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Accessibility to Oral Health Care Services and Oral Health-Related Quality of Life among Children with Cerebral Palsy

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ABSTRACT

Children with cerebral palsy (CP) are highly dependent on their caregivers to access oral health care services (OHS), which leads to unmet oral health needs that affect their oral health-related quality of life (OHRQoL). This study explored accessibility to OHS and OHRQoL among children with CP attending Community-Based Rehabilitation (CBR) centres in Kelantan by their primary caregivers. A cross-sectional study using Accessibility to Oral Health Care Services (CP2OHS) and Parental-Caregiver Perception Questionnaire (P-CPQ) was conducted on 81 children with CP and their primary caregivers. CP2OHS domains are "ability to perceive", "ability to engage", "ability to seek", "ability to pay", and "ability to reach", while PCPQ domains include oral symptoms, functional limitation, emotional well-being, and social well-being. Children with CP were mostly males (63.0%), with a mean (SD) age of 10.3 (3.93) years, Gross Motor Function Classification System (GMFCS) Level V (46.9%), and Communication Function Classification System (CFCS) Level III (33.3%). Their caregivers were mainly female (85.2%), aged 43.6 (9.34) years. The mean (SD) total score for CP2OHS was 29.67 (10.81) of –56 to 56 and P-CPQ was 13.21 (5.89) of 8 to 40. There was a significant difference in accessibility scores between tertiary, lower secondary, and primary levels of education (p = 0.009); village and city/town residents (p = 0.013); and transportation with personal car and motorcycle (p = 0.004). The Pearson analysis revealed a weak positive correlation between accessibility and OHRQoL scores (r = 0.158, p = 0.16) that was not statistically significant. Children with CP posed high CP2OHS scores and low P-CPQ scores, indicating high accessibility to OHS and high OHRQoL. Strengthening OHS utilisation among these children is crucial for a better quality of life for them.

Keywords: *Caregiver; cerebral palsy; disability; oral health; quality of life*

INTRODUCTION

Children with cerebral palsy (CP) experience motor impairments that are frequently accompanied by disruptions in sensation, perception, cognition, communication, and behaviour (Sadowska *et al.*, 2020). Due to their physical disability, they faced obstacles in obtaining access to oral health care (Akhter *et al.*, 2019; da Silva-Selva *et al.*, 2022). These children either totally or partially rely on caregivers for their activities of daily life, including eating, moving around, maintaining good oral hygiene, and maintaining general cleanliness (Guerreiro *et al.*, 2021). This puts a strain on caregivers, which leads to delaying or forgetting to practice good oral hygiene (da Silva-Selva *et al.*, 2022). The physical limitations of children with CP and transportation challenges hinder access to oral healthcare services (OHS), as caregivers struggle with the need for special equipment and extra effort for mobility (Abduludin *et al.*, 2019).

In addition, Abduludin *et al.* (2019) also reported that negative societal attitudes towards children with CP can socially isolate caregivers, making them feel powerless and frustrated. This discourages them from seeking necessary health services. These barriers can contribute to unmet oral health needs in this population (Silva *et al.*, 2020). A study by Cardoso *et al.* (2014) showed the high prevalence of dental caries (59.3%), gingival bleeding (94.7%), calculus (79.6%), shallow (12.9%), and deep (3.22%) periodontal pockets among the children with CP. Children with CP at Gross Motor Function Classification System (GMFCS) Levels IV to V have a 5.81 times higher risk of dental caries compared to those at Levels I to III, indicating a link between motor impairment severity and caries risk (Akhter *et al.*, 2017). Dental caries raises the likelihood of poor oral health-related quality of life (OHRQoL) in children with CP (Akhter *et al.*, 2019). The consequences of these discrepancies in oral health care access significantly impact not only oral health but also the overall well-being of the children. Inadequate oral health can result in malnutrition, speech difficulties in childhood, severe infections that can be life-threatening, and a diminished QoL (IOM & NRC, 2011). Another study by Abanto *et al.* (2012), found that the OHRQoL of children with CP was also significantly influenced by family income, dental health, and their communication abilities.

