systems are not a principle employer of SLPs (Speech Pathology Australia, 2001). In the state of New South Wales (NSW), where the present study was undertaken, few SLPs are employed in the education sector, whether in public or private schools. The majority are employed in the health sector (L. McAllister, personal communication, November 10, 2004). Thus, the present investigation into the prevalence of children with communication disorders in NSW, Australia provides a unique insight into the identification of and provisions made for children with speech disorders within a schooling system where the ultimate responsibility for appropriate education rests within the education department. The majority of support for these children is provided by classroom and special education teachers within the education system, and not by SLPs.

A Catholic diocese in Sydney, Australia, in collaboration with the first author, undertook extensive data collection between 1994 and

2001 in order to "assist schools to focus their support for students and properly allocate school resources" (Catholic Schools Office, 2001, p. 1). The "Special Needs Survey" (Catholic Schools Office, 1996) was developed to facilitate identification of *all* students requiring additional support.

There were four waves of data collection. The data collected during the 1990s (Waves 0, 1, and 2) were focused on broad priority areas of need, including communication disorders, specific learning disabilities, intellectual disability, vision impairment, hearing impairment, behavioral/emotional difficulty, physical/medical disability, and early achievers/advanced learners. These areas were identified by the diocesan special needs consultant in consultation with the three special needs advisors. Data collected in the 1990s under the heading of communication disorders included difficulty with understanding language, producing oral and written language, social communication, articulation, voice, and/or fluent speech (Catholic Schools Office, 1998). Prevalence figures from Waves 1 and 2 are reported elsewhere (McKinnon & McLeod, 2005; McLeod & McKinnon, 2006).

The final wave of data collection (Wave 3, reported in the present study) focused on children with disorders who did not attract educational funding from government agencies (Catholic Schools Office, 2001), including children who stuttered or had a voice or speech-sound disorder. Thus, this 2001 phase of data collection provided a unique opportunity to examine the prevalence of stuttering, voice disorders, and speech-sound disorders as identified by teachers and confirmed by speech-language pathology report.

Consequently, the aims of the present investigation were threefold: (a) to report Australian teachers' estimates of the prevalence of three speech disorders (specifically, stuttering, voice, and speech-sound disorders) in 36 primary schools in one Catholic diocese in Sydney, Australia in 2001; (b) to consider the correspondence between the prevalence of speech disorders and the following variables: gender, grade level, and socioeconomic status (SES); and (c) to describe Australian teachers' perceptions concerning the level of support and planning that is provided to children with speech disorders. It is recognized that the prevalence figures of these speech disorders as identified by teachers will be different from the prevalence figures that were generated from studies employing initial identification by SLPs (e.g., Tomblin et al., 1997). Nonetheless, with limited Australian prevalence data available and no SLPs directly available to the NSW education system to conduct such a study, the estimates generated provide a conservative estimate for agencies that are attempting to provide support services for children with speech disorders. They also provide data for international comparison of teachers' estimates of children with communication disorders.

METHOD

Participants

All children (N = 10,425) attending 36 primary schools in one Catholic diocese in Sydney, Australia during 2001 were considered in the present investigation. There were 5,106 males and 5,319 females. The children ranged from kindergarten (the first year of formal schooling) to Grade 6. The socio-economic index for areas (SEIFA) scale (Australian Bureau of Statistics, 2003) was used to determine SES for the schools attended by each student. This scale is a composite that is calculated from the educational attainment, income, employment, and occupation data supplied by households during the 2001 Australian National Census. In this article, the SEIFA scale was categorized into six quantiles: top 10% (>90%), next 15% (75%–90%), next 25% (50%–74%), next 25% (25%–49%), next 15% (10%–24%), and lowest 10% (<10%). There were no schools in the lowest two categories of SEIFA in this study.

