# Untreated dental caries in children with cerebral palsy in the Brazilian context

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**Objectives.** To assess the prevalence of untreated dental caries in children with cerebral palsy and to assess socio-demographic, behavioural, and clinical covariates. **Design.** Cross-sectional assessment of 200 children and adolescents with cerebral palsy (2–17 years old) enrolled in a specialized healthcare unit in São Paulo, Brazil. The dental examination followed the World Health Organization's guidelines for oral health surveys; familial caretakers informed on socio-economic status and behaviour; the patient's medical record informed their clinical status.

**Results.** The proportion of children that presented at least one tooth affected by untreated caries was

49.5%. Poor socio-economic standings and a higher frequency of sugar consumption associated with a worse profile of dental health; different types of cerebral palsy (spastic, tetraparesis) did not. The prevalence of untreated caries was higher than reference values assessed for the overall population of the same age range.

**Conclusions.** The high burden of untreated dental caries on cerebral palsy patients reinforces the importance of the dentist in the interdisciplinary healthcare team attending these children. Factors associated with this outcome are the same for the general population; these findings underscore the necessity of implementing effective caries prevention in this population of cerebral palsy children.

#### Introduction

Cerebral palsy (CP) is an 'umbrella term' covering a group of nonprogressive, but often changing motor disorders that occur during early stages of life due to damage to the brain<sup>1</sup>. This syndrome may be congenital or acquired after birth, and its early symptoms usually manifest during the perinatal period. Although CP differs from person to person and may change over time, it often includes difficulties with fine motor tasks, involuntary movements, imbalance and walking inability. Moderately severe or severe CP was estimated to affect from 1.5 to 2.5 per 1000 live births<sup>2</sup> in Brazil. An increase of incidence in Brazil followed an improved survival of children with low birthweight<sup>3</sup>.

Cerebral palsy comprises different clinical that may increase the risk of caries or make

Correspondence to:

dental treatment more difficult. Spastic CP refers to patients presenting stiffness of muscles and awkward movement. Nonspastic CP comprised ataxic (lack of motor coordination), athetoid (ceaseless involuntary writhing movements), and mixed conditions. Damage to brain tissue may result in partial or generalized paralysis of CP patients. Tetraparesis refers to paralysis of all four limbs, hemiparesis refers to reduced movement of one side of the body and diparesis of two corresponding limbs.

Most people affected by CP also present other medical disorders such as mental impairment, diminished emotional control and sensorial perception, convulsions and uncontrolled movements, stiffness, deafness, and strabismus. As regards to the stomatognathic system, CP patients frequently suffer a reduced function of speech, mastication, and swallowing, which increases their risk of caries and rehabilitation process<sup>4</sup>.

Cerebral palsy patients present a reduced self-cleansing function of the oral cavity, due to account of drooling and abnormal movements

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of the tongue and facial muscles. Their usual diet is rich in pastry food and carbohydrates, and familial caregivers have difficulties in complying with an appropriate oral hygiene<sup>4,5</sup>. No specific oral pathology is associated with CP; the same diseases that affects the overall population can affect these children, although with a higher prevalence or severity due to their impaired motor skills<sup>6</sup>. In special cases, dental caries, gingival alterations, malocclusion, bruxism, dental erosion and enamel hypoplasia have been reported as more frequent or severe<sup>6,7</sup>.

The insufficient provision of dental care specifically programmed for special children has been reported as a longstanding condition<sup>8</sup>. Waldman and Perlman<sup>9</sup> stated that dentists have not been fully integrated into the interdisciplinary healthcare team assisting CP patients, and that the syllabus of dental schools usually does not provide adequate experience for managing patients with disabilities.

Despite the recent decline of caries indices for the overall population, a significant proportion of children with CP remain at an increased risk for the disease<sup>5</sup>. The current study aims to address the prevalence of untreated dental caries in the primary and permanent dentition of children and adolescents with CP in the Brazilian context, and to assess socio-demographic, behavioural, and clinical covariates.