However, limited studies were being conducted to address their accessibility to OHS and their correlation with the OHRQoL among children with CP. This study aims to determine the accessibility to OHS and OHRQoL among children with CP. The accessibility to OHS scores was also compared between the different levels of communication ability and motor function of the children with CP, and categories of their primary caregivers' profiles. In addition, the correlation between accessibility to the OHS score and the OHRQoL score among children with CP was also determined. Findings from this study would be expected to enhance comprehension of the factors that hinder or facilitate caregivers in accessing oral health services for their children with CP. It would help to improve the oral health care accessibility and strategise the oral health preventive measures, and the overall QoL for these disadvantaged groups of children, while promoting equality in health care services.

MATERIAL AND METHODS

A cross-sectional study was conducted on children with CP between the ages of 5 and 17 years old and their primary caregivers who were registered at the Community Based Rehabilitation (CBR) centres in Kelantan, which is situated in the north-eastern part of peninsular Malaysia, from 17 April to 2 May 2024. The children with CP and their primary caregivers who were invited to take part in this study were based on inclusion and exclusion criteria. Malaysian citizenship children with CP aged 5–17 years old of all types which are based on physiological,

topographical, and functional capacity, and their primary caregivers aged 18 years old and above who are responsible for making decisions and taking care of daily activities of the children as well as able to communicate in Malay were recruited. Primary caregivers who have physical disabilities and acute mental illness were excluded. The sample size was determined using G-Power software to calculate the sample size based on the correlation bivariate normal model. To achieve 80% power at a 0.05 significance level for detecting a correlation of 0.3, a total of 84 children with CP were needed in the current study. There was a total of 103 children with CP registered with CBR centres in Kelantan. Of these, only 81 children fulfilled the inclusion and exclusion criteria during the data collection period. Therefore, the universal sampling method was applied to recruit a total of 81 children with CP and their primary caregivers.

Permission from the Department of Social Welfare (Ref. No.: JKMM 100/12/5/2:2024/004) to conduct a study at CBR centres and ethical approval from Human Research and Ethics Committee of Universiti Sains Malaysia (Ref. No.: USM/JEPeM/KK/24010077) were obtained. Informed consent forms were provided to the primary caregivers before the questionnaire distribution. The sociodemographic profiles of the children with CP included age (years), biological sex, the number of siblings in the family, the communication method, Communication Function Classification System (CFCS), GMFCS of the children with CP, medical history, and availability of an assistive device for children with CP. The CFCS, introduced by Hidecker *et al.* (2011), categorises individuals with CP based on their daily communication abilities. It classifies communication into five levels: Level I (effective sender and receiver with both familiar and unfamiliar partners), Level II (effective but slower-paced sender and/or receiver with both familiar and unfamiliar partners), Level III (effective sender and receiver with familiar partners), Level IV (inconsistent sender and/or receiver with familiar partners), and Level V (seldom effective sender and receiver with familiar partners). The GMFCS is a tool used to assess motor impairment in individuals with CP. It categorises gross motor function on a 5-level scale which are: Level I (walking without limitations), Level II (walking with some limitations), Level III (walking with a handheld mobility device), Level IV (self-mobility with limitations, possibly using powered mobility), and Level V (transported in a manual wheelchair) (Rethlefsen *et al.*, 2010). It was followed by the sociodemographic profiles of caregivers, which included age (years), biological sex, relationship with the CP children, ethnicity, education level, occupation, monthly household income, residential area, the distance between the residential area to the nearest government dental clinic, the distance between the residential area to nearest private dental clinic, and modes of transportation to access the dental clinic.