Procedure

A four-stage process was used to identify students who stuttered or had a voice or speech-sound disorder. The filtering effect of the four stages was designed to increase the reliability of identification of students. The first of the four-stage process was an information session that was conducted by the special needs advisors for every principal and learning support teacher within the school district to train them in the data collection process. A "descriptors booklet" (see excerpt below) provided descriptions of the various areas of special need of interest to the diocesan school office. The descriptors for the speech disorders were constructed in consultation with an SLP.

Next, these principals and learning support teachers trained *every* teacher within the 36 schools about the purposes and identification methods of the study during a staff meeting in the second term of the school year. The teachers were supplied with the descriptors booklet and class survey sheet. Within 1 week, the teachers were required to identify all students in their class who warranted identification. The following information was collected for each student: enrolment number, date of birth, gender, special learning need (including whether the child stuttered or had a voice or speech-sound disorder), level of learning support provided, curriculum adaptations made, whether an individualized education plan (IEP) was in place, outside agencies that were consulted for the student, and the teacher's perception of the student's support needs to be included in the classroom. The teachers involved in the identification of children with speech disorders acted as a filter to identify potential candidates in need of intervention. The procedures adopted for this study sensitized classroom teachers to the identification of children with speech disorders and consequently initiated support mechanisms for interventions to be enacted.

The following definitions from the descriptors booklet (Catholic Schools Office, 2001, p. 7) were used by the teachers to identify students with the specific speech disorders of interest to the present investigation:

> *Stuttering:* Students produce a "repetition or prolongation of syllables, sounds, and speech postures."
>
> *Voice disorders:* Students have a "consistently hoarse or husky voice with some periods of voice loss; voice has a nasal quality; voice is too soft/loud/high/low."
>
> *Articulation:* "Articulation disorders are those characterized by substitution, omission or distortion of speech sounds."
>
> *Verbal dyspraxia:* "Verbal dyspraxia is the difficulty controlling voluntary movements of the musculature involved in speech, e.g., sound production (mispronunciation of words and/or age-appropriate sounds), poor saliva control and muscle coordination."

It is acknowledged that the identification of stuttering included only those children who stuttered at school. No parent report was sought during the identification process; thus, it was possible that the prevalence of stuttering may have been underidentified. The categories of articulation and verbal dyspraxia were combined post hoc under the label *speech-sound disorders* because differentiation between different speech-sound disorders is controversial, even

within the speech-language pathology profession (see discussions of the controversy surrounding the identification of verbal dyspraxia [also called *childhood apraxia of speech*] in Forrest, 2003; McCabe, Rosenthal, & McLeod, 1998; and Shriberg, Aram, & Kwiatkowski, 1997). Ninety-eight children were identified as having an articulation disorder, and 13 children were identified as having verbal dyspraxia.

The third phase of identification entailed the learning support teacher in each school reviewing the teacher's recommendations and confirming the assessment using supporting documentation. An SLP's report was required as supporting documentation for confirmation of a speech disorder. As mentioned earlier, school systems in Australia in general, and NSW in particular, do not have direct access to SLPs. Rather, in NSW, speech-language pathology is a service that is typically funded from within the Department of Health. The private school system, of which the diocesan system is but one part, had to pay for the assessment of students with communication disorders. Alternatively, students could access an SLP outside the school system in the Department of Health or in private practice. This third phase of identification was likely to have excluded a number of children with speech disorders due to difficulties accessing speech-language pathology services. This conservative approach was used in order to ensure robustness within the sample; however, it has the potential limitation of underreporting children with speech disorders. It is typical for Australian SLPs to use perceptual, instrumental, and/or standardized assessments for the identification of voice, stuttering, and speech-sound disorders. The identification of stuttering by the SLPs would have been heavily influenced by the work of Onslow and colleagues (e.g., Onslow & Packman, 1999), who are Australian researchers and educators.

In the fourth stage, the principal and learning support teacher reviewed the information about each identified student and presented the data to the schools' special needs committees. Each committee included a diocesan-based special needs advisor who was an educational psychologist who worked with each school's special needs committee to vet all students who were identified as requiring support. The advisor provided a measure of external validation to the process and ensured consistency across schools.