## Methods

## Patients

The Associação de Assistência à Criança Deficiente (AACD-SP) is a large nongovernmental organization specializing in providing medical and social care to children with disabilities in the city of São Paulo, Brazil. All children and adolescents with CP and enrolled in this institution from February to May 2004 were considered eligible for the study. The sample consisted of 200 patients aged 2–17 years; 88 (44%) of them were females. As to clinical conditions, 178 (89%) patients had spastic CP; tetraparesis affected 74 (37%) of them, and diparesis affected 75 (38%). Five patients presented a negative history of peroral nutrition and were exclusively fed by gastrostomy tube insertion. The assessment of prevalence did not

exclude these patients, despite acknowledging their reduced caries risk.

# *Clinical, socio-demographic, and behavioural information*

The clinical status of examined children and adolescents was informed by the patient record available at the healthcare unit. Examined patients were classified as presenting spastic or nonspastic CP, and as affected or non-affected by tetraparesis.

Familial caretakers answered a detailed questionnaire assessing their own socio-demographic characteristics: schooling level (comparing those that completed 8 years of fundamental education with those that did not), income (as measured in terms of the Brazilian minimum wage, a standard for this type of assessment, which nearly corresponds to \$U\$100), occupation, kinship to the patient, and household characteristics (number of rooms and dwellers, whether the patient has any siblings). The form also contained a section on behavioural characteristics of patients, which contained information on the frequency of tooth brushing, if they were able to brush their own teeth, and if caretakers had been informed on how to perform or monitor the patient's oral hygiene. In Brazil, the market share of fluoride toothpaste corresponds to almost 100% since 1990<sup>13</sup>; therefore, the regular use of dentifrice is an important implement to caries prevention.

The questionnaire also inquired into aspects of their diet: whether it comprised solid, liquid, or pastry food, and the frequency of sugar intake, in an assessment that specifically addressed sugary foods and beverages. No specific food frequency questionnaire was applied; familial caretakers were simply asked to recall the whole food intake during the last three days, which allowed summing up how many times the child ate sweets, sugared crackers and candies, and drank soft drinks or sugared beverages. The pattern of sugar consumption was inferred from this scheme: high (more than three daily events of sugar intake during the last three days), medium (three daily events of sugar intake), or low (one or two daily events).

## Dental examination

A single dentist performed the examinations following international criteria standardized by the World Health Organization<sup>10</sup> for oral health surveys. The dentist was specifically trained by the School of Dentistry of the University of São Paulo, one of the governmental agencies that sponsor the training of dentists for the official surveys on oral health conducted in Brazil. The assessment of intra-observer reproducibility involved the re-examination of one-tenth of the whole sample; the resulting kappa statistics for the assessment of caries (0.98) was considered satisfactory for this type of assessment<sup>11</sup>.

Patients were examined at the dental office of the AACD-SP, using a dental chair, corrected artificial illumination (blue-white colour spectrum), gloves, plane mouth mirrors, and periodontal (CPI) probes. The use of artificial illumination is not supported by the World Health Organization's guidelines; notwithstanding, we choose to use resources available at the dental facility as we were unaware of evidence reporting that this option might yield systematic bias for the gathering of data.

The appraisal of caries experience used the dmft<sup>10</sup>. A multiple entry scheme for comparative analyses discriminated 166 children presenting primary dentition and 113 for the permanent dentition. Seventy-two children with mixed dentition were concurrently assessed for caries in deciduous and permanent teeth.

DMFT and dmft information allowed differentiating between children and adolescents with and without untreated dental caries; a variable extensively used by a collaborative international study<sup>12</sup> conducted by the World Health Organization and the University of Chicago for the appraisal of effectiveness of dental healthcare systems. Having at least one deciduous or permanent tooth affected by untreated caries (a nonzero 'dt' or 'DT' components of the dmft and DMFT indices) was the outcome variable of the study.