Both the questionnaire Accessibility to Oral Health Care Services (CP2OHS) and the Parental-Caregivers Perception Questionnaire (P-CPQ) were distributed as paper-based questionnaires to the primary caregivers. The CP2OHS questionnaire in Malay language was adopted from Abduludin *et al.* (2021). The Cronbach's alpha coefficient for the overall questionnaire was 0.93, and the intraclass correlation coefficient (ICC) was 0.96. It comprises 28 items distributed across five domains: "ability to perceive" (9 items), "ability to engage" (11 items), "ability to seek" (2 items), "ability to pay" (2 items), and "ability to reach" (4 items). Responses were recorded using a 5-point Likert scale: strongly disagree (–2), disagree (–1), unsure (0), agree (1), and strongly agree (2). Notably, items in the ability to seek and ability to pay domains were reverse-scored: strongly disagree (2), disagree (1), unsure (0), agree (–1), and strongly agree (–2). Therefore, the possible score ranges from –56 to 56. Higher ratings indicate fewer barriers to OHS faced by the caregivers of children with CP. The short-form version of the P-CPQ,

a validated tool consisting of eight items, was originally developed by Thomson *et al.* (2013) to assess the OHRQoL of children as perceived by their primary caregivers. It evaluates the impact of oral health issues across four domains: oral symptoms, functional limitations, emotional well-being, and social well-being. The Malay language translation of P-CPQ by Nasir *et al.* (2021), which achieved internal consistency and test reliability analysis between 0.6%–0.9% for all domains and subscales, was adapted in this study. A minor modification on the P-CPQ was made, replacing two items of "been irritable or frustrated" and "not wanted to talk" with "bad breath" and "had trouble sleeping" as these two items were more relevant to children with CP and reflected the oral health problem. The revised questionnaire includes eight items, distributed among oral symptoms (tooth pain, food stuck, bad breath), functional limitations (difficulty chewing, slow eating, trouble sleeping), emotional well-being (feeling upset), and social well-being (missed school). The questions pertained to the frequency of occurrences within the preceding three months. Responses were assessed using a five-point Likert scale (options: never = 1, once or twice = 2, sometimes = 3, often = 4, every day or almost every day = 5).

The overall instrument score, as well as scores for specific subscales (domains), were computed by adding up the numerical values corresponding to the five-point Likert scale. The instrument's score range spans from a minimum of 8 to a maximum of 40. Higher scores indicate a lower OHRQoL, and conversely. The questionnaires included two global items questions: (1) "How would you rate the health of your child's teeth, lips, jaws, and mouth?" and (2) "How much is your child's overall well-being affected by the condition of his/her teeth, lips, jaws or mouth?". Responses were structured on a five-point scale ranging from "excellent", "very good", "good", "fair" to "poor" for the child's oral health, and from "not at all", "very little", "some", "a lot" to "very much" for the overall well-being. The global items and the domains' scores were independently analysed and discussed. The data were entered and analysed utilising SPSS version 28.0. The independent *t*-test and one-way ANOVA test analysis were used to compare the mean accessibility to OHS score between different levels of communication ability, motor function, and categories of family profiles. In addition, the Pearson correlation test was done to see the relationship between two numerical variables of accessibility score to OHS and OHRQoL score in children with CP. The strength of correlation "*r*" is determined as 0.90–1.0 (very strong correlation), 0.70–0.89 (strong correlation), 0.40–0.69 (moderate correlation), and 0.10–0.39 (weak correlation), 0.00–0.10 (negligible correlation) (Schober *et al.*, 2018). The significant level was set at $p < 0.05$.

RESULTS

Sociodemographic Profiles

A total of 81 children with CP and their primary caregivers were recruited in this study. Most of the children with CP were males (63.0%) with a mean (SD) age of 10.3 (3.93) years, GMFCS Level V (46.9%), and CFCS Level III (33.3%), as shown in Table 1. The primary caregivers were predominantly female (85.2%), aged 43.6 (9.34) years old. Mainly, the primary caregivers (44.4%) had attained an upper secondary level of education, while a smaller proportion (8.9%) had only completed primary education. Residential locations varied, with 56.8% residing in villages, and 79.0% living less than 10 kilometers from the nearest public dental clinic. Personal cars were the most common mode of transportation (82.7%) to the dental clinic among the 70 caregivers who had experience bringing their children with CP to the dental clinics. Only 3.7% of them use motorcycles, and none of them use taxi/Grab car/private car charter (Table 2).

