Pesquisa Brasileira em Odontopediatria e Clínica Integrada 2020; 20:e5485
https://doi.org/10.1590/pboci.2020.114
ISSN 1519-0501 / eISSN 1983-4632

ORIGINAL ARTICLE

Association Between Water Sanitation and Living Conditions and Dental Caries in Brazilian Schoolchildren

José Carlos Martins Júnior[1], Mauro Henrique Nogueira Guimarães de Abreu[2], Lucilene Conceição Vieira[3], Diana Gaudereto[4], Danielle Alves Andrade[5], Rafaela da Silveira Pinto[2], Simone Dutra Lucas[2]

[1]General Hospital, University of São Paulo, São Paulo, SP, Brazil.
[2]Department of Social and Preventive Dentistry, School of Dentistry, Federal University of Minas Gerais, Belo Horizonte, MG, Brazil.
[3]City Hall of Brumadinho, Brumadinho, MG, Brazil.
[4]School of Dentistry, Faculty of Sete Lagoas, Belo Horizonte, MG, Brazil.
[5]Transportation Social Service and National Learning Service for Transport (SEST / Senat), Juatuba, MG, Brazil.

Author to whom correspondence should be addressed: Simone Dutra Lucas, Rua Desembargador Tinoco, 196/501, Monsenhor Messias, Belo Horizonte, MG, Brazil. 30720-480. Phone: +55 31999739239. E-mail: simonedlucas@gmail.com.

Academic Editor: Wilton Wilney Nascimento Padilha

Received: 28 December 2019 / Accepted: 19 May 2020 / Published: 22 June 2020

How to cite this article: Martins Júnior JC, Abreu MHNG, Vieira LC, Gaudereto D, Andrade DA, Pinto RS, et al. Association between water sanitation and living conditions and dental caries in Brazilian schoolchildren. Pesqui Bras Odontopediatria Clín Integr. 2020; 20:e5485. https://doi.org/10.1590/pboci.2020.114

Abstract

Objective: To analyze the association between water sanitation and living conditions and dental caries in Brazilian schoolchildren. **Material and Methods:** A list containing names of children enrolled in 18 urban public schools was obtained. Then, data registered by community health agents from the family health strategy were consulted, aiming to obtain information about socio-environmental variables such as house type, number of rooms in the house, water supply, water treatment, waste, feces and urine disposal. For sample calculation, 95% confidence level, 80% test power and 5% error rate were used A total of 199 5-year-old and 137 12-year-old schoolchildren participated in the research. For examinations, World Health Organization recommendations for epidemiological surveys of dental caries were followed. **Results:** For 5-year-old children, dental caries prevalence was related to municipality of origin, water supply system and sewage system. For 12-year-old children, untreated water and waste collection were related to higher dental caries rates. **Conclusion:** Dental caries was associated to house type and water sanitation.

Keywords: Dental Caries; Fluoridation; Quality of Life; Housing; Public Health.

Introduction

Dental caries is the most common chronic disease in children and constitutes an important public health problem due to its high prevalence and individual and collective impact for causing pain, discomfort [1-4], nutritional impairment, deterioration of the general state and social and functional limitations that can affect children's quality of life [2,3,5-8].

National data have shown that 53.4% of Brazilian children had caries disease in the primary dentition at the age of five, and at 12 years of age, 56.5% had the same condition in the permanent dentition. In this study, uneven dental caries distribution was observed, being worse in states of Northeastern and Northern Brazil, compared to those of Southern and Southeastern Brazil [9].

Studies have shown that caries disease affects populations unevenly [1,5,6,10,11]. While in the past, the focus of studies on dental caries was the relationship between biological and dietary variables in the process of the appearance of dental caries, in the last decades, there has been greater interest in researching how demographic and socioeconomic characteristics play a role in the prevalence of this disease in the population [2].

Worse oral health rates are observed in low-income children [1,3,5,11-15]. Regarding socio-demographic variables, a statewide study carried out in Minas Gerais found higher dental caries prevalence in 12-year-old children when comparing countryside cities with the state capital [16].

