Frequency and severity of dental caries in foster care children of Turin, Italy: a retrospective cohort study

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Abstract

Aim Aim of this retrospective cohort study was to assess the frequency and severity of dental caries (DC) among foster care children in the city of Turin, in North West Italy, and to compare these data with those of a general paediatric population.

Materials and methods From May 2016 to September 2018, 75 paediatric subjects between the age of 4 and 12, located in 11 residential child care communities were recruited. Instructions were provided concerning oral health, caries and correlation with dietary habits. Oral and dental examination were carried out to establish frequency and severity of caries (not-penetrating, nPC, corresponding to the International Caries Detection and Assessment System (ICDAS) codes: 1–4, vs. penetrating, PC, corresponding to ICDAS codes: 5-6). Decayed, missed, filled teeth (DMFT) index was used. Data for comparison were acquired from the WHO Collaboration Center For Epidemiology and Community Dentistry of Milan (WHO-CCOMS), belonging to a nationwide sample of 2,141 Italian children.

Results Only 13 subjects (17%) were caries-free; 187 caries were identified: 133 were PC, whereas 54 were nPC. Overall, 76% of the caries were found in deciduous teeth. Mean DMFT was 3.43 (D = 2.97; M = 0.24; F = 0.22). When the study data were compared to those from WHO-CCOMS, a significantly higher DMFT (3.43 vs 0.96; $p < 0.00001$) and D (2.97 vs 0.62; $p < 0.00001$) was detected.

Conclusion A significant higher frequency of caries in foster care children in Turin, Italy compared to the general population was detected.

KEYWORDS Caries, Children, Foster-care, Special needs, Restrospective.

Introduction

Oral health is essential to general health and it contributes to overall wellbeing, as established by the World Health Organization (WHO) Constitution in 1948. Maintenance of oral health is paramount to reach an appropriate psychophysical development, both in childhood and adolescence.

Although the prevalence of dental caries (DC) has decreased in the last decades [Frencken et al., 2017] WHO data show that it is still the most common disease worldwide. The most recent report available showed 2.4 billion people suffering from caries of permanent teeth, and 486 million children from caries of primary teeth [GBD 2016 Disease and Injury Incidence and Prevalence Collaborators, 2017]. DC is one of the most prevalent diseases among children, harboring a multifactorial aetiopathogenesis: a systematic review in 2004 identified more than 100 risk factors [Harris et al., 2004]. Furthermore, a more recent systematic review revealed that the strongest risk factors for DC in high-income countries are presence of dentinal caries, high titles of *Streptococcus mutans*, recurrent intake of sweetened foods, poor oral hygiene and presence of visible plaque [Kirthiga et al., 2019]. By 2020, WHO expressed the aim of 80% caries-free among 4–5-years-old children, and a Decayed, Missed, Filled Teeth (DMFT) index of <1 amid the 12 year-olds [Hobdell et al., 2003]. However, there is still a great disparity among the different sections of the population, with children from the lowest socioeconomic groups experiencing caries at significantly higher rates [Fontana, 2015]. Therefore, oral health care remains one of the most challenging health needs, especially among the youngest patients from low-income families and/or ethnic minorities. Concerning this issue, professional organisations and government agencies across Italy provide alternative oral health programmes for this special healthcare need population.

In 2016, the Turin Network for Community Dentistry (*Rete Torinese di Odontoiatria Sociale*) where several partners and the main dental local voluntary associations have been involved, proposed a project about oral health among children in foster homes. These young patients notoriously have poor general health because of poverty, abuse and neglect. Moreover, they are exposed to an insufficient education concerning oral health, leading to higher prevalence of untreated dental caries and traumatic dental injuries. Thus, they need more intensive and complex approaches compared to their peers [Council on foster care et al., 2015; Muirheadet al., 2017].

Around 400,000 children in the US and an estimated one million children in the European Union are in the foster care system, amounting for 1% of the EU child population [Courtney et al., 2013; Eurochild, 2010]. In Italy, 26,420 children and adolescents live outside their biological family: 12,400 live in residential homes, whereas the remaining 14,020 live with foster parents. More in detail, between 2016 and 2018 the

authors focused their efforts on 75 children between 4 and 12 years of age welcomed in seven foster homes in Turin. A team of dentists and dental hygienists provided education on the main characteristics of DC, and the importance of diet and sugar intake. They also instructed the children on how to conduct the everyday oral hygiene procedures. In the meantime, frequency and severity of DC was collected in each patient, and compared to the mean values of DC in Italy, provided by WHO for the same age group (4 to 12-year-olds).