Table 1 Sociodemographic profiles of children with CP (n = 81)

Variables	Frequency (%)
Age	10.30 (3.93)[a]
Sex	
Male	51 (63.0)
Female	30 (37.0)
Number of siblings	
1–3	38 (46.9)
4–6	35 (43.2)
More than 6	8 (9.9)
Method of communication	
Speech	24 (29.6)
Sounds	47 (58.0)
Eye gaze, facial expression, gesturing and/or pointing	10 (12.3)
CFCS level	
Level I	11 (13.6)
Level II	13 (16.0)
Level III	27 (33.3)
Level IV	14 (17.3)
Level V	16 (19.8)
GMFCS level	
Level I	3 (3.7)
Level II	3 (3.7)
Level III	9 (11.1)
Level IV	28 (34.6)
Level V	38 (46.9)
Other medical problems	
Epilepsy	10 (12.3)
Asthma	5 (6.2)
Others	9 (11.1)
Nil	57 (70.4)
Type of mobility aid	
Wheelchair	51 (63.0)
Frame walker	2 (2.5)
Stroller	18 (22.2)
Not using mobility aid	10 (12.3)

Note: [a] Mean (SD)

Table 2 Sociodemographic profiles of the primary caregivers (n = 81)

Variables	Frequency (%)
Age	43.60 (9.34)[a]
Sex	
Male	12 (14.8)
Female	69 (85.2)
Marital status	
Married	71 (87.7)
Single mother/father/unmarried	10 (12.3)
Relationship with children (CP)	
Mother	61 (75.3)
Father	12 (14.8)
Other (Grandmother and sister)	8 (9.9)
Number of children with chronic illness/disabled including CP children	
One	71 (87.7)
Two	10 (12.3)
Ethnicity	
Malay	80 (98.8)
Siamese	1 (1.2)
Education level	
Tertiary	32 (39.5)
Upper secondary	36 (44.4)
Lower secondary	6 (7.4)
Primary	7 (8.6)
Employment sector	
Public	22 (27.2)
Private	6 (7.4)
Self-employed	13 (16.0)
Housewife	34 (42.0)
Unemployed	6 (7.4)
Monthly household income group	
B40 (RM4,849 and below)	61 (75.3)
M40 (RM4,850–RM10,959)	18 (22.2)
T20 (RM10,960 and above)	2 (2.5)
Residential location	
City	22 (27.2)
Town	13 (16.0)
Village	46 (56.8)
Distance to the nearest public dental clinic	
Less than 10 kilometres	64 (79.0)
11 kilometres–20 kilometres	13 (16.0)
21 kilometres–30 kilometres	4 (4.9)
31 kilometres–40 kilometres	0 (0.0)
More than 41 kilometres	0 (0.0)

(*continued on next page*)

Table 2 (*continued*)

Variables	Frequency (%)
Distance to the nearest private dental clinic	
Less than 10 kilometres	56 (69.1)
11 kilometres–20 kilometres	15 (18.5)
21 kilometres–30 kilometres	7 (8.6)
31 kilometres–40 kilometres	1 (1.2)
More than 41 kilometres	2 (2.5)
Mode of transportation (n = 70)	
Motorcycle	3 (3.7)
Personal car	67 (82.7)
Taxi/Grab/private car charter	0 (0.0)

Note: [a] Mean (SD)

