Comparative Analysis of Dental Treatment for Children With and Without Special Healthcare Needs at Academic Dental Hospitals in South Africa

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Abstract

***Background*:** Children with special healthcare needs (CSHCN) experience higher unmet dental treatment needs than their healthy peers (NSHCN).

Aim: We compared dental treatment received by CSHCN and NSHCN at academic dental hospitals in South Africa (SA).

Design: Clinical records of 1-16-year-old children who had dental treatment under general anaesthetic (GA) between 2017 and 2023 were reviewed. Descriptive analyses were performed, and the Chi-square/Fisher's exact test used to analyse the categorical variables.

***Results*:** Four hundred records (CSHCN: 116 [29%] and NSHCN: 284 [71%]) were analysed. The median age at assessment was 5 years (IQR: 3–6.5). CSHCN were older than NSHCN, ($p < 0.001$). More CSHCN (52.6%) than NSHCN (25.4%) were referred from primary health centres, ($p < 0.001$). Caries was the main dental diagnosis. Multiple extractions were done in 54.7% of CSHCN < 6 years and 52.8% of 6-11-year-old NSHCN. Restorative treatment was performed in 26.1% of 6–11-year-old CSHCN and 27.2% of NSHCN < 6 years.

***Conclusions*:** Most of the CSHCN and NSHCN who needed GA were young with extensive caries. Treatment provided to both groups was primarily extractions, perhaps due to late presentation and limited resources. Timely preventative strategies for children at risk of caries could enhance oral health and reduce the burden of GA in SA.

Summary

- Why this study is important to paediatric dentists?
    - Paediatric dentists play an important role in providing both primary and comprehensive oral healthcare to infants, children, adolescents including CSHCN. There are only a few paediatric dentists in developing countries. Thus,

there is a need to advocate for training of these specialists to build capacity to manage CSHCN in PHC centres and improve access to oral healthcare.

- Dentists should emphasise on preventative care for children at risk of caries. Providing a dental home for regular prophylaxis, fluoride and sealants may reduce the risk of dental caries requiring more extensive dental treatment under GA.
- A proper referral pathway from PHC settings to ADHs is important to facilitate access to dental care for both CSHCN and NSHCN. An integrated system is essential for providing comprehensive and holistic care.

1 Introduction

Children with special healthcare needs (CSHCN) may be more at risk of common oral diseases, yet encounter greater barriers and unequal access to dental care compared to healthy children [1, 2]. Special health care needs are defined as 'any physical, developmental, mental, sensory, behavioural, cognitive, or emotional impairment or limiting condition that requires medical management, health care intervention, and/or use of specialised services or programs.' [3] Oral health is integral to overall well-being [4] and especially in CSHCN as some may experience greater barriers to dental care because of their chronic medical condition [5].

In the 2011 SA census, the prevalence of disability was 7.5% and more than 600 000 children aged between 5 and 14 years had a disability [6]. National data in SA on the status of oral health for CSHCN are lacking. A few studies reported dental caries prevalence ranging between 22.5% and 85.2% among CSHCN in SA [7-11]. Furthermore, in the 1999–2002 National Children's Oral Health Survey (NCOHS) [12], only 39.7% of the 6-year-old age group were caries-free, a figure well below the 50% target that had been set by the Department of Health (DoH) for the year 2000 [13]. This survey did not include CSHCN.

Dental caries, despite being preventable, mostly goes untreated in children globally [14]. In SA, according to last NCOHS, over 80% of the dental caries in children was untreated [12] leading to pain and/or sepsis. Tooth extraction is commonly done for pain relief, especially in CSHCN [15], while restorative treatment needs are not met [1].

Children with SHCN may face different hurdles while receiving dental care compared to their healthy peers. Dental anxiety, uncooperative behaviour, or having a developmental disability interferes with the safe delivery of routine dental treatment [16]. Sedation or general anaesthesia (GA) are needed to provide quality and comprehensive dental treatment in a single sitting. These procedures are more risky in CSHCN, and are costly [17]. Thus, the provision of dental treatment for CSHCN particularly in resource constrained settings can increase oral health inequity.

