

Dental Status and Treatment Needs of Special Needs Children in Negeri Sembilan, Malaysia

S. Mohd Mokhtar, L. Abd Jalil, N. Muhd Noor, B. C. Tan, Z. Shamdol, H. Ali Hanafiah

Abstract— The aim of the study is to determine the dental status and treatment needs of special needs children in Negeri Sembilan, Malaysia and to investigate the association of caries prevalence and oral health status with sociodemographic variables. **Methodology:** This is a cross sectional study involving 574 special needs children aged 17 and below who attended Community-based Rehabilitation centres and special classes in the government schools. They were examined for dental caries (dmft/DMFT index of World Health Organization) and oral hygiene (Simplified Oral Hygiene Index, OHI-S of Green Vermillion). Statistical analyses include frequency, percentages, mean and standard deviation for descriptive statistics, whilst one-way ANOVA, simple and multiple logistic regressions were used for association analysis. **Result:** Majority of the children was mentally handicapped. Over 90% were from parents of middle and lower level educational background. The caries prevalence was 54.9% with mean dmft/DMFT of 1.03±2.13/1.22±2.23. There was no significant association between caries prevalence with parents' education and monthly household income. The only sociodemographic factor that showed significant association with caries prevalence ($p < 0.001$) was age. The mean of OHI-S was 1.13±1.03. The oral hygiene status was inversely associated with age, parents education and monthly household income. 52.8% of the children required dental treatment. In the very young, aged 2 to 6 years, 85.2% of decayed teeth (d+D) were untreated and required some form of treatment (restoration or/and extraction). **Conclusion:** High caries prevalence and dental treatment needs were found among the special needs children in Negeri Sembilan. This study highlights the necessity to prioritize the service delivery to the younger age group. The findings will be useful as baseline data to enable future planning of oral health care delivery for children with disabilities.

Index Terms—Caries prevalence, dental treatment need, oral health status, special needs children.

I. INTRODUCTION

It is due to the nature of the disabling condition that the special needs children are, to a lesser or greater extent, more susceptible to developing oral diseases. The overall quality of life can be much affected by dental pain and tooth loss due to caries and periodontal disease. Special needs children (SNC) are handicapped children who over an appreciable period of time are prevented by physical or mental conditions from full participation in normal activities of their age group

S. Mohd Mokhtar, L. Abd Jalil, N. Muhd Noor, B. C. Tan, Department of Paediatric Dentistry, Hospital Tuanku Jaafar Seremban, Negeri Sembilan, Malaysia

Z. Shamdol, Oral Health Division, Ministry of Health Malaysia, Putrajaya, Malaysia

H. Ali Hanafiah, Oral Health Division, Health Department of Malacca, Ayer Keroh, Melaka, Malaysia

including those of a social, recreational, educational and vocational nature [1]. Included in this definition are Down's syndrome, autism, cerebral palsy, slow learner, mental disorder and global developmental delay. By the end of 2012, 445,006 persons registered with the Department of Social Welfare as persons with disabilities which represent 1.5% of Malaysian population [2].

The Ministry of Health Malaysia (MOH) has been the primary national stakeholders that provide programmes and services for the care of SNC. Provision of dental care was hampered by poor coverage, lack of trained dental personnel and public awareness [1]. In 2004, MOH developed a guideline 'Oral HealthCare for Children with Special Needs' intending to address oral health barrier issues. There was interconnection, but lack of effective synergy, in the provision of healthcare, education, rehabilitation, protection and welfare services [2]. As recommended by the guideline, dedicated teams called 'Caring Team' or '*Pasukan Penyayang*' were established in Negeri Sembilan in 2009 to provide dental services to this group of patients in the Community Based Rehabilitation centres, special classes in schools and those bounded at home. The SNC were visited at regular intervals during which preventive treatment and possibly curative treatment in a temporary set up were provided [3].

In Malaysia, school aged SNC attend special classes either in schools, institutions or Community-based Rehabilitation (CBR) centres. CBR centres were established throughout the country by the Department of Social Welfare since year 1984 as preferred alternatives to institutional care. These centres are normally prioritized for those who are found to be ineligible to be admitted to mainstream schools irrespective of social economic background and operate during daytime and weekdays only [2]. Because there are not many private institutions in Malaysia for SNC, most families of the higher socioeconomic group send their SNC to the government schools.

