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Prevalence of stuttering among school age children in Dakshina Kannada district of Karnataka, India

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ABSTRACT

Purpose: Stuttering is a fluency disorder with a worldwide prevalence of 1%. Reports on the epidemiology of stuttering in India is limited. Our primary goal was to examine the prevalence of the disorder among school children. The study also aimed to study the impact of several risk factors on the prevalence of stuttering.
Method: A total of 3437 children in the age range of 6–15 years were screened in 16 camps conducted in and around schools of Dakshina Kannada. The children were screened for stuttering using a screening tool by an SLP based on their grade and medium of instruction and further validated using Stuttering Severity Instrument-4.
Result: The prevalence of stuttering in school going children was 1.68%. Gaussian test reveals effect of gender on the prevalence of stuttering ($Z_1 = 3.501$, $p < 0.001$) with a ratio of 2.4:1 among males and females respectively. No significant association was obtained for socioeconomic status ($X2_2 = 1.42$, $p = 0.492$) and linguistic structure (Z_1=1.653, $p = 0.0984$) on the prevalence of stuttering. Good to excellent inter-rater and intra-rater reliability was obtained.
Conclusion: The prevalence of stuttering in Dakshina Kannada is established for the first time in the current study which helped determine in early identification and intervention for children with stuttering leading to better prognosis and quality of life.

1. Introduction

Stuttering is a fluency disorder characterized by repetitions of syllables/words, prolongations and blocks, thereby affecting the rate and rhythm of speech. It typically originates in early childhood, with approximately 95% of children who stutter have their onset before 4 years of age.[1] Overall, the lifetime prevalence of stuttering was estimated to be 0.72%.[2] These data on prevalence forms the basis for the scientific knowledge about Stuttering and gives information about the overall number of people affected with stuttering, the factors associated with the occurrence and non-occurrence of the problem, and the presence or absence of various co-morbid conditions.

Various studies have been carried out worldwide to assess the prevalence of stuttering in children. Earlier studies in the twentieth century have reported a prevalence rate of stuttering ranging from 0.35% to 2.61% in the English speaking American and British children.[3–8] Studies in the twenty first century revealed the overall stuttering prevalence ranging from 1.15% to 2.52%, 0.58%–2.2%, 0.33%–1.8% and 1.03% in the US[9] Europe,[10,11] Australia[2,12,13] and Africa[14] respectively.

Among the Asian countries, the prevalence of stuttering has been investigated in Iran,[15,16] Iraq,[17] Pakistan,[18] Nepal[19] and few parts of India[20–24] However, the Indian studies reviewed have reported either the prevalence of speech problems in general including stuttering[20–24] or in a specific disabled population.[25,26] These studies have not investigated the prevalence of stuttering in specific among the school going

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children except for the study done by Hegarty (1968)[21] and Devi et al. (2018)[22] in Delhi and Tamil Nadu states of India respectively. Devi et al. (2018)[22] have reported 0.46% prevalence for stuttering among the school going children in Tamil Nadu state of India whereas Hegarty (1968)[21] reported a 1.2% prevalence for stuttering in New Delhi. However, there are no studies which has reported prevalence of stuttering in the state of Karnataka.

The prevalence rate of stuttering is affected by several variables due to the multifactorial nature of stuttering itself. Gender is considered to be one of the factors that contribute to stuttering where males are affected more than females. Studies have reported the male-to-female ratio of individuals who stutter can be as large as 4:1. However, younger children has smaller ratios in gender differences.[1] Males were reported to be 1.48 times more likely to persist in stuttering than females.[27]

Prevalence also varies among children based on age/standard due to the nature of spontaneous recovery. The prevalence rate is found to be much higher among young children when compared to older children.[2] The highest prevalence of 1.44% was obtained in pre-schoolers and early school children, with the prevalence rate decreasing to 0.53% for ages 11–20 years.[2] Similar findings were reported in the Europe and USA as well.[9,10] Higher Stuttering incidence of 11.2% have been reported in preschool-aged children[28] with prevalence estimates ranging between 2.2% and 5.6%[28]

Prevalence of stuttering also varies depending on the financial status of the family.[29] A specific study revealed that one-third of the children who stuttered belong to the high socioeconomic status.[29] Similar finding was reported where there is a statistically significant relationship between the prevalence of stuttering and SES in children aged 3–17 years.[30] Another study found no relationship between SES and speech disorders; however specific data about stuttering was not available in theis study.[26] These findings were further supported, where no association between prevalence of speech disorders including stuttering and SES was found.[31]

Prevalence of stuttering based on the number of languages known, revealed that the stuttering prevalence to be 2.8% in bilinguals and 1.8% in monolinguals.[32] Similar findings were reported among 1861 children where the prevalence of stuttering in monolingual children was 1.66% and 2.16% among bilinguals[33] However, there is research which reported no obvious differences in stuttering prevalence between monolingual and bilingual participants.[34] It is also unclear whether language similarities between L1 and L2 affect the stuttering prevalence. There are studies that report that linguistically similar language may produce more confusion and therefore more disfluencies than more different pairs.[35] However, it could also be that nonrelated pairs of languages make more disfluencies due to more mental activities in learning two different lexical and syntactic systems.

