Use of Dental Care and Prevalence of Caries among Immigrant and Spanish-Born Children

Miguel Angel Tapias-Ledesma, PhD
Pilar Carrasco Garrido, PhD
Mercedes Esteban y Peña, MD
Valentín Hernánez-Barrera, PhD
Ángel Gil de Miguel, PhD
Rodrigo Jiménez-Garcia, PhD

ABSTRACT

Purpose: The purpose of this paper was to describe the use of dental services and the prevalence of dental caries in children living in Madrid, Spain.
Methods: A descriptive, cross-sectional study was conducted using data from the Madrid City Health Survey. The questions asked were: (1) When was the last time your child visited the dentist? (2) What was the reason for your child's last visit? and (3) Is your child currently suffering from caries, fillings, or bleeding from the gums when brushing? The independent variables included: sex; age; education level; and nationality.
Results: Data from 960 children (approximately 27% of whom were immigrants) were analyzed. Over the last year, approximately 59% of the children had received dental care and 28% suffered from caries. After multivariate analysis, we observed that 3- to 6-year-old children, immigrants, and children of parents with low education levels are more likely not to have received dental care during the last year. We also found that children are more likely to suffer from caries as they get older and if they are immigrants.
Conclusions: Being an immigrant and from a lower education level typically results in a less frequent use of dental health services, and children of immigrants have a greater risk of suffering from dental caries. It is essential to investigate the reasons why and introduce strategies to reduce barriers to dental health access among immigrants.
(J Dent Child 2011;78:36-42)
Received August 27, 2009; Last Revision December 17, 2009; Revision Accepted December 18, 2009.

KEYWORDS: CARIES, EPIDEMIOLOGY, DENTAL SERVICES, PUBLIC HEALTH, IMMIGRANTS

Madrid, the capital of Spain, has a population of 3.2 million inhabitants. On January 1, 2007, the population of children younger than 16-years-old was 424,169 inhabitants, of whom 62,232 were immigrants (approximately 15%).[1]

Pediatric dental care in Madrid and throughout Spain is provided by the private and public health sectors.[2] Although the services provided to children by the public system have increased in recent years, they are still mainly confined to preventive and orodental health promotion programs.[2,3] Currently, apart from preventive measures and health education and promotion activities, pediatric dental care programs offer other services, including filling in the first and second permanent molars. There is no conservative option, however, for the primary dentition or for the treatment of malocclusions.[4-6]

In Spain and other European countries, pediatric orodental care has improved in the last few years.[7-14] Nevertheless, the prevalence of caries in the primary dentition in 6-year-olds continues to be high, although it has fallen in the last 10 years from approximately 40% to 50% in 1990 to 33%, according to the 2000 Spanish Oral Health Survey.[15]

Dr. Tapias-Ledesma is a medical doctor and dentist, Dr. Hernánez-Barrera is a medical doctor, Dr. Garrido is medical doctor, Dr. de Miguel is a medical Doctor, Dr. Peña is a medical doctor, and Dr. Jiménez-Garcia is a medical doctor, all at the Preventive Medicine and Public Health Teaching and Research Unit, Health Sciences Faculty, Rey Juan Carlos University, Madrid, Spain.
Correspond with Dr. Jimenez-Garcia at rodrigo.jimenez@urjc.es

The prevalence of caries in the permanent dentition, as shown by studies from the early 1990s, was approximately 70% for 12-year-olds,[6,8] falling to 40% to 50% at the end of the 1990s.[7,15] Similarly, the use of orodental health services in Spain has increased constantly over the last few decades. Thus, the number of people visiting the dentist during the previous 3 months rose from approximately 14% in 1987 to 17% in 1997, with the biggest increase being in the number of visits among the younger age groups.[16,17]

The importance of sociodemographic variables in oral health and the use of dental care services by children have been confirmed in many Western countries.[18,22] These data have shown that immigrants have a greater risk of suffering from caries[23] and use dental services more often.[24]

Based on sociodemographic variables, the purpose of this study was to describe the use of dental services and the prevalence of dental caries in 3- to 15-year-old patients living in Madrid. Special attention was paid to the differences arising between immigrants and Spanish-born patients.