The aim of the present study was to evaluate if such socio-economic inequality could lead to a statistically significant difference in the distribution of DC between the two groups.

Materials and methods

Design of the protocol and ethical approval

All the foster children living within the Turin area (11 houses) have been involved in the study. The operators, dental hygienists and dentists, were firstly instructed to obtain a similar, calibrated performance in their procedures.

The first appointment was performed at che child's foster home. Through a 45–60 minutes learn-through-play approach, they were taught on the main characteristics of the teeth and the main roles played by the oral cavity in eating, speaking, and swallowing. Basic notions were also provided concerning the onset of dental caries and its correlations with oral hygiene and diet. At the end of the session, a child-friendly brochure specially outlined by the Italian National Health Service (NHS) and available on the Italian NHS site was given to each child. Finally, the first meeting ended with the delivery of an erythrosine-based chewing tablet, which was used in the bathrooms of the foster home, in order to allow visualisation of plaque. Then a first tooth brushing session was carried out, with three to four kids brushing their teeth under the supervision of one dentist or dental hygienist.

Also the second appointment was carried out at the foster home: in this case, a comprehensive oral and dental examination was conducted by a dentist together with a dental hygienist. The team was first calibrated to conventional examination following the WHO directives to obtain a similar performance in their procedures. The clinical visit was carried out using explorer, ball-ended probe, mouth mirror and a suitable light source. A comprehensive oral health assessment was established, and a WHO oral health form was fulfilled.

The study was conducted in line with the principles of the Helsinki Declaration of 1975, as revised in 2000, and accepted by the Main Board of the CIR-Dental School, University of Turin.

Frequency and severity of DC in Foster care (Turin) sample

Frequency of DC was determined through Decayed, Missing, Filled Teeth, used either as dmft (range 0–20) for kids with just deciduous teeth, or DMFT (range 0–28), among the 12-year-olds with permanent teeth. For the remaining patients with a mixed dentition, a DMFT/dmft index with no range had to be used.

Severity of DC was assessed as follows: not-penetrating caries (nPC) were defined by absent or minimal involvement of dentine, consistent with code 1–4 of the International Caries Detection and Assessment System (ICDAS), whereas penetrating caries (PC) were recognised whenever dentine yielded at probing, as code 5 and 6 of ICDAS scoring system [Gugnani et al., 2011].

Comparison group

Comparison between DMFT/dmft from the foster care (Turin) sample and the Italian paediatric population was drawn through DMFT data of the WHO Collaboration Center For Epidemiology and Community Dentistry of Milan (WHO-CCOMS), published in 2017, where a total of 2,141 children, of which 1,111 4-year-olds and 1,030 12-year-olds, were recruited from nine Italian cities (Ancona, Catanzaro, Merano, Milano, Palermo, Roma, Teramo, Trento, Udine) throughout Italy.

Statistical analysis

A single sample t-test was applied, to compare the mean of DMFT, as well as D, M, F, and T of the study sample with the mean corresponding DMFT values from the Italian paediatric population. Hypothesis tests were 2-sided and statistical significance was set at $p = 0.01$. Statistical analyses were performed using the statistical software SAS, v9.3.

Results

Frequency and severity of DC in Foster care (Turin) sample

Of 75 patients (35 M; 40 F; mean age: 8.5 ±3.17 years old), 13 (17%) were caries-free. Among the remaining 62 patients, 187 caries were identified. Of these, 133 were PC (110 within the deciduous teeth), of which 88 as ICDAS code 5 and 45 as ICDAS code 6, whereas 54 were nPC (32 within the deciduous teeth), of which 3 as ICDAS code 1, 12 as ICDAS code 2, 25 as ICDAS code 3, and 14 as ICDAS code 4 (Table 1). Moreover, 76% of the caries detected were found in deciduous teeth, of which 59% as PC. The remaining 24% detected in the permanent teeth were PC in half (12%) of the cases (Table 2).

Mean DMFT was 3.43 (±3.26). A major role was played by D (decayed), amounting for 2.97 (±2.93); on the contrary, M

ICDAS CODES	nPC: (ICDAS 1-4) N	%	PC: (ICDAS 5-6) N	%
TOTAL	54	29%	133	71%
CODE 1: Opacity or discoloration of enamel at the entrance to the pit or fissure seen after prolonged air drying	3	1.6%		
CODE 2: Distinct visual change in enamel visible when wet; also lesion visible after drying of tooth surface	12	6.4%		
CODE 3: Localised enamel breakdown when wet, and after prolonged drying of tooth surface	25	13.5%		
CODE 4: Underlying dark shadow from dentine	14	7.5%		
CODE 5: Distinct cavity with visible dentine			88	47%
CODE 6: Extensive, distinct cavity involving more than half of surface, with visible dentine			45	24%

TABLE 1
Frequency of not-penetrating Caries (nPC) and penetrating caries (PC) within the Foster Sample, in accordance with International Caries Detection and Assessment System (ICDAS) codes.