Unfortunately, prevalence data for all these variables throughout the entire school-age population within a single study of the same population pool are very few. Most large-scale studies have used questionnaires returned by teacher/informants. These studies have large criticisms which include the non-uniform perception of stuttering by the informants. Moreover, definitions of stuttering given to these informers may also be different in different studies. It may also be possible that no definitions of stuttering have been given to these informants. Some studies have used the combination of questionnaires returned by teachers followed by a face to face examination of stuttering individuals. Keeping these aspects in mind, we felt the need to estimate the prevalence of stuttering among school-going children in Dakshina Kannada using standardized screening test. Studying epidemiology of stuttering among school-going children is of utmost importance in a country like India to predict the statistical distribution of the disorder and its impact on personal, societal and national levels. This data would probably attract the attention of the policymakers towards stuttering for the promotion of prevention, identification and management of stuttering among school-going children.

2. Materials and methods

2.1. Study design, setting, and patient selection

The present study was conducted after receiving ethical approval from the Institutional Ethics Committee (Approval No: IEC KMC MLR 03–18/44). Participants of the study were recruited from schools using Cluster sampling where both the government and private schools under Rural and urban areas were chosen using a random number generator procedure. In this way, a total of 16 schools were identified in and around regular schools of rural and urban societies of Dakshina Kannada district. The schools represent both government and private educational sectors, with students from different socio-economic backgrounds. A total of 3437 children participated in the study Informed consent was obtained from parents of the children and assent form was duly filled up from the students before the start of the study.

Based on the data obtained about the education of the head of the family member, occupation of the head of the family member, and total family income, the students were stratified into three socioeconomic strata of the society using Modified Kuppuswamy Classification Scale.[36] They are:

a) Upper Socioeconomic class. (including upper and upper middle)
b) Middle Socioeconomic class (including lower middle and upper lower)
c) Lower Socioeconomic class

The students were also stratified based on the linguistic structure of the known languages i.e., students knowing languages which has similar linguistic structure (Dravidian languages i.e. Kannada, Tulu, Malayalam, Beary, etc) and students knowing languages with different linguistic structure (Dravidian language and English).

Participants with any history of neurological, visual, hearing or any other communication deficits were excluded using the WHO Ten Point Disability Checklist[37] modified by the investigators for the purpose.

2.2. Procedure

Screening Camps were organized in the school premises of rural and urban schools in the Dakshina Kannada district of Karnataka state, India. These camps were organized with the prior permission from the District Block Education officer and the school authorities. Screening was performed using a Test of Stuttering Screening in Children (TSSC)[38]). The screening tool consisted of two sections: Reading/Picture Description and Spontaneous Speech. For each task, the child was asked to read a passage or a picture description task and recite a topic from the screening test. The minimum length of speech sample necessary to compute stuttering severity estimates was 200 syllables.[39] The sample of approximately 150–250 syllables were considered. During this time a video recording of each child was taken with prior permission for reliability analysis. The child was considered 'fail' in the screening test if any of the below-mentioned errors were observed.

a) Sound & syllable repetition of more than 2%
b) Presence of whole word repetition of more than 5%
c) Duration of prolongation instances can be more than 1 s
d) Effortful dysfluencies
e) Presence of secondary characteristics

5% of the children who passed the screening and all the children who failed in TSSC were subjected to reliability testing. The video samples were analyzed by another qualified speech-language pathologist who had an experience of more than 5 years in the field of stuttering for the purpose of interrater reliability.

2.3. Data and statistical analysis

Data were then tabulated in the Microsoft Excel sheet. SPSS, version 25.0 was used for statistical analysis. Chi-square test was performed to obtain the association of socioeconomic status, and stuttering. Gaussian test was performed to obtain the association of effects of gender and exposure to languages based on linguistic structure. Intra-class correlation coefficient was employed to obtain the inter-rater and intra-rater reliability for TSSC.

3. Results

Details of the participants stratified by gender, socio economic status and exposure to languages based on the linguistic structure in each age range/Standard are shown in Table 1.

3.1. Prevalence of stuttering

A total of 58 children out of the 3437 children were identified to have stuttering, indicating an overall prevalence of 1.68% among school-going children.

