

## **Need for dental treatment in individuals with disabilities under general anesthesia: A retrospective cohort study**

**Necessidade de tratamento odontológico em pessoas com deficiência sob anestesia geral: Um estudo de coorte retrospectivo**

**Necesidad de tratamiento dental en personas con discapacidad bajo anestesia general: Un estudio de cohorte retrospectivo**

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## **Resumo**

Foi realizado um estudo de coorte retrospectivo como objetivo comparar a necessidade de tratamento odontológico, realizado sob anestesia geral (AG) em indivíduos com deficiência intelectual (DI), paralisia cerebral (PC), transtorno do espectro do autismo (TEA) ou síndrome de Down (SD) atendidos no serviço odontológico do Hospital São Julião, em Mato Grosso do Sul, Brasil. Foram coletados dados de 790 prontuários odontológicos de indivíduos de ambos os sexos com necessidades especiais de saúde (NES) entre 0 a 59 anos de idade, que realizaram tratamento sob anestesia geral (AG). Os pacientes foram avaliados, pelo prontuário os indivíduos foram divididos em quatro grupos: G1 (ID [n=321]); G2 (CP [n=285]); G3 (TEA [n=131]); e G4 (DS [n=53]). Procedimentos preventivos, restauradores e cirúrgicos foram realizados em centro cirúrgico; o estágio da doença cárie foi avaliado usando o instrumento *Caries Assessment Spectrum and Treatment* (i.e., CAST). O teste qui-quadrado e a análise de variância foram utilizados para as comparações, com nível de significância de 5%. Houve maior percentual de homens ( $p=0,0062$ ) e de indivíduos entre 19 e 35 anos ( $p<0,0001$ ). Os grupos diferiram significativamente ( $p<0,05$ ) quanto à média de idade, sendo o G3 o mais jovem. Com relação ao instrumento CAST, os sujeitos do G1 e G2 apresentaram percentual significativamente

maior do código 7 ( $p < 0,01$  [teste qui-quadrado]). Doze meses após o primeiro procedimento realizado sob AG, apenas 16,45% retornaram para uma segunda consulta. A necessidade de tratamento odontológico acumulou nos quatro grupos, com maior número de sujeitos diagnosticados com DI e PC (ou seja, G1 e G3, respectivamente).

**Palavras-chave:** Deficiência intelectual; Paralisia cerebral; Transtorno do espectro autista; Síndrome de Down; Saúde bucal.

### Abstract

This retrospective cohort study aimed to compare the need for dental treatment performed under general anesthesia (GA) among individuals with intellectual disabilities (ID), cerebral palsy (CP), autism spectrum disorder (ASD) or Down syndrome (DS) attended at the dental service of São Juliao's Hospital, in Mato Grosso do Sul, Brazil. Data from 790 dental records of individuals of both sexes with special health care needs (SHCNs) and 0 to 59 years of age, who underwent treatment under GA, were collected. Patients were evaluated and divided into four groups: G1 (ID [ $n=321$ ]); G2 (CP [ $n=285$ ]); G3 (ASD [ $n=131$ ]); and G4 (DS [ $n=53$ ]). Preventive, restorative, and surgical procedures were performed in a surgery center; the stage of caries disease was assessed using the Caries Assessment Spectrum and Treatment (i.e., CAST) instrument. The chi-squared test and analysis of variance were used for comparisons, with a significance level of 5%. There was a higher percentage of males ( $p=0.0062$ ) and subjects between 19 and 35 years of age ( $p < 0.0001$ ). The groups differed significantly ( $p < 0.05$ ) in terms of mean age, with G3 the youngest. Regarding the CAST instrument, subjects in G1 and G2 demonstrated a significantly higher percentage of code 7 ( $p < 0.01$  [chi-squared test]). Twelve months after the first procedure performed under GA, only 16.45% returned for a second appointment. The need for dental treatment accumulated in all four groups, with the greatest number of subjects diagnosed with ID and CP (i.e., G1 and G3, respectively).