Access to fluoride in fluoridated water benefits mainly the most vulnerable children, because the caries-preventing power of fluorination is relatively more effective in situations of greater economic and social inequality. However, for the population to have access to treated water, sanitation should be implemented, thus guaranteeing a better quality of life for the population [5,11,17].

Housing and sanitation situations were recorded on forms used to register families by Community Health Agents (ACS), called Form A from 1996, whose objective was to use data in the planning and creation of strategies of health interventions by the primary care management, considering the real needs of the community [18].

Replacing form A, used by the Family Health Strategy (FHS), the Ministry of Health started to adopt e-SUS from 2013, and one of its items in the household register, whose purpose is to identify the socio-sanitary characteristics of households in the territory covered by Primary Care teams, in the housing conditions block [19].

Through home visits, it is possible to know the living conditions and surroundings, understand what guidelines are necessary for people to take better care of their health and improve their quality of life and to identify families that need more frequent or special follow up.

It is worth highlighting that, for the federal government, oral health was among actions of the community health agent. In the 2000/2003 Pluriannual Plan (PPA) bill, among the four indicators, dental caries reduction was included [20].

Even though the registration of families in Primary Care is being carried out throughout the Brazilian territory, the housing and sanitation situation is assessed, and little is known about its predictive potential for dental caries. In this context, this study aimed to analyze the association between housing and sanitation condition and dental caries in schoolchildren in the Family Health Strategy of two municipalities in the state of Minas Gerais.

Material and Methods

Study Design

This is a primary cross-sectional and analytical study of epidemiological inquiry type, using secondary data to compose the independent variables to be analyzed.

Variables

Among housing and sanitation characteristics, this study considered only those present in Form A and e-SUS (Table 1). This option is due to the fact that data collection took place in 2012, when Form A was in force and the elaboration of this article took place when e-SUS was in force. Therefore, the findings of this research can be considered current.

Table 1. Housing and sanitation characteristics present in Form A and e-SUS.

Variables	Detailing
House Type	Masonry / Brick
	Covered Lath and Plaster
	Uncovered Lath and Plaster
	Wood
	Reused Material
Waste Destination	Collected
	Burned / Buried
	Left Uncollected
Water Treatment at Home	Filtration
	Boiling
	Chlorination
	No Treatment
Water Supply	General Water Network
	Well or Spring
Feces and Urine Destination	Sewer System / General Network
	Untreated Sump
	No Treatment

Data Collection

Data collection began in 2012 in the municipalities of Fortuna de Minas and Brumadinho, the first being small-sized and the second medium-sized [21,22], with a population of 2,705 and 33,973 inhabitants, respectively [23]. As for household sewage, in 2010, Brumadinho had a rate of 65.4% and Fortuna de Minas 3.2% [23]. Public water supply was not fluorinated in Fortuna de Minas and in Brumadinho was, but without control of fluorine content. The company responsible for the treatment of public water supply in Brumadinho is the "*Companhia de Saneamento de Minas Gerais*" (COPASA) and meets the requirements of the Ministry of Health Ordinance No. 2.914 / 2011 [24,25].

Children whose parents did not allow their participation in the study or were not present in schools on the day of examination were excluded from the study, being replaced by other children of the same age.

Children aged 5-12 years were randomly selected and examined, which age group is adopted by the World Health Organization (WHO) for epidemiological surveys [26] in 18 public schools in urban areas. All children at this age group who agreed to be examined and were present at schools on the day of examination and whose parents / guardians signed the informed consent form were included in the study. Examinations were carried out in schools due to the easier access to children.

To evaluate dental caries in children, the DMF-T / dmf-t index was used, obtained by the sum of decayed, missing or with extraction indication due to caries injury and filled teeth [27] using # 5 flat mouth mirror and # 1 dental probe, without previous prophylaxis, in place provided of natural light.