Accessibility Scores to OHS and OHRQoL

As shown in Table 3, the mean (SD) for ability to perceive, ability to engage, ability to seek, ability to pay, and ability to reach were 12.07 (3.80), 11.88 (5.70), 2.0 (1.86), 1.77 (1.8), and 1.95 (2.47), respectively with a total score of 29.67 (10.81). The relatively high total score of CP2OHS indicates the high accessibility of children with CP to OHS in Kelantan. The mean (SD) for oral symptoms, functional limitation, emotional well-being, and social well-being were 5.98 (2.63), 4.56 (2.88), 1.47 (0.79), and 1.21 (0.56), respectively with a total score of 13.21 (5.89). The relatively low total P-CPQ scores indicate the high OHRQoL of children with CP in Kelantan. There was a moderate correlation between the P-CPQ scores and the global rating of oral health scores ($r = 0.57$; $p < 0.001$) and the global rating of overall well-being score ($r = 0.543$; $p < 0.001$), respectively as shown in Table 4.

Table 3 Accessibility score to OHS and P-CPQ score (n = 81)

Questionnaires	Domains	Mean (SD)	Min–Max Score
CP2OHS	Ability to perceive	12.07 (3.80)	–18 to 18
	Ability to engage	11.88 (5.70)	–22 to 22
	Ability to seek	2.00 (1.86)	–4 to 4
	Ability to pay	1.77 (1.80)	–4 to 4
	Ability to reach	1.95 (2.47)	–8 to 8
	Total score	29.67 (10.81)	–56 to 56
P-CPQ	Oral symptoms	5.98 (2.63)	3 to 15
	Functional limitation	4.56 (2.88)	3 to 15
	Emotional well-being	1.47 (0.79)	1 to 5
	Social well-being	1.21 (0.56)	1 to 5
	Total score	13.21 (5.89)	8 to 40

Table 4 Correlation analysis of P-CPQ and global rating score among children with CP (n = 81)

Variable	Variables	r	*p*-value
P-CPQ score	Global rating oral health score	0.570	0.001
	Global rating overall well-being score	0.543	0.001

Comparison of Communication and Motor Function with Accessibility Scores to OHS

Table 5 shows the accessibility scores to OHS among children with CP based on their motor function (GMFCS) and communication abilities (CFCS). The analysis reveals no significant difference in accessibility between children with higher mobility (GMFCS Levels I, II, and III) and those with lower mobility (GMFCS Levels IV and V), with a *p*-value of 0.64. Similarly, there is no significant difference in accessibility between children with higher communication abilities (CFCS Levels I, II, and III) and those with lower communication abilities (CFCS Levels IV and V), $p = 0.57$.

Comparison of Primary Caregivers' Profiles with Accessibility Score to OHS

Table 6 shows the comparison of primary caregivers' profiles with accessibility scores to OHS among children with CP analysed using one-way ANOVA/independent *t*-test. There were significant differences in accessibility scores to OHS among children with CP based on their primary caregivers' profiles. Significant factors include education level ($p = 0.009$), residential location ($p = 0.031$), and mode of transportation to the dental clinic ($p = 0.004$). Post hoc least significant difference (LSD) tests revealed specific differences in accessibility scores based on education levels. The tertiary education level had significantly higher accessibility mean (SD) scores [33.63(11.31)] compared to the lower secondary education level [21.83(3.87)] and the primary education level [22.00(7.44)], *p*-values of 0.011 and 0.008, respectively.

Correlation between Accessibility Scores to OHS and OHRQoL

Table 7 shows a correlation between accessibility to OHS and OHRQoL among children with CP. The Pearson correlation analysis showed a weak positive relationship between accessibility to OHS and OHRQoL ($r = 0.158$). However, the correlation was not statistically significant ($p = 0.16$).