There is a dearth of studies in SA focusing on the dental treatment provided for CSHCN at public hospitals except for one study which was conducted at a SA children's hospital almost a decade ago [15]. Disparities in oral health persist among CSHCN in SA more than two decades post-independence [18]. To minimise these disparities and promote dental care provision for CSHCN, understanding the medical profile of patients receiving GA treatment is key. The aim of our retrospective study was to describe the characteristics of, and dental

treatment received under GA for CSHCN and NSHCN at academic dental hospitals in SA. The results may facilitate better planning of comprehensive and integrated oral healthcare services for CSHCN.

2 Materials and Methods

2.1 Study Design and Setting

This was a retrospective descriptive study. All five academic dental hospitals (ADHs) in SA were approached for inclusion in the study. These ADHs are in three of the nine provinces of SA, as shown in Figure 1. Three of the ADHs are in Gauteng Province, one in the Western Cape Province and one in KwaZulu-Natal Province. The delivery of dental services in SA is decentralised to the provincial governments and provided through the primary health care (PHC) system. The services provided in PHC facilities consist primarily of pain relief extractions and management of infections. Thus, patients in need of more comprehensive services are referred to tertiary level or academic hospitals which have additional facilities and specialised health/dental professionals to manage CSHCN. However, access to these facilities is a challenge for caregivers of CSHCN living in remote areas of SA.

FIGURE 1. Map of SA showing the location of the dental academic hospitals (red dots) [19].

2.2 Study Population

Participants were CSHCN and NSHCN aged between 1 and 16 years. All records of children receiving dental treatment under GA between 1 January 2017 and 30 June 2023 were included. Children receiving routine dental treatment under local anaesthetic (LA) were excluded from the study. Due to the challenges of establishing the accurate number of patients seen in each ADH per year, the sample size was estimated based on an earlier study conducted at one of the study settings [20]. The number of children who received dental treatment under GA over a two-year period was reported as approximately 40 per annum [20]. This was estimated to approximately 240 records per hospital over the study period (January 2017–June 2023) to constitute our study sample.

2.3 Records Review

A standardised record review form was used to retrieve demographic and clinical data [21]. Only one reviewer was involved in the data extraction to reduce inter-reviewer variability. Pilot testing of the review form was done with ten clinical records for patients attending the routine paediatric dental clinic at hospital A prior to the data collection exercise, to check if the review form had documented the required information. Minor adjustments were done on the review form and the records used for piloting were not included for the study analysis. The data extracted included: age at the time of first visit in years which was categorised according to dental developmental stage (i) younger than 6 years (deciduous dentition), (ii) 6–11 years (transitional dentition) and (iii) 12–16 years (permanent dentition); sex (male and female); self-referred/referral information; previous dental history (yes or none); medical health status (CSHCN/NSHCN); the type of medical indication for GA treatment and, the dental diagnosis (dental caries and caries-related [caries, pulpitis, periapical infection])/non-caries related (dentofacial anomalies, trauma, cysts). The type of behavioural management was categorised as follows; (i) dental treatment under GA, (ii) sedation (iii) local anaesthetic, (iv) non-pharmacological or (v) not indicated. Sedation, LA and non-pharmacological methods were subsequently grouped together as non-GA. The treatment provided was categorised as (i) preventative (prophylaxis, fluoride, fissure sealants, preventative restorations); (ii) multiple extractions only; (iii) restorative and rehabilitation (pulp treatment, stainless steel crowns and extractions); (iv) Other (dentofacial/orthodontics, endodontics, biopsy) or (v) treatment not assigned.

2.4 Data Analyses

Information from the records review form were captured in an Excel spreadsheet. All personal identifiers were removed from the records. Each study centre was assigned a unique identifier for anonymity. The data were stored in a password protected computer. Data were coded and imported into STATA Version 14 (Stata Corporation Inc., College Station, TX, USA). The Shapiro–Wilk test was used to assess normality and confirmed that the age of the sample was not normally distributed. Participant age was reported as median and inter-quartile range (IQR). Descriptive analyses were used to summarise the data using frequencies and percentages. The Mann–Whitney test was used to determine differences in age between CSHCN and NSHCN. Chi-square/Fisher's exact test were used to examine differences between the categorical variables. All statistical tests were conducted at a 5% significance level.