**Keywords:** Intellectual disability; Cerebral palsy; Autism spectrum disorder; Down syndrome; Oral health.

### Resumen

Se realizó un estudio de cohortes retrospectivo con el objetivo de comparar la necesidad de tratamiento odontológico, realizado bajo anestesia general (AG) en individuos con discapacidad intelectual (DI), parálisis cerebral (PC), trastorno del espectro autista (TEA) o síndrome de Down (SD) atendido en el servicio de odontología del Hospital São Julião, en Mato Grosso do Sul, Brasil. Se recogieron datos de 790 fichas odontológicas de individuos de ambos sexos con necesidades especiales de salud (NEE) entre 0 y 59 años de edad, que fueron sometidos a tratamiento bajo anestesia general (AG). Los pacientes fueron evaluados, con base en las historias clínicas, los individuos fueron divididos en cuatro grupos: G1 (DI [ $n=321$ ]); G2 (PC [ $n=285$ ]); G3 (TEA [ $n=131$ ]); y G4 (DS [ $n=53$ ]). En quirófano se realizaron procedimientos preventivos, reparadores y quirúrgicos; el estadio de la enfermedad de caries se evaluó utilizando el instrumento *Caries Assessment Spectrum and Treatment* (es decir, CAST). Para las comparaciones se utilizó la prueba de chi-cuadrado y análisis de varianza, con un nivel de significación del 5%. Hubo mayor porcentaje de hombres ( $p=0,0062$ ) y de individuos entre 19 y 35 años ( $p < 0,0001$ ). Los grupos difirieron significativamente ( $p < 0,05$ ) en términos de edad media, siendo G3 el más joven. Con respecto al instrumento CAST, los sujetos de G1 y G2 tuvieron un porcentaje significativamente mayor de código 7 ( $p < 0,01$  [prueba de chi-cuadrado]). Doce meses después del primer procedimiento realizado bajo GA, solo el 16,45% volvió para una segunda cita. La necesidad de tratamiento odontológico se acumuló en los cuatro grupos, con mayor número de sujetos diagnosticados de DI y PC (es decir, G1 y G3, respectivamente).

**Palabras clave:** Discapacidad intelectual; Parálisis cerebral; Trastorno del espectro autista; Síndrome de Down; Salud bucal.

## 1. Introduction

Individuals with special health care needs (SHCNs) exhibit physical, intellectual, sensory, developmental, and behavioral features, which often lead to limitations in the activities of daily living (Kuo et al. 2022).

According to results obtained from the 2000 Demographic Census (IBGE 2000), approximately 24.5 million individuals (14.5% of the population) reported some type of disability. This figure almost doubled according to the Demographic Census in 2010 (IBGE 2010), when 45.6 million individuals registered, corresponding to 23.9% of the Brazilian population with some type of disability. Of these, 12.7 million (6.7% of the total population) had at least one type of severe disability (IBGE 2022).

These individuals face many difficulties in performing dental treatment, such as the lack of trained dentists who want to treat them, the difficulty of accessing offices or treatment centers, the waiting time at the dental office and financial

difficulties (Pini et al. 2016) in addition to having difficulties to perform oral hygiene due to their disabling condition, favoring the onset of oral diseases, such as caries and periodontal disease, which in turn affect quality of life (Aburahma et al. 2021; Rodrigues dos Santos et al. 2003).

Some conditions favor the progression of these diseases, such as those requiring continuous use of antiepileptic medication(s) and reduced salivary flow (Ferreira et al. 2019; Mallineni & Yiu 2016). Often, the lack of cooperation from patients with SHCNs undergoing outpatient dental treatment leads to the accumulation of dental needs, requiring a differentiated approach (Ciftci & Yazicioglu 2022). Indications for dental treatment(s) performed under general anesthesia (GA) are based on an individual's lack of cooperative capacity, anxiety problems, intellectual deficit, and physical disability, in addition to the large number of dental procedures to be performed (Ciftci & Yazicioglu 2022; Ahuja et al. 2016).

There is a relationship between dental caries and cerebral palsy, according to the systematic review and meta-analysis carried out in 2020 by Bensi and collaborators (Shepherd & Ali 2015).

Interruption of the progression of oral disease(s) reduces pain and discomfort, thus justifying dental intervention under GA. Among dental treatments performed under GA in individuals with SHCNs, restorative and surgical procedures (e.g., extractions) are prominent (Rollon-Ugalde et al. 2020; De Souza 2014). With the longitudinal follow-up of these patients, an improvement in quality of life related to oral health has been observed, with positive effects on daily activities (Leal et al. 2017).

