Comparison of Factors Affecting Perceived and Objective Dental Needs

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Background: With increased interest in oral health, several efforts have been made to improve oral health conditions. To achieve this, needs for oral health must be precisely determined and accurately measured. Therefore, factors influencing both objective unmet dental needs, which were determined by experts, and perceived unmet dental needs, which were determined by patients, were examined in this study.

Methods: Responses of 17,735 respondents aged greater than 19 years from the Korean National Health and Nutrition Survey collected using the fifth (2010 ~ 2012) rotation sample survey were analyzed. Based on the information collected from the survey and dental examination, we determined the associations between the independent (sex and socioeconomic level) and dependent variables using a chi-squared test. Moreover, ordinal logistic regression analyses on multiple categorical values were performed using perceived and objective dental needs as the dependent variables.

Results: Generally, factors influencing both perceived and objective dental needs were similar. These included sex, household income, educational level, private insurance, and subjective oral health status. However, the high-income groups had lesser perceived and objective dental needs compared to the low-income groups. Furthermore, factors such as sex, educational level, and marital status had different influence on both needs.

Conclusion: Generally, factors that affect perceived and objective dental needs were similar. To minimize unmet dental needs, factors influencing both perceived and objective dental needs should be examined for a broad dental insurance coverage, and efforts to prevent oral diseases are also required.

Key Words: Objective needs, Oral health, Perceived needs, Unmet needs

Introduction

Generally, unmet needs refer to needs and/or healthcare services that are not timely and properly provided and performed, representing one of the problems of the healthcare system¹). Unmet needs are divided into objective dental needs and perceived dental needs depending on the appraising subjects²). Objective needs are needs assessed by healthcare professionals, while perceived dental needs, referred to as medical wants, indicate the subjective dental needs that the patients themselves perceive³). It is possible that in assessing the unmet needs based on the needs perceived by the patients themselves, bias in the process of remembering and reporting experiences by the patients and questions on whether subjective assessment can assure an objective assessment may be observed⁴), with the patients’ subjective evaluation and recognition influencing the utilization of healthcare services and treatment compliance.

Particularly, oral health is significantly related to systemic health, and oral diseases, if improperly and untimely treated, lead to worsening of the disease and expensive treatment. Subsequently, economic burden increases. Nevertheless, low utilization rate of dental services and unmet dental needs have been consistently observed worldwide⁵-⁷).

Recently, there have been studies conducted that examine the unmet dental needs, with studies reporting the
unmet dental needs for specific groups such as children in the low-income group, children with disabilities, youth, and workers; or studies determining the factors affecting unmet dental needs. Only socioeconomic factors such as income or employment status and status of private insurance and dental fear were considered the causes of unmet dental needs, and studies that confirm the difference between subjective dental needs and objective dental needs in unmet dental care were not conducted.

Consequently, this study aimed to confirm the difference between objective dental needs (need) and perceived dental needs (want) in the unmet dental care and to determine the factors that influence objective dental needs and perceived dental needs in Korean adults using the materials of the Fifth Korean National Health and Nutrition Survey. This way, this study was able to widely determine the unmet dental needs and recommend an increased access to dental care services to reduce the unmet dental needs.

Materials and Methods

1. Materials

This study used the materials from the Korean National Health and Nutrition Survey using the fifth (2010 ∼ 2012) rotation sample survey. The average participation rate in the study over the past 3 years was 80%, comprising 3,800 households from the 192 sampling areas each year with data of all the household members over the age of 1 year in the sampled households. It includes comprehensive information, such as disease morbidity, healthcare utilization, and demographic and socioeconomic characteristics of the subjects in the study. This study was performed to analyze 17,735 adults aged greater than 19 years who had received an oral examination.

2. Variables

Despite the need for dental treatment, individuals who do not want to receive dental treatment was defined as a perceived dental need. In this case, actual needs (needs or objective dental needs) based on medical diagnosis and subjective dental needs (wants or perceived dental needs) can be distinguished, depending on the patients who require dental care.