Children were examined by a single previously calibrated examiner in each municipality (Kappa intra-examiner 0.82 for Brumadinho and 0.90 for Fortuna de Minas), according to WHO recommendations [28]. Examiners were assisted by an annotator and registration was performed in a specific and individual odontogram for each child.

Registrations of participants made by community health agents of the Family Health Strategy were consulted to obtain information on socio-environmental variables contained in Form A such as house type, number of rooms in the house, water supply, water treatment, waste, feces and urine destination.

For sample calculation, 95% confidence level, 80% test power, 5% error were used, as well as SB 2003 prevalence data [29] such as percentage of caries-free five-year-old children and DMF-T for those at the age of 12 years in the southeastern region; and population data from the Family Health Program of both municipalities in 2012. To assess socio-demographic conditions, Form A was used as instrument.

Data Analysis

Categorical outcomes were analyzed using Pearson's chi-square and Fisher's exact tests, when indicated. After assessing the normality of quantitative variables by the Kolmogorov-Smirnov test, the Mann-Whitney and Kruskal-Wallis tests were used, seeking to associate the independent variables of Form A with the oral health situation. For five-year-old children, the dichotomous variable being or not free from caries in the primary dentition was used and for those aged 12 years, the DMF-T index was used. The statistical significance level adopted was $p < 0.05$. Data were analyzed using the Statistical Package for Social Science software (SPSS for Windows, version 19.0, IBM Corp., Armonk, NY, USA).

Ethical Aspects

This study was approved by the Ethics Research Committee of the Federal University of Minas Gerais on 06/14/2012 (CAAE 02435712.4.0000.5149) and parents / guardians signed the free and informed consent form.

Results

Distribution of participants in the two municipalities, according to the age group and sample size, can be seen in Table 2.

Table 2. Population and sample of schoolchildren aged 5-12 years.

Municipality	5 Years		12 Years	
	Population[1]	Sample	Population[1]	Sample
Brumadinho	311	164	325	89
Fortuna de Minas	35	35	50	48

[1]Source: Brumadinho and Fortuna de Minas Family Health Program Records, 2012.

Caries prevalence in children aged 5 years was higher (62.9%) in the city of Fortuna de Minas when compared to the city of Brumadinho (39.0%) ($p=0.010$) (Table 3).

In addition, at the age of five, statistically significant relationships were found between presence of caries and water supply system (p=0.003) and type of sewage system (p=0.001). Children from Fortuna de Minas, with public water supply and official sewage collection, had lower caries prevalence in primary dentition (Table 3).

Table 3. Presence or absence of caries according to socio-sanitary factors in five-year-old children.

Variables	dmf-t >0 N (%)	dmf-t = 0 N (%)	p-value
Municipality			
Brumadinho	64 (39.0)	100 (61.0)	0.010*
Fortuna de Minas	22 (62.9)	13 (37.1)	
Sex			
Female	45 (49.5)	46 (50.5)	0.103*
Male	41 (38.0)	67 (62.0)	
House Type			
Masonry / Brick	84 (43.1)	111(56.9)	1.0†
Reused Materials	0 (0.0)	1 (100.0)	
Number of Rooms in the House (Minimum / Median / Maximum)	4 / 6 / 9	2 / 6 / 10	0.724‡
Water Supply			
Public Network	42 (34.4)	80 (65.6)	0.003*
Well or Spring	42 (56.0)	33 (44.0)	
Water Treatment			
Filtration	57 (41.3)	81 (58.7)	0.603†
Boiling	1 (50.0)	1 (50.0)	
No Treatment	21 (50.0)	21 (50.0)	
Waste			
Collected	75 (41.0)	108 (59.0)	0.133†
Burned / Buried	6 (75.0)	2 (25.0)	
Left Uncollected	1 (50.0)	1(50.0)	
Feces and Urine			
Sewer System (Official Network)	32 (31.4)	70 (68.6)	0.001†
Untreated Sump	49 (57.6)	36 (42.4)	
No Treatment	2 (50.0)	2 (50.0)	

*Pearson's chi-square test; †Fisher's exact test; ‡Mann-Whitney.