The Caries Assessment Spectrum and Treatment (CAST) instrument is an epidemiological tool that reports the prevalence and incidence of dental caries, covering the entire spectrum of detection of caries lesions, from a healthy tooth surface to the loss of the tooth element due to caries injury (Solanki et al. 2016). It is a tool that enables visualization of changes in disease progression, which is highly important for understanding the pattern of transition(s) in oral health over time (Bensi 2020).

Few studies have evaluated dental treatments performed under GA in individuals (Rollon-Ugalde et al. 2020; Qiao et al. 2020) with intellectual disability (ID) (Leal et al. 2017), cerebral palsy (CP) (Shepherd & Ali 2015), autism spectrum disorder (ASD) (AlJameel et al. 2020), or down syndrome (DS) (Frencken et al. 2015).

In a retrospective study comparing dental treatment under general anesthesia between healthy uncooperative patients and patients with special needs, a greater number of tooth extractions was observed in the group of special patients (Ahuja et al. 2016).

As the patients of the four groups studied are not collaborative, the viable hypothesis of this study would determine a greater need for treatment over time.

Thus, the aim of this 16-year retrospective comparative study was to compare the differences among the dental treatment performed under GA in individuals with ID, CP, ASD, and DS.

## **2. Methodology**

All dental treatments were performed by a professional duly qualified to treat patients in surgical centers under general anesthesia. He was responsible for recording the procedures performed.

This study was reviewed and approved by the Human Research Ethics Committee of the Federal University of *Mato Grosso do Sul*, Brazil, number 1.233.130. Informed consent was obtained from the caregivers of each participant after receiving information about the study.

This retrospective cohort study included individuals with SHCNs referred to the Dental Service of the Hospital São Julião, a reference hospital in the Unified Health System, in Mato Grosso do Sul, Brazil, for dental treatment under GA.

The allocation of participants into age groups followed the Statute of Children and Adolescents (Escanilla-Casal et al. 2014) and the Statute of the Elderly (Corridore et al. 2020).

Data from the medical records of 790 subjects with SHCNs of both sexes, between 0 and 59 years of age, who were referred from other health units for dental treatment under GA due to non-cooperative behavior between 1999 and 2015, were collected and reviewed. In this study, a convenience sample was employed, in which all available medical records were used. As methodological support for this study, protocols based on various authors were followed (Estrela C., 2018; Pereira A. S. et al., 2018; Toassi. Et al., 2021).

The medical records of non-cooperative individuals with SHCNs with serious conduct disorders that required surgical procedures, extensive treatment(s), or accumulated dental needs were included in this study. Medical records considered to be incomplete were excluded because they did not contain essential information for patient identification, diagnostic hypothesis, omission of performed procedures, and consent for dental treatment under GA.

Initially, individuals with SHCNs were evaluated by an anesthesiologist at the Hospital São Julião to identify possible systemic conditions that would contraindicate dental treatment under GA. The participants were subsequently examined by a single dental surgeon—a specialist in hospital dentistry—with 16 years' experience in treating and monitoring individuals with SHCNs. Dental procedures were performed under GA in the morning and on pre-scheduled dates.

The CAST instrument (Diéguez-Pérez et al. 2016) was used to assess the stage of progression of caries present among those with SHCNs (Table 1). Oral hygiene was performed using a toothbrush and toothpaste, with the patient sedated in the operating room. Then, with the aid of a mouth mirror and periodontal probe (Community Periodontal Index-CPI probe), gauze and cotton rolls, a clinical examination was performed, recording the code assigned to the surface of each tooth, as described in the CAST manual (Diéguez-Pérez et al. 2016). Through the clinical examination notes, the maximum CAST code score was obtained per tooth per individual.

According to the maximum CAST score, individuals with SHCNs were grouped according to the severity of disease as follows: healthy (CAST = 0, 1, or 2); pre-morbidity stage (CAST = 3); morbidity stage (CAST = 4 or 5); severe morbidity (CAST = 6 or 7); and mortality (CAST = 8).