Currently there is no comprehensive and structured data collection mechanism on SNC [2]. The sporadic available published data around the country appeared to show high caries prevalence with perceived much needed and yet highly unmet dental service [4], [5].

The aim of this study is to determine the dental status, the treatment needs and to investigate the association of caries prevalence and oral health status with sociodemographic variables of SNC in Negeri Sembilan, Malaysia. The findings from this study will be used as baseline for the current programme and will help inform service providers on which areas to prioritize in the provision and development of dental

health services for SNC in Malaysia.

II. MATERIALS AND METHODS

The participants were special needs children aged 17 and below who attended fourteen CBR centres and eighteen special classes of government schools in all districts (Seremban, Rembau, Jelebu, Jempol, Tampin, Port Dickson and Kuala Pilah District) of Negeri Sembilan. The time frame of the study was one year where three visits were made to each CBR centres and special classes. Minimal sample size (n=525) was calculated based on estimated proportion of caries prevalence of population of two CBR centres and two schools.

The study was registered with National Medical Research Register of National Institute of Health Malaysia (NMRR-11-1154-8589). A Government State Survey Steering Committee has endorsed the overall conduct of the survey. Calibration and standardization of the examiners for dental caries and oral hygiene index status were undertaken prior to the study. Written consents and particulars of these children were obtained from the parents or guardians. Visual oral examination was carried out by seven examiners from each district to all SNC present on the days of screening. Uncooperative SNC who refused to participate were excluded from the study. Screening by means of plane mouth mirrors and blunt probes under portable artificial light were adopted as recommended by World Health Organization.

Sociodemographic data of interest were age, gender, parents education level and monthly household income. Education level was classified according to Malaysia National Oral Health Survey of Schoolchildren, NOHSS 2007 [6], whilst income level was classified according to Malaysia Household Income Survey 1970-2014 [7]. Type of disability was categorized based on categorization by the Ministry of Health Malaysia (MOH). Mental disabilities refer to Down’s syndrome, autism, attention deficit hyperactivity disorder, global developmental delay and slow learner. Physical disabilities refer to hearing impairment, blindness and limb deficiency, and multiple disabilities means having more than one type of disability such as cerebral palsy and Down’s syndrome with heart disease.

The indices for caries assessment and oral hygiene assessment were dmft/DMFT index [8], and Simplified Oral Hygiene Index score (OHI-S) respectively [9]. Treatment needs (for scaling, restoration and extraction) was assessed based on expert opinion of examiners.

Data were cleaned and verified. Statistical analyses were carried out using Statistical Package for Social Sciences for Windows® version 18(SPSS Inc., Chicago, IL) which include descriptive statistics such as frequency and percentages for categorical variables, and means and standard deviation (SD) for continuous variables. One-way ANOVA was used to analyze the distribution of dmft/DMFT and OHI-S by age group.

The associations of each potential risk factor with caries prevalence and oral hygiene status were examined through simple logistic regression. Crude or unadjusted odd ratio will be reported. Then, multiple logistic regression were used to evaluate all the risk factors through enter selection

procedure. The adjusted odd ratio and 95% confidence interval for each potential factor were calculated, and p-value of less than 0.05 was considered significant.

III. RESULT

A total of 574 SNC aged 2-17 years (mean 11.57±3.53 years) with male to female ratio of 1.8:1 were included in the study. Majority of the children (83.1%) were categorized as mentally disabled. Over 90% were from parents of middle and lower level educational background and 85.7% were from lower level income group.

Overall caries prevalence amongst SNC in Negeri Sembilan was 54.9% [95% CI 50.9, 58.9].

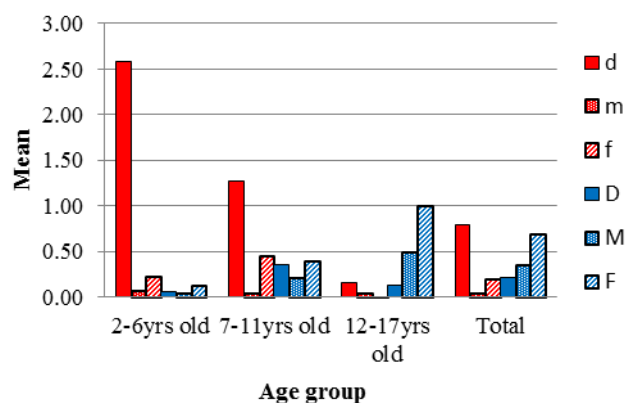
Table 1: Distribution of caries prevalence by type of dentition

Dentition	Caries Prevalence		Mean±SD
	No n (%)	Yes n (%)	
Primary (dmf)	388 (67.6)	186 (32.4)	1.03±2.13
Secondary (DMF)	368 (64.1)	206 (35.9)	1.22±2.23

Logistic regression analysis was used to determine the association between caries prevalence and gender, age, parents education, monthly household income, and type of disability.