(missed) and F (filled) contribution was considerably lower (0.24±0.8, and 0.22±1.03, respectively). Despite the high prevalence of PC (71% in the whole sample), very few teeth received an appropriate restorative treatment. Table 3 outlines the mean values and standard deviation of each DMFT component collected in the study sample.

Comparison group

Data provided by WHO-CCOMS showed that among the 2,141 children enrolled, 1,674 (78.2%) were caries-free, with a mean DMFT of 0.95 (0.81 for 4-year-olds and 1.09 for 12-year-olds). D contributed much more to DMFT score than M and F. Mean value of D was 0.62 (0.60 for 4-year-olds, 0.65 for 12-year-olds); mean value of M was 0.14 (0.19 for 4-year-olds, 0.09 for 12-year-olds); mean value of F was 0.19 (0.03 for 4-year-olds, 0.35 for 12-year-olds) (Table 2). WHO-CCOMS report offers neither information concerning the PC-nPC ratio, nor the standard deviation (SD) of the collected data.

Statistical analysis

Single sample T-test revealed an extremely significant difference between the two groups concerning DMFT and D: both values were significantly higher in the study sample when compared to the Italian paediatric population (p<.00001). Conversely, M and F teeth did not differ significantly (p = 0.32 for M and p = 0.78 for F, respectively) (Fig. 1; Table 2).

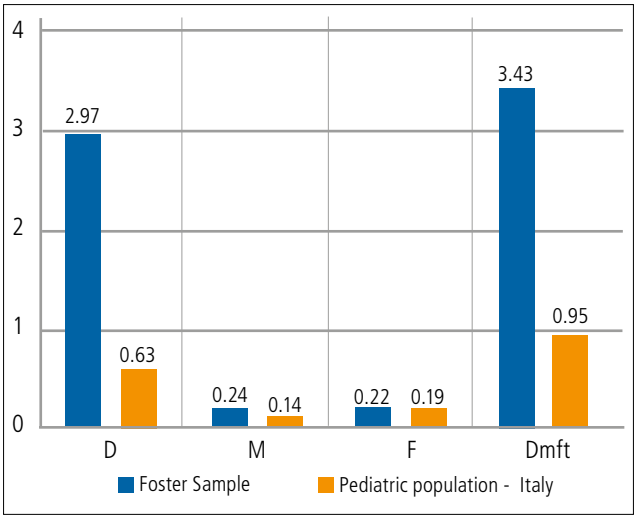
Discussion

Aim of the present study was to assess the oral health status on foster-home children in Turin, focusing on the frequency and severity of dental caries. DC is notoriously the most frequent oral pathology worldwide, bearing several implications in terms of impairment of the oral system, and subsequently on general health.

Among the industrialised countries, a remarkable improvement of oral health in paediatric population has been achieved in the last decades. Community Medicine and Health Care Programs and evidence-based preventive strategies promoted by WHO played a major role in fulfilling this achievement.

Despite these international guidelines and approaches, poor hygienic and nutritional habits amid the weakest sections of population might be responsible for the persisting high risk of caries [Selwitz et al., 2007].

Subsequently, the influence of the familiar environments can have a paramount impact on children's oral health. As suggested in a recent systematic review [Castilho et al., 2013], up to 80% of caries in the Western countries are



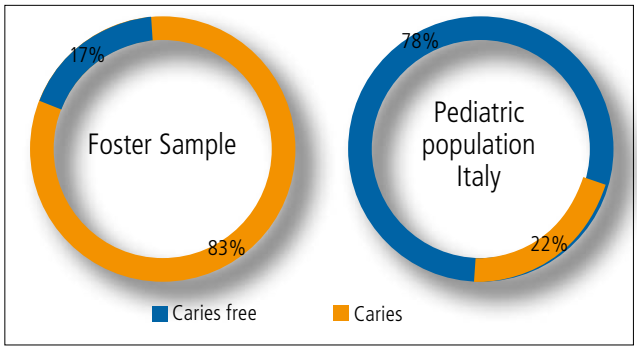


FIG. 1A. Comparison of mean values of DMFT and each component between Foster Sample and the Italian paediatric population (WHO-CCOMS, 2017). D = decayed; M = missed; F = filled; 1b: Caries/Caries-free Ratio in Foster Sample vs Italian paediatric population (WHO-CCOMS, 2017)

