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Occupational differences between Alzheimer's and aphasic dementias: implication for teachers

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Abstract

We aimed to determine if there is an association between teaching and the development of progressive speech and language disorders (SLDs). Occupation was compared between 100 patients with a progressive SLD, 404 Alzheimer's dementia patients, and the 2008 US census. In SLDs the most common occupation was teacher (22%), versus 8% in Alzheimer's dementia. The odds ratio of being a teacher in SLDs compared to Alzheimer's dementia was 3.4 (95% CI=1.87, 6.17). No differences were observed in the frequency of other occupations. The frequency of teachers was higher in SLDs compared to the US census; odds ratio of 6.9 (95% CI=4.3, 11.1). Farming, forestry and fishing occupations were more frequent in SLDs compared to the US census. We identified an association between progressive SLDs and the occupation of teaching. Since teaching is a communication demanding occupation, teachers may be more sensitive to the development of speech and language impairments.

Keywords

Alzheimer's; dementia; aphasia; teacher; occupation

Introduction

The development of speech and language skills occurs during early childhood, and is fundamental to participation in society. Typically, language function is maintained throughout life, with the ability to communicate being preserved right up until death. There are, however progressive neurological disorders that destroy various aspects of speech and language, and hence communication. In some instances, communication becomes extremely

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challenging, as patients lose the ability to express themselves, as well as to comprehend others around them.

Patients with these devastating neurological disorders may present to their evaluating physicians with complaints such as “I can’t find my words”, “I can’t get my words out”, “I’m having trouble pronouncing words”, or “I am losing words”. In essence, the main problem affecting the patient’s ability to function in day to day life is a loss of communication skills. Neurological evaluation may identify speech production sound errors, grammatical errors, problems with comprehension, difficulty naming simple objects, or loss of word meaning. These progressive neurological symptoms were first described at the turn of the 20th century(1). Patients typically are diagnosed as having primary progressive aphasia(2), aphasic dementia(3), non-fluent aphasia(4), logopenic progressive aphasia(5) or primary progressive apraxia of speech(6). Of importance is the fact that these patients are different from patients with an Alzheimer’s dementia, in whom loss of memory for events is the primary problem(7).

Over the last 2 1/2 years we have been recruiting adult patients with progressive aphasia and/or apraxia of speech due to a progressive neurological disorder, for a study funded by the National Institutes on Deafness and Other Communication Disorders. Intriguingly, during the course of this study we have noticed that the occupation of many patients was, or had been, teaching. As a result, we performed a case-control study to assess for an association between the occupation of teaching and a progressive speech and language disorder (SLD).

Methods

All patients with a progressive SLD that presented to the Department of Neurology, Mayo Clinic, Rochester MN, between July 1st, 2010 and December 3rd, 2012 that met criteria for primary progressive aphasia(2) or apraxia of speech⁶ were recruited into the study (n=100). All patients were accompanied by a significant other, typically a close family member, were seen by a study coordinator (SMP), and underwent a neurological examination by a board certified behavioral neurologist (KAJ). Occupation for each patient was recorded independently by both the study coordinator and behavioral neurologist with 100% agreement. Each patient also underwent a detailed speech and language examination and had recordings made of their formal speech and language assessment and general conversation by one of two Speech and Language Pathologists (JRD or EAS).

All patients underwent MRI which did not identify any structural or post traumatic lesions, such as strokes or tumors, which could explain the progressive speech and language impairment. All patients had focal atrophy consistent with the diagnoses. None of the patients had any features of, or met criteria for, Alzheimer’s dementia(7) or another neurodegenerative(4, 8) or vascular dementia(9). The study was approved by the Mayo Clinic IRB and all patients consented for participation.

In order to determine whether there is a particular association between teaching and progressive SLD, we compared the frequency of teachers in our SLD cohort to 404 patients that fulfilled clinical criteria for a diagnosis of Alzheimer’s dementia(7). The Alzheimer’s dementia patients had been recruited between January 1st, 1996 and January 1st, 2006 into the Alzheimer’s Disease Research Center (ADRC) which recruits individuals seeking medical care in the Department of Neurology, Mayo Clinic, Rochester, MN. Occupation was documented by study coordinators. By comparing our SLD cohort to the cohort of Alzheimer’s dementia patients from the ADRC, we account for any institutional recruitment

bias. Patients recruited into both the SLD and ADRC cohorts are from different areas of the US, but predominantly from the Midwest.