The procedures performed included preventive treatment (prophylaxis, application of sealants, and application of fluoride), restoration (silver amalgam, composite resin or glass ionomer cement), surgical (removal of elements involving furcation, residual roots, or with impossibility of restorative treatment), endodontic (pulp involvement), and periodontal (scraping and coronal-radicular smoothing, periodontal surgeries). Radiographs were captured in the operating room.

The CAST index was not found in the charts; however they were filled in according to the CAST codes (Anders & Davis 2010).

**Table 1** - The codes and descriptions of the Caries Assessment Spectrum and Treatment (CAST) index.

Characteristic	Code	Description
Sound	0	No visible evidence of a distinct carious lesion is present
Sealed	1	Pits and fissures have been at least partially sealed with a sealant material
Restored	2	A cavity has been restored with an (in)direct restorative material currently without a dentine carious lesion and no fistula/abscess present
Enamel	3	Distinct visual change in enamel. A clear carious related discolouration (white or brown in colour) is visible, including localized enamel breakdown without clinical visual signs of dentine involvement
Dentine	4	Internal caries-related discolouration in dentine. The lesion appears as shadows of discoloured dentine visible through enamel which may or may not exhibit a visible localized breakdown
	5	Distinct cavitation into dentine. No (expected) pulpal involvement is present
Pulp	6	Involvement of pulp chamber. Distinct cavitation reaching the pulp chamber or only root fragments are present
Abscess/fistula	7	A pus containing swelling or a pus releasing sinus tract related to a tooth with pulpal involvement due to dental caries is present
Lost	8	The tooth has been removed because of dental caries
Other	9	Does not match with any of the other categories

Source: Authors.

The Table 1 describes dental conditions that have been classified into codes to facilitate statistical analysis. Descriptive statistical analyses were performed on demographic data. Inferential analyses were performed using the chi-squared test and analysis of variance (ANOVA). The data obtained were analyzed using SPSS version 20.0 (IBM Corporation, Armonk, NY, USA) for Windows (Microsoft Corporation, Redmond, WA, USA); differences with  $P < 0.05$  were considered to be statistically significant.

### 3. Results and Discussion

Individuals with SHCNs were divided into four groups according to medical diagnosis, as follows: G1 (ID [n=321]); G2 (CP [n=285]); G3 (ASD [n=131]); and G4 (DS [n=53]) (Table 2).

Regarding sex, the groups differed significantly, with males accounting for the highest percentage ( $p = 0.0062$  [chi-squared test]). Regarding age group, there was a higher percentage of individuals with SHCNs between 19 and 35 years of age ( $p < 0.0001$  [chi-squared test]).

The groups differed significantly with regard to mean age of individuals with SHCNs, with G3 the youngest ( $p < 0.05$  [one-way ANOVA, post hoc Tukey]).

Regarding the CAST instrument, participants with ID and CP demonstrated a significantly higher percentage of code 7 (presence of swelling containing pus or a pus delivery conduit related to a tooth with pulp involvement) ( $P < 0.01$  [chi-squared test]).

**Table 2** - Distribution of the 790 participants in the initial time (T0) according to the variables sex, age, mean age and CAST for the groups intellectual disability (G1), cerebral palsy (G2), autism spectrum disorder (G3) and down syndrome (G4).

Variables	Groups				Total	P-value
	G1	G2	G3	G4		
	321(40.6)	285(36.1)	131(16.1)	53(6.71)		
<b>Sex (n, %)</b>						
Female	158 (49.2)	140 (49.1)	50 (38.2)	15 (28.3)	363 (45.9)	0.0062*#
Male	163 (50.8)	145 (50.9)	81 (61.8)	38 (71.7)	427 (54.1)	
<b>Age (n, %)</b>						
0 – 11 (%)	58 (18.1)	94 (33)	37 (28.2)	19 (35.8)	208 (26.4)	<0.0001*#
12 – 18 (%)	60 (18.7)	67 (23.5)	30 (22.9)	12 (22.6)	169 (21.4)	
19 – 35 (%)	152 (47.4)	104 (36.5)	61 (46.6)	16 (30.2)	333 (42.1)	
36 – 59 (%)	51 (15.9)	20 (7)	3 (2.3)	6 (11.3)	80 (10.1)	
<b>Mean Age (±SD)</b>	25.2±13.9 A	17.3±10.7A	16.3±8.5B	18.8±12.9 A		<0.05*&
<b>CAST (n, %)</b>						
0	5 (1.6)	8 (2.8)	2 (1.5)	1 (1.9)	16 (2.1)	<0,01*#
3	6 (1.8)	2 (0.7)	1 (0.8)	1 (1.9)	10 (1.3)	
5	80 (24.9)	72(25.3)	47 (35.9)	12 (22.6)	211 (26.7)	
6	32 (10)	29 (10.2)	11 (8.4)	11 (20.7)	83 (10.5)	
7	109 (34)	101 (35.4)	41 (31.3)	16 (30.2)	267 (33.8)	
8	89 (27.7)	73 (25.6)	29 (22.1)	12 (22.7)	203 (25.7)	
9	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	