METHODS

A descriptive, cross-sectional study was conducted on the use of dental health services and prevalence of caries among 3- to 15-year-olds living in Madrid.

Our study was based on individual data drawn from the Madrid City Health Survey (Encuesta de Salud de la ciudad de Madrid, ESCM 05), undertaken by the Madrid City Council from November 2004 to June 2005 on a representative sample of the city's population. The sampling procedure was conducted in 2 stages, with stratification by clusters. The survey covered a total of 1,163 children, and the estimated overall sample error was ±0.7%.[25]

Information was collected via personal, home-based interviews of each child's parents using a structured questionnaire. ESCM 05 methodology is described elsewhere.[25] The questions asked in the survey were as follows:

TO EVALUATE THE USE OF DENTAL HEALTH CARE SERVICES

1. When was the last time your child visited the dentist and/or stomatologist? For purposes of the analysis, this question was categorized into 3 groups—children who had: (a) visited their dentist during the last 12 months; (b) visited their dentist more than 12 months ago; and (c) never visited a dentist.
2. What was the reason for your child's last visit to the dentist? The parent could answer "yes" to 1 or more of the following options: (a) check-up; (b) cleaning; (c) fillings; (d) extractions; (e) orthodontic treatment; (f) fitting of crowns, bridges, or prosthesis; (g) treatment of gum disease; (h) sealants and/or application of fluoride; and (i) other.

TO EVALUATE DENTAL HEALTH

3. Is your child currently suffering from any of the following orodental conditions? The parent could answer "yes" to 1 or more of the following options: (a) caries; (b) fillings in teeth/molars; (c) bleeding from the gums when brushing.

To analyze dental health, a new variable was created. Patients were considered "caries affirmative" if they answered "yes" to option c of question 2 and/or options a and/or b of question 3.

The following were analyzed as independent variables: sex; age; type of consultation; education level of the parent and/or tutor; and whether the patient was an immigrant or Spanish-born. The child was considered Spanish-born, regardless of the country of birth, if his or her father was Spanish. Educational level was measured by asking the parent or tutor at what age they stopped going to school or to other educational institution (high school, college, or university). The answer was categorized in three categories "Halted prior to 15-years-old," "Halted between 15 and 18-years-old."

A bivariate analysis was performed, with calculation of proportions and odds ratios (**OR**). Logistic regression was used for the multivariate analysis. Two models were presented for the independent variables "no dental care during the last 12 months" and "Caries affirmative," using the sociodemographic variables recorded as independent variables.

Estimates were made using the "svy" (survey commands) functions of the STATA program, which enabled us to incorporate the sampling design and weights into all our statistical calculations (descriptive, confidence intervals, logistic regression). Statistical significance was set at $P<.05$ (P-values are 2-tailed).

RESULTS

Data from 960 children were analyzed. The mean age for the whole sample was 9.19 years (3.92±SD); approximately 52% were males, and 68% of the parents and/or guardians had completed their education by 15- to 18-years of age. For purposes of this study, 27% of the children were considered immigrants.

Table 1 shows the results for the use of dental services and prevalence of caries according to sociodemographic variables. In the last 12 months, 59% of the children included in the study had received dental care, although this figure was only approximately 31% in 3- to 6-year-olds. We also observed that the higher the parents' education level, the more visits to the dentist. Overall, private dentists received more visits (68 total [97%]).

Of the total sample, approximately 28% suffered from or were treated for caries; by age group, the prevalence

was approximately 43% in 13- to 15-year-olds and 9% in 3- to 6-year-olds.

Regarding children whose parents have a high education level, approximately 24% were treated for caries vs 34% of children whose parents have a low education level. These differences were statistically significant ($P<.01$). Table 2 shows the reasons for visiting the dentist. The most frequent was checkup (70%), followed by fillings (7%).