Teeth	nPC (ICDAS CODE: 1-4) N	%	PC (ICDAS CODE: 5-6) N	%	Total N	%
Deciduous	32	17%	110	59%	142	76%
Permanent	22	12%	23	12%	45	24%
Total	54	29%	133	71%	187	100%

nPC: not-Penetrating Caries. PC: Penetrating Caries

TABLE 2 Percentage distribution of caries severity in deciduous and permanent dentition in Foster Sample.

	D	m	f	Dmft
Foster sample	2.97±2.93	0.24±0.8	0.22±1.03	3.43±3.26
Italian paediatric population	0.63# (0.60 = 4 y-o 0.65 = 12 y-o)	0.14# (0.19 = 4 y-o 0.09 = 12 y-o)	0.19# (0.03 = 4 y-o 0.35 = 12 y-o)	0.95# (0.81 = 4 y-o 1.09 = 12 y-o)
t-value	6.280850	0.999075	0.273467	6.008117
p-value	****< .00001	0.32	0.785418	****< .00001

D: decayed. M: missed. F: filled. y-o: years old. #: Standard Deviation not available
*****: extremely significant p-value*

TABLE 3 Descriptive statistics: T-value and p-value for each of the DMFT parameters calculated in Foster sample and Italian paediatric population (WHO-CCOMS, 2017). Statistical significance set at p = 0.01.

detected in children belonging to disadvantaged or low-income families [Roberts, 2008; Vadiakas, 2008].

Undoubtedly, foster care children fall under the deprived sections of society aforesaid, and should be addressed as a healthcare special-need population.

This study revealed lack of education on oral health, starting with the basic practices of oral hygiene. Nonetheless, most of these patients showed high compliance, and desire to learn throughout the whole educational oral health programme. Many of the children enrolled asked to be assessed again right after the first examination, and displayed a remarkable adherence to the preventive protocols.

This study showed that DMFT among foster care children in Turin was 3–4 times higher than the WHO-CCOMS comparison group. Interestingly, a DMFT of 3.43 would be much more similar to the DMFT recorded in Italy during the 1980s, as provided by WHO oral health information systems [World Health Organization. Oral Health information systems, 2003]. Additionally, a discouraging 17% of caries-free children was detected, in antithesis with a national mean of 78% caries-free children (Fig. 1b).

The main strength of this paper relies in its novelty. To the best of our knowledge, no previous articles have been published regarding the frequency and severity of caries among foster care children in Italy. Moreover, when searching caries foster care, caries foster home, oral health foster care, oral health foster home in the main scientific databases (PubMed, Scopus, Up to Date, Web of Science), no statistical comparison between DMFT of foster care sample and DMFT from either general population or WHO data can be found. On the other hand, this study shows the limitation of the sample size (n = 75), which is justified by the narrow geographical area covered by Turin, Piedmont region.

The approach provided to these children appeared to be successful: in particular, the usage of erythrosine-based chewing tablet offered an easy-to-grasp interpretation of an otherwise cryptic concept of oral biofilm and bacteria. Kids welcomed positively the teeth-brushing group session, particularly when supervised by a friendly adult, which led to a sense of comradeship and mutual support between the children. However, the results emerged are discouragingly far from the WHO Global goals for Oral Health 2020, consisting in 80% caries-free among 4–5-year-old children and DMFT <1 amid 12-year-olds [Hobdell et al., 2003], pushing our sample's oral health status back to more than 30 years [World Health Organization. Oral Health information systems, 2003]. The authors presume that a correlation exists between the low socioeconomic conditions within the study sample, the severe lacking of oral health education, and the predominance of caries.

The main challenge ahead lays in the necessity to provide steady and appropriate treatment of the high number of caries we detected on deciduous teeth. Such a condition can compromise the switch between primary and secondary dentition, leading to further difficulties in eating, speaking, aesthetics and social interactions.

Conclusion

To our knowledge, this is the first attempt to assess the dental and oral health status among foster care children in Italy, with no prior publication in literature. The present study revealed a statistically significant higher frequency of caries in foster care children when compared to the general paediatric population in Italy. Further epidemiological investigations on larger foster care children cohorts are warranted, to assess the validity of the results presented.

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Conflict of interest

The authors have no conflict of interest to declare.

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