Although this four-stage process was designed to increase the reliability of identification of all students with special learning needs, no interrater reliability data were funded or collected by the diocese in relation to the specific identifications by teachers. The careful vetting process over the four stages was designed to provide a conservative estimate of teacher-identified prevalence of communication disorders within the school district.

It is important to note that identification of all students with special needs (medical, behavioral, communication, etc.) had been undertaken using this four-stage process on four occasions (Waves 0–3) spanning 8 years, this being the fourth occasion. Consequently, the majority of people involved in the data collection process had received training, feedback, and professional development sessions regarding student identification. However, on this fourth occasion (2001), additional specific categories were added to the data collection process, including the identification of students with speech disorders as well as other medical and behavioral disorders that are not mentioned further in this article.

Data Analysis

Prevalence figures for the areas of stuttering, voice disorders, and speech-sound disorders were analyzed using the Statistical Package for the Social Sciences (SPSS, 2004). Measures of association involving chi-square with gender and SES were examined. Finally, the provision of support and planning was determined.

RESULTS

Prevalence of Speech Disorders

Overall, 34 students were identified as stuttering at school, 13 were identified as having a voice disorder, and 111 were identified as having a speech-sound disorder (see Table 1). Thus, the estimated prevalence of stuttering was 0.33%, voice disorders was 0.12%, and speech-sound disorders was 1.06%. The combined prevalence of speech disorders (excluding language disorders) in this population was estimated to be 1.51%.

The Impact of Variables on Prevalence Figures

Gender. Table 2 shows the prevalence of speech disorder by gender. The pattern of prevalence of the three speech disorders was significantly different according to gender ($\chi^2 = 8.243$, $df = 2$, $p = 0.016$). There was a higher prevalence of all three speech disorders in males as compared to females. For example, the ratio of males to females was 2.85:1 for speech-sound disorders.

Grade level. Table 3 shows the prevalence of speech disorder by grade level. It was not possible to test the association of this due to the small numbers in the majority of cells; however, it can be seen that there was an overall decreasing prevalence of identified speech disorders with increasing grade level. For example, the prevalence of speech-sound disorders was higher in kindergarten as compared with all other grades.

SES. Table 4 shows the prevalence of speech disorder by SES. There was no significant difference in the pattern of prevalence across the three speech disorders and four SES quantiles ($\chi^2 = 10.89$, $df = 9$, $p = 0.283$). Nonetheless, students who were identified with a speech disorder were more likely to be in the higher SES groups.

Table 1. Prevalence of speech disorder by type.

Speech disorder	*Frequency*	*Prevalence in the population (N = 10,425)*
Stuttering	34	0.33%
Voice disorder	13	0.12%
Speech-sound disorder	111	1.06%
Total	158	1.51%

Table 2. Prevalence of speech disorder by gender.

Speech disorder	*Gender*		*Total*
	Male	*Female*	
Stuttering	30	4	34
Voice disorder	12	1	13
Speech-sound disorder	75	36	111
Total (frequency)	117	41	158
% of total population ($N = 10,425$)	2.29%	0.77%	1.51%

Table 3. Prevalence of speech disorder by grade level.

Speech disorder	Grade level							Total
	Kindergarten	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	
Stuttering	9	10	5	4	5	1	0	34
Voice disorder	0	1	4	2	2	1	3	13
Speech-sound disorder	40	27	17	20	4	1	2	111
Total (frequency)	49	38	26	26	11	3	5	158
Total in entire grade	1,611	1,555	1,526	1,585	1,423	1,367	1,358	10,425
% of total in each grade	3.04%	2.44%	1.70%	1.64%	0.77%	0.22%	0.37%	1.51%

Level of Support and Planning Provided

The next series of analyses determined the level of support needed and planning that was provided for students with speech disorders.