3.2. Reliability measures

The results reveal a good inter-rater reliability (0.75–0.9) when 5% of the children who passed and all the children who failed TSSC were assessed again by another qualified speech language pathologist with an experience of >5 years. The results also revealed an excellent (>0.9) intra-rater reliability score when the same speech language pathologist assessed the video recording of the 5% of the children using Stuttering Severity Instrument-4[40]) who passed and all the children who failed TSSC after a period of two weeks after the initial screening. The results show that the diagnosis of the participant was the same among both the speech-language therapist at least 151 out of 170 times, yielding a good (0.75–0.9) inter-rater reliability.

3.3. The impact of variables on the prevalence of Stutte3.3.1 gender

A total of 41 out of 1630 males and 17 out of 1807 females were identified as having stuttering. Further, a Gaussian test was employed to investigate the effect of gender on stuttering and the results revealed a significant main effect of gender at $Z_1 = 3.501$, $p < 0.001$ where males are affected more than females with a ratio of 2.41:1. The prevalence of stuttering based on gender is given in Table 2.

3.3.1. Age/grade

It was not possible to test the association of stuttering based on Age/Grade due to the small number of children having stuttering in the majority of the Grades. However, it can be observed that there was no trend in the prevalence of stuttering across the Age/Grade. Table 3 depicts the prevalence of stuttering by Grade.

3.3.2. Socioeconomic status

Table 4 shows the prevalence of stuttering by socioeconomic status. Chi-square test was performed to assess the effect of socioeconomic status on stuttering. Results revealed no statistically significant association between the prevalence of stuttering and socioeconomic status at $X2_2 = 1.42$, $p = 0.492$.

3.3.3. Exposure to languages based on different and similar linguistic structure

Table 5 depicts the prevalence of stuttering in children exposed to languages with similar and different linguistic structure. A total of 29 out of 2080 bilingual students had exposure to languages with similar linguistic structure and 29 out of 1357 who were exposed to languages with different linguistic structure were identified as having stuttering yielding a prevalence of 1.4% and 2.1% respectively. Gaussian test was performed and there was no association obtained between the use of languages with a similar and different linguistic structure on stuttering (Z_1=1.653, $p = 0.0984$).

Table 2
The prevalence of stuttering based on gender.

	Male	Female
Children with Stuttering	41	17
Total Children	1630	1807
Prevalence of stuttering	2.50%	0.94%

Table 1
Participant details.

Standard	Gender distribution		Socio Economic Status			Exposure to languages		Total number of children
	Males	Females	High Socioeconomic status	Middle Socioeconomic status	Low Socioeconomic status	Exposure to languages with similar linguistic structure	Exposure to languages with different linguistic structure	
1	150 (55.55%)	120 (44.44%)	44 (16.29%)	51(18.88%)	175 (64.8%)	181(67.03%)	89 (32.96%)	270 (7.85%)
2	151 (49.18%)	156 (50.8%)	52(16.93%)	98 (31.92%)	157 (51.14%)	197 (64.16%)	110 (35.83%)	307 (8.93%)
3	163 (52.92%)	145 (47.07%)	81 (26.29%)	119 (38.63%)	108 (35.06%)	229 (74.35%)	79 (25.64%)	308 (8.96%)
4	164 (53.77%)	141 (46.22%)	74 (24.26%)	100 (32.78%)	131 (42.95%)	216 (70.81%)	89 (29.18%)	305 (8.87%)
5	194 (53.44%)	169 (46.55%)	69 (19%)	113 (31.12%)	181 (49.86%)	205 (56.47%)	158 (43.52%)	363 (10.56%)
6	158 (55.05%)	129 (44.94%)	75 (26.13%)	84 (29.26%)	128 (44.59%)	158 (55.05%)	129 (44.94%)	287 (8.35%)
7	147 (48.67%)	155 (51.32%)	74 (24.5%)	118 (39.07%)	110 (36.42%)	173 (57.28%)	129 (42.71%)	302 (8.78%)
8	192 (38.55%)	306 (61.44%)	97 (19.47%)	146 (29.31%)	255 (51.2%)	268 (53.81%)	230 (46.18%)	498 (14.48%)
9	191 (42.72%)	256 (57.27%)	82 (18.34%)	155 (34.67%)	210 (46.97%)	237 (53-02%)	210 (46.97%)	447 (13%)
10	120 (34.28%)	230 (65.71%)	90 (25.71%)	92 (26.28%)	168 (48%)	216 (78.85%)	134 (38.28%)	350 (10.18%)
	1630 (47.42%)	1807 (52.57%)	738 (21.47%)	1076 (31.2%)	1623 (47.22%)	2080 (60.51%)	1357 (39.48%)	3437

Table 3
The prevalence of stuttering based on Grade.