#### Data analysis

The statistical analysis used Stata 8.0, 2003. The association between the prevalence of

untreated caries and each covariate on sociodemographic, clinical, and behavioural characteristics of children with CP was appraised in terms of the prevalence ratio, as assessed by multivariate Poisson regression analysis<sup>14</sup> with robust variance estimation and control by age. We also fitted a multivariate model of Poisson regression analysis, also controlled by age, which adjusted the outcome to covariates selected by a forward stepwise procedure, with P < 0.25 as the cut-off for entering and P < 0.05for keeping covariates in the model.

# Ethical approval

The study protocol observed international statutes and national legislation on ethics in research involving human beings, and was approved by the participant institutions' committees (AACD-SP – N. 72/2003; and School of Dentistry of the University of São Paulo – N. 221/03).

#### Results

In this group of children and adolescents with CP, the caries prevalence increased with age (Table 1). Regarding the distribution of decayed, missing and filled teeth, more treatment had been performed in the permanent dentition than in the primary (Fig. 1). Eighty percent of children with caries in the primary dentition had had no dental treatment at all; a significantly higher proportion than the corresponding figure for patients with caries in the permanent dentition: 56% (P = 0.005).

The overall proportion of patients with untreated caries was 49.3%. Reflecting the concurrent increase in caries indices and access to dental treatment with age, the prevalence of untreated caries in deciduous or permanent teeth also varied amongst the age groups (Fig. 1).

The prevalence of untreated caries associated with socio-demographic and behavioural characteristics was examined in children and adolescents. Patients with CP had at least one sibling presenting higher prevalence of untreated dental caries, in an assessment controlled by age (Table 2); the same was observed for those dwelling in crowded households. The educational attainment of the familial caretaker significantly

	Age group				
Primary dentition	2–3 years old ( <i>n</i> = 42)	4–7 years old ( <i>n</i> = 90)	8–12 years old ( <i>n</i> = 33)		
dmft = 0	30 (71%)	36 (40%)	11 (32%)		
Decayed teeth	2.2 (4.8)	2.7 (3.8)	2.8 (3.5)		
Missing teeth	0.0 (0.0)	0.1 (0.3)	0.1 (0.7)		
Filled teeth	0.0 (0.0)	0.4 (1.2)	0.5 (1.1)		
dmft index	2.2 (4.8)	3.1 (4.0)	3.3 (3.9)		
Permanent dentition	4–7 years old ( <i>n</i> = 39)	8–12 years old ( <i>n</i> = 40)	13–17 years old ( <i>n</i> = 27)		
DMFT = 0	35 (90%)	25 (63%)	8 (30%)		
Decayed teeth	0.0 (0.2)	0.8 (1.4)	1.4 (2.0)		
Missing teeth	0.0 (0.2)	0.0 (0.2)	0.1 (0.3)		
Filled teeth	0.2 (0.7)	0.1 (0.4)	1.2 (2.2)		
DMFT index	0.2 (0.7)	0.9 (1.4)	2.7 (2.8)		

Table 1. Proportion of patients free of caries, and dmft and DMFT averages (standard deviation) among children and adolescents with CP, by age groups and type of dentition.



**Fig. 1.** Prevalence of untreated caries in deciduous or permanent teeth (DT,  $dt \ge 1$ ) and 95%, confidence interval of children and adolescents with CP.

correlated with the outcome variable, and the dental profile of children and adolescents with CP benefited from being cared by people that had completed at least the basic schooling level.

A higher frequency of sugar intake was the main behavioural covariate associated with the outcome on untreated caries (prevalence ratio = 2.00; P < 0.001). As to the clinical status of participating children, those presenting tetraparesis or spastic CP had a poorer profile on dental caries than their counterparts (Table 2). The multivariate assessment of risk factors for untreated caries in children and adolescents with CP comprised of two covariates on sociodemographic characteristics and one covariate on behaviour (Table 3). Being attended by a familial caretaker who completed the basic schooling level anticorrelated with the outcome variable (adjusted prevalence ratio = 0.70, P = 0.042); having at least one sibling (adjusted prevalence ratio = 1.66, P = 0.017), and consuming sugared foods and beverages at a medium or high frequency (adjusted prevalence ratio = 1.91, P = 0.001) correlated with a higher burden of dental disease.