Table 5 Comparison between communication ability and motor function with accessibility score to OHS among children with CP (n = 81)

Category	Accessibility to OHS score				
	n	Mean (SD)	Mean difference (95% CI)	t-statistic[a] (df)	*p*-value
GMFCS					
Level I, II, and III	15	28.47 (12.08)	–1.47 (–7.66, 4.71)	–0.47 (79)	0.64
Level IV and V	66	29.94 (10.58)			
CFCS					
Level I, II and III	51	29.14 (10.14)	–1.43 (–6.40, 3.54)	–0.57 (79)	0.57
Level IV and V	30	30.57 (11.99)			

Note: [a] Independent t-test

Table 6 Comparison of primary caregivers' profiles with accessibility score to OHS among children with CP (n = 81)

Family profiles	n	Accessibility to OHS score		
		Mean (SD)	F-statistic/ t-statistic (df)	*p*-value
Sex				
Male	12	28.75 (10.95)	–0.32 (79)	0.75[a]
Female	69	29.83 (10.86)		

(*continued on next page*)

Table 6 (*continued*)

Family profiles	n	Accessibility to OHS score		
		Mean (SD)	F-statistic/ t-statistic (df)	*p*-value
Marital status				
Married	71	29.59 (10.55)	–0.17 (79)	0.87[a]
Single mother/father/unmarried	10	30.20 (13.15)		
Relationship with children (CP)				
Mother	61	30.67 (11.15)		
Father	12	28.75 (10.95)	1.69 (2)	0.19[b]
Other (grandmother and sister)	8	23.38 (5.10)		
Number of children with chronic illness/ disability including CP·				
One	71	29.17 (10.80)	–1.11 (79)	0.27[a]
Two	10	33.2 (10.77)		
Education level				
Tertiary	32	33.63 (11.31)		
Upper secondary	36	28.94 (10.24)	4.15 (3)	0.009[bc]
Lower secondary	6	21.83 (3.87)		
Primary	7	22.00 (7.44)		
Employment sector				
Public and private	28	30.64 (12.63)		
Self-employed	13	28.54 (12.38)	0.20 (2)	0.82[b]
Housewife and unemployed	40	29.35 (8.99)		
Monthly household income				
B40	61	28.62 (10.36)	–1.53 (79)	0.13[a]
M40 and T20	20	32.85 (11.79)		
Residential location				
City and town	35	26.71(9.68)	–2.20 (79)	0.031[a]
Village	46	31.91(11.17)		
Distance to the nearest public dental clinic				
Less than 10 kilometres	64	28.88 (10.84)	–1.28 (79)	0.203[a]
More than 10 kilometres	17	32.65 (10.48)		
Distance to the nearest private dental clinic				
Less than 10 kilometres	56	30.52 (11.34)	1.06 (79)	0.29[a]
More than 10 kilometres	25	27.76 (9.44)		
Mode of transportation to dental clinic*				
Motorcycle	3	26.33 (1.53)	–3.39 (17)	0.004[a]
Personal car	67	31.57 (10.37)		

Notes: [a] Independent *t*-test; [b] One-way ANOVA; [c] Post hoc multiple comparison LSD shows there is a significant difference between tertiary and lower secondary education levels ($p = 0.011$), and tertiary and primary education levels ($p = 0.008$); *n = 70

Table 7 Correlation analysis of accessibility score to OHS and OHRQoL among children with CP (n = 81)

Variable	Variable	r	*p*-value
Accessibility score (CP2OHS)	OHRQoL (P-CPQ score)	0.158	0.16

DISCUSSION

This study involved 81 children with CP and their primary caregivers, registered at 26 CBR centres in Kelantan, Malaysia. The CBR centres, initiated by the Department of Social Welfare under the Ministry of Women, Family, and Community Development in Malaysia, aim to provide rehabilitation therapy, social development, vocational training, and various activities for individuals with disabilities. Primary caregivers were mainly middle-aged, predominantly female, and the majority were married, with mothers being the primary caregivers in most cases. Mothers often feel responsible for managing their children's health and are more actively involved in caring for children with CP (Malta *et al.*, 2020). Caregivers had varied educational backgrounds, with many having completed upper secondary education similar to the study by Ying *et al.* (2021). The caregivers who participated in this study largely had male children with CP in late childhood, consistent with Abduluddin *et al.* (2019). Most of their children with CP used non-verbal communication, and over half were classified in CFCS Levels III–V, highlighting communication challenges in interacting with health care providers. Communication problems hinder children with CP from informing caregivers about dental pain or discomfort (Abduludin *et al.*, 2019). A significant majority were in GMFCS Levels IV and V, reflecting a reliance on wheelchairs or strollers. This report aligns with studies by Ying *et al.* (2021) and Ismail *et al.* (2022), who found that most children with CP have GMFCS Levels IV and V.