The results from the SLD cohort were also compared to occupation data from the 2008 US census (<http://www.census.gov/hhes/www/ioindex>). Since the census data includes only paid occupations, home makers (all of which were unpaid) were removed from the SLD cohort before comparison to the census data. Unpaid home makers were however included when the SLD cohort was compared to the Alzheimer's dementia cohort.

All occupations were grouped into 12 categories, as in Table 1, based on the categorization of occupations by the US Census Bureau. Chi-squared analysis was used to compare the frequency of occupations between the SLD and the Alzheimer's dementia and 2008 US census cohorts; Fisher's exact test if small numbers. Bonferroni correction was used to adjust for multiple comparisons, with $p < 0.004$ considered significant. Odds ratios and 95% confidence intervals were calculated. Student T-test was used to compare age at onset and education.

Results

Of the 100 SLD patients, 53% were women. Average age at onset of communication difficulties (mean $\pm$ standard deviation) was 65.0 ± 8.4 years and education was 15.5 ± 2.7 years. Of the 404 patients with Alzheimer's dementia, 58% were women. Average age at onset was 69.6 ± 8.8 years and education was 13.9 ± 3.1 years. Education and age at onset differed between groups ($p < 0.001$).

In the SLD cohort the most common occupation was teacher (22%), followed by nonteacher professionals (Table 2). The occupation breakdown differed between the SLD and Alzheimer's dementia cohorts ($p = 0.01$). In Alzheimer's dementia, non-teacher professionals was the most common occupation, followed by administrative support workers (Table 2). Only 8% of the Alzheimer's dementia cohort was teachers. The frequency of teachers was the only occupation that significantly differed across cohorts (Table 2). The odds ratio of being a teacher in the SLD cohort compared to the Alzheimer's dementia cohort was 3.4 (95% CI=1.87, 6.17). The frequency of teachers within professionals also differed across cohorts ($p = 0.001$).

The frequency of teachers in the SLD cohort was also significantly higher than the frequency of teachers in the 2008 US census (4%, $p < 0.001$) (Figure 1). The odds ratio of being a teacher in the SLD cohort compared to the US census was 6.9 (95% CI=4.3, 11.1). The only other category that differed between cohorts, was farming, forestry and fishing occupations which had a lower frequency in the 2008 US census (1%, $p < 0.001$) with an odds ratio of 7.9 (95% CI=3.2, 19.3).

Discussion

In our cohort of 100 SLD patients, almost a quarter were teachers, significantly higher than the proportion of teachers in a cohort of Alzheimer's dementia patients. In fact, SLD patients were 3.6 times more likely to be teachers than Alzheimer's dementia patients. This finding suggests that there may be an association between progressive speech and language disorders and the occupation of teaching.

It is unlikely that this finding was confounded by a recruitment bias since both cohorts of patients were recruited in a similar manner, from the same department, and from the same institution. We do acknowledge that patients evaluated at Mayo Clinic, and hence recruited into both studies, may be more likely to be professionals compared to the general

population. However, we did not observe a difference in the frequency of professionals that were non-teachers between the SLD cohort and the 2008 US census, or between the SLD cohort and the Alzheimer's dementia cohort. Education could represent a bias since it was higher in the SLD cohort compared to the Alzheimer's dementia cohort. However, if this was case, one would expect to see an over representation of all highly educated professions in the SLD cohort, not just teachers. The fact that the frequency of professional non-teachers did not differ across cohorts argues against our findings being secondary to education.

It is difficult to determine why there is an association between teaching and the development of a progressive speech and language disorder. One possibility is that teaching requires continuous, daily verbal and written communication and hence teachers have more opportunity to observe changes in their speech and language. Similarly, teachers may be more sensitive to subtle changes in their speech and language abilities because they are attuned to proper speech and language, and are constantly evaluating the spoken and written language of their students. Other professionals, whilst highly educated, may not depend as much on constant, or correct or accurate verbal and written communication. Physicians, for example, while highly educated, typically communicate by using abbreviations, modified sentence structures, telegraphic speech, and even incorrect grammar. We cannot entirely exclude the possibility that the development of progressive speech and language impairments are due to the continuous and daily use of verbal and written communication. There are other occupations that involve a similar amount of daily communication that were not more frequent in our SLD cohort. This later argument is also contrary to the popular notion that "the more you use it the less likely you are to lose it" and the concept of cognitive reserve(10). The difference observed between SLD and Alzheimer's dementia could also suggest that teaching may in fact be protective for Alzheimer's dementia. While this is possible, the higher proportion of teachers in the AD cohort compared to the US census argues somewhat against this hypothesis. Additionally, the lower proportion of teachers compared to nonteacher professionals in the US census, suggests that the lower proportion of teachers in the Alzheimer's dementia cohort is typical.