#### Discussion

The proportion of CP children with caries that never received dental restorative treatment was higher in younger children with a primary dentition than in older children with a permanent dentition. An analysis of caries prevalence of children living in São Paulo showed that a low level of restorative dental treatment in the primary dentition in 5- and 6-year-old children<sup>15</sup>. The lower provision of restorative dental treatment for children with primary dentition is widespread and has been attributed to cultural factors involving both dental caregivers and parents<sup>16</sup>.

The prevalence of untreated caries assessed in the 4- to 7-year-old (54.4%) and 8- to

Socio-demographic characteristics         Females         46         42         1.07 (0.81–1.42)         0.632           Who is the caretaker         Mother         84         85         1.04 (0.70–1.55)         0.839           Occupation of the familial caretaker         Do work         27         23         1.11 (0.82–1.51)         0.500           Do not work         72         78         1.11 (0.82–1.51)         0.500           Instruction of the familial caretaker         Complete basic schooling         24         47         0.59 (0.41–0.86)         0.005           Instruction of the familial caretaker         Complete basic schooling         75         4         1.72         0.74 (0.50–1.11)         0.143           Familial income $\geq$ 3 Brazilian MW**         17         25         0.74 (0.50–1.11)         0.143           Household crowding $\leq$ 1.0 inhabitants per room         71         44         1.92 (1.38–2.69)         < 0.011           Having at least one sibling         Yes         82         64         1.74 (1.13–2.67)         0.012           Type of cerebral palsy         Spastic         87         91         0.93 (0.61–1.43)         0.751           Affected by tetraparesis         Yes         38         36         1.09 (0.82–1		Comparison groups ratio* (95% CI)	DT, dt ≥ 1	DT, dt = 0	Prevalence	<i>P</i> -value
Gender         Females         46         42         1.07 ( $0.81-1.42$ )         0.632           Males         53         59           Who is the caretaker         Mother         84         85         1.04 ( $0.70-1.55$ )         0.839           Occupation of the familial caretaker         Do work         27         23         1.11 ( $0.82-1.51$ )         0.500           Instruction of the familial caretaker         Do not work         72         78         1         1         0.59 ( $0.41-0.86$ )         0.005           Instruction of the familial caretaker         Complete basic schooling         75         54         76           Familial income $\geq 3$ Brazilian MW**         17         25         0.74 ( $0.50-1.11$ )         0.143 $< 3$ Brazilian MW**         17         25         0.74 ( $0.50-1.11$ )         0.143 $< 3$ Brazilian MW**         82         76         76           Household crowding         > 1.0 inhabitants per room         71         44         1.92 ( $1.38-2.69$ )         < 0.011	Socio-demographic characteristics					
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Who is the caretaker         Mother         84         85         1.04 (0.70-1.55)         0.839           Occupation of the familial caretaker         Do work         27         23         1.11 (0.82-1.51)         0.500           Instruction of the familial caretaker         Complete basic schooling         24         47         0.59 (0.41-0.86)         0.005           Familial income $\geq$ 3 Brazilian MW**         17         25         0.74 (0.50-1.11)         0.143           Familial income $\geq$ 3 Brazilian MW**         82         76         0.001         0.012           Household crowding         > 1.0 inhabitants per room         71         44         1.92 (1.38-2.69)         < 0.012		Males	53	59		
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Occupation of the familial caretaker         Do work         27         23         1.11 (0.82–1.51)         0.500           Instruction of the familial caretaker         Complete basic schooling         24         47         0.59 (0.41–0.86)         0.005           Familial income $\geq$ 3 Brazilian MW**         17         25         0.74 (0.50–1.11)         0.143           Household crowding $\geq$ 3 Brazilian MW**         17         25         0.74 (0.50–1.11)         0.143           Household crowding $>$ 1.0 inhabitants per room         71         44         1.92 (1.38–2.69)         <0.012		Others	15	16		