The mean (SD) accessibility score of 29.67 (10.81) indicates a relatively high level of perceived accessibility among respondents. In the meantime, this score also highlights areas where improvements are needed across the five domains measured to ensure equitable access for all children with CP. The ability to perceive domain had the highest mean score among all domains, indicating strong awareness and a proactive attitude among caregivers towards addressing the oral health care needs of children with CP. However, negative attitudes from caregivers, community members, and health care professionals can result in a lack of support, creating barriers to accessing necessary medical care (Adugna *et al.*, 2020; Oguntade *et al.*, 2022). The ability to engage domain also demonstrated a high mean score, indicating a generally favourable perception of factors such as the usefulness of signage, support from government or non-governmental organisations, the treatment received from oral health care personnel, and positive treatment outcomes. Positive interactions with health care personnel and successful treatment outcomes enhance caregivers' experiences (Mohd *et al.*, 2023). Conversely, some primary caregivers reported dissatisfaction with long waiting times for dental treatment, noting their children were uncomfortable waiting, and a small proportion felt their children were not prioritised. Prolonged waits can increase stress, anxiety, and behavioural challenges, reducing the quality of care. Studies by Abduludin *et al.* (2019) and Balkaran *et al.* (2022) found that long waiting times often deter families from seeking dental services for their special needs children. The ability to seek domain from this study suggests that primary caregivers generally feel confident in seeking OHS for their children. Many caregivers disagreed that family problems and public stigmatisation hindered access to care, in contrast to findings from another study by Oguntade *et al.* (2022). Cultural support and familiarity with CBR staff and health care providers likely contribute to this confidence (Hasan & Al-Junid, 2019). The ability to pay domain reflected a generally positive perception, showing that most caregivers felt capable of managing the financial costs associated with oral health care. Despite this, a fraction of caregivers reported high transportation costs as a barrier. Subsidising transportation and utilising CBR services can help mitigate these financial challenges (Adugna *et al.*, 2020; Oluyede *et al.*, 2022). The ability to reach domain had the lowest mean score, indicating significant issues with transportation and physical access. Primary caregivers identified insufficient disabled parking as a barrier, particularly

at hospitals. This challenge can discourage attendance at dental appointments, especially during busy times. Studies by Goodridge *et al.* (2015) and Abduludin *et al.* (2019) also highlighted difficulties with disabled parking as a significant obstacle to accessing health care services for individuals with disabilities.

All primary caregivers indicated that oral conditions negatively affected the OHRQoL (P-CPQ > 0) of children with CP which was almost similar to the finding reported by Nqcobo *et al.* (2019). Due to muscle deficiencies that reduce mobility and inactivity, children with CP face an increased risk of chronic illnesses (Modlesky & Zhang, 2019). They are also more susceptible to dental caries and periodontal disease (Sruthi *et al*., 2021), which reported a negative impact on their OHRQoL requiring serious attention. Children with CP often need complex dental treatments, sometimes under general anesthesia, even for minor procedures (Shetty *et al.*, 2021). Caregivers frequently reported issues like tooth pain, food stuck, and bad breath in the oral symptom's domain. These findings align with Nqcobo *et al.* (2019), who also reported the impact of untreated caries in children with disabilities. Addressing oral symptoms with targeted dental strategies such as restoration, pulp therapy, or dental extractions can improve oral health outcomes for children with special health care needs (Ezzeldin *et al.,* 2023). The functional limitation domain indicates some challenges with chewing firm foods, eating, and sleeping. Children with severe motor impairments (GMFCS Levels IV–V) face higher risks of feeding difficulties (Leonard *et al*., 2020). Many caregivers in the current study reported that their children were on soft or liquid diets to ease these challenges, promoting more efficient feeding experiences. The emotional and social well-being domains show a minimal impact from oral conditions, a finding that aligns with Nqcobo *et al.* (2019) where social well-being was less affected. In this study, over half of caregivers claimed their child had not experienced tooth pain in the past three months, contributing to low emotional and social distress scores. Lastly, caregivers' global ratings indicated that a minority rated their children's oral condition as fair or poor, while a majority felt their children's overall well-being was little or not at all affected by oral conditions. The Pearson correlation analysis showed a significant moderate positive correlation between P-CPQ scores and both the global oral health rating and overall well-being rating. This positive perception aligns with the relatively low total scores of P-CPQ, reflecting high OHRQoL among children with CP and fewer oral health issues, functional limitations, and emotional/social challenges.