Table 3 compares visits to dental health services, the reason for the visit, and the presence of caries among immigrant and Spanish-born children. Lower numbers of immigrant children were observed to have visited the dentist. There also were significant differences in the reasons for visits—extractions were significantly more common among immigrant children, whereas orthodontic treatment was less common.

After making a multivariate adjustment according to the variable "no dental care during the last 12 months" (Table 4), we observed that: 3- to 6-year-olds are 5 times (95% confidence interval [CI]=3.42-7.31) more likely not to have received dental care than 13- to 15-year-olds; immigrant children are 1.42 times (95% CI=1.03-1.96) more likely not to have received dental care than Spanish-born children; and the children of parents or guardians with a low education level are 2.77 times (95% CI=1.74-4.42) more likely not to have received dental care during the last year than children of parents with a higher education level.

After performing a multivariate analysis using logistic regression for the association between "caries affirmative" (Table 5) and sociodemographic variables, we observed significant ORs for the age and immigrant variables. This means that children are more likely to suffer from caries as they get older and if they are immigrants.

Table 1. Prevalence of Use of Dental Care Services and Caries According to Sociodemographic Variables

Sociodemographic variables	N	Last time the child visited the dentist (%)			Caries affirmative (%)
		≤12 mos (%)	>12 mos (%)	Never (%)	
Sex					
Male	504	57	17	25	28
Female	456	61	21	23	29
Age group (ys)					
3-6	281	31	9	60	9
7-9	216	73	13	14	29
10-12	209	73	19	8	38
13-15	254	67*	26	7	43*
Education level					
Halted prior to 15 ys old	133	44	25	31	34
Halted at 15-18 ys old	549	59	17	27	30
Higher education	270	64*	12	24	24*
Dentists					
Public	220	75	25	N/A†	36
Private	489	81	19		36
Total	960	59	17	24	28

* Statistically significant at P<.01. † N/A=not available.

Table 2. Reasons Cited for Last Visit to the Dentist According to Age Group

Reason for last visit to the dentist	Age group (ys)				
	3-6 (%)	7-9 (%)	10-12 (%)	13-15 (%)	All* (%)
Examination or checkup	76	67	67	70	69
Teeth cleaning	0	2	1	5	3
Fillings (obturation)	4	9	9	6	7
Tooth extraction	3	5	7	3	4
Fitting of crowns, bridges, or other type of prosthesis	1	0	1	1	1
Gum disease treatment	1	0	1	0	1
Orthodontics	2	3	6	10	6
Sealants/fluoride application	7	11	6	2	6
Other	6	3	2	3	3

DISCUSSION

Regional Health Surveys and National Health Surveys are used by Spanish investigators to study different aspects of health[26,28] as well as specific aspects of orodental health.[23,29]

The percentage of 13- to 15-year-olds from Madrid who received dental care during the last year was approximately 59%, which is lower than the figures from England and similar to those from France.[30] They are better than the figures from the 2001 National Health Survey, however, in which approximately 47% of children had received dental care during the last year.[19] Differences in the funding of dental care and in the socioeconomic level between countries can explain these variations.[12,16] Donaldson and Kinirons[31] suggest that, to reduce social inequalities, school dental screening programs should be established and an effort made to encourage dental health care.

Our study showed that immigrant children used dental services significantly less during the previous year. On the other hand, Canadian immigrants use dental services more,[24] although these differences may be affected by the population's age, since the population

studied by Newbold and Patel was 12 or older.[24] This study and others showed that younger children visit the dentist less often.[3,18]

In fact, 3- to 6-year-olds from Madrid use dental services 5 times less than 13- to 15-year-olds, thus corroborating the results obtained in other studies in which younger children visit the dentist less often.[17,31] Huan et al. found that, in the United States, children younger than 5-years-old used dental services 3 times less than 11- to 17-year-olds and that foreign-born non-citizen children had no dental visit in the past 12 months—2 times less than US-born citizen children.[32] The number of visits increased, however, for Madrid children (31%) vs Spanish children as a whole (21%) in the 2001 National Health Survey, although it is still low. Therefore, parents and guardians should be encouraged to take their children to the dentist sooner, as is the case in other countries.[19,33]