2.5 Ethics Approval

The study was approved by the Human Research Ethics Committee (Clearance number: M220266). Further permissions to access and review patient records were sought from each ADH, and written approval was provided from each of the hospitals that gave consent for the study. Guidelines regarding the protection of personal data stipulated in the POPIA were observed [22].

3 Results

Data were collected from three of the five ADHs that provided permission for the study. A convenient sample was used due to the inability to obtain the estimated sample size. The availability of patients' records varied across the hospitals. In hospital A, the highest number of records were accessed and reviewed because they were filed and stored in alphabetical order in a storage room. The files for children treated under GA were marked with a sticker and easily identifiable. Fewer records were retrieved from hospitals B and C as the paediatric records for GA over the study period were not kept in an orderly manner. All the available files retrieved were included for the analyses.

3.1 Demographic Profile of Participants

A total of 400 records were obtained and analysed from the three ADHs. Most of the patients (n = 187; 46.8%) were from centre A, followed by centre C (n = 114=; 29%) whilst centre B had the lowest records retrieved (n = 99; 25%) as shown in Table 1. There was a statistically significant difference between the CSHCN and NSHCN by centre, (p = 0.02).

TABLE 1. Demographic characteristics of children with and without special healthcare needs.

Characteristics	***N* = 400**	**CSHCN (*n* = 116)**	**NSHCN (*n* = 284)**	***p***
Median age years (IQR)	5 (3–6.5)	6 (4–10)	4 (4–6)	< 0.001
Age category				
Younger than 6 years	237 (59.3)	53 (45.7)	184 (64.8)	< 0.001
6–11 years	135 (33.7)	46 (39.6)	89 (31.3)	
12 years and above	28 (7)	17 (14.7)	11 (3.9)	
Gender, *n* (%)				
Male	225 (56.3)	68 (58.6)	157 (55.3)	0.54
Female	175 (43.7)	48 (41.4)	127 (44.7)	
Number of children at each Centre, *n* (%)				
A	187 (46.8)	66 (56.9)	121 (42.6)	0.02
B	99 (24.8)	26 (22.4)	73 (25.7)	
C	114 (28.5)	24 (20.7)	90 (31.7)	
Referral status, *n* (%)				
Referred	133 (33.3)	61 (52.6)	72 (25.4)	< 0.001
Self-referral	267 (66.7)	55 (47.4)	212 (74.6)	

Abbreviation: IQR, Inter-quartile range.

There were 116 patients (29%) in the CSHCN group and 284 (71%) in the NSHCN group. The median age of the patients was 5 years (IQR: 3–6.5), 56.3% of whom were male. The CSHCN were older than NSHCN ($p < 0.001$). Two-thirds of the patients 267 (66.7%) were self-referred while 133 (33.3%) were referrals mostly from PHC facilities. A significantly greater percentage (52.6%) of CSHCN than NSHCN (25.4%) were referred, ($p < 0.001$). The patients' demographic characteristics are presented in Table 1, and the age distribution is depicted in Figure 2.

