Influence of Sociodemographic Variables on Dental Service Utilization and Oral Health Among the Children Included in the Year 2001 Spanish National Health Survey

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Abstract

***Objectives**: To ascertain the possible influence of sociodemographic variables on dental service utilization and oral health among Spanish children. **Methods**: This is a descriptive cross-sectional study using secondary individualized data drawn from 4,023 interviews conducted with parents or guardians of children aged 3-15 years as part of the 2001 Spanish National Health Survey. The dependent variables analyzed were use of dental services in the preceding 12 months, and caries ever. Classification of children was affirmative if their parents answered that the last time their child visited the dentist it was for a filling and/or had fillings in his/her teeth/molars. Independent variables were sex, age, size of town or city, parents' educational level and monthly income of the family unit. **Results**: A total of 47.1% of the study children had visited a dentist, stomatologist or dental hygienist in the preceding 12 months. Children having parents or guardians with the lowest educational level were 1.36 times (95% CI: 1.10-1.68) more likely to have received no dental care than those having parents or guardians with the highest educational level. The likelihood of not having made use of such dental services rose 2.03-fold (95% CI: 1.58-2.61) in cases where monthly income was less than 900 euros versus greater than 1800 euros. Reported prevalence of caries for the sample as a whole was 31.45%. Children whose parents were in the lowest educational range were 1.37 times (95% CI: 1.08-1.71) more likely to have caries than those in the highest range. **Conclusion**: There is social inequality in the use of dental services and oral health among Spanish children.*

Key Words: Oral health, dental care, dental caries, health surveys, social class

Introduction

Dental care is provided to Spain's childhood population by both public and private health delivery systems (1). Despite the fact that public services have expanded in recent years, inequalities continue to exist in Spain, and efforts are still largely confined to preventive and oral-dental health promotion programs (1,2). Although some regional childhood dental care programs for the population aged 6-14 years offer services other than standard health promotion and education-related preventive measures, which include fillings, root-canal work and jacket crowns in first and second permanent molars, there is no preventive service for temporary dentition or treatment of malocclusions (3-5). In line with other European countries, oral health has improved among Spanish children in recent years (6-13). Even so, the childhood population under age six years continues to register a high prevalence of caries in temporary dentition (14), despite the fact that the past ten years has seen this decline from around 45%-50% in the early 1990's to the figure of 33.3% reported in the 2000 Spanish Oral Health Survey (3, 6, 14, 15).

Similarly, a review of caries prevalence in permanent dentition shows that, whereas studies targeting the 12-year-old age group registered prevalences of nearly 70% in the early 1990s (6, 8), this figure had subsequently fallen to 40%-50% by the end of the decade (7, 14). Use of oral health services has also shown a constant rise in Spain in recent decades, i.e., the percent of Spaniards who reported visiting the dentist in the preceding three months rose from 13.6% in 1987 to 17.2% ten years later, with the increase in the number of visits being more marked in the younger age groups (16).

The importance of socio-demographic variables vis-à-vis oral health and use of dental services among children has been demonstrated in many western countries (17-20). Until recently, this association has hardly been studied in Spain, and those studies that do exist have covered samples that were somewhat unrepresentative (14, 21-23). However, the fact that National Health Surveys are now conducted every four years means that different factors exerting an influence on the health of Spanish citizens can be assessed (24, 25).

Accordingly, this study sought to ascertain the influence of sociodemographic variables on dental service utilization and oral health, using representative data from the 2001 National Health Survey (*Encuesta Nacional de Salud* -ENS) of the Spanish population aged 3-15 years.

Methods

This was a descriptive cross-sectional study based on secondary individualized data drawn from the most recent Spanish National Health Survey conducted by the Ministry of

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Health & Consumer Affairs in 2001(26). These National Health Surveys are periodically undertaken and cover a random sample representative of the non-institutionalized Spanish population. For study purposes, the data used was from 4063 interviews that were held with the parents or guardians of children aged 3-15 years, addressing different aspects of such children's health. All interviews were conducted by purpose-trained interviewers at participants' homes. The following survey questions were used.