Table 4 shows associations between caries prevalence and variables related to 12-year-old children. Statistically significant relationships were found for health variables such as water treatment (p=0.044) and waste collection (p=0.004) when associated with the M component of DMF-T. The "F" component of DMF-T was also associated with water treatment (p=0.034).

Table 4. Association between DMF-T and its components and health variables in children aged 12 years.

Variables	DMF-T			D			M			F		
	Min.	Med.	Max.	Min.	Med.	Max.	Min.	Med.	Max.	Min.	Med.	Max.
Municipality												
Brumadinho	0	0	9	0	0	4	0	0	2	0	0	7
Fortuna de Minas	0	0	5	0	0	3	0	0	1	0	0	4
p-value*		0.669			0.706			0.887			0.173	
Sex												
Female	0	0	9	0	0	4	0	0	2	0	0	7
Male	0	0	6	0	0	4	0	0	2	0	0	4
p-value*		0.786			0.797			0.205			0.660	

House Type												
Masonry / Brick	0	0	9	0	0	4	0	0	2	0	0	7
Wood	0	0	0	0	0	0	0	0	0	0	0	0
Others	0	0	0	0	0	0	0	0	0	0	0	0
p-value†		0.453			0.724			0.930			0.597	
Water Supply												
Public Network	0	0	5	0	0	4	0	0	1	0	0	4
Well or Spring	0	1	9	0	0	4	0	0	2	0	0	7
Others	0	0	6	0	0	2	0	0	2	0	0	3
p-value†		0.684			0.838			0.217			0.823	
Water Treatment												
Filtration	0	0	9	0	0	4	0	0	2	0	0	7
Boiling	2	3	4	0	0.5	1	0	0.5	1	2	2	2
Chlorination	0	0	4	0	0	4	0	0	0	0	0	3
No Treatment	0	1	4	0	0	1	0	0	0	0	1	3
p-value†		0.222			0.712			0.044			0.034	
Waste												
Collected	0	0	9	0	0	4	0	0	2	0	0	7
Burned / Buried	0	2	6	0	0	2	0	0	2	0	1	3
p-value*		0.055			0.072			0.004			0.232	
Feces and Urine Destination												
Sewer System	0	0	0	0	0	3	0	0	1	0	0	4
Untreated Sump	0	0	0	0	0	4	0	0	2	0	0	7
No Treatment	0	2	2	0	2	4	0	0	0	0	0	0
p-value†		0.859			0.476			0.400			0.587	

Min.: Minimum; Med.: Median; Max.: Maximum; *Mann-Whitney test; †Kruskal-Wallis test.

Discussion

At the age of 5 years, the following were associated with dental caries prevalence: municipality of origin, water supply system and sewage system. At the age of 12 years, absence of water treatment and waste collection were related to higher caries rates.

Five-year-old children living in Fortuna de Minas had higher caries prevalence when compared to those living in Brumadinho. In this case, the first possible explanation is due to the fact that there are differences in the Human Development Index (HDI) between these two municipalities. Brumadinho occupies the 599th HDI position, with value of 0.747, being considered high human development index, while Fortuna de Minas occupies position 2028, with value of 0.696, being considered medium human development [30]. This result corroborates some studies in the literature that also found worse oral health conditions in cities with low HDI [13]. In this study, HDI is an important indicator of social inequality because it presents, among others, income data [30].

The second explanation may be associated with the lower sewage rate in households of Fortuna de Minas, indicating worse quality of life. It is known that worst oral health situation is associated with worse quality of life [3,6].