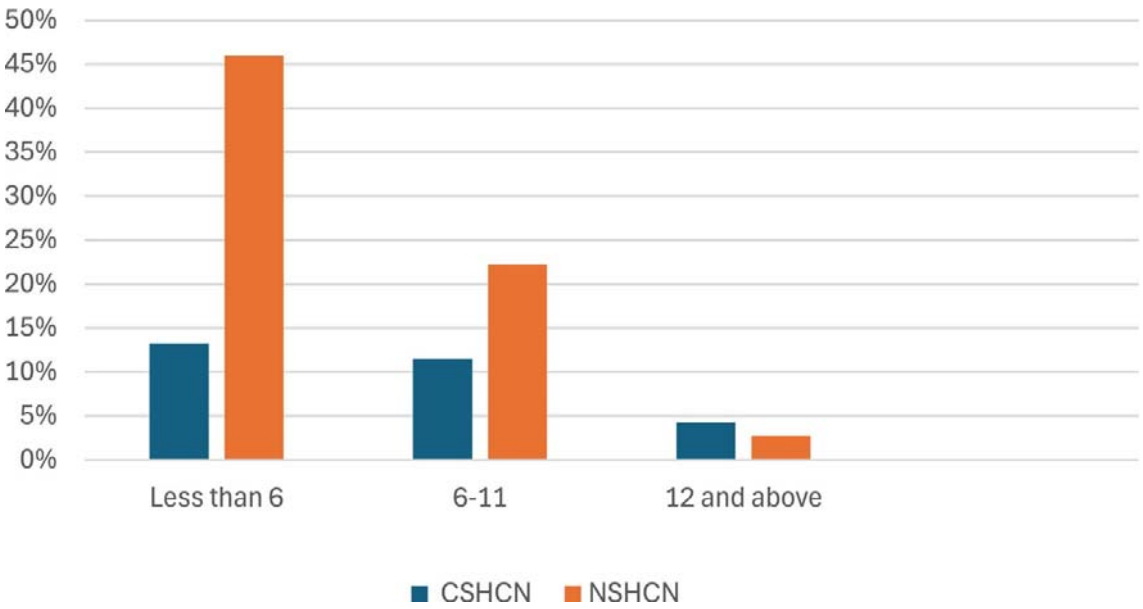

FIGURE 2. Age distribution of children with and without special healthcare needs.

3.2 Clinical Profile of the CSHCN

Figure 3 shows the medical conditions of the CSHCN who presented for dental treatment under GA. The majority of the CSHCN had cerebral palsy (CP) ($n = 26$; 22.4%) followed by 19% who had various systemic conditions, inter alia cardiac, endocrine, respiratory, immune suppression or cancer.

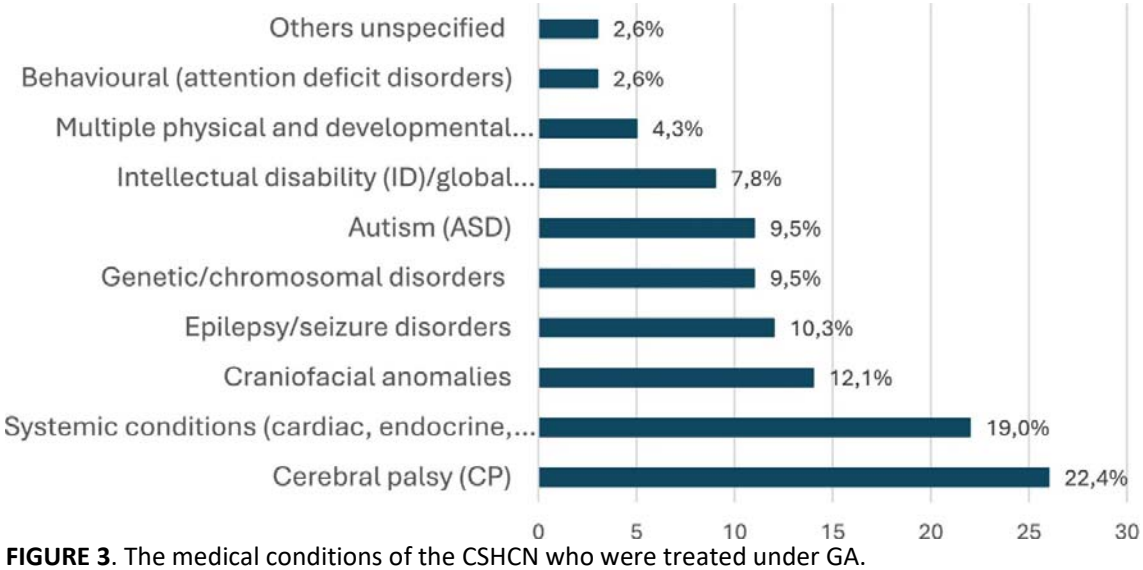

FIGURE 3. The medical conditions of the CSHCN who were treated under GA.

The characteristics of the entire population categorised by age are shown in Table 2. There were significant associations between centre ($p < 0.001$), sex ($p = 0.033$), being CSHCN ($p < 0.001$), dental diagnosis ($p < 0.001$) and the age category of the child. There was not enough evidence to show a statistically significant association between referral status and age category of the child.

TABLE 2. Study sample variables by age category.