n=number of participants; %=percentage; SD=standard deviation; \*statistically significant at p<0.05. Chi-square test: #; analysis of variance: & (one-way ANOVA, post hoc tukey). Different capital letters denote statistically significant differences. Source: Authors.

The Table 2, the number of participants in the groups, their variables, and their significant statistical results are observed. Within a maximum interval of 12 months after undergoing the first care under GA, 130 individuals with SHCN returned for new treatments, with the largest number in group G1 (n = 46 [35.4%]), followed by G2 (n = 42 [32.3%]), G3 (n = 34 [26.2%]), and G4 (n = 8 [6.1%]) (Table 3). The return rate after the first visit was only 16.45%.

**Table 3** - Distribution of the 130 participants in Time 1 (T1) according to the variables sex and CAST for the groups intellectual disability (G1), cerebral palsy (G2), autism spectrum disorder (G3) and down syndrome (G4) who returned during the period of 12 months after the first treatment under general anesthesia.

Variables	Groups				P-value
	G1	G2	G3	G4	
	<b>46 (35.4)</b>	<b>42 (32.3)</b>	<b>34 (26.2)</b>	<b>8 (6.1)</b>	
<b>Sex (n, %)</b>					
Female	24 (52.2)	22 (52.4)	18 (52.9)	4 (50)	0.9991
Male	22 (47.8)	20 (47.6)	16 (47.1)	4 (50)	
<b>CAST (n, %)</b>					
0	3 (6.5)	2 (4.8)	2 (5.9)	1 (12.5)	0.9852
2	20 (43.5)	18 (42.9)	15 (44.1)	2 (25)	
3	5 (10.8)	3 (7.1)	1 (2.9)	0 (0.0)	
5	8 (17.4)	7 (16.6)	8 (23.5)	2 (25)	
6	2 (4.3)	2 (4.8)	3 (8.9)	1 (12.5)	
7	1 (2.2)	1 (2.4)	0 (0.0)	0 (0.0)	
8	7 (15.3)	9 (21.4)	5 (14.7)	2 (25)	
9	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	

n=number of participants; %=percentage; \*statistically significant at  $p<0.05$ ; chi-square test. The groups did not differ in terms of gender ( $p=0.9991$ ) or in relation to the CAST instrument ( $p=0.9852$ ). Source: Authors.

The Table 3, statistical comparisons were made related to the codes created in table 1 for different dental conditions related to the groups. One of the serious problems in Brazil is the demand of unassisted patients with cerebral palsy, regarding the need for treatment in a hospital environment – highly complex treatments for non-cooperative patients; often requiring deep sedation or general anesthesia. This retrospective cohort study reveals how much hospital dental care reduces the demand for care for high-risk patients.

There is a significant need for studies addressing dental treatment among individuals with SHCNs, especially those who are non-cooperative, in relation to oral health (Ciftci & Yazicioglu 2022; Ahuja et al. 2016). These types of studies are essential to inform correct planning, care, and monitoring of these individuals so that the treatment remains effective over time. This study demonstrated the accumulated need for dental treatment among individuals with ID, CP, ASD, and DS( Leal et al. 2017, Cheng et al.2007; Akpinar 2019; Makkar et al. 2019; Lima et al. 2021; Brasil).

In a literature review addressing dental treatment performed under GA among individuals with SHCNs, 10 studies were evaluated, in which the majority had a higher prevalence of males (Ciftci & Yazicioglu 2022), as well as in other recent studies of patients with disabilities (Mallineni & Yiu 2016; Brasil Edi 2013; Ferrazzano et al. 2020; Pitts 2009). This prevalence is probably due to the greater difficulty in stabilizing patients with SHCNs, especially males, during outpatient treatment due to their physical strength (Pitts 2009), thus corroborating the higher prevalence of males among the four groups included in the present study.