Table 2 summarizes sociodemographic factors associated with caries prevalence using multiple logistic regression. The only sociodemographic factors that has significant association with caries prevalence was age. Compared to those in 12 to 17 years age group of SNC, 2 to 6 years age group have 0.54 times higher odds (95% CI=0.28 to 1.03) and 7 to 11 years age group have 0.48 times higher odds (95% CI=0.34 to 0.69) of having caries.

Figure 1: Distribution of dmft and DMFT by age group



It was noted that caries in primary dentition (d) was seen as early as 2 years amongst SNC and caries in permanent dentition (D) has occurred as soon as permanent teeth erupt.

Overall mean dmft and DMFT of SNC in Negeri Sembilan was 2.25±3.12. There was no significant association between OHI-S for all age group as presented in Table 3.

Table 2: Distribution of caries prevalence and independent variables

Independent Variable	Caries Prevalence		Unadjusted OR (95% CI)	Adjusted OR (95% CI) ^a	Wald ^a (df)	p value ^a
	Yes	No				
	n=315 (54.9%) n (%)	n=259 (45.1%) n (%)				
Sex						
Male	200 (54.3)	168 (45.7)	(ref)	(ref)		
Female	115 (55.8)	91 (44.2)	0.942(0.668,1.328)	1.117(0.784, 1.591)	0.375(1)	0.540
Age						
12 to 17 years	141 (46.5)	162 (53.5)	(ref)	(ref)	16.563(2)	<0.001
7 to 11 years	144 (64.6)	79 (35.4)	0.477(0.335, 0.681)	0.482(0.336, 0.692)	3.522(1)	<0.001
2 to 6 years	30 (62.5)	18 (37.5)	0.522(0.279, 0.977)	0.536(0.280, 1.028)	0.099(1)	0.061
Parents education						
Lower secondary	163 (53.4)	142 (46.6)	(ref)	(ref)	0.151(2)	0.927
Higher secondary	141 (56.6)	108 (43.4)	0.879(0.628, 1.231)	0.963(0.672,1.380)	0.042(1)	0.838
Tertiary	11 (55.0)	9 (45.0)	0.939(0.378, 2.331)	1.153(0.403,1.742)	0.070(1)	0.791
Monthly household income						
<RM2000	267 (54.3)	225 (45.7)	(ref)	(ref)		
≥RM2000	48 (58.5)	34 (41.5)	0.841(0.523, 1.350)	0.971(0.555,1.698)	0.011(1)	0.918
Type of disability						
Multiple disability	43 (59.7)	29 (40.3)	(ref)	(ref)	0.643(2)	0.725
Physical disability	16 (64.0)	9 (36.0)	0.834(0.325, 2.141)	0.852(0.327,2.222)	0.107(1)	0.744
Mental disability	256 (53.7)	221 (46.3)	1.280(0.773, 2.119)	1.141(0.680,1.915)	0.248(1)	0.619

Note:1. ^aThe multiple logistic regression model is reasonably fit with the Hosmer-Lemeshow goodness-of-fit. The full model containing all predictors was statistically significant, $\chi^2(8, N=574) = 19.47, p < .05$. The model as a whole explained between 3.3% (Cox and Snell R square) and 4.5% (Nagelkerke R squared) of the variance in caries prevalence, and correctly classified 58.7% of cases.