A study of the prevalence of caries reveals a possible limitation of health surveys, since the use of self-reported data on orodental health could underestimate the real prevalence of oral diseases vs data collected using objective methods. Thus, a recent survey on the dental health of Spanish children conducted by physical examination revealed approximately 43% prevalence of caries at 12-years-old and a 59% prevalence at 15-years-old, that is, greater rates than those of our sample.[15] A study using the 2001Spanish National Health Survey revealed approximately a 31% prevalence of caries, greater than the 28% prevalence observed in our study, thus confirming the downward trend of the prevalence of caries.[19] In Italy, Ferro et al., obtained a prevalence of dental caries in 5- and 12-year-olds that is similar to those of other industrials countries. When their results for 12-year-olds were compared with those of 2 previous surveys (1984 and 1994), a major decline in the prevalence of dental caries was observed.[34]

It seems unlikely that underestimating the prevalence of caries will bias the effect of socioeconomic variables. We observed that the prevalence of caries increases with age, although this is lower in all age groups than the rate observed by Jiménez et al.,[18] thus corroborating the decrease in the prevalence of dental caries. Other authors also have associated sociodemographic variables with dental caries and observed, as did we, that the risk of caries increases with age, thus confirming age as a risk factor.[26,35-37]

Studies using objective measures of caries, such as one by Llodra Calvo et al.,[15] found a DMFT (mean number of decayed, missing, or filled teeth) of 1.26 in 12-year-olds from a lower socioeconomic stratum compared with 0.85 among those from a higher socioeconomic stratum (P<.05). Similar results were found in Ceuta by Nieto García et al.,[35] who observed a higher DMFT in children from a lower socioeconomic stratum. The results presented by Dominguez Rojas et al.,[37] who used a methodology similar to ours, also show that belonging to a lower socioeconomic stratum is associated with a higher probability of caries. Marthaler reported that children of low socioeconomic status and immigrants from outside Western Europe, generally have higher caries prevalence.[38]

In Oslo, Norway, Skeie et al., analyzed existing disparities in oral health among immigrant and western native children, finding that, among the 5-year-olds,

Table 3. Dental Care, Reasons for Last Visit to the Dentist, and Presence of Caries among Immigrants and Spanish-born Children Living in Madrid

	Category	Immigrants (%)	Spanish-born (%)*
Last time the child visited the dentist *	≤12 mos*	50	62
	>12 mos	19	25
	Never	31	13
Reason for last visit to the dentist	Examination or checkup	65	71
	Teeth cleaning	4	2
	Fillings (obturation)	9	7
	Extraction of teeth or molars*	9	3
	Fitting of crowns, bridges, or other types of prosthesis	1	1
	Gum disease treatment	0	1
	Orthodontics*	2	7
	Sealants/fluoride application	5	6
	Other reasons	5	2
Caries affirmative	Yes	32	27
	No	68	73

** Statistically significant at P<.01.*

Table 4. Crude and Adjusted Odds Ratios (OR) for Sociodemographic Factors Associated With "No Dental Care in Preceding 12 Months"

Variable	Category	Crude OR (95% confidence interval)	Adjusted OR (95% confidence interval)
Sex	Female	1	1
	Male	1.15 (0.88-1.49)	1.34 (1.01-1.78)
Age group	13-15 ys	1	1
	10-12 ys	0.74 (0.50-1.11)	0.76 (0.50-1.15)
	7-9 ys	0.75 (0.50-1.11)	0.76 (0.51-1.51)
	3-6 ys	4.50 (3.13-6.48)	5.00 (3.42-7.31)
Education level	Halted after 18 ys old	1	1
	Halted at 15-18 ys old	1.24 (0.92-1.68)	1.31 (0.94-1.84)
	Halted prior to 15 ys old	2.27 (1.49-3.47)	2.77 (1.74-4.42)
Nationality	Spanish-born	1	1
	Immigrant	1.61 (1.21-2.15)	1.42 (1.03-1.96)