In this study, objective dental need is reclassified according to the extent of treatment needed as assessed during oral examination of the teeth into the following: “unneeded of treatment,” “dental conservative treatment needs,” “dental prosthetic treatment needs,” and “extraction needs.” In assessing the patients’ perceived dental needs, the following question was asked: “Haven’t you ever been given dental treatment for 1 year lately in spite of thinking that you needed dental care?,” with a “yes” or “no” answer (Table 1). Regarding the variables considered to be factors that influence dental treatment needs, sex and age were considered as the demographic variables, and region, equivalent income, educational level, marital status, and status of private insurance were considered as the socioeconomic variables.

3. Data analysis

Descriptive statistics were generated to describe the

| Table 1. Descriptive Variables |
|-------------------------------|
| Classification | Detail |
|-----------------|--------|
| Dependent variable |  |
| Perceived needs | 0=no, 1=yes |
| Objective needs | 0=treatment unneeded |
| 1=dentist conservation treatment needs |
| 2=dental prosthetic treatment needs |
| 3=teeth extraction needs |
| Independent variable |  |
| Sex | 1=male, 2=female |
| Age (y) | 1= 19 ~ 44, 2= 45 ~ 64, 3= 65 or older |
| Region | 1=urban, 2=rural |
| Household income | 1=low, 2=mid-low, 3=mid-upper, 4=upper |
| Educational attainments | 1=elementary or less, 2=middle school, 3=high school, 4=college or more |
| Marital status | 1=living together, 2=living apart, 3=bereavement, 4=divorce, 5=unmarried |
| Private insurance | 1=yes, 2=no |
| Subjective oral health | 1=very good, 2=good, 3=medium, 4=poor, 5=very poor |
| Regular oral examination | 1=yes, 2=no |
prevalence of perceived (or objective) needs and subjective dental needs for oral health. We determined the associations between the independent and dependent variables using a chi-squared test. Moreover, multiple logistic regression analysis was performed to determine the factors affecting perceived dental needs, with the following two answers: “yes” or “no.” Ordinal logistic regression analysis was performed to determine the variables affecting objective dental needs, which had the following multiple categorical values: “unneeded of treatment,” “dental conservative treatment needs,” “dental prosthetic treatment needs,” and “extraction needs.” Stata version 11.0 (Stata Co., College Station, TX, USA) was used to perform all the statistical analyses, and p<0.05 was considered significant.

**Results**

1. Comparison between perceived and objective dental needs

Tables 2 and 3 summarize the results regarding the association between perceived dental needs and objective dental needs based on the patients’ general characteristics. In the case of perceived dental needs, lower income and worse subjective status of oral health without oral examinations but with private insurance were statistically significant (p<0.001). While in the case of objective dental needs, it was statistically confirmed that there was a significantly lower need for dental treatment in urban areas (80.11%) than in rural areas (19.89%) (p<0.001).

2. Factors affecting subjective and objective dental needs

The result of determining the variables affecting perceived dental needs and objective dental needs is shown in Table 4. The perceived and objective dental needs were 1.03 times and 1.15 times higher, respectively, for people who live in rural areas than those who live in urban areas (p<0.01). Moreover, the high-income groups had lesser perceived and objective dental needs compared to the low-income groups. Regarding educational level, patients who were college graduates or who had advanced degrees had 1.18 times higher perceived dental needs and 0.77 times lower objective dental needs compared to patients with elementary school or lower educational level. Patients who did not undergo oral examination for 1 year had a higher perceived and objective dental need compared to patients who underwent oral examination for 1 year (p<0.01).