To assess use of dental health services: 1) "How long ago did your child last visit a dentist, stomatologist or dental hygienist?" For analysis purposes, this question was categorized into three groups, namely, children that had sought dental care: in the preceding 12 months; over 12 months ago; and never. 2) "The last time your child visited the dentist, did he/she do so for one or more of the following reasons?" Parents could answer affirmatively to one or more of the following options: a) examination or check-up; b) teeth cleaning; c) fillings; d) extractions; e) fitting of crowns, bridges or prosthesis; f) gum treatment; g) orthodontics; h) sealants and/or application of fluoride; and f) other reasons.

To assess dental health: 3) "Is your child currently suffering from any of the following dental and oral diseases or disorders?" Parents could answer affirmatively to one or more of the following options: a) my child has cavities; b) my child has fillings in his/her teeth/molars; and c) my child's gums bleed when his/her teeth are brushed.

To analyze dental health, a new variable was created. Subjects were classed as "Caries ever affirmative" if they answered affirmatively to option "c" in Question 2 and/or affirmatively to options "a" and/or "b" in Question 3. Analysis included selected independent variables: sex, age, size of town or city, educational level of the head of the family, and monthly income of the family unit categorized as shown in Table 1.

A bivariate analysis was performed, with calculation of proportions and Odds Ratios (OR). Using logistic regression as a technique of multivariate analysis, two models were constructed for the dependent variables "Caries ever" and "No dental care in the preceding 12 months." For study purposes, all statistical and epidemiologic calculations were performed using the SPSS v. 11.5 statistical software program (27).

Results

Results broke down as follows: 51.2% of study subjects were male; mean age for the total sample was 9.36 years (SD 2.48); 41.5% resided in cities or towns of over 10,000 inhabitants; only 14.9% of those for whom the "monthly income" variable was recorded were in the over 1800 euros per-month income bracket; and 58.4% of parents or guardians had completed their formal education before age 15 years (Table 1).

Only 47.1% of children in the study had visited a dentist, stomatologist or dental hygienist in the preceding 12 months. As can be seen from Table 1, the visit the dentist in the preceding twelve months was greatest among the 7- to 9-year age group, and rose significantly with parents educational level and monthly income.

The reasons for such visits are shown in Table 2. The most frequent reason cited was examination or check-up (68.8%), followed by fillings (19.3%), while orthodontics and application of sealants and topical fluoride accounted for 11.4% and 8.7% of all dental visits, respectively.

Multivariate adjustment for no dental visit in the preceding 12 months (Table 3) showed that children having parents or guardians with the lowest educational level were 1.4 times (95% CI: 1.096-1.679) more likely to have received no dental care in the preceding year than peers having parents or guardians with the highest educational level. Similarly, the likelihood of not having made use of these healthcare services rose two-

TABLE 1
Prevalence of use of dental services and dental caries, by sociodemographic variables

Socio-demographic indicators	n	Yes, dental care in preeceeding 12 months (%)	Yes, dental over 12 months ago (%) *	Never dental care (%)	Caries ever (%)
Sex					
Male	2082	46.5	22.5	31.0	30.9
Female	1981	47.7	21.2	31.1	32.0
Age group					
3-6 years	1159	21.0	7.5	71.5	9.8
7-9 years	953	61.3	19.1	19.6	33.9
10-12 years	1199	57.4	29.4	13.3	41.2
13-15 years	752	53.1 †	35.4	11.6	45.4 †
Town or city					
<10,000 inhab.	968	42.4	24.5	33.2	35.5
10-100,000 inhab.	1410	47.8	21.4	30.8	32.8
>100,000 inhab.	1685	49.3 ‡	20.7	30.1	28.1 †
Educational level					
Halted prior to age 15 yrs.	2301	44.0	24.0	32.0	34.9
Halted at ages 15-18 yrs.	785	53.1	19.2	27.6	28.4
Higher education	851	52.2 †	19.4	28.4	24.5 †
Monthly income					
< 900 Euros	1041	36.4	24.3	39.3	33.8
900-1800 Euros	1631	48.6	21.5	29.9	28.4
>1800 Euros	556	56.5 †	19.2	24.3	28.7 ‡
All	4063	47.1	21.85	31.05	31.45

*Visit to dentist, stomatologist or dental hygienist
† Statistically significant P <0.01
‡ Statistically significant P <0.05