Do not work7278Instruction of the familial caretakerComplete basic schooling24470.59 (0.41–0.86)0.005Incomplete basic schooling7554Familial income $\geq$ 3 Brazilian MW**17250.74 (0.50–1.11)0.143 $<$ 3 Brazilian MW**8276767878Household crowding> 1.0 inhabitants per room71441.92 (1.38–2.69)<0.001	Occupation of the familial caretaker	Do work	27	23	1.11 (0.82–1.51)	0.500
Instruction of the familial caretaker Complete basic schooling 24 47 0.59 (0.41–0.86) 0.005 Incomplete basic schooling 75 54 Familial income $\geq$ 3 Brazilian MW** 17 25 0.74 (0.50–1.11) 0.143 < 3 Brazilian MW** 82 76 Household crowding $>$ 1.0 inhabitants per room 71 44 1.92 (1.38–2.69) $<$ 0.001 $\leq$ 1.0 inhabitants per room 28 57 Having at least one sibling Yes 82 64 1.74 (1.13–2.67) 0.012 No 17 37 Clinical characteristics Type of cerebral palsy Spastic 87 91 0.93 (0.61–1.43) 0.751 Monspastic 12 10 Affected by tetraparesis Yes 38 36 1.09 (0.82–1.45) 0.560 No 61 65 Behavioural characteristics Who does the oral hygiene Other 79 86 0.90 (0.63–1.28) 0.554 The patient itself 20 15 Oral hygiene (frequency) $\geq$ 3 times per day 41 42 No 72 66 Received instruction for performing oral hygiene Yes 27 35 0.81 (0.59–1.13) 0.213 No 72 66 Diet Solid 74 74 1.02 (0.74–1.41) 0.906 Diet Solid 74 74 1.02 (0.74–1.41) 0.906 Nonsolid 25 27 Nocturnal nursing bottle Yes 15 16 1.06 (0.70–1.60) 0.785 No 84 85 Sugar intake Medium or high frequency 78 57 1.92 (1.16–2.26) 0.005		Do not work	72	78		
Incomplete basic schooling7554Familial income $\geq$ 3 Brazilian MW**17250.74 (0.50-1.11)0.143 $<$ 3 Brazilian MW**827676Household crowding $>$ 1.0 inhabitants per room71441.92 (1.38-2.69)< 0.001	Instruction of the familial caretaker	Complete basic schooling	24	47	0.59 (0.41-0.86)	0.005
Familial income $\geq$ 3 Brazilian MW**       17       25       0.74 (0.50-1.11)       0.143         A Brazilian MW**       82       76       76         Household crowding       > 1.0 inhabitants per room       71       44       1.92 (1.38-2.69)       <0.001		Incomplete basic schooling	75	54		
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Household crowding       > 1.0 inhabitants per room       71       44       1.92 (1.38–2.69)       < 0.001		< 3 Brazilian MW**	82	76		
$\leq 1.0 \text{ inhabitants per room} 28 57$ Having at least one sibling Yes 82 64 1.74 (1.13–2.67) 0.012 No 17 37 Clinical characteristics Type of cerebral palsy Spastic 87 91 0.93 (0.61–1.43) 0.751 Nonspastic 12 10 Affected by tetraparesis Yes 38 36 1.09 (0.82–1.45) 0.560 No 61 65 Behavioural characteristics Who does the oral hygiene Other 79 86 0.90 (0.63–1.28) 0.554 The patient itself 20 15 Oral hygiene (frequency) $\geq 3$ times per day 41 42 1.00 (0.75–1.33) 0.993 Received instruction for performing oral hygiene Yes 27 35 0.81 (0.59–1.13) 0.213 No 72 66 Diet No 72 66 Diet Nonsolid 25 27 Nocturnal nursing bottle Yes 15 16 1.06 (0.70–1.60) 0.785 No 84 85 Sugar intake Medium or high frequency 78 57 1.92 (1.16–2.26) 0.005	Household crowding	> 1.0 inhabitants per room	71	44	1.92 (1.38–2.69)	< 0.001
Having at least one sibling       Yes       82       64       1.74 (1.13–2.67)       0.012         No       17       37         Clinical characteristics       Type of cerebral palsy       Spastic       87       91       0.93 (0.61–1.43)       0.751         Affected by tetraparesis       Yes       38       36       1.09 (0.82–1.45)       0.560         Behavioural characteristics       Yes       38       36       0.90 (0.63–1.28)       0.554         Who does the oral hygiene       Other       79       86       0.90 (0.63–1.28)       0.554         Oral hygiene (frequency)       ≥ 3 times per day       41       42       1.00 (0.75–1.33)       0.993         < 3 times per day	J. J	≤ 1.0 inhabitants per room	28	57		
No1737Clinical characteristicsType of cerebral palsySpastic87910.93 (0.61–1.43)0.751Affected by tetraparesisYes38361.09 (0.82–1.45)0.560No6165Behavioural characteristicsWho does the oral hygieneOther79860.90 (0.63–1.28)0.554Oral hygiene (frequency) $\geq$ 3 times per day41421.00 (0.75–1.33)0.993< 3 times per day	Having at least one sibling	Yes	82	64	1.74 (1.13–2.67)	0.012