The third possible explanation may be that the water from the public supply of Fortuna de Minas is not fluoridated, unlike Brumadinho, which has fluoridated water. Statistically significant relationship was found between use of well or spring and greater risk of caries in 5-year-old children (p=0.003). Of children who used well or spring as water supply, 56.0% had caries experience, while this same prevalence was approximately 60% lower in children assisted by the official water supply network. These findings confirm data

from literature, which point to the consumption of fluoridated water as a protective factor against dental caries compared to populations deprived of water fluoridation [5,6,11,17].

In the present study, it was found that 12-year-old children who are not assisted by water treatment (p=0.044) and waste collection (p=0.004) have greater number of missing teeth. Similar results have been found in some studies [31,32], where water treatment was considered a potential factor associated with better oral health indexes.

In a study [33] on the use of dental services by children aged 5-9 years, access to waste collection and sewage treatment stood out. According to these authors, waste collection and sewage treatment are benefits directly related to housing conditions, that is, better financial conditions. Children who had benefits at home were 1.7 (1.40-2.06) more likely of accessing health services, as is the case of those who had waste collection, and 1.39 (1.16-1.66) in the case of those that had sewage treatment. It should be highlighted that the Human Right to Water and Sanitation (DHAES) was internationally recognized after the adoption of resolution A/RES/64/292 in 2010 [34] by the United Nations General Assembly and Human Rights Council.

The fact that municipalities were chosen for convenience and do not represent the set of municipalities in the State is a study limitation. In addition, the non-inclusion of the population living in the rural area means that children enrolled may not represent all the children in the municipality, especially at the age of five. Another limitation is that only students who were present on the day of examination were included, with no second attempt to retrieve absent ones. However, this study has the potential of identifying variables of the social and economic environment that influence dental caries. The literature often does not include sanitation and housing factors on the dental caries experience. Variables associated with dental caries, such as water supply system, water treatment, sewage system and waste collection, indirectly represent quality of life and corroborate other studies [2,3,5,6,8] that even without using these variables, have shown similar results. The results found can help managers to better plan oral health actions.

Conclusion

Dental caries experience was associated with housing and water sanitation.

Authors' Contributions

JCMJ	0000-0002-9964-0440	Conceptualization, Methodology, Investigation, Formal Analysis and Writing – Original Draft Preparation.
MHNG	0000-0001-8794-5725	Conceptualization, Methodology, Investigation, Formal Analysis and Writing – Original Draft Preparation.
LCV	0000-0001-7499-7999	Conceptualization, Methodology, Investigation, Formal Analysis and Writing – Original Draft Preparation.
DG	0000-0001-9294-5543	Conceptualization, Methodology, Investigation, Formal Analysis and Writing – Original Draft Preparation.
DAA	0000-0001-9607-743X	Conceptualization, Methodology, Investigation, Formal Analysis and Writing – Original Draft Preparation.
RSP	0000-0002-6169-7708	Conceptualization, Methodology, Investigation, Formal Analysis and Writing – Original Draft Preparation.
SDL	0000-0001-7875-4492	Conceptualization, Methodology, Investigation, Formal Analysis, Writing – Original Draft Preparation and Writing – Review and Editing.

All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

Financial Support

None.

Conflict of Interest

The authors declare no conflicts of interest.

References

[1] Nunes VH, Perosa GB. Dental decay in 5-year-old children: sociodemographic factors, locus of control and parental attitudes. Cienc Saúde Coletiva 2017; 22(1):191-200. https://doi.org/10.1590/1413-812320172211.13582015

[2] Antunes LAA, Ornellas G, Fraga RS, Antunes LS. Oral health outcomes: the association of clinical and socio-dental indicators to evaluate dental caries in preschool children. Cienc Saúde Coletiva 2018; 23(2):491-500. https://doi.org/10.1590/1413-812320182322.21022015

[3] Kramer PF, Priesnitz M, Celeste RK, Pereira MJ, Benelli KG, Feldens CA. Spatial distribution of dental caries among preschool children in Canoas, Southern Brazil. Acta Odontol Latinoam 2019; 32(1):3-9.