TABLE 2
Reasons cited for last dental visit, by age group

Reason for dental visit	AGE GROUP (YEARS) 3-6 (%)	7-9 (%)	10-12 (%)	13-15 (%)	All*(%)
Examination or check-up	80.5	72.3	66.5	62.8	68.8
Teeth cleaning	3.4	6.0	7.7	13.0	8.0
Fillings (obturation)	13.3	16.6	19.3	25.1	19.3
Extraction of teeth or molars	2.5	10.3	11.5	9.6	9.7
Fitting of crowns, bridges or other types of prosthesis	0.6	1.0	1.5	1.5	1.3
Treatment of gum disease	1.4	0.9	0.3	0.6	0.6
Orthodontics	1.4	6.1	13.6	18.7	11.4
Sealants, application of fluoride	3.4	14.3	7.8	6.4	8.7
Other reasons	6.5	2.5	2.8	2.0	3.0

* Total can exceed 100% due to the possibility of more than one intervention being undertaken at any given visit

fold (95% CI: 1.576-2.618) in cases where the monthly income was <900 euros versus >1800 euros. The logistic regression model for "no dental care in preceding 12 months" globally predicted 76.3% of observed data.

Overall prevalence of caries ever was 31.4% and increased significantly with age, rising from 9.8% in the 3- to 6-year group to a maximum of 45.4% in the 13- to 15-year age group (Table 1).

Reported prevalence was higher in population centers with fewer inhabitants, and was linked to parents' educational level and monthly income in the bivariate analysis. The significance of the variables "age" and "educational level" was still in evidence after multivariate logistic regression. Children with parents in the lowest educational range were 1.4 times (95% CI: 1.078-1.708) more likely to have reported caries than those in the highest range (Table 4). The logistic regression model for "caries ever" globally predicted 69.6% of observed data.

Discussion

National Health Surveys have been employed by Spanish researchers to study a number of health-related aspects (28-29), including those specific to oral health (16, 24, 25).

The percentage of Spanish children that made use of dental services in the preceding year was 47.1%, a result slightly worse than those obtained for England and France (30) and similar to those for other European countries (31), but better than that reported by the 1997 Spanish National Health Survey (ENS97), which demonstrated that 60% of Spanish children had not visited the dentist in the preceding year (25). Differences in oral-health funding and the socioeconomic levels in the countries concerned may explain these differences (12, 16).

In this study, children in households with a lower family income and parents or guardians with the lowest educational level registered a significantly lower use of dental services in the preceding year. These results are in line with those reported by Bravo and Jiménez (16, 25). Donaldson suggests that in order to reduce social inequalities, dental screening programs should be implemented and dental care fostered among schoolgoers (31). Edelstein points out that US children from low-income families experience the greatest amount of oral disease, the most extensive disease, and the most frequent use of dental services for pain relief. Yet,these children have the fewest overall dental visits (32).

Spanish children who are aged 3-6 years or live in towns and villages of <10,000 inhabitants make less use

TABLE 3
Crude and adjusted odds ratios for sociodemographic factors associated with no dental care in preceding 12 months

Variable	Category	Crude OR (95% CI)	Adjusted OR (95% CI)
Sex	Female	1	1
	Male	1.049 (0.927 1.187)	1.071 (0.921 1.247)
Age group	13-15 years	1	1
	10-12 years	0.838 (0.697 1.006)	0.814 (0.657 1.008)
	7-9 years	0.713 (0.587 0.865)	0.692 (0.552 0.867)
	3-6 years	4.247 (3.473 5.193)	4.708 (3.718 5.962)
Town or city	>100,000 inhab.	1	1
	10,000 - 100,000 inhab.	1.062 (0.922 1.223	0.991 (0.831 1.181)
	<10,000 inhab.	1.322 (1.127 1.550)	1.219 (0.999 1.487)
Parents educational level	Halted after 18 years of age	1	1
	Halted at ages 15 - 18 years	0.962 (0.792 1.169)	1.123 (0.880 1.433)
	Halted prior to age 15 years	1.389 (1.186 1.627)	1.299 (1.039 1.624)
Monthly income	>1800 euros	1	1
	900 - 1800 euros	1.370 (1.129 1.663)	1.370 (1.129 1.663)
	<900 euros	2.264 (1.835 2.793)	2.032 (1.576 2.618)

TABLE 4
Crude and adjusted odds ratios for sociodemographic factors associated with caries ever