The study examines accessibility to OHS among children with CP, comparing motor functions and communication abilities. It found no significant difference in accessibility scores between those with higher (GMFCS Level I–III) and lower mobility (GMFCS Level IV–V) or communication abilities. This contrasts with Claus *et al.* (2022), who reported increased obstacles at higher GMFCS levels. The lack of difference may be due to biannual services at CBR centres provided by the Ministry of Health. Johansen *et al.* (2024) found more frequent health care interactions for children with higher GMFCS levels, indicating a need for more specialised care. The study suggests that motivation and economic factors, rather than motor or communication abilities, play a significant role in accessing health care, highlighting the importance of addressing broader social determinants of health (Ismail *et al*., 2022). Further research is needed on the association between CFCS levels and health care accessibility.

This study analysed the impact of primary caregivers' characteristics on accessibility to OHS for children with CP, revealing significant findings. Higher education levels among caregivers (tertiary education level) significantly improved accessibility scores, consistent with previous research linking higher education to better health care access and family functioning (Vergunst *et al.,* 2017; Ying *et al.,* 2021). Our study found that caregivers in village areas had better access to OHS than those in towns or cities, due to the

presence of public dental clinics and personal car ownership. In a previous study, a positive correlation between vehicle access and health care accessibility was noted, with 82% of individuals attending appointments having access to a car (Syed *et al.* 2013).

The current study found no significant relationship between accessibility to OHS and OHRQoL of children with CP. The complexities of assessing OHRQoL in children with CP were influenced by caregiver perceptions, cognitive development, and behavioural issues (Choe *et al.*, 2021). Internalising problems like anxiety and depression can uniquely impact a child's OHRQoL and orofacial pain, affecting both the child's and parents' OHRQoL. Additionally, Arnold *et al.* (2013) noted that caregiver-reported symptoms decrease in accuracy over time, suggesting potential recall bias when assessing OHRQoL over three months. These factors may explain the non-significant correlation observed in this study.

A key strength of this study is its focus on the unique challenges faced by children with CP, a vulnerable population often experiencing significant health disparities in oral health care. This study provides meaningful findings on accessibility to OHS and OHRQoL among children with CP in Kelantan, emphasising the strengths of using the validated tool that was developed specifically for children with CP and a representative sample from multiple CBR centres in one of the north-eastern states of Malaysia. However, its cross-sectional design limits causal inferences, and reliance on self-reported caregiver data may introduce social desirability bias. Cultural and regional differences affect generalisability, and not all confounding variables were accounted for. Additionally, the voluntary registration of children in CBR programmes means that some caregivers and their children were not included in the study.

CONCLUSION

Children with CP in the current study posed relatively high CP2OHS scores and relatively low P-CPQ scores indicating high accessibility to OHS and high OHRQoL. Strengthening OHS utilisation among children with CP is crucial to a better quality of life for these disadvantaged groups of children. Future research could combine oral examinations with OHRQoL assessments in children with CP to verify if reported OHRQoL matches actual oral health. Additionally, evaluating caregivers' oral health literacy is crucial to understand how their perceptions influence their responses.

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