Variable	**< 6 years *n* = 237**	**6–11 years *n* = 135**	**12–16 years *n* = 28**	***p***
Centre *n* (%)				
A	100 (42.2)	70 (51.9)	17 (60.7)	< 0.001
B	48 (20.3)	48 (35.5)	3 (10.7)	
C	89 (37.5)	17 (12.6)	8 (28.6)	
Sex *n* (%)				
Female	109 (46)	49 (36.3)	17 (60.7)	0.033
Male	128 (54)	86 (63.7)	11 (39.3)	
SHCN *n* (%)				
NSHCN	184 (77.6)	89 (65.9)	11 (39.3)	< 0.001
CSHCN	53 (22.4)	46 (34.1)	17 (60.7)	
Previous dental history *n* (%)				
Yes	19 (8.0)	37 (27.4)	6 (21.4)	< 0.001
No	218 (92.0)	98 (72.6)	22 (78.6)	
Dental diagnosis *n* (%)				
Dental caries related	229 (96.6)	118 (87.4)	15 (53.6)	< 0.001
Non-caries related	8 (3.4)	17 (12.6)	13 (46.4)	

Note: Dental caries related = caries, pulpitis, periapical infection; non-caries related = dentofacial anomalies, trauma, cysts.

The dental diagnosis and management of CSHCN and NSHCN categorised by age, are presented in Table 3. Dental caries, pulpitis and periapical infections occurred most commonly in both CSHCN and NSHCN across all age groups, except in NSHCN older than 12 years. Multiple extractions were commonly done among CSHCN across age categories (45%–54%) and among the NSHCN aged 6–11 years (52.8%). In addition, about a quarter (26.1%) of CSHCN aged 6–11 and 27.2% of NSHCN younger than 6 years received restorative care. Overall, both groups received mainly extractions (43.5%), while 20% had restorative care and < 10% had preventative care.

TABLE 3. Dental diagnosis and management of CSHCN and NSHCN.

Characteristic	**CSHCN *n* = 116**			**NSHCN (*n* = 284)**			**Total (*n* = 400)**
Age category	< 6	6–11	12–16	< 6	6–11	12–16	
n(%)	53(45.7)	46(39.6)	17(14.6)	184(64.8)	89(31.3)	11(3.9)	
Sex *n* (%)							
Female	18 (34)	19 (41.3)	11 (64.7)	91 (49.6)	30 (33.7)	6 (54.5)	175 (43.7)
Male	35 (66)	27 (58.7)	6 (35.3)	93 (50.5)	59 (66.3)	5 (45.5)	225 (56.3)
Previous dental history *n* (%)							
No	46 (86.8)	36 (78.3)	15 (88.2)	172 (93.4)	62 (69.7)	7 (63.6)	338 (84.5)
Yes	7 (13.2)	10 (21.7)	2 (11.8)	12 (6.5)	27 (30.3)	4 (36.4)	62 (15.5)
Clinical diagnosis *n* (%)							
Dental caries	48 (84.9)	41 (89.1)	13 (76.5)	181 (98.4)	77 (86.5)	2 (18.2)	362 (90.5)
Non-caries related	5 (9.4)	5 (10.9)	4 (23.5)	3 (1.6)	12 (13.5)	9 (81.8)	38 (9.5)
Dental treatment provided *n* (%)							
Preventative	4 (7.5)	—	3 (17.6)	20 (10.9)	9 (10.1)	2 (18.2)	38 (9.5)
Multiple extractions	29 (54.7)	21 (45.7)	8 (47.1)	68 (37)	47 (52.8)	1 (9.1)	174 (43.5)
Restorative	6 (11.3)	12 (26.1)	1 (5.9)	50 (27.2)	10 (11.2)	—	79 (19.8)
Others	2 (3.8)	3 (6.5)	1 (5.9)	—	8 (9)	2 (18.2)	16 (4)
Treatment not indicated	12 (22.6)	10 (21.7)	4 (23.5)	46 (25)	15 16.8	6 (54.5)	93 (23.2)
Pharmacological management *n* (%)							
GA	37 (69.8)	32 (69.6)	9 (52.9)	111 (60.3)	34 (38.2)	—	223 (55.8)
LA	4 (7.5)	3 (6.5)	4 (23.5)	22 (12)	31 (34.8)	3 (27.3)	67 (16.7)
IV Sedation	—	—	—	—	5 (5.6)	—	5 (1.2)
Non-pharmacological	—	1 (2.2)	—	5 (2.7)	4 (4.5)	2 (18.2)	12 (3)
Treatment not indicated	12 (22.6)	10 (21.7)	4 (23.5)	46 (25)	15 (16.9)	6 (54.5)	93 (23.2)