Clinical characteristicsType of cerebral palsySpastic $87$ $91$ $0.93$ ( $0.61-1.43$ ) $0.751$ Nonspastic12 $10$ Affected by tetraparesisYes $38$ $36$ $1.09$ ( $0.82-1.45$ ) $0.560$ No $61$ $65$ Behavioural characteristicsWho does the oral hygieneOther $79$ $86$ $0.90$ ( $0.63-1.28$ ) $0.554$ Oral hygiene (frequency) $\geq 3$ times per day $41$ $42$ $1.00$ ( $0.75-1.33$ ) $0.993$ < 3 times per day	5	No	17	37		
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Affected by tetraparesisYes3836 $1.09 (0.82-1.45)$ $0.560$ Mo6165Behavioural characteristicsWho does the oral hygieneOther7986 $0.90 (0.63-1.28)$ $0.554$ Oral hygiene (frequency) $\geq$ 3 times per day4142 $1.00 (0.75-1.33)$ $0.993$ Received instruction for performing oral hygieneYes2735 $0.81 (0.59-1.13)$ $0.213$ No72667474 $1.02 (0.74-1.41)$ $0.906$ DietSolid7474 $1.02 (0.74-1.41)$ $0.906$ No848557 $1.92 (1.16-2.26)$ $0.075$ Sugar intakeMedium or high frequency7857 $1.92 (1.16-2.26)$ $0.075$		Nonspastic	12	10		
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Who does the oral hygiene       Other       79       86       0.90 (0.63-1.28)       0.554         The patient itself       20       15       15       15         Oral hygiene (frequency) $\geq$ 3 times per day       41       42       1.00 (0.75-1.33)       0.993         < 3 times per day	Rehavioural characteristics	NO	01	05		
Who does the oral hygiciteOral is a final set of a hygiciteOral is a hygiciteOr	Who does the oral bygiene	Other	79	86	0.90 (0.63_1.28)	0.554
Oral hygiene (frequency) $\geq 3$ times per day41421.00 (0.75-1.33)0.993< 3 times per day	Who does the oral hygicile	The nationt itself	20	15	0.50 (0.05 1.20)	0.554
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Received instruction for performing oral hygiene       Yes       27       35       0.81 (0.59–1.13)       0.213         No       72       66         Diet       Solid       74       74       1.02 (0.74–1.41)       0.906         Noturnal nursing bottle       Yes       15       16       1.06 (0.70–1.60)       0.785         No       84       85         Sugar intake       Medium or high frequency       78       57       1.92 (1.16–2.26)       0.005		2 3 times per day	58	42 59	1.00 (0.75-1.55)	0.995
No         72         66           Diet         Solid         74         74         1.02 (0.74–1.41)         0.906           Nonsolid         25         27         1.06 (0.70–1.60)         0.785           No         84         85           Sugar intake         Medium or high frequency         78         57         1.92 (1.16–2.26)         0.005	Received instruction for performing oral hygiene	Vos	27	35	0.81 (0.59_1.13)	0.213
No         72         00           Diet         Solid         74         74         1.02 (0.74–1.41)         0.906           Nonsolid         25         27         74         1.06 (0.70–1.60)         0.785           No         84         85         74         1.92 (1.16–2.26)         0.005           Sugar intake         Medium or high frequency         78         57         1.92 (1.16–2.26)         0.005	Received instruction for performing oral hygiene	No	72	66	0.01 (0.39-1.13)	0.215
Nonsolid         25         27         1.02 (0.74 1.41)         0.500           Nonsolid         25         27         25         27           Nocturnal nursing bottle         Yes         15         16         1.06 (0.70–1.60)         0.785           No         84         85           Sugar intake         Medium or high frequency         78         57         1.92 (1.16–2.26)         0.005	Diet	Solid	77	7/	1 02 (0 74-1 41)	0 906
Nocturnal nursing bottle         Yes         15         16         1.06 (0.70–1.60)         0.785           No         84         85           Sugar intake         Medium or high frequency         78         57         1.92 (1.16–2.26)         0.005		Nonsolid	25	27	1.02 (0.74 1.41)	0.500
No         84         85           Sugar intake         Medium or high frequency         78         57         1.92 (1.16–2.26)         0.005	Nocturnal nursing bottle	Voc	15	16	1.06 (0.70_1.60)	0 785
Sugar intake Medium or high frequency 78 57 1.92 (1.16–2.26) 0.005		No	84	85	1.00 (0.70-1.00)	0.785
Sugar make Simplified and Simplified	Sugar intake	Medium or high frequency	78	57	1 92 (1 16-2 26)	0.005
		Small frequency	21	11	1.52 (1.10 2.20)	0.000