2. OR = Odd ratio

CI = Confidence interval

df = Degree of freedom

Table 3: Distribution of dmft, DMF and Oral Hygiene Index by age group

Indices and Components	Age			p value ^b	Total (n=574) mean±SD
	2-6 years (n=48)	7-11 years (n=223)	12-17 years (n=303)		
	mean±SD	mean±SD	mean±SD		
Decayed teeth (dt+DT)	2.65±3.70	1.62±2.65	0.28±0.86	<0.001	1.00±2.21
Missing teeth (mt+MT)	0.10±0.37	0.26±0.83	0.52±1.11	0.001	0.38±0.98
Filled teeth (ft+FT)	0.35±1.02	0.84±1.28	1.01±1.72	0.018	0.89±1.52
dmft +DMFT	3.10±3.84	2.73±3.21	1.77±2.84	<0.001	2.25±3.12
Distribution of Oral Hygiene Index by age group					
Debris Index (DI)	0.72±0.59	0.78±0.64	0.83±0.67	0.443	0.80±0.65
Calculus Index (CI)	0.30±0.57	0.25±0.44	0.40±0.54	0.004	0.33±0.51
Simplified Oral Hygiene Index (OHI-S= DI +CI)	1.03±1.05	1.03±0.96	1.23±1.08	0.062	1.13±1.03

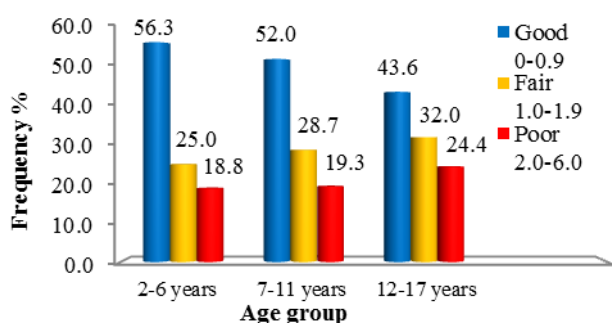
Note: ^b One-way ANOVA test

Table 4: Distribution of Oral Hygiene Status and independent variables

Independent Variable	Oral Hygiene Status			Unadjusted OR (95% CI)	Adjusted OR (95% CI) ^a	Wald ^a (df)	P value ^a
	Good n (%)	Fair n (%)	Poor n (%)				
Total	288 (50.2%)	163 (28.4%)	123 (21.4%)				
Sex				(ref)	(ref)		
Female	104 (50.5)	60 (29.1)	42 (20.4)	1.104 (0.729,1.673)	1.135(0.734, 1.757)	0.325 (1)	0.569
Male	184 (50.0)	103 (28.0)	81 (22.0)				
Age				(ref)	(ref)	7.014 (2)	0.030
2 to 6 years	30 (62.5)	10 (20.8)	8 (16.7)	1.400 (0.648,3.026)	2.471 (1.061, 5.758)	4.396 (1)	0.036
7 to 11 years	121 (54.3)	61 (27.4)	41 (18.4)	1.035 (0.466, 2.298)	1.537(0.654, 3.615)	0.971 (1)	0.324
12 to 17 years	137 (45.2)	92 (30.4)	74 (24.4)				
Parents education				(ref)	(ref)	10.506 (2)	0.005
Lower secondary	182 (59.7)	78 (25.6)	45 (14.8)	2.012 (1.328, 3.048)	1.905 (1.224,2.966)	5.685 (1)	0.017
Higher secondary	99 (39.8)	82 (32.9)	68 (27.3)	5.354 (2.114, 13.588)	3.804 (1.268,11.409)	1.695 (1)	0.193
Tertiary	7 (35.0)	3 (15.0)	10 (50.0)				
Monthly household income				(ref)	(ref)		
<RM2000	260 (52.8)	141 (28.7)	91 (18.5)	2.710 (1.648, 4.456)	2.136 (1.178,3.873)	6.255 (1)	0.012
≥RM2000	28 (34.1)	22 (26.8)	32 (39.0)				
Type of disability				(ref)	(ref)	1.347 (2)	0.510
Multiple disability	24 (33.3)	34 (47.2)	14 (19.4)	1.611 (0.564, 4.605)	1.882 (0.636,5.570)	1.306 (1)	0.253
Physical disability	13 (52.0)	5 (20.0)	7 (28.0)	1.169 (0.627,2.179)	1.289 (0.672,2.471)	0.583 (1)	0.445
Mental disability	238 (49.9)	134 (28.1)	105 (22.0)				