Variable	Category	CrudeOR (95% CI)	Adjusted OR (95% CI)
Sex	Male	1	1
	Female	0.953 (0.836 1.086)	(0.956 (0.815 1.121)
Age group	3-6 years	1	1
	7-9 years	4.711 (3.731 5.950)	5.335 (4.046 7.034)
	10-12 years	6.431 (5.128 8.033)	7.316 (5.624 9.533)
	13-15 years	7.641 (6.030 9.683)	8.443 (6.621 11.206)
Town or city	>100,000 inhab.	1	1
	10,000 - 100,000 inhab.	1.249 (1.073 1.453)	1.139 (0.946 1.371)
	<10,000 inhab.	1.410 (1.193 1.665)	1.202 (0.976 1.479)
Parents educational level	Halted after 18 years of age	1	
	Halted at ages 15 - 18 years	1.222 (0.983 1.518)	1.027 (0.767 1.341)
	Halted prior to age 15 years	1.652 (1.385 1.971)	1.377 (1.078 1.708)
Monthly income	>1800 euros	1	1
	900 - 1800 euros	1.180 (0.871 1.599)	0.854 (0.673 1.084)
	<900 euros	1.674 (1.191 2.353)	1.041 (0.799 1.357)

of dental services, thereby confirming the results reported in other studies (16,8,25) and rendering it necessary for measures to be taken to encourage parents or guardians to take their children to dental services a minimum of once per year from the time they are born, as is the case elsewhere (33, 34). The reason for this is that, by the time preventive programs begin in Spain at age six years, approximately 30% of children already have caries in their temporary dentition (4, 5, 16).

Insofar as the study of caries prevalence is concerned, reliance on self-reported oral health data could lead to the true prevalence of dental and oral diseases being inaccurately estimated. In this regard, a recent examination-based survey on the dental health of Spanish children yielded a caries prevalence of 43.3% at age 12 years and 59.1% at age 15 years. While these results are comparable to those for this sample (16), higher prevalences have been reported by other authors (2, 10); even so, it seems rather unlikely that underestimation would bias the influence of socioeconomic variables on caries prevalence Accordingly, studies with objective measures of caries, such as that undertaken by Llodra Calvo *et al.* (14), report a mean number of decayed, missing or filled teeth (DMFT) of 1.26 for low-class versus a mean of 0.85 ($p<0.05$) for high-class 12-year-olds. Similar results were reported by Nieto Garcia *et al.* in Ceuta, Spain, who observed a higher DMFT among children coming from a low socioeconomic level (21), and by Dominguez Rojas *et al.* who, in a study relying on methodology similar to that of this study, found that lower social class was associated with a higher likelihood of cavities (22).

In the *Children's Dental Health in Europe* study, a collaborative study which covered a total of 3,200 children, comprising samples of 5-year-old and 12-year-old children from eight European Union countries who had undergone clinical examination by well-calibrated dentists, the authors concluded that, taking into account the total material for the 1600 children in each age-group, the risk indicators for caries, identified by logistic and multiple regression analyses, were: social class of the family; the mother's smoking habits; and, among the 5-year-olds, the number of siblings (12).

The most frequently quoted reason for dental visits was check-up, inasmuch as 68.8% of the children had been examined in the preceding 12 months, 5% more than the figure obtained by Jiménez *et al.* on the basis of the 1997 health survey (25). Higher frequencies were likewise obtained for visits motivated by the need for orthodontics and application of sealants and/or fluoride (11.4% vs 11.2% and 8.7% vs 4.8%). These results confirm those obtained in the childhood dental care program in other regions in Spain, where greater response to preventive programs and higher percentage of children with sealants were observed (4, 5).

When sociodemographic variables were associated with dental caries, risk of caries was observed to rise with age group, thereby confirming age as a risk factor for dental caries (25, 35 36).

Bivariate analysis of socio-demographic factors and dental caries showed an association for small towns, lower educational levels and lower income. However, when the model was adjusted, significance was lost for income and size of town or city. On comparing these results against those obtained in the 1997 survey, the authors observed a risk of 1.5 for children whose parents had an income of less than 600 euros: possibly this difference is due to the fact that the low-income reference cat-

egory in this study was increased to 900 Euros (25). In the 1997 survey, Jiménez *et al.* failed to observe an association for parents' educational level. In contrast, in this study multivariate analysis showed that low parents' educational level was associated with a risk of 1.4 of suffering from caries, thus corroborating the finding that a lower educational level of parents or guardians increases the risk of dental caries (37).