Abbreviations: GA, general anaesthesia; IV, intravenous; LA, local anaesthetic; Others, dentofacial/orthodontics, endodontics, biopsy.

More than two thirds (69.8%) of CSHCN and 60% of NSHCN younger than 6 years had treatment under GA. In contrast, in the 6–11-year-old age group, a higher percentage (69.6%) of CSHCN received treatment under GA than their NSHCN (38.2%). About one-third (34.8%) of NSHCN aged 6–11 years had treatment under local anaesthetic.

The demographic and clinical characteristics of the patients by the type of behavioural management (GA/non-GA) are shown in Table 4. Of the total sample, only 307 patients received treatment while 93 patients did not have any treatment recorded and were omitted from further analyses. There were significant associations between age ($p < 0.001$), being CSHCN ($p < 0.001$), dental diagnosis ($p < 0.001$), treatment provided ($p < 0.001$) and the type of behavioural management. There was not enough evidence to show a statistically significant association between referral status and centre with type of behavioural management.

TABLE 4. Sample characteristics according to GA and non-GA management.

	GA = 223 (72.6)	**Non-GA = 84 (27.4)**	**Total = 307 (100)**	***p***
Age groups				
Younger than 6 years	148 (66.4)	31 (36.9)	179 (58.3)	< 0.001
6–11 years	66 (21.5)	44 (52.4)	110 (35.8)	
12 years and above	9 (12.1)	9 (10.7)	18 (5.9)	
Medical status				
CSHCN	78 (35)	12 (14.3)	90 (29.3)	< 0.001
NSHCN	145 (65)	72 (85.7)	217 (70.7)	
Centre				
A	80 (35.9)	35 (41.7)	115 (37.4)	0.22
B	67 (30)	29 (34.5)	96 (31.3)	
C	76 (34.1)	20 (23.8)	96 (31.3)	
Dental diagnosis				
Caries related	220 (98.7)	64 (76.2)	284 (92.5)	< 0.001
Non-caries related	3 (1.3)	20 (23.8)	23 (7.5)	
Treatment provided				
Preventative	16 (7.2)	22 (26.2)	38 (12.4)	< 0.001
Multiple extractions only	136 (61)	38 (45.2)	174 (56.7)	
Restorative and rehabilitation	71 (31.8)	8 (9.5)	79 (25.7)	
Others	0 (0)	16 (19.0)	16 (5.2)	
Referral status				
Referred	77 (34.5)	21 (25)	98 (31.9)	0.11
Self-referral	146 (65.5)	63 (75)	209 (68.1)	

Note: GA = dental treatment under general anaesthesia; significant at *p*-value < 0.05; 'others' = dentofacial/orthodontics, endodontics, biopsy; () = %.

4 Discussion

This study compared the dental care provided to CSHCN and NSHCN treated under GA at ADHs in SA. Among the CSHCN, the medical indications for treatment under GA included CP, various systemic conditions, craniofacial disorders, seizure disorders, autism, and intellectual disabilities. This finding emphasizes the need to understand individual risk factors based on the underlying medical condition to reduce the need for treatment under GA for these children.

Our study is among the first to assess the dental care provided under GA to CSHCN in ADHs. The results of our study highlighted the types of paediatric patients both CSHCN and NSHCN

that are perceived by dentists to be more challenging to treat in the PHC settings. Our study findings revealed a lack of comprehensive data on CSHCN in the ADHs of SA, therefore, proper planning for dental care services for these children is difficult.