Note: ^a Multiple logistic regression

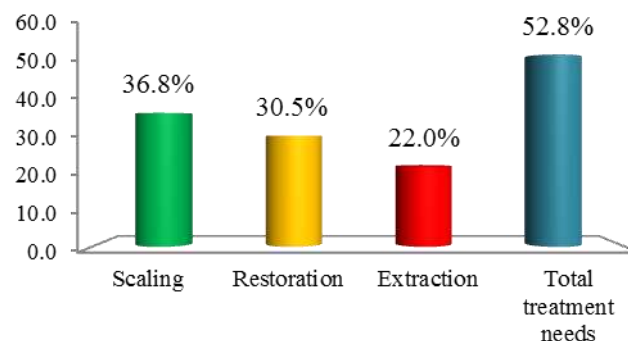
Figure 2: Distribution of OHI-S by age group



Oral hygiene status of SNC was significantly associated with age, parents education and monthly household income. Compared to those in 2 to 6 years old age group, 7 to 11 years old age group have 2.47 times higher odds (95% CI=1.06 to 5.76), and 12 to 17 years old age group have 1.54 times higher odds (95% CI=0.65 to 3.62) of having poor oral hygiene.

In view of parents education, parents with higher secondary level have 1.91 times higher odds (95% CI=1.22 to 2.97), and parents with tertiary education level have 3.80 times higher odds (95% CI=1.27 to 11.41) of having poor oral hygiene than those with lower secondary education level. The odds of having poor oral hygiene are about 2.14 times greater for those with monthly household income more than RM2000 than those with income less than RM2000.

Figure 3: Treatment needs



A total of 52.8% required dental treatment which composed of restoration (30.5%), extraction (22.0%), and/or scaling (36.8%).

Table 4: Distribution of Unmet Need Index (d, D) by age group

Unmet Need Index (UMNI)	Age			Total (n=574)
	2-6 years (n=48)	7-11 years (n=223)	12-17 years (n=303)	
^P UMNI x 100%	89.9	72.0	78.0	76.8
^S UMNI x 100%	27.3	36.7	8.4	17.4
^D UMNI x 100%	85.2	59.5	16.0	44.5

Note: ^P UMNI = d/dmf
^S UMNI = D/DMF
^D UMNI = (d+D)/(dmf+DMF)

In the very young, aged 2 to 6 years, 85.2% of decayed teeth (d+D) were left untreated and required some form of treatment (restoration or/and extraction).

IV. DISCUSSION

A. Caries prevalence

This study demonstrated high caries prevalence amongst SNC in Negeri Sembilan, where 54.9% of 574 SNC had dental caries with mean dmft+DMFT of 2.25 ± 3.12 . These findings are consistent with other studies which have noted an increased prevalence of dental caries among patients with disabilities [10]-[12], whilst much lower caries prevalence was noted amongst the disabled children in South Africa (dmf of 27.6% and DMF of 33.6%) [13].

Based on our literature search, only three local studies on dental caries in SNC had been published and they focused on specific type of disabilities of a particular center with smaller sample size. High caries prevalence was found in children with cerebral palsy (85.3%) [4], hearing impaired (dmf of 88%, DMF of 85%) [14] and Down's syndrome (dmf of 57%, DMF of 74%) [15].

Many studies documented lower caries prevalence in healthy controls when compared to SNC [16], [17]. Similar findings from Malaysia National Oral Health of Schoolchildren survey reported lower caries prevalence of 32.8% (mean DMFT of 0.67 ± 4.3) in the 12-year-old healthy children of general population [6].

There was no difference in caries experience across gender, monthly household income and level of education. Social inequalities which are apparent in many countries were not observed here [12], [18]-[23]. Possible reason for such observation in this country is that the public dental care service provided by the government such as the '*Pasukan Penyayang*' programme for SNC in CBR centres and the community fluoridated water supply in Negeri Sembilan could have been effective. Besides, there are not many non-governmental specialized centres that cater for these children contributing to the high reliance of the families with SNC, regardless background, on the public services. This is supported by a recent study which found almost 90% of private dental practitioners in three cities in Malaysia treated less than 5 SNC in their clinic in a month and the nature of treatment was commonly single visit treatment of emergency, extraction, and simple restorations [24].

Although socioeconomic status and disability were not risk factors for caries in this study, there are other variables that were not investigated in this study. Among others are low frequency of brushing, increased frequency of sugar consumption between meals and dental malocclusion which were found significantly related to dental caries in disabled children [17].