Teachers' perception of students' support needs. The teachers were required to indicate their "perception of the level of support required to successfully include each identified student in their classroom" (Catholic Schools Office, 2001, p. 4). A six-point scale was used from *0* = no support needed to *5* = very high level of support needed. Table 5 shows that 7.6% (12) of the students needed no support to be included successfully in the classroom, 22.8% (36) needed a very low level of support, and 15.8% (25) needed a low level of support. However, the majority of students needed a moderate (34.8%), high (13.3%), or very high (5.7%) level of support. Of the 9 students who required a very high level of support, 3 stuttered, 5 had a speech-sound disorder, and 1 had a voice disorder.

Actual level of learning support. The classroom teachers then were asked to describe the actual level of learning support that was provided for each identified student in order to be maintained in that particular classroom. The hierarchical scale ranged from least to greatest level of need and is described in greater detail in McKinnon and Gordon (1999). The interrater reliability of the scale was determined by Thomas (1997) to be 0.82. For the students with speech disorders, one third (n = 53) received no learning support (see Table 6), and 22% (n = 35) received minimal support whereby the class teacher, after consultation with the learning support teacher, observed, collected data, monitored, reviewed, and modified teaching strategies. Some students (7.5%, n = 12) received direct short-term support mechanisms such as peer tutoring, reading tutor programs, volunteer helpers and/or mentors, and/or short-term support from the learning support teacher. Almost a quarter of the students (21.5%, n = 34) received occasional direct long-term support. This level of support entailed the learning support teacher/assistant/volunteer supporting the classroom teacher by working directly with the student (in the classroom setting or by withdrawing individuals or small groups) once or twice a week on a long-term basis. Some students (13.3%, n = 21) received direct support as outlined in the previous category, but occurring three or more times per week (i.e., frequently). The final category applied to only 3 students with speech-sound disorders. Here the learning support teacher/assistant/volunteer supported the classroom teacher by working directly with the student (in class or by withdrawing individuals or small groups) daily, at a significant level, on a long-term basis.

Curriculum adaptation. Table 7 shows that no curriculum adaptation was made for 38.6% (61) of the students, whereas minor curriculum adaptations were made for 46.2% (73) of the students. Moderate or major curriculum adaptations were made for only 13.9% (22) and 1.2% (2) students, respectively.

Provision of IEPs. Only 8.9% (14) of the students with communication disorders had a developed IEP or ITP (individual transition program) in place (see Table 8). The rest (91.1%) did not. IEPs are not mandatory in NSW, Australia, unlike countries such as the United States where it is mandatory, by law, to have an IEP for students with special needs.

Involvement of outside agencies. Table 9 provides cross-tabulations of students with different types of speech disorders by the involvement of outside agencies in their education. Slightly more than 24% (38) of the students had no involvement with outside agencies; 19.6% (31) of the students' teachers consulted with outside agencies (such as SLPs) regarding teaching strategies, assessment, and

Table 4. Prevalence of speech disorder by socioeconomic status quantile.

Speech disorder	Socioeconomic status quantile				Total
	>90%[a]	75%–90%	50%–74%	25%–49%	
Stuttering	21	5	5	3	34
Voice disorder	8	3	1	1	13
Speech-sound disorder	63	18	20	10	111
Total (frequency)	92	26	26	14	158
Number of children with special needs	873	419	387	200	1,879
% of children with special needs	10.54%	6.21%	6.72%	7.00%	8.41%

[a] >90% is equivalent to the highest level of socioeconomic status.

Table 5. Speech disorder by teachers' perceived level of support required.

	Teachers' perceived level of support						
Speech disorder	*No support needed*	*Very low level of support*	*Low level of support*	*Moderate level of support*	*High level of support*	*Very high level of support*	*Total*
Stuttering	4	6	7	11	3	3	34
Voice disorder	0	5	2	5	0	1	13
Speech-sound disorder	8	25	16	39	18	5	111
Total (frequency)	12	36	25	55	21	9	158

adaptations required; and 17.1% (27) of the students worked directly with outside agencies on a short-term basis (up to one school term, i.e., 10 weeks). The remainder of the students, 39.2% (62), worked with an outside agency (such as an SLP) on a continuous long-term basis.