One third of our study sample were CSHCN, 50% of whom presented with developmental disabilities (DD) such as CP, ID, epilepsy, developmental delay or ASD. These children were typically under 6 years, male and half had been referred from PHC centres. Comparable findings were reported in a study conducted at an academic hospital in the United States (US) where 29.2% of the 1708 children treated under GA were CSHCN the majority with various DD [2]. Notably, despite the socio-economic differences in study settings (SA: middle income and US: high-income) the proportions of children with DD were similar, and perhaps point to common challenges of providing dental treatment for children with DD at PHC centres. This underscores the need to improve training in special care dentistry to facilitate access to dental care for CSHCN and reduce oral health disparities. Furthermore, the prevalence of children with DD has been shown to be greater in low-and middle-income countries [23] which increases the demand for health services for these children.

In our study, the CSHCN were significantly older compared to NSHCN. The mean age in our study (CSHCN: 6 years; NSHCN: 4 years) was lower than in a study in Turkey (CSHCN: 7.9 years; NSHCN: 5.7 years) [24]. In Taiwan, the findings were comparable to our study (CSHCN: 7.2 years; NSHCN 3.6 years) [25]. Whilst in one SA study the mean age of CSHCN treated under GA was 6.7 years which was comparable to our study [15]. In another SA study, the mean age was 3.7 years which was close to the average age of 4 years among NSHCN in our study [20].

The majority of the patients receiving treatment under GA in our study were CSHCN below the age of 11 years and NSHCN younger than 6 years. Pre-school children in need of extensive dental treatment are unable to withstand multiple dental appointments, possibly resulting in higher referrals for GA treatment. Sedation or GA is recommended to provide comprehensive, safe, and quality dental care for CSHCN when physical restraint for stabilisation is not feasible [16]. Furthermore, there is a great need in SA for strategies to prevent caries that target pre-school children including CSHCN to reduce the need for GA treatment. Interventions that reduce caries and the cost of care are likely to be more effective from a public health and policy making perspective [26]. An integrated maternal and oral health policy could perhaps address the burden of childhood caries in SA [27].

Our study found that most of the patients were self-referrals (66.8%) and only one third of the patients had been referred to ADHs for treatment. A significantly greater number of CSHCN (52.6%) were referred for treatment under GA than NSHCN (25.4%). Comparable findings were reported in Canada where primary GA treatment centres for CSHCN were hospitals [28]. The relatively higher referral of CSHCN compared to NSHCN groups suggest challenges in providing dental care for CSHCN by oral healthcare professionals working in PHC settings. These challenges were not explored in our study but could be attributed to limited personnel trained in special care dentistry and may indicate the need for specialised paediatric clinics.

Most of the CSHCN (78%–88%) across the age categories and NSHCN younger than 6 years (93%) had no previous dental care. There was an association between previous dental history

and age category. However, there was no association between previous dental treatment and having a special health care need. In contrast to our findings, in the US, significantly more children with DD compared to those without DD reported having used dental care services in the previous 12 months (86.1% vs. 76.1%) [29]. Some of the reasons for the lack of dental care reported among CSHCN from the parents' perspectives included a fear associated with dental treatment, uncooperative behaviour and a medical condition that could affect dental treatment [5]. We did not examine the barriers to the use of dental care services among the parents/caregivers. This is an area of future research.

Dental caries and its sequelae were the most common indications for GA treatment among the children in our study who were mainly under 6 years of age. There were significant associations between age, being CSHCN, dental diagnosis with type of behavioural management. Dental caries was the most common reason for GA treatment among CSHCN in Alberta [28]. Childhood caries is a common problem in SA children with prevalence rates of 47.74% reported in 2 to 5-year-old children in Johannesburg [30] and 71.6% among children under 6 years of age in the Western Cape [31]. Studies have found that the caries prevalence ranges between 22.5% and 85.2% among CSHCN in SA [7-11]. This high burden of childhood caries is a public health concern [13], and is a strain on the health system due to the high cost of providing GA treatment. Other challenges facing the SA public health sector include a lack of budgetary allocation for oral health care services [32] and a lack of human resources [33].