Table 2. Assessment of association between the prevalence of untreated caries in deciduous or permanent teeth (DT,  $dt \ge 1$ ) and characteristics of children and adolescents with CP assisted at the AACD-SP, Dental Department, 2004.

\*Prevalence ratio and 95% confidence interval, adjusted by age, unadjusted by the remaining characteristics presented in the table, as assessed by Poisson regression with robust variance estimation.

\*\*Brazilian MW, Brazilian minimum wage, unit for measuring income, broadly corresponding to \$US100.

12-year-old (58.5%) groups were higher for CP children than for the overall population. The most recent dental survey in the state of São Paulo<sup>17</sup> found untreated caries for 44.7% of 5-year-old children and 34.8% of 12-year-old children. This observation is consistent with the hypothesis that children with neuromotor impairment would be more likely to have an impaired dental status.

Patients of low socio-economic status had higher levels of dental treatment needs. As the children and adolescents examined in this study were enrolled for attendance at a freeof-cost medical facility, they mostly came from low socio-economic areas and a high prevalence of untreated caries. The lower category of monthly income comprised 78.3% of the cohort; and 63.8% of them were assisted by a familial caretaker who had not completed the basic schooling level.

Household crowding has been used as a proxy for socio-economic status in epidemiological studies assessing the distribution of dental caries, because poorer subjects in Brazil live in crowded households<sup>18</sup>. Having a sibling also correlated with the outcome variable, which suggests the inability to properly monitor the diet, dental hygiene and treatment of CP children by parents who have more children. Restrictive socio-economic conditions was

Table 3. Multivariate assessment of association between the prevalence of untreated caries in deciduous or permanent teeth
(DT, dt $\geq$ 1) and characteristics of children and adolescents with cerebral palsy assisted at the AACD-SP, Dental Department,
2004.