A single literature review, including studies published between January 1966 and May 2012, did not describe the diversity within age groups, having evaluated individuals between 1 and 50 years of age who underwent a large number of restorative procedures (Ciftci & Yazicioglu 2022). In a retrospective study using data from August 2002 to March 2019, the greatest number of patients with SHCNs treated under GA were 11 to 20 years of age, followed by those between 21 and 30 years of age (Pitts 2009). In the present study, the highest percentage of individuals who required dental treatment under GA were between 19 and 35 years of age and were in groups G1, G2, and G3. This finding is particularly noteworthy. Individuals

with ASD were prominent, with a lower mean age among the groups studied, probably because they sought earlier dental care due to fractures or dental injuries caused by motor stereotypies, a characteristic of ASD itself (Ismail et al 2007).

The CAST instrument is a dental caries detection tool that combines elements of the International System for Caries Assessment and Detection (ICDAS II) ( Monse et al. 2010; WHO 1997), from the PUFA index, which records caries lesions with pulp involvement (P/p ), ulceration caused by displaced tooth fragments (U/u), fistula (F/f), and abscess (A/a) (Voruganti et al. 2020), and the caries experience index dmft (for decayed primary teeth, with indicated extraction and filled teeth) and DMFT (for decayed, missing, and filled permanent teeth) (Batawi & Fakhrudin 2017) and has been used in epidemiological studies of normoactive school-age populations( Reddy et al. 2017; Baginska et al. 2016; Pesaressi et al. 2020). However, to our knowledge, no studies in the literature have addressed individuals with SHCNs at different ages using this instrument. Thus, our study was the first to use the CAST instrument in a cohort of subjects with SHCNs, in addition to having been applied to a wide age range in this population (i.e., 0 to 59 years).

A study comparing dmft/DMFT, ICDAS II, and CAST indexes in a school-age population in India reported a DMF index of 5.54%, ICDAS of 6.7%, and a CAST of 6.95% (Pesaressi et al. 2020), demonstrating the similarity between the latter two indexes. However, a study involving 269 children with CP, ID, ASD, and DS, using the dmft and DMFT indices, with a mean ( $\pm$  SD) age of  $11.63 \pm 3.64$  years, reported caries prevalences of 86.53%, 86.18%, 76%, and 68.57% in groups of children with CP, ID, ASD, and DS, respectively (31). These data corroborate the results of our study in terms of the percentage of lesions with greater severity (i.e., code 7 of the CAST instrument), with the CP group exhibiting more severe caries lesions, followed by the ID group.

One limitation of this study was the reduced number of follow-up visits for subjects with SHCNs (16.45%), corroborating data in the literature, in which, of 10 selected studies, only two reported that there was follow-up of patients treated under GA (Ciftci & Yazicioglu 2022). The absence of pain after the treatment performed, mobility difficulty, and the overload of tasks that these patients demand from their caregivers appears to explain the small percentage of return visits (Leal et al. 2017).

The failure to carry out a pilot study was also considered a limitation of the study. Another limitation was the classification of patients in the Cast index by the notes on their files (the CAST instrument was not found in the medical records; however they were filled out according to the CAST index (Anders & Davis 2010).

One of the serious problems in Brazil is the demand of unassisted patients with SHCNs, regarding the need for treatment in a hospital environment – highly complex treatments for non-cooperative patients; often requiring deep sedation or general anesthesia. This retrospective cohort study reveals how much hospital dental care reduces the demand for care for high-risk patients.

#### **4. Conclusion**

Further studies that facilitate the development of protocols for dental care under GA for non-cooperative individuals with SHCNs are of fundamental importance, in addition to regular visits, to increase the durability of the treatment(s) performed and the improvement in the quality of life this patient population. The need for dental treatment accumulated in the four groups studied, with the greatest number of participants diagnosed with ID and CP.

New studies, especially multicenter ones, conducted in various hospitals in the country, would be essential to adapt hospital dental care to patients who require more complex care, which requires technical resources superior to those available in outpatient clinics.



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