DISCUSSION

Prevalence refers to "the proportion or percentage of cases in a given population at a specified time" (Law et al., 2000, p. 166) and is of interest for a number of reasons. Prevalence figures assist in the planning of service delivery by informing decisions about resource allocation. Prevalence data can also be used to calculate the level of impact of intervention and to indicate the boundaries between impairment and typical development (Law et al., 2000). The current study has provided new data on the prevalence of stuttering, voice, and speech-sound disorders in a large cohort of primary school students. The combined prevalence of speech disorders (excluding language disorders) in this population was estimated to be 1.51%. The present study has much in common with the Keating et al. (2001) study that reported the prevalence of communication disorders in Australian children to be 1.7%. Both studies collected data via report from a significant adult (the Keating et al. study employed parent report; the present study employed teacher report) on a large number of children (the Keating et al. study reported on 12,388 children; the present study reported on 10,425 students). The age range of the Keating et al. study was slightly broader (0–14 years) than that of the present study (grades K–6, approximately corresponding to 5–12 years). It is hypothesized that the inclusion of younger children could be the reason for the slightly higher figure reported by Keating et al. The Keating et al. study also included a broader definition of communication disorders (i.e., included language disorders), which could be another reason for the slightly higher prevalence figure.

Overall, the estimated prevalence of specific speech disorders in the present study was lower than that of many previous investigations. The estimated prevalence of stuttering in the present study was 0.33%. This is lower than the prevalence reported by Craig, Hancock, Tran, Craig, and Peters (2002), who determined the prevalence of stuttering in their population to be 0.72%. In the present study, the estimated prevalence of voice disorders was 0.12%. Again, this was lower than the reported prevalence from Aronson (1990), who suggested that 6% of children have voice disorders, and Akif Kilic et al. (2004), who determined that the prevalence of vocal nodules in schoolchildren was 30.4%. The estimated prevalence of speech-sound disorders in the present study was 1.06%. Again, this was lower than the prevalence in studies reviewed for this manuscript, which reported the prevalence of speech-sound disorders to range from 6.4% (Beitchman et al., 1986) to 43.9% (Dudley & Delage, 1980). One of the major reasons for the lower estimate figures is the differing methodologies employed. Typically, studies that use screening or diagnostic techniques report higher prevalence figures than those that use parent or teacher reports (Keating et al., 2001). Another reason for lower prevalence figures in the present investigation is the age range of the cohort. A number of studies have acknowledged the decreasing incidence of communication disorders with age (Craig et al., 2002; Harasty & Reed, 1994; Keating et al., 2001; Kirkpatrick & Ward, 1984), and the data from the present study confirmed that this trend continues through primary school.

In the present study, the ratio of males to females with a speech-sound disorder was 2.85:1. This significantly higher presence of speech-sound disorders in males as compared to females was similar to findings of other studies of prevalence of speech-sound disorders (e.g., Aithal, 1985; Beitchman et al., 1986; Keating et al., 2001), age of acquisition of speech sounds (e.g., Dodd, Holm, Hua, & Crosbie, 2003; McCormack & Knighton, 1996; Smit, Hand, Frelinger, Bernthal, & Bird, 1990), and risk factors for speech-sound disorders

Table 6. Speech disorder by learning support.

	Learning support						
Speech disorder	*No Support*	*CT + consultancy/ resources*	*CT + direct short-term support*	*CT + occasional direct long-term support*	*CT + frequent direct long-term support*	*CT + intensive direct long-term support*	*Total*
Stuttering	9	10	2	8	5	0	34
Voice disorder	5	3	1	2	2	0	13
Speech-sound disorder	39	22	9	24	14	3	111
Total (frequency)	53	35	12	34	21	3	158

Note. CT = Classroom teacher.