**Table 2. Relation between General Characteristics and Perceived Dental Needs (n=17,735)**

| Classification         | No        | Yes        | p-value |
|------------------------|-----------|------------|---------|
| Sex                    |           |            |         |
| Male                   | 4,932 (43.70) | 2,586 (40.10) | <0.000 |
| Female                 | 6,354 (56.30) | 3,863 (59.90) |         |
| Age (y)                |           |            |         |
| 19 ~ 44                | 4,557 (40.38) | 3,041 (47.15) | <0.000  |
| 45 ~ 64                | 3,747 (33.20) | 2,143 (33.23) |         |
| 65 or older            | 2,982 (26.42) | 1,265 (19.62) |         |
| Region                 |           |            |         |
| Urban                  | 8,943 (79.24) | 5,100 (79.08) | 0.803   |
| Rural                  | 2,343 (20.76) | 1,349 (20.92) |         |
| Household income       |           |            |         |
| Low                    | 2,684 (24.07) | 1,634 (25.56) | 0.006   |
| Mid-low                | 2,787 (24.99) | 1,593 (24.92) |         |
| Mid-upper              | 2,771 (24.85) | 1,639 (25.64) |         |
| Upper                  | 2,910 (26.09) | 1,527 (23.89) |         |
| Educational attainments|           |            |         |
| Elementary or less     | 3,016 (26.78) | 1,551 (24.12) | 0.001   |
| Middle school          | 1,229 (10.91) | 700 (10.89) |         |
| High school            | 3,684 (32.71) | 2,195 (34.14) |         |
| College or more        | 3,335 (29.61) | 1,984 (30.86) |         |
| Marital status         |           |            |         |
| Living together        | 8,419 (74.65) | 4,661 (72.30) | <0.000  |
| Living apart           | 59 (0.52) | 41 (0.64) |         |
| Bereavement            | 1,066 (9.45) | 579 (8.98) |         |
| Divorce                | 243 (2.15) | 215 (3.33) |         |
| Unmarried              | 1,491 (13.22) | 951 (14.75) |         |
| Private Insurance      |           |            |         |
| Yes                    | 7,822 (70.16) | 4,584 (71.95) | 0.012   |
| No                     | 3,327 (29.84) | 1,787 (28.05) |         |
| Subjective oral health |           |            |         |
| Very good              | 171 (1.54) | 33 (0.52) | <0.000  |
| Good                   | 1,757 (15.78) | 356 (5.60) |         |
| Medium                 | 5,042 (45.27) | 1,927 (30.30) |         |
| Poor                   | 3,539 (31.78) | 3,159 (49.68) |         |
| Very poor              | 628 (5.64) | 884 (13.90) |         |
| Regular oral examination|           |            |         |
| No                     | 8,111 (72.83) | 5,100 (80.21) | <0.000  |
| Yes                    | 3,026 (27.17) | 1,258 (19.79) |         |

Values are presented as n (%). p-values by chi-square test.
Table 3. Relations between General Characteristics and Objective Dental Needs (n=17,735)