Our study found that extractions were commonly done among CSHCN aged below 11 years and adolescents above 12 years (45%–54%), and among the NSHCN aged 6–11 years (52.8%). In addition, about a quarter (26.1%) of CSHCN aged 6–11 and 27.2% of NSHCN younger than 6 years received restorative care. Comparable findings were reported in Alberta where treatment provided under GA for CSHCN was primarily extractions (76.5%) but with higher (57.5%) restorative care [28]. In Taiwan, a greater mean number of teeth was extracted in patients with disabilities compared to healthy children [25]. Similarly, in Turkey, the mean number of extracted teeth was greater in the CSHCN group than NSHCN [24]. Pulp treatment at initial GA treatment in younger patients with multiple disabilities increased the risk of subsequent GA need whereas extractions, preventive and crowns reduced the risk of future GA treatment [28]. Notably, only a very small proportion of children in our study received preventative treatment. There is a need to emphasise preventative care post GA treatment to reduce the risk of subsequent GA for these children. Establishing dental homes that are accessible to the children may increase access to regular preventative care. Oral health promotion activities targeting parents/caregivers of CSHCN are important in creating awareness especially in PHC centres.

We found that almost a quarter of the children who had received an initial GA assessment had not received treatment, pointing to a lack of access to care. This may have been partly due to the long waiting time for GA in the ADHs. The average waiting time from the initial dental assessment to the date of GA treatment has been reported in SA as 4.98 months [20]. Perhaps the relatively higher number of children receiving GA treatment versus non-GA in our study may have caused delays in accessing GA services in our hospitals. Failure of the patients to arrive for their appointment due to distance from the hospitals is another possible reason and is an area of future research.

Finally, our study indicated that the dental treatment provided was associated with the type of behavioural management. More preventative treatment was provided in non-GA cases while multiple extractions, restorative and crowns were done under GA. Although GA is indicated for some CSHCN, it has risks including airway obstruction, aspiration in CP patients or oversedation. Furthermore, GA increases the economic burden due to the need for theatre facilities, personnel, children's ward, and supplies [17]. Proper follow-up of children after GA treatment is essential as limited access to preventative care may increase the need for future GA for re-treatment of dental caries [2]. This has been highlighted by one study at an academic hospital in Pretoria, SA, where only 18% of children returned for follow-up within 15 months after GA, and half of them required further GA treatment for severe caries [20].

Understanding the barriers to preventative dental care for young children (NSHCN) and CSHCN, may enhance follow-up after GA treatment. Child anxiety, provider willingness and proximity to such providers are some of the challenges faced by parents of CSHCN in obtaining dental care [2]. Providing a dental home for CSHCN in PHC centres may improve access to early and continued preventative dental care [34], and perhaps reduce the burden of GA in our resource constrained settings. The proposed maternal and child oral health policy for SA [27] suggests that integrating oral healthcare into PHCs specifically in maternal and child services and enhanced interdisciplinary networks could improve the oral health of SA children under 6 years.

Our study had some limitations such as the retrospective design and the use of secondary data from the clinical records. Also, the estimated sample size was affected by a lack of organised filing of records in hospitals B and C, resulting in a smaller sample. Furthermore, 93 of the patients had no treatment assigned, which limited the ability to carry out regression analyses. These records were not designed and documented for research study purposes. Therefore, the results of this study cannot be generalised for all the CSHCN and NSHCN in SA but serves as a background for further studies. It is recommended that record keeping of all patients be done in a standardised and comprehensive manner to facilitate future clinical audits. Electronic or digital records could facilitate and improve data storage and access.

In conclusion, patients in need of GA treatment at ADHs in SA were CSHCN or NSHCN typically under the age of 6 years, presenting with extensive caries. The treatment provided consisted mainly of extractions with little restorative care. Limited preventative treatment was provided highlighting the need to identify children at risk of caries to institute timely preventative strategies to promote better oral health and reduce the burden of treatment under GA. In addition, we recommend a review of the curriculum for general dentists in SA which incorporates child management together with training of specialist paediatric dentists.

Author Contributions

N.N. designed the study, collected, and analysed the data, led the writing as part of her PhD thesis. A.M. and P.H. edited, revised, and critically reviewed the work. All authors approved the final paper.

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Ethics Statement

The study was approved by the Human Research Ethics Committee (Medical) of the University of the Witwatersrand (Clearance number: M220266).

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data for this study may be available from the corresponding author upon reasonable request.

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