Table 7. Speech disorder by curriculum adaptation.

	Curriculum adaptation				
Speech disorder	*None*	*Minor curriculum adaptation*	*Moderate curriculum adaptation*	*Major curriculum adaptation*	*Total*
Stuttering	14	16	3	1	34
Voice disorder	3	8	1	1	13
Speech-sound disorder	44	49	18	0	111
Total (frequency)	61	73	22	2	158

(Campbell et al., 2003). For example, Beitchman et al. (1986) stated that approximately 36% of the identified boys and 30% of the girls had speech problems only (i.e., no difficulty with language skills). Dodd et al. (2003) found a significant difference between school-aged males' and females' acquisition of speech sounds. This difference, however, was not found in younger children in the Dodd et al. study.

In this study, the ratio of males to females with a stutter reported was higher (7.5:1) than in previous reports. Bloodstein (1995) summarized results from a number of studies in which the ratios ranged from 2.2:1 to 6.3:1. A variety of explanations are possible but remain speculative. There are well recognized fluctuations in the reported incidence of stuttering at different ages. In younger children, lower male–female ratios have been reported. For example, Bloodstein reported a ratio of 3:1 in the first grade, rising to 5:1 in the fifth grade. Craig et al. (2002) reported a similar rise from 2.3:1 in primary school-aged children to 4:1 in adolescence. The students in the present study were younger and, in the main, preadolescents. Although the male–female ratio increases as children get older, this could not entirely account for the much higher ratio found in this study. There are many reports in the literature of gender differences in development (e.g., Prior, Smart, Sanson, & Oberklaid, 1993), with an increase in major psychosocial differences emerging with increasing age. In addition, teachers rate boys as having more problems in academic and behavioral domains the first 3 years of school (Prior et al., 1993), and biological influences have not been ruled out as an explanation. The finding raises a number of questions that we are not able to answer within the confines of this study. For example, could teachers' reporting of stuttering be biased by gender; that is, could teachers be more likely to report stuttering in male rather than female students? Were the boys in these schools less likely to seek previous stuttering intervention than the girls? Finally, is it possible that the increased gender ratio is an isolated finding?

The present study found no significant difference in the pattern of prevalence across the three speech disorders and four SES quantiles, although students who were identified with a speech disorder were more likely to come from schools with higher SES rankings. This finding differs from studies that found more children with communication disorders in environments with lower SES rankings (e.g., Roberts, Mack, & Woodhead, 1976) but is more in accord with studies that found a similar number of children with communication disorders in high and low SES environments (e.g., Felsenfeld & Plomin, 1997). There are two limitations of the present investigation with respect to SES. First, there were no schools within the lowest two SES quantiles; thus, comparisons cannot be made with studies that have included children from the lowest socioeconomic areas. Second, the SES for individual children was not obtained. Instead, children's SES was inferred from that of the school they attended. This was seen as a reasonable assumption given the selection procedures for entry to Catholic schools in NSW, where children live locally to their schools. Further, there were no schools located on the boundaries between identified SES areas, so it is presumed that most children lived within the SES area identified for their school. Despite these limitations, it is a relevant finding that more students from schools within a higher SES region were identified as having a communication disorder. A number of explanations are possible for this, including that high SES environments have higher expectations of communicative competence, less need to focus on more basic needs, greater infrastructure, and more strategies to access grants and other support mechanisms for their schools.

Table 8. Speech disorder by presence of an individualized education plan (IEP).