Table 5. Crude and Adjusted Odds Ratios (OR) for Sociodemographic Factors Associated With "Caries Affirmative"

Variable	Category	Crude OR (95% confidence interval)	Adjusted OR (95% confidence interval)
Sex	Male	1	1
	Female	1.01 (0.76-1.33)	1.12 (0.83-1.51)
Age group	3-6 ys	1	1
	7-9 ys	4.31 (2.58-7.19)	4.54 (2.71-7.62)
	10-12 ys	6.50 (3.93-10.76)	6.85 (4.22-11.40)
	13-15 ys	7.92 (4.86-12.88)	8.21 (5.01-13.48)
Education level	Halted after 18 ys old	1	1
	Halted at 15-18 ys old	1.35 (0.96-1.88)	1.26 (0.88-1.79)
	Halted prior to 15 ys old	1.64 (1.05-2.60)	1.36 (0.84-2.21)
Nationality	Spanish-born	1	1
	Immigrant	1.28 (0.94-1.74)	1.49 (1.07-2.08)

the caries risk indicators were: immigrant background; parental indulgence; attitude to diet; attitude to oral hygiene; social status; and age when tooth-brushing began. Being an immigrant was closely associated with higher caries prevalence and experience. Parental attitudes to oral hygiene, diet, and indulgence and caries-related behaviours distinguished immigrants from western natives.[39]

The most common reason for a visit to the dentist is a check up; this reflects the results obtained by Tapias-Ledesma et al.,[19] from the 2001 National Health Survey. Lower frequencies, however, are obtained for the application of fluoride or sealants. Therefore, new strategies should be applied in Madrid to boost preventive services and to continue to reduce the prevalence of caries, as is the case in other parts of Spain and neighboring countries,[6,40,41] where the prevalence of caries is lower in children who have greater access to prevention programs and a higher number of sealants.[4,5] Newbold and Patel suggested that foreign-born respondents obtained dental services to address the needs for physical oral care (eg, attending to teeth, gums, cleaning, fluoride, maintenance, fillings, or extractions) more often than native-born Canadians.[24]

The multivariate analysis showed that the sociodemographic factors associated with not visiting the dentist during the last 12 months relate to: a lower age group; a lower education level among parents; and being an immigrant. When these data are compared with those obtained from studies carried out in Spain and abroad, they agree regarding the relationship between age and lower education level.[18,19,26]

In the bivariate analysis of sociodemographic factors, a relationship is established with age and lower education level (Table 5). In Germany, immigrant children have a poorer dental health status than native children coming from the same low socioeconomic classes.[42] In Sweden, Hjern et al., suggested a strong relationship between caries in childhood and socioeconomic status; this study suggested a need for developing selective preventive oral health strategies for lower classes.[20] When the model is adjusted, however, significance is lost for education level and reached for being an immigrant, with an OR of 1.49 (95% CI=1.03-1.96). Comparing these results with those of the 2001 National Health Survey, a risk of 1.37 for the children of parents with a lower education level is observed. This agrees with the results of other authors,[19,43] who also show that the lower the parents' education level, the higher the risk of dental caries. The children of immigrant parents have a 1.49-times greater risk of caries, thus confirming the results of Almerich-Silla and Montiel-Campany,[23] who found a greater risk of suffering from caries in the immigrant population. In Madrid, we must readapt our oral health care prevention programs to immigrants and socially disadvantaged groups, since they have a greater risk of suffering from caries and can increase its caries prevalence.[38]

There are a number of limitations to our study. First, unvalidated self-reported data on the use of dental care services and dental caries could entail a possible bias. Secondly, any information obtained within an interview context may be subject to recall error or the tendency of interviewees to give socially desirable responses. Lastly, the initial response rate for the ESCM 05 was 40%, and the nonresponse rate was slightly higher among females, individuals with a lower education level, and immigrants, so that the existence of a possible nonresponse bias should, therefore, be considered.[25] Regarding the immigrant population, it is logical to think that those having legal residence status or a longer period of residence in Madrid would be over-represented in the sample. In Spain, by the time the study was conducted, obtaining Spanish nationality was a long process that often required demonstrating at least 10 years of legal residency. Immigrants with legal residency could have their families join them, but the children that migrated into Spain could not receive Spanish nationality status until their parents obtained it.