[4] Pitts N, Baez R, Diaz-Guallory C, et al. Early Childhood Caries: IAPD Bangkok Declaration. Int J Paediatr Dent 2019; 29:384-6. https://doi.org/10.1111/ipd.12490

[5] Bastianini ME, Gusman DJR, Telles LQ, Assunção LRS, Marsicano JA, PradoRL. Dental caries among preschool children: effects of social inequality and the impact of a university extension Project. RGO 2019; 67:e20190037. https://doi.org/10.1590/1981-86372019000373632

[6] Nóbrega AVD, Moura LFAD, Andrade NS, Lima CCB, Dourado DG, Lima MDM. Impact of dental caries on the quality of life of preschoolers measured by PedsQL questionnaire. Cienc Saúde Coletiva 2019; 24(11):4031-42. https://doi.org/10.1590/1413-8123201824411.04712018

[7] Nora AD, Rodrigues CS, Rocha RO, Soares FZM, Braga MM, Lenzi TL. Is caries associated with negative impact on oral health-related quality of life of pre-school children? a systematic review and meta-analysis. Pediatr Dent 2018; 40(7):403-11.

[8] Malele-Kolisa Y, Yengopal V, Igumbor J, Nqcobo CB, Ralephenya TRD. Systematic review of factors influencing oral health-related quality of life in children in Africa. Afr J Prim Health Care Fam Med 2019; 11(1):e1-e12 https://doi.org/10.4102/phcfm.v11i1.1943

[9] Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Secretaria de Vigilância em Saúde. Departamento de Atenção Básica. Coordenação Geral de Saúde Bucal. SB Brasil 2010 – Resultados Principais; Brasília, 2012. [In Portuguese]

[10] Tas, JTVD, Kragt L, Elfrink MEC, Bertens LCM, Jaddoe VWV, Moll HA, et al. Social inequalities and dental caries in six-year-old children from the Netherlands. J Dent. 2017; 62:18-24. https://doi.org/10.1016/j.jdent.2017.04.008

[11] Santos CR, Flório FM, Zanin L. Association between familial risk and caries risk in 5 year old scholars. RGO 2018; 66 (4):331-7. https://doi.org/10.1590/1981-863720180004000063570

[12] Cianetti S, Lombardo G, Lupatelli E, G Rossi, I Abraha, S Pagano, et al. Dental caries, parents educational level, family income and dental service attendance among children in Italy. Eur J Paediatr Dent 2017; 18(1):15-8. https://doi.org/10.23804/ejpd.2017.18.01.03

[13] Guskuma RC, Lages VA, Hafner MB, Rando-Meirelles MP, Maciel, Cypriano S, Sousa MLR, et al. Factors associated with the prevalence and intensity of dental pain in children in the municipalities of the Campinas region, São Paulo. Rev Paul Pediatr 2017; 35(3):322-30. https://doi.org/10.1590/1984 0462/;2017;35;3;00001

[14] Aguiar BD, Fernandes MEF, Aguiar MHR, Torquato DSA, Peres EC, Teixeira AKM. Nutritional status and dental caries of schoolchildren from Sobral – Ceará. RGO 2019; 67:e20190049. https://doi.org/10.1590/1981-86372019000493499

[15] Santos LC, Oliveira DS, Silva ACF, Pimentel AMS, Ribeiro MDF, Marques LC. Influence of eating habits and socioeconomic profile on students' oral health. RGO 2019; 67:e201909. https://doi.org/10.1590/1981-86372019000093629

[16] Pinto RS, Leal DL, Santos JS, Roncalli AG. Projeto SB Minas Gerais 2012: Pesquisa das Condições de Saúde Bucal da População Mineira: Métodos e Resultados Principais. Arq Odontol 2018; 54:1-12. https://doi.org/10.7308/aodontol/2018.54.e14

[17] Goldfeld S, Francis KL, Hoq M, Do L, O'Connor E, Mensah F. The impact of policy modifiable factors on inequalities in rates of child dental caries in Australia. Int J Environ Res Public Health 2019; 16(11):1970. https://doi:10.3390/ijerph16111970