We observed the only sociodemographic factor that showed significant association with caries prevalence ($p < 0.001$) was age. Compared to those in 12 to 17 years age group, the younger age group of 2 to 6 years and age group of 7 to 11 gave higher odds to develop caries (Odd Ratio of 0.90 and 1.90 times respectively).

This study highlights the necessity to prioritize the service delivery to the younger children which stresses the greater need to involve parents and caregivers in the future planning. Previously dental care is elective in nature. Parents depend almost wholly on school or CBR centres' dental care for their children's oral health. They must be convinced of their importance in participating in oral health programme conducted for their children at school. Education of parents/caregivers is critical for ensuring appropriate and regular supervision of daily oral hygiene.

The training of oral health promotion and the necessary skills in handling SNC must take into account the nature of caries at the particular age group. The very young SNC aged below 6 in this study suffered considerably from a specific kind of dental caries, commonly named early childhood caries (ECC). Recognizing the difficulties in treating ECC, which is a diet-induced disease characterized by early onset and rapid progression, these patients must receive aggressive preventive approach. This includes atraumatic restorative treatment, fluoride applications, oral hygiene instruction, dietary counselling, and restorative measures. To prevent further tooth destruction and encourage better overall health, treatment should be instituted immediately and specifically. Preventive measures cannot, and will not, work unless parents and caregivers follow and adhere to the preventive methods being prescribed. When cavitation has occurred, more definitive treatment is required [25]. These approaches can also be applied for children in the mixed dentition group.

Current dental services to the SNC in Negeri Sembilan are mostly of preventive in approach. Considering the caries prevalence, a more active curative management to reduce the consequence of dental diseases to the patients should be adopted. Without doubt, these patients must be placed under the care of the expert in cases where caries becoming very fast progressing and beyond control. Referral to the paediatric dental specialist must be recognized and hastened.

B. Oral hygiene status

The OHI-S index by Greene and Vermillion was adopted because of its simplicity and practicality. It was used to assess plaque accumulations and calculus deposition which reflect the daily oral care. More than half of the SNC in this study demonstrated substandard oral hygiene status (OHS).

SNC experience greater challenges to proper oral hygiene and health care, often due to a lack of basic manual skills and intellectual abilities that precludes adequate practices, such as tooth brushing [26]. Physical inadequacy of mechanical plaque removal from the teeth was suggested to be the main factor related to gingival and periodontal disease in institutionalized intellectually disabled subjects [27]. This is in accordance with a recent finding of a study in Malaysia, which found a high prevalence of periodontal disease in SNC (86.8% of 125 samples) [28]. It is important, for that reason, the training of the providers must emphasize the care of periodontal disease in its earliest incipient stages in order to prevent destructive nature of chronic periodontal disease.

In Negeri Sembilan, the income and level of education were found to have an inverse association with OHS. It is not clearly understood why higher income and level of education show poorer OHS, whilst an inverse relationship of these

variables and OHS are commonly revealed from numerous studies globally [23]. There is a need to identify as to why the relationship was such. This is the limitation of the study where other socio-behavioural risk factors associated with it were not addressed. Nonetheless, a study of knowledge and attitude of caretakers on local population found that parents showed relatively good knowledge on early childhood health related factors, but poor attitude and practice towards the oral health of their children. Cultural influences were evident in the observed attitudes and oral health practices among the community [29].

C. Treatment need

A total of 52.8% of SNC needed dental treatment. Local report revealed a very much lower proportion of healthy children in the same region requiring dental treatment (35.7% in primary schools and 18.9% in secondary schools) (Report of Health Department of Negeri Sembilan) [30].

A recent local study on service equity measured perceived need from the point of view of caregivers and found that the dental services of SNC was perceived as very much needed and yet highly unmet (49.6% needed, 59.9% unmet) [5].

The prevalence of untreated caries was 27.2% in primary dentition, 9.4% in permanent dentition and 30.5% in both.

On the same note, most of the decayed teeth (d or D) were left untreated which was particularly evident in the younger age group (unmet needs of 85.0% in 2-6 years, 15.8% in 12-17 years).

Globally, the treatment needs and unmet dental needs of children with disabilities remain high, reaching as high as 100% in South Africa and generally higher than healthy children [13], [17], [31].