CONCLUSIONS

Based on this study's results, the following conclusions can be made:

1. Being an immigrant of lower socioeconomic status results in less frequent use of dental health services, and immigrant children have a greater risk of suffering from dental caries.
2. It is essential to investigate the reasons for the aforementioned and introduce strategies to reduce the barriers to dental health access among immigrants.

Similarly, measures should be taken to improve the oral health of the most disadvantaged children by implementing school dental screening programs, increasing the number of prevention services available, and starting prevention programs at an earlier age.

ACKNOWLEDGMENTS

The authors wish to thank the Public Health Institute of the Madrid City Council (Instituto de Salud Pública—Ayuntamiento de Madrid) for furnishing the 2005 Madrid City Health Survey database.

REFERENCES

1. National Statistical Institute Of Spain. Demographics and population 2007. Available at: "www.ine.es/inebase/index.htlm". Accessed June 11, 2009.
2. Ministry of Health and Consumer Affairs. *Buccodental Health Program: Direction of Sanitary Planning.* Madrid, Spain: Ministry of Health and Consumer Affairs.; 1987.
3. Tapias MA, De Miguel G, Jimenez-Garcia R, González 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;1:440-6.
4. Freire JM. The Child Oral Care Program (PADI) of Navarra and Basque Country: Achievements and new goals. An Sist Sanit Navar 2003;26:423-8.
5. Ministry of Health and Consumer Affaires. Common Services Portfolio National Health System. Royal decree 10-30-2006, as of September 15. Available at: "www.boe.es". Accessed June 11, 2009.
6. 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;26:373-82.
7. Alvarez-Arenal A, Alvarez-Riesgo JA, Pena-Lopez JM, Fernandez Vazquez JP, Villa Vigil MA. DMFT, dmft, and treatment requirements of schoolchildren in Asturias, Spain. Community Dent Oral Epidemiol 1998;26:166-9.
8. 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;18:111-5.
9. Salas-Wadge MH. Dental caries experience in 7-, 12-, and 14-year-old children in Andalucia, Spain. Community Dent Health 1994;11:135-41.
10. Sundberg H. Changes in the prevalence of caries in children and adolescents in Sweden: 1985-1994. Eur J Oral Sci 1996;104:470-6.
11. Lorenzo Garcia V, Smyth Chamosa E, Hervada Vidal X, et al. Oral health in Galician schoolchildren: 1995. Rev Esp Salud Publica 1998;72:539-46.
12. 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.
13. Bolin AK, Bolin A, Jansson L, Calltorp J. Children's dental health in Europe. Swed Dent J 1997;21:25-40.
14. Deputy General Director of Epidemiology, Promotion and Health Education. *National Health Survey of Spain 2001*. Madrid, Spain: Ministry of Health and Consumption; 1999.
15. Llodra Calvo JC, Bravo Perez M, Cortes Martincorena FJ. Encuesta de Salud Oral en España (2000) [Oral Health Survey in Spain (2000)] Article in Spanish. RCOE 2002;7:19-63. Available at: "http://scielo.isciii.es/scielo.php?script=sci_arttext&pid=S1138-123X2002000200003&lng=es&nrm=iso". Accessed January 21, 2010.
16. Almerich-Silla JM, Montiel-Campany JM. Oral health survey of the population in the Valencia Region of Spain (2004). Med Oral Patol Oral Cir Bucal 2006;11:369-81.
17. 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.
18. Jiménez R, Tapias-Ledesma MA, Gallardo-Pino C, Carrasco P, de Miguel AG. Influence of sociodemografic variables on use services, oral health, and oral hygiene among Spanish children. Int Dent J 2004;54:187-92.
19. Tapias-Ledesma MA, Jimenez R, Carrasco-Garrido P, Gil de Miguel. Influence of sociodemographic variables on dental utilization and oral health among the children included in the year 2001 National Health Survey. J Public Health Dent 2005;65:215-20.
20. Hjern A, Grindefjord M, Sundberg H, Rosem M. Social inequality in oral health and use of dental care in Sweden. Community Dent Oral Epidemiol 2001;29:167-74.
21. Gibson S, Williams S. Dental caries in preschool 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;33:101-13.
22. Schou L, Uitenbroek D. Social and behavioral indicators of caries experience in 5-year-old children. Community Dent Oral Epidemiol 1995;23:276-81.
23. Almerich-Silla JM, Montiel-Campany JM. Influence of immigration and others factors on caries in 12- and 15-year-old children. Eur J Oral Sci 2007;115:378-83.