In the opinion of the authors, some strategies that may help to reduce the inequalities in the use of dental services and oral health among Spanish children include implementing free preventive programs at earlier ages; dental screening programs for schoolgoers; and increasing dental care educational programs at schools and health care centers.

There are some possible study limitations. First, information on the validity of parents' reports on the use of dental services and dental caries is not yet available. In this respect, however, national health surveys have been previously used for several studies on the use of dental care services and dental health in Spain and other countries (16, 18, 24, 25). Lastly, the existence of possible non-response bias should be considered.

The conclusions to be drawn from this study are that Spanish children from the lowest social classes make less use of dental services, which might possibly be explained by the lack of free, publicly funded dental restoration services. In addition, children from these social classes face a higher risk of suffering from caries, so that measures should be taken to attend to the most disadvantaged children.

Fortunately, some of Spain's autonomous regions have recently introduced free public dental restoration services for the 6- through 15-year age range, a measure that will have to be assessed in the coming years in order to ascertain whether it indeed contributes to reducing the existing social inequality in dental health service utilization and oral health among Spanish children.

References

1. Ministerio de Sanidad y Consumo de España. Programa de Salud Bucodental. Dirección de Planificación Sanitaria. Madrid. 1987.
2. Tapias MA, De Miguel G, Jimenez-Garcia R, Gonzalez A, Dominguez V. Incidence of caries in an infant population in Mostoles, Madrid. Evaluation of a preventive program after 7.5 years of follow-up. Int J Paediatr Dent 2001; 11(6):440-6.
3. Gomis Subira M. [Evaluation of dental caries in 6-year old students in the Manresa basic area (Barcelona)]. Aten Primaria 2000; 26: 35-37.
4. Freire JM.[The Child Oral Care Program (PADI) of Navarra And the Basque Country: achievements and new goals]. An Sist Sanit Navar 2003; 26: 423-428.
5. Cortes FJ, Ramón JM, Cuenca E.[Twelve years of the child oral care program (PADI) in Navarra (1991-2002). Utilization and health indicators]. An Sist Sant Navar 2003; 26: 373-382.
6. Alvarez-Arenal A, Alvarez-Riesgo JA, Pena-Lopez JM, Fernandez-Vazquez JP. DMFT, dmft and treatment requirements of schoolchildren in Asturias, Spain. Community Dent Oral Epidemiol 1998;26: 166-169.
7. Dolado I, Casanas P, Nebot M, Manau C. [The prevalence of caries and associated factors in 12-year-old schoolchildren of Barcelona]. Aten Primaria 1996; 18: 111-115.
8. Salas-Wadge MH. Dental caries experience in 7-, 12- and 14-year-old children in Andalucia, Spain. Community Dent Health 1994; 11: 135-141.
9. Sundberg H. Changes in the prevalence of caries in children and adolescents in Sweden 1985-1994. Eur J Oral Sci 1996;104 (Pt 2): 470-476.
10. Lorenzo Garcia V, Smyth Chamosa E, Hervada Vidal X, Fernandez Casal R, Alonso Meijide JM, Amigo Quintana M et al. [Oral health in Galician schoolchildren. 1995]. Rev Esp Salud Publica 1998; 72: 539-546.
11. Pieper K, Schulte AG. The decline in dental caries among 12-year-old children in Germany between 1994 and 2000. Community Dental Health 2004; 21: 199-206.
12. Bolin AK, Bolin A, Jansson L, Calltorp J. Children's dental health in Europe. Swed Dent J. 1997; 21: 25-40.
13. [Spanish National Health Survey 1997]. Subdirección General de Epidemiología, Promoción y Educación para la Salud. Encuesta Nacional de Salud de España 1997. Ministerio de Sanidad y Consumo, 1999.
14. Llodra Calvo JC, Bravo Perez M, Cortes Martincorena FJ.[Oral Health Survey in Spain (2000)]. RCOE 2002; 7 (Special number): 19-63.
15. Tapias MA, Gil de Miguel A, Domínguez Rojas V.[Prevalencia de caries en una poblacion infantil de Móstoles]. Av odontoestomatol 2000; 4: 241-250.
16. Bravo M. Age-period-cohort analysis of dentist use in Spain from 1987 to 1997. An analysis based on the Spanish National Health Interview Surveys. .Eur J Oral Sci. 2001; 109: 149-54.
17. Eklund SA. The impact of insurance on oral health. J Am Coll Dent. 2001; 68: 8-11.
18. Hjern A, Grindefjord M, Sundberg H, Rosen M. Social inequality in oral health and use of dental care in Sweden. Community Dent Oral Epidemiol. 2001; 29: 167-74.
19. Gibson S, Williams S. Dental caries in pre-school children: associations with social class, toothbrushing habit and consumption of sugars and sugar-containing foods. Further analysis of data from the National Diet and Nutrition Survey of children aged 1.5-4.5 years. Caries Res. 1999; 33: 101-113.
20. Schou L, Uitenbroek D. Social and behavioural indicators of caries experience in 5-year-old children. Community Dent Oral Epidemiol. 1995; 23: 276-281.
21. Nieto Garcia VM, Nieto Garcia MA, Lacalle Remigio JR, Abdel-Kader Martin L.[Oral health of school children in Ceuta. Influences of age, sex, ethnic background and socioeconomic level]. Rev Esp Salud Publica. 2001; 75: 541-549.
22. Dominguez-Rojas V, Astasio-Arbiza P, Ortega-Molina P, Gordillo-Florencio E, Garcia-Nunez JA, Bascones-Martinez A. Analysis of several risks factors involved in dental caries through multiple logistic regression. Int Dent J. 1993; 43: 149-156.
23. Navarro-Rubio MD, Jovell AJ, Schor EL. Socioeconomic status and preventive healt-care by children in Spain. Am J Prev Med 1995; 11: 256-262.
24. Bravo M. Private dental visits per dentist in Spain from 1987 to 1997. An analysis from the Spanish national Health Interview Surveys. Community Dent Oral Epidemiol. 2002; 30: 321-328.
25. Jiménez R, Tapias-Ledesma MA, Gallardo-pino C, Carrasco P, Gil de Miguel A. Influence of sociodemografic variables on use servicies, oral health and oral higiene among Spanish children. Int Dent J 2004; 54: 187-192.
26. [Spanish National Health Survey 2001]. Subdirección General de Epidemiología, Promoción y Educación para la Salud. Encuesta Nacional de Salud de España 2001. Ministerio de Sanidad y Consumo, 2003.
27. SPSS for Windows version 11.5. SPSS Inc 2003. Chicago, Illinois, USA.
28. Lasheras L, Aznar S, Merino B, Lopez EG. Factors associated with physical activity among Spanish youth through the National Health Survey. Prev Med. 2001; 32: 455-464.
29. Lete I, Bermejo R, Coll C, Duenas JL, Doval JL, Martinez-Salmean J, Masset