V. CONCLUSION

The present cross sectional study provides an insight into caries prevalence, oral hygiene status and treatment needs of special needs children attending Community Rehabilitation Centres and Special classes in Negeri Sembilan, one of the states in Malaysia. This study highlights the necessity to prioritize the service delivery to the younger age group. The findings will be useful as baseline data to enable future planning of oral health care delivery for children with disabilities.

ACKNOWLEDGMENT

We would like to thank the Dental Officers who were involved with the screening and examination of the special needs children and also to the Director General of Health Malaysia for his permission to publish this article.

REFERENCES

- [1] *Oral healthcare for children with special needs*, Oral Health Division, Ministry of Health Malaysia, 2004, pp. 1-16.
- [2] "Children with disabilities in Malaysia: mapping the policies, programmes, interventions and stakeholders," United Nations Children's Fund, Malaysia, May 2014.
- [3] *Guidelines for caring team of special needs children program in Negeri Sembilan Darul Khusus*, Oral Health Division, Negeri Sembilan Health Department, 2009, pp. 1-19.
- [4] M. Rusmah, Z. A. Majid, and H. Aida, "Dental health of the handicapped at the Selangor Spastic Centre," *Sing Dent J*, vol. 12, no. 1, 1987.

- [5] S. H. Tan, "Unmet health care service needs of children with disabilities in Penang, Malaysia," *Asia-Pacific J. Public Heal.*, vol. 27, no. 8 Suppl, p. 41S-51S, 2015. Available: <http://aph.sagepub.com/cgi/doi/10.1177/1010539515592461>
- [6] *National oral health survey of schoolchildren 12-year-olds 2007 (NOHSS 2007)*, Oral Health Division, Ministry of Health Malaysia, August 2010.
- [7] Departments of Statistics Malaysia. (2015, August 25). *Household income survey* [Online]. Available: <http://www.epu.gov.my/en/household-income-poverty>
- [8] *Oral health survey: basic methods*, 3rd ed., WHO, Geneva, 1987, pp. 761-871.
- [9] J. C. Green and J. R. Vermillion, "The simplified oral hygiene index," *J Am Dent Assoc*, vol. 68, pp. 7-13, 1964.
- [10] A. James, C. J. Hendriksz, and O. Addison, "The oral health needs of children, adolescents and young adults affected by a mucopolysaccharide disorder," *JIMD Rep.*, vol. 2, pp. 51-58, 2012.
- [11] E. Velasco-Ortega, J. J. Segura-Egea, S. Córdoba-Arenas, A. Jiménez-Guerra, L. Monsalve-Guil, and J. López-López, "A comparison of the dental status and treatment needs of older adults with and without chronic mental illness in Sevilla, Spain," *Med. Oral Patol. Oral Cir. Bucal*, vol. 18, no. 1, pp. e71-e75, 2013.
- [12] M. Jain, A. Mathur, L. Sawla, G. Choudhary, K. Kabra, P. Duraiswamy, and S. Kulkarni, "Oral health status of mentally disabled subjects in India.," *J. Oral Sci.*, vol. 51, no. 3, pp. 333-40, 2009.
- [13] C. B. Nqobobo, V. Yengopal, M. J. Rudolph, M. Thekiso, and Z. Joosab, "Dental caries prevalence in children attending special needs schools in Johannesburg, Gauteng Province, South Africa.," *J. South African Dent. Assoc.*, vol. 67, pp. 308-13, 2012.
- [14] N. A. Rahman, A. Yusoff, M. K. M. Daud, and F. N. Kamaruzaman, "Salivary parameters, dental caries experience and treatment needs of hearing-impaired children in a special school for deaf in Kelantan, Malaysia," *Arch Orofac Sci.*, vol. 10, no. 1, pp. 17-23, 2015.
- [15] A. R. Normastura, Z. Norhayani, Y. Azizah, and M. D. Mohd Khairi, "Saliva and dental caries in down syndrome children," *Sains Malaysiana*, vol. 42, no. 1, pp. 59-63, 2013.
- [16] D. B. Roa, A. M. Hegde, and A. K. Munshi, "Caries prevalence amongst handicapped children of South Canara district, Karnataka," *J Indian Soc Pedo Prev Dent.*, vol. 19, no. 2, pp. 67-73, June 2001.
- [17] B. M. Purohit and A. Singh, "Oral health status of 12-year-old children with disabilities and controls in Southern India," *WHO South-East Asia Journal of Public Health*, vol. 1, no. 3, pp. 330-338, 2012.
- [18] A. C. A. E. Luna, M. J. Rodrigues, V. A. Menezes, K. M. G. Marques, and F. A. D. Santos, "Caries prevalence and socioeconomic factors in children with sickle cell anemia," *Braz. Oral Res.*, vol. 26, no. 1, pp. 43-49, 2012.
- [19] S. T. Reisine and W. Psoter, "Socioeconomic status and selected behavioral determinants as risk factors for dental caries," *J Dent Educ*, vol. 65, no. 10, pp. 1009-1016, Oct. 2001.
- [20] P. L. Poon, "The association between socioeconomic status and dental caries in preschool children: a systematic review," M.S. thesis, Dept. Public Health, Hong Kong Univ., Pokfulam, Hong Kong, 2011.
- [21] C. H. Chu, P. L. Ho, and E. C. Lo, "Oral health status and behaviours of preschool children in Hong Kong," *BMC Public Health*, vol. 12, p. 767, 2012.
- [22] A. P. MacKay, L. A. Fingerhut, and C. R. Duran, "Health status," in *Health, United States, 2000 With Adolescent Health Chartbook*, Hyattsville, Maryland: National Center for Health Statistics, 2000, pp. 36-37.
- [23] T. Timis, and D. I., "Socioeconomic Status and Oral Health," *J. Prev. Med.*, vol. 13, no. 2, pp. 116-121, 2005.
- [24] P. Bindal, C. W. Lin, U. Bindal, S. Z. Safi, Z. Zainuddin, and A. Lionel, "Dental treatment and special needs patients (snps): dentist's point of view in selected cities of Malaysia," *Biomed. Res.*, vol. 26, no. 1, pp. 152-156, 2015.
- [25] S. Zafar, S. Y. Harnekar, and A. Siddiqi, "Early childhood caries: etiology, clinical considerations, consequences and management," *Int. Dent. SA*, vol. 11, no. 4, pp. 24-36, 2009.
- [26] D. Rao, H. Amitha, and A. K. Munshi, "Oral hygiene status of disabled children and adolescents attending special schools of South Canara, India," *Hong Kong Dent J*, vol. 2, no. 2, pp. 107-113, Dec. 2005.
- [27] N. S. Kadam, R. Patil, A. N. Gurav, Y. Patil, A. Shete, R. N. Tari, D. Agarwal, D. T. Shirke, and P. Jadhav, "Oral Hygiene Status, Periodontal Status, and Periodontal Treatment Needs among institutionalized intellectually disabled subjects in Kolhapur District, Maharashtra, India," *J. Oral Disease*, Dec. 2014, Article ID 535316, DOI:10.1155/2014/535316.
- [28] A. A. Alsanabani, N. M. Ismail, A. R. Ismail, H. A. Alyamani, and M. M. T. Oo, "Periodontal status and its relationship with