24. Newbold KB, Patel A. Use of dental services by immigrant Canadians. J Can Dent Assoc 2006; 72:143.
25. Madrid City Council. Madrid City Health Survey. Available at: "www.madridsalud.es/publicaciones/encuesta-salud2005.pdf". Accessed July 14, 2009.
26. Navarro-Rubio MD, Jovell AJ, Schor EL. Socioeconomic status and preventive health care by children in Spain. Am J Prev Med 1995;11:256-62.
27. Lasheras L, Aznar S, Merino B, Lopez EG. Factors associated with physical activity among Spanish youth through the National Health Survey. Prev Med 2001;32:455-64.
28. Lete I, Bermejo R, Coll C, et al. Use of contraceptive methods in Spain: Results of a national survey. Contraception 2001;63:235-8.
29. 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;30:321-8.
30. Slater M. Dental health of 14-year-old children in St. Queen, France and Salford, England. Community Dent Health 1994;11:164-6.
31. Donaldson M, Kinirons M. Effectiveness of the school dental programme in stimulating dental attendance for children in need of treatment in Northern Ireland. Community Dent Oral Epidemiol 2001;29:143-9.
32. Huang ZJ, Yu SM, Ledsky R. Health status and health service access and use among children in US immigrant families. Am J Public Health 2006; 96:634-40.
33. Axelsson P, Paulander J, Svärdström G, Tollskog G, Nordensten S. Integrated caries prevention: Effect of a needs-related preventive program on dental caries in children. Caries Res 1993;27:83-94.
34. Ferro R, Meneghetti B, Stellini E. Prevalence and severity of dental caries in 5- and 12-year-old children in the Veneto Region (Italy). Community Dent Health 2007;24:88-92.
35. Nieto Garcia VM, Nieto Garcia MA, Lacalle Remigio JR, Abdel-Kader Martín L. Oral health of schoolchildren in Ceuta: Influences of age, sex, ethnic background, and socioeconomic level. Rev Esp Salud Publica 2001;75:541-9.
36. Varsio S, Vehkalahti M. Evaluation of preventives treatment by risk of caries among 13-year-olds. Community Dent Oral Epidemiol 1996;24:277-81.
37. Dominguez-Rojas V, Astasio-Arbiza P, Ortega-Molina P, Gordillo-Florencio E, Garcia-Nuñez JA, Bascones-Martinez A. Analysis of several risks factors involved in dental caries through multiple logistic regression. Int Dent J 1993;43:149-56.
38. Marthaler TM. Changes in dental caries 1953-2003. Caries Res 2004;38:173-81.
39. Skeie MS, Riordan PJ, Klock KS, Espelid I. Parental risk attitudes and caries-related behaviors among immigrant and western native children in Oslo. Community Dent Oral Epidemiol 2006;34: 103-13.
40. 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; 26:398-404.
41. Fejerskov O. Strategies in the design of preventive programs. Adv Dent Res 1995;9:82-8.
42. Bissar AR, Schulte AG, Muhjazi G, Koch MJ. Caries prevalence in 11- to 14-year-old migrant children in Germany. Int J Public Health 2007; 52:103-8.
43. 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: 256-62.