	Comparison groups	Prevalence ratio* (95% CI)	P-value
Socio-demographic characteristics			
Instruction of the familial caretaker	Complete basic schooling	0.69 (0.48-0.99)	0.045
	Incomplete basic schooling		
Having at least one sibling	Yes	1.59 (1.05–2.40)	0.030
	No		
Behavioural characteristics			
Sugar intake	Medium or high frequency	1.81 (1.25–2.63)	0.002
	Small frequency		
Goodness-of-fit			
–2 Log likelihood	321.916		

\*Prevalence ratio and 95% confidence interval, adjusted by age and by the remaining characteristics presented in the table, as assessed by Poisson regression with robust variance estimation.

highlighted as a relevant factor for the dental status of patients presenting neurological deficit and reduced motor skills<sup>5,19,20</sup>, irrespective of the context they live in.

The intake of sugared foods and beverages, as regards to the comparison between usual frequency levels, associated with the prevalence of untreated caries in the sample; and was included in the multivariate model as the most relevant covariate, after adjustment for age and indices of socio-economic status. The frequent intake of food rich in starch and sugar is a well-known risk factor for dental caries<sup>4,6,21</sup>. The current assessment of association between caries prevalence and socio-economic and dietary characteristics is consistent with studies appraising children with CP in different contexts<sup>22–25</sup>.

The study protocol did not include a thorough debridement of the dentition during the examination, which may have affected the assessment of caries indices, on account that the quality of the examination may have been influenced by the cooperation and the oral hygiene status of the examined individual.

CP is classified according to the type of mobility alteration presented by the affected child: spastic, athetoid, ataxic and mixed. Spastic is the most common type of CP, accounting for nearly 80% of all cerebral palsy cases. Children with this type of cerebral palsy have one or more tight muscle groups which limit movement<sup>26</sup>. In the dental office, children with spastic CP have difficulties in cooperating, due to their high sensitivity to physical contact and neuromotor response to unusual stimulus such as noise, artificial light and position at the dental chair<sup>27</sup>. However, nonspastic children with CP did not have a better oral health in this study.

Tetraparesis also represents a further level of physical limitation for CP children. Patients with tetraparesis, however, did not present a poorer profile of unmet dental care needs than nonparetic patients or those with diparesis or hemiparesis.

Results presented here mostly refer to CP children and adolescents of poor socio-economic standings, and are relevant for the planning of health services. In particular, the indication of factors associated with caries experience, household conditions, instruction of the familial caretaker, sugar intake, can instruct healthcare professionals and families as to the importance of the attention that CP children can receive within their own household for the prevention of dental disease. The finding of a low level of restorative dental care in these patients reinforces the importance of promoting the integration of the dentist to the interdisciplinary team that provides healthcare for this segment of population. The access of CP children to an appropriate dental treatment may be effective for caries prevention, in addition to providing rehabilitation for dental disease, and reduce preventable pain, thus improving their functional status.

#### What this paper adds

- Children and adolescents with CP suffer a higher burden of untreated dental caries than their non-CP counterparts.
- Factors associating to the prevalence of untreated caries in patients with CP are the same, usually associated to this outcome for the overall population.
- CP children and adolescents with a spastic or tetraparetic clinical status did not present a higher prevalence of unmet dental care need.

#### Why this paper is important to paediatric dentists

- Being aware of factors associated with the prevalence of untreated caries in CP patients, dentists can instruct familial caretakers as to the importance of the attention that these children receive at their own households for the prevention of dental disease.
- The increased prevalence of untreated caries in this population reinforces the importance of integrating the dentist to the interdisciplinary team that provides assistance for children with CP.

#### Conclusions

Three important findings were found from this study. First, CP patients were reported to present a poorer dental status than other children of corresponding age group and geographical area, both for the primary and permanent dentition. Second, the most severe clinical forms of CP (spastic, tetraparetic) were highlighted as not being associated with a worse dental condition. Third, the most important factors associating with the dental health profile of CP patients (socio-economic and dietary characteristics) were analogous to those usually acknowledged for the overall population.

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