J, Parrilla JJ, Serrano I. Use of contraceptive methods in Spain: results of a national survey. Contraception. 2001; 63: 235-238.
30. Slater M. Dental health of 14-year-old children in St. Ouen, France and Salford, England.. Community Dent Health. 1994;11: 164-166.
31. Donaldson M, Kinirons M. Effectiveness of the school dental programme in stimulating dental attendance for children in need of treatment in Northern Ireland. Communty Dent Oral Epidemiol 2001; 29: 143-149.
32. Edelstein BL. Disparities in oral health and access to care: findings of national surveys. Ambul Pediatr. 2002; 2(supll II):141-147.
33. Axelson P, Paulander J, Svärdström G,Tollskog R, Nordensten S. Integrated caries prevention: effect of a needs-related preventive program on dental caries in children. Caries Res 1993; 27(supll I): 83-94.
34. Varsio S, Vehkalahti M. Evaluation of preventives treatment by risk of caries among 13-year-old. Community Dentistry Oral Epidemiol 1996; 24: 277-281.
35. Ferjerskov O. Strategies in the desing of preventive programs. Adv Dent Res 1995; 9: 82-88.
36. Mora Leon L, Martinez Olmos J. [The prevalence of caries and associated factors in children 2-5 years old from the Almanjayar and Cartuja Health Centers of the capital Granada]. Aten Primaria. 2000 15; 26: 398-404.
37. Vanobberge JN, Martens LC, Lesaffre E, Declerck D. Parenteral occupational status related to dental caries experience in 7-year-old children in Flanders (Belgium). Community Dent Health 2001; 18: 256-262.