Compared to the 2008 US census, the SLD cohort had a higher proportion of teachers, consistent with the differences observed with Alzheimer's dementia, but also had a higher proportion of farming, forestry and fishing occupations. The later finding is most likely driven by the fact that the Mayo Clinic is located in the Midwest where these occupations are common.

This study has important implications for early detection of progressive SLDs. A large cohort study focusing on teachers may improve power to identify risk factors for these disorders.

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Figure 1.
Occupation frequencies for the speech and language disorder (SLD) and 2008 US census cohorts. Plots include paid occupations.

Table 1

Occupation categories with example occupations

Occupation category	Examples
Administrative support	Administrative supervisors, office managers, computer equipment operators, secretaries, stenographers, typists, receptionists, file clerks, bookkeepers, accounting and auditing clerks, telephone operators, mail distribution occupations, general clerks, insurance adjusters, examiners and investigators, bank tellers
Executive, administrative and managerial	Officials, administrators, legislators, managers, management analysts, construction inspectors, financial officers, accountants and auditors, buyers and purchasing agents
Farming, forestry and fishing	Farm, agricultural, forestry and fishing managers, workers and operators
Home maker (unpaid)	Home maker
Machine operators, assemblers and inspectors	Metal work, printing, textile, laundering and other machine operators, welders and cutters, assemblers, hand working occupations, product inspectors and testers
Precision production, craft and repair	Mechanics, carpenters, builders, plumbers, electricians, construction and maintenance workers, brick masons, stonemasons, installers, plasterers, glaziers, roofers, extractive occupations, manufacturing, machinists, precision metal and textile workers, plant and system operators
Professional specialty (non-teacher)	Architects, engineers, scientists, physicians, dentists, veterinarians and other health diagnosing practitioners, registered nurses, pharmacists, therapists, librarians, counselors, social scientists, urban planners, social workers, religious workers, lawyers, writers, artists, entertainers, athletes
Professional specialty (teacher)	Pre-kindergarten, kindergarten, elementary school, secondary school, high school, college, adult education, and special education teachers
Sales	All sales occupations, including real estate, insurance, advertising, retail, cashiers, auctioneers
Service	Food preparation, cooks, waiters, nursing aides, dental assistants, cleaning and building service occupations, interpreter, hairdresser, fire fighters, police, guards
Technicians	Health technicians, licensed technicians, engineering and science technicians, electrical technicians, drafting and surveying technicians, airplane pilots and navigators, computer programmers
Transportation	Motor vehicle operators, truck drivers, bus drivers, rail and water occupations, material moving, excavating, grading and dozer machine operator, moving equipment operator, freight handlers, hand packers,

Table 2

Occupation frequency

Occupations	Speech and language disorders (n=100)	Alzheimer's dementia (n=404)	Odds ratio (95% confidence interval)	p-value
Administrative support	11 (11%)	72 (18%)	0.57 (0.29, 1.12)	0.10
Executive, administrative and managerial	15 (15%)	46 (11%)	1.37 (0.73, 2.58)	0.32
Farming, forestry and fishing	5 (5%)	26 (6%)	0.77 (0.29, 2.05)	0.59
Home makers	5 (5%)	43 (11%)	0.44 (0.17, 1.15)	0.09
Machine operators, assemblers and inspectors	1 (1%)	8 (2%)	0.50 (0.06, 4.04)	0.51
Precision production, craft and repair	6 (6%)	18 (4%)	1.37 (0.53, 3.54)	0.52
Professional (non-teachers)	16 (16%)	76 (19%)	0.82 (0.46, 1.48)	0.51
Professional (teachers)	22 (22%)	31 (8%)	3.39 (1.87, 6.17)	<0.001
Sales	10 (10%)	43 (11%)	0.93 (0.45, 1.93)	0.85
Service	7 (7%)	20 (5%)	1.45 (0.59, 3.52)	0.42
Technicians	1 (1%)	8 (2%)	0.50 (0.06, 4.04)	0.51
Transportation	1 (1%)	13 (3%)	0.30 (0.04, 2.35)	0.23