Speech disorder	*IEP Absent*	*IEP Present*	*Total*
Stuttering	30	4	34
Voice disorder	13	0	13
Speech-sound disorder	101	10	111
Total (frequency)	144	14	158

The final area examined in the present investigation was the level of support provided to these primary school students with speech disorders. These results enable a holistic understanding of the situation of these students in NSW schools. Despite the prevalence of students with these disorders, the teachers felt that most of the students received no (33.5%) or minimal (22%) learning support. No curriculum adaptation was made for 38.6% of the students, and only minor curriculum adaptations were made for 46.2% of the students with speech disorders. The majority (91.1%) of students with speech disorders did not have an IEP or ITP, and approximately a quarter (24.1%) of the students had no involvement with outside agencies. In contrast to these findings, the teachers rated (on a six-point scale) their "perception of the level of support required to successfully include each identified student in their classroom" (Catholic Schools Office, 2001, p. 4) to be moderate (34.8%), high (13.3%), or very high (5.7%). That is, more than half of the students were perceived to require at least a moderate level of support. Lack of available speech-language pathology services could be one of the reasons for the difference between the actual and perceived level of support for these students. SLPs are rarely employed by schools within NSW, whether in the public or private sector. SLPs are predominantly employed

Table 9. Speech disorder by involvement of outside agencies.

Speech disorder	Outside agencies[a] None	Outside agencies consulted	Outside agencies short-term direct	Outside agencies long-term direct	Total
Stuttering	6	6	8	14	34
Voice disorder	5	5	1	2	13
Speech-sound disorder	27	20	18	46	111
Total (frequency)	38	31	27	62	158

[a]Outside agencies included speech-language pathologists.

within the NSW health sector, but a number of these services are only provided for preschool children. Once these children go to school, their access to speech-language pathology services often is limited.

CLINICAL IMPLICATIONS

The current research has many implications. These data indicated that Australian teachers identified 1.51% of children in their primary school classrooms as either stuttering or having a voice or speech-sound disorder. They also indicated that more than half of these children needed curriculum adaptations and additional support to enhance their educational outcomes; however, in many cases, these additional supports were not able to be provided. It would be of interest for school systems throughout the world to consider the incidence of and support for children with speech disorders and to determine whether these were complementary. For example, Law et al. (2000) discussed the lower reporting of communication disorders in Jamaica and suggested that because that country had fewer resources, they were more stringent in the identification criteria for documenting cases.

There were also specific clinical implications for the school district. The data revealed that there were a considerable number of school students with speech disorders who required more intensive communication support than they were receiving. The data also highlighted that within the school district, there were procedures that limited the prompt identification of students. Consequently, a number of positive changes have occurred within the school district since these data were collected. The "Special Needs Survey" created conditions within the Catholic Schools Office to implement better procedures to identify and support students with communication disorders. Now, classroom teachers work in consultation with learning support teachers and education officers to identify students with communication disorders before employing a consultant SLP to collaborate in their assessment and development of intervention strategies (M. Raper, personal communication, November 9, 2004). The current situation is more expedient, allowing the designated education officers who are associated with particular schools to make recommendations that students should be assessed by an SLP; at the time of the 2001 data collection, this process could have taken a number of months. This Catholic school system can be seen as a model for catering to the needs of children with speech disorders in a broader state education system where support is not available. It also suggests that SLPs might play a role in the collaborative team who is charged with constructing educational programs for children with speech disorders in the wider educational community.

CONCLUSION

To summarize, 0.33% of the 10,425 students in this study were identified as stuttering, 0.12% were identified as having a voice disorder, and 1.06% were identified as having a speech-sound disorder. Identification occurred initially via classroom teachers and was confirmed by evidence from speech-language pathology reports. The pattern of prevalence of the three speech disorders was significantly different according to gender. There was an overall decreasing prevalence of identified speech disorders with increasing grade level, and there was no significant difference in the pattern of prevalence across the three speech disorders and four socioeconomic groups; however, students who were identified with a speech disorder were more likely to be in the higher SES groups. The "Special Needs Survey" serves as a specific example of how large-scale studies can identify shortcomings in service provision, leading to the development of policies and procedures to facilitate support for teachers in including children with speech disorders within their classrooms.

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