Grade										
	I	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*
Children with Stuttering	3	1	4	6	7	7	8	6	12	4
Total Children	270	307	308	305	363	287	302	498	447	350
Prevalence of stuttering	1.10%	0.32%	1.29%	1.96%	1.93%	2.40%	2.72%	1.20%	2.68%	1.14%

Table 4
Prevalence of Stuttering based on Socioeconomic Status Quantile.

	Low SES	Middle SES	High SES	Total
Children with Stuttering	30	14	14	58
Total Children	1623	1076	738	3437
Prevalence of Stuttering	1.90%	1.30%	1.80%	1.68%

Table 5
The Prevalence of Stuttering Based on the exposure of languages with similar and different linguistic structure.

	Different Language Structure Exposure	Similar Language Structure Exposure
Children with Stuttering	29	29
Total Children	1357	2080
Prevalence of stuttering	2.1%	1.4%

4. Discussion

The present study aimed at assessing the prevalence of Stuttering among the large cohort of school going children from standard 1 to 10 in Dakshina Kannada district of Karnataka state. The prevalence was estimated to be 1.68% among school-going children i.e. 58 children were identified to stutter among a cohort of 3437 children. Similar findings were reported across the globe[9]). In contrast, very low prevalence of stuttering ie.0.70%, 0.33% and 0.46% is reported in USA, Australia and India respectively[3] because these studies considered teacher identification method as opposed to the current study where children were screened by a qualified speech-language pathologist who are more efficient to identify a child with borderline or mild stuttering.

4.1. The impact of variables on the prevalence of stuttering

The prevalence of stuttering based on gender was 2.50% in males and 0.94% in females yielding a ratio of 2.4:1. This finding indicates a higher prevalence of stuttering in males when compared to that of females. Similar findings were obtained in various studies[20] However, wide variations in the male to female ratio is reported at different age group i.e. male to female ratio in first grade was found to be 3:1 and this ratio increases to 5:1 in the fifth grade.[41] Similar findings were previously reported as well.[2] However, variations of male to female ratio across the age groups was not investigated in the present study as there were small number of children with stuttering across the age groups. Hence the current study is in lines with several other studies reporting a higher prevalence of stuttering among males compared to females.

No trend was observed in the current study for the prevalence of stuttering based on standard (equivalent to Grade in the Western countries). Although the results of various studies from literature revealed a decrease in the prevalence of stuttering with an increase in the age,[13] we could not investigate the effect of standard (age) on the prevalence of stuttering due to the uneven distribution of stuttering children identified at each standard.

Results also revealed no significant association between the prevalence of stuttering and SES. The results of our study concur with several other populations and clinical studies that have examined the socioeconomic profile of children with stuttering.[32] This does not mean that they do not influence the pattern of stuttering and/or its development. It may influence parents' motivation to report stuttering, seek expert advice and/or treatment, and their interest or ability in implementing such advice. Additionally, access to other information sources, such as the internet, as well as the availability of services, might also act as influential factors.

Another variable considered in the current study was the effect of language similarities on the prevalence of stuttering i.e. a child exposed to languages with similar language structure (Dravidian Languages) compared to a child exposed to languages with different language structure (Dravidian Language and English). Our findings indicate no significant association between language similarities and the stuttering prevalence in the bilingual children tested in the current study. In the current study, the prevalence obtained was 1.4% among children exposed to similar Dravidian languages which are in similar lines to Ref. 42) who reported a prevalence of 1.3% among bilingual children exposed to two similar structure language Kurdish and Farsi. On the other hand, the prevalence of stuttering was 2.1% among the children exposed to two different language structure (English-Dravidian Language) in the current study. Our findings contradict the views suggested by.[35]

In a nutshell, the present study established the prevalence of stuttering among the school going children in India. This data would be of interest to the policy makers in designing effective identification, prevention and management strategies.

5. Conclusion

Little is known about the prevalence of stuttering and impact of several variables on it in a country like India with diverse population. The current study determined the prevalence of stuttering to be 1.68% among school going children from standard 1 to 10 in Dakshina Kannada district, India where males were affected more than females with a ratio of 2.4:1. The study also revealed no association between Stuttering and variables such as SES, and the language structure of these bilingual children. Further research on prevalence studies are warranted in other parts of India, with a larger sample cohort from both rural and urban population to compare the prevalence data across rural and urban population.

Author contribution

Aiswarya LizVarghese, Dr. Radish Kumar B, Dr. Unnikrishnan B: Conceptualization, Methodology.

Palak Devani, Lakshmi S Kunnath, Aiswarya Liz Varghese: Data curation, Writing- Original draft preparation.

Dr.Gagan Bajaj, Dr.Sudhin Karuppali, Dr.Unnikrishnan B: Visualization, Investigation, Dr. Radish Kumar B: Supervision.

Aiswarya Liz Varghese, Dr.Radish Kumar B: Writing- Reviewing and Editing.

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Declaration of competing interest

Nil.

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