[18] Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. O trabalho do Agente Comunitário de Saúde. Brasília: Ministério da Saúde, 2009. [In Portuguese]

[19] Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. e-SUS Atenção Básica: Manual do Sistema com Coleta de Dados Simplificada: CDS –Versão 3.0. Brasília: Ministério da Saúde, 2018. [In Portuguese]

[20] Brasil. Ministério da Saúde. Secretaria Executiva. Programa Agentes Comunitários de Saúde (PACS).Brasília: Ministério da Saúde, 2001. [In Portuguese]

[21] Calvo MCM, Lacerda JT, Colussi C, Schneide IJ C, Rocha TAH. Municipalities stratification for health performance evaluation. Epidemiol Serv Saúde 2016; 25(4):767-76. https://doi.org/10.5123/s1679-49742016000400010

[22] Stamm CS, Jefferson ARL, Jandir F, Wadi YM. Urban population and dissemination of medium size cities in Brazil. Interações 2013; 14(2):251-65. https://doi.org/10.1590/S1518-70122013000200011
[23] Instituto Brasileiro de Geografia e Estatística. Censo Demográfico 2010. Cidades. Available from: https://cidades.ibge.gov.br/brasil/mg/panorama. [Acessed on Jun 18, 2020]. [In Portuguese]
[24] Minas Gerais. Companhia de Saneamento de Minas Gerais. COPASA Relatório 2014.COPASA, 2014. [In Portuguese]
[25] Brasil. Ministério da Saúde. Portaria nº 2.914, DE 12 de dezembro de 2011. Dispõe sobre os procedimentos de controle e de vigilância da qualidade da água para consumo humano e seu padrão de potabilidade. Brasília: Ministério da saúde, 2011. [In Portuguese]
[26] World Health Organization. Oral Health Surveys: Basic Methods. 4th. ed. Geneva: WHO, 1997.
[27] Klein H, Palmer CE. Dental caries in American indian children. Publ Health Bull 1937; 239:1-54.
[28] World Health Organization. Calibration of examiners for oral health epidemiological surveys. Geneva: ORH/EPID; 1993.
[29] Brasil. Ministério da Saúde. Projeto SB Brasil 2003: Condições de Saúde Bucal da População Brasileira 2002-2003. Brasília: Ministério da saúde, 2004. [In Portuguese]
[30] Programa das Nações Unidas para o Desenvolvimento. Instituto de Pesquisa Econômica Aplicada. Fundação João Pinheiro. Atlas do desenvolvimento humano no Brasil. Brasília: PNUD / Ipea / FJP; 2013. [In Portuguese]
[31] Rando-meireles MP, Olivati FN, Franco DH, Bittar T, Marques TCN, Sousa MLR. Comparison of caries experience in residents of two Brazilian municipalities with and without fluoridation of the public water supplies. Rev Eletron Comun Inf Inov Saúde 2016; 10(4):1-10. https://doi.org/10.29397/reciis.v10i4.1089
[32] Petersen PE, Lennon MA. Effective use of fluorides for the prevention of dental caries in the 21st century: the WHO approach. Community Dent Oral Epidemiol 2004; 32(5):319-21. https://doi.org/10.1111/j.1600-0528.2004.00175.x
[33] Noro LRA, Roncalli AG, Júnior FIRM, Lima KC. Use of dental care by children and associated factors in Sobral, Ceará State, Brazil. Cad Saúde Pública 2008; 24(7):1509-16. https://doi.org/10.1590/S0102-311X2008000700005
[34] UN-Water Decade Programme on Advocacy and Communication (UNW-DPAC). United Nations Human Settlements Programme (UN-Habitat). UN-Water Decade Programme on Capacity Development (UNW-DPC). Water Supply and Sanitation Collaborative Council (WSSCC). Water and Sanitation as a Human Right at the Deutsche Welle Global Media Forum. Germany, 2011.