sociodemographic factors among special needs children in schools of Kota Bharu, Kelantan, Malaysia,” *Int. Med. J.*, vol. 19, no. 1, pp. 61–64, Mar. 2012.

- [29] S. A. Mani, J. John, W. Y. Ping, and N. M. Ismail . (2012) “Early Childhood Caries: Parent’s Knowledge, Attitude and Practice Towards Its Prevention in Malaysia,” in *Oral Health Care - Pediatric, Research, Epidemiology and Clinical Practices*, Prof. Mandeep Viridi, Ed. InTech, DOI: 10.5772/33898. Available: <http://www.intechopen.com/books/oral-health-care-pediatric-research-epidemiology-and-clinical-practices/early-childhood-caries-parent-s-knowledge-attitude-and-practice-towards-its-prevention-in-malaysia>
- [30] “Health Department of Negeri Sembilan annual report 2011,” Health Dept. Negeri Sembilan, Annual Rep., pp. 108, 2011.
- [31] C. Y. Chen, Y. W. Chen, T. P. Tsai, and W. Y. Shih, “Oral health status of children with special health care needs receiving dental treatment under general anesthesia at the dental clinic of Taipei Veterans General Hospital in Taiwan.,” *J. Chin. Med. Assoc.*, vol. 77, no. 4, pp. 198–202, Apr. 2014.