| Classification       | 0   | 1   | 2   | 3   | p-value |
|----------------------|-----|-----|-----|-----|---------|
| Sex                  |     |     |     |     |         |
| Male                 | 4,925 (40.11) | 950 (43.03) | 305 (44.20) | 1,456 (51.56) | <0.000 |
| Female               | 7,353 (59.89) | 1,258 (56.97) | 385 (55.80) | 1,368 (48.44) |         |
| Age (y)              |     |     |     |     |         |
| 19 ~ 44              | 4,909 (39.98) | 1,242 (56.25) | 278 (40.29) | 1,180 (41.78) | <0.000 |
| 45 ~ 64              | 4,196 (34.17) | 662 (29.98) | 249 (36.09) | 809 (28.65) |         |
| 65 or older          | 3,173 (25.84) | 304 (13.77) | 163 (23.62) | 835 (29.57) |         |
| Region               |     |     |     |     |         |
| Urban                | 9,836 (80.11) | 1,674 (75.82) | 541 (78.41) | 2,154 (76.27) | <0.000 |
| Rural                | 2,442 (19.89) | 534 (24.18) | 149 (21.59) | 670 (23.73) |         |
| Household income     |     |     |     |     |         |
| Low                  | 2,933 (24.20) | 473 (21.62) | 195 (28.68) | 843 (30.32) | <0.000 |
| Mid-low              | 3,071 (25.34) | 558 (25.50) | 149 (21.91) | 653 (23.49) |         |
| Mid-upper            | 2,931 (24.18) | 585 (26.74) | 187 (27.50) | 752 (27.05) |         |
| Upper                | 3,186 (26.28) | 572 (26.14) | 149 (21.91) | 532 (19.14) |         |
| Educational attainments |   |     |     |     |         |
| Elementary or less   | 3,138 (26.22) | 397 (18.46) | 180 (26.99) | 821 (30.37) | <0.000 |
| Middle school        | 1,293 (10.81) | 232 (10.79) | 84 (12.59) | 298 (11.02) |         |
| High school          | 3,857 (32.23) | 838 (38.96) | 222 (33.28) | 880 (32.56) |         |
| College or more      | 3,678 (30.74) | 684 (31.80) | 181 (27.14) | 704 (26.05) |         |
| Marital status       |     |     |     |     |         |
| Living together      | 9,155 (74.68) | 1,590 (72.08) | 499 (72.42) | 1,981 (70.32) | <0.000 |
| Living apart         | 64 (0.52) | 14 (0.63) | 5 (0.73) | 24 (0.85) |         |
| Bereavement          | 1,240 (10.12) | 118 (5.35) | 77 (11.18) | 309 (10.97) |         |
| Divorce              | 286 (2.33) | 60 (2.72) | 16 (2.32) | 101 (3.59) |         |
| Unmarried            | 1,514 (12.35) | 424 (19.22) | 92 (13.35) | 402 (14.27) |         |
| Private insurance    |     |     |     |     |         |
| Yes                  | 8,573 (70.78) | 1,658 (75.85) | 462 (68.04) | 1,736 (62.45) | <0.000 |
| No                   | 3,540 (29.22) | 528 (24.15) | 217 (31.96) | 1,044 (37.55) |         |
| Subjective oral health |   |     |     |     |         |
| Very good            | 162 (1.32) | 26 (1.18) | 4 (0.58) | 15 (0.53) | <0.000 |
| Good                 | 1,718 (14.01) | 208 (9.44) | 49 (7.12) | 194 (6.88) |         |
| Medium               | 5,303 (43.23) | 869 (39.43) | 192 (27.91) | 781 (27.71) |         |
| Poor                 | 4,270 (34.81) | 924 (41.92) | 350 (50.87) | 1,354 (48.05) |         |
| Very poor            | 813 (6.63) | 177 (8.03) | 93 (13.52) | 474 (16.82) |         |
| Regular oral examination |   |     |     |     |         |
| No                   | 8,904 (73.66) | 1,723 (79.44) | 500 (73.96) | 2,237 (81.52) | <0.000 |
| Yes                  | 3,184 (26.34) | 446 (20.56) | 176 (26.04) | 507 (18.48) |         |

Values are presented as n (%).
p-values by chi-square test.
0: unneeded of treatment, 1: dental conservative treatment needs, 2: dental prosthetic treatment needs, 3: extraction needs.

Discussion

This study aimed to distinguish between perceived dental needs and objective dental needs based on the unmet dental needs for adults and to determine the factors influencing perceived and objective dental needs. Several factors that influence perceived and objective dental needs were determined. These included sex, individual income, educational level, status of private insurance, and subjective oral health status. According to sex, females showed higher perceived dental needs than males. On the contrary, males had higher objective dental needs than females. These results show that females are more concerned about their oral health than males, and
Table 4. Factors Affecting Perceived and Objective Dental Needs

| Classification          | Perceived dental needs | Objective dental needs |
|-------------------------|------------------------|------------------------|
|                         | OR (95% CI)            | OR (95% CI)            |
| **Sex**                 |                        |                        |
| Male                    | -                      | -                      |
| Female                  | 1.185 (1.105 ~ 1.271)  | 0.690 (0.645 ~ 0.739)  |
| **Age (y)**             |                        |                        |
| 19 ~ 44                 | -                      | -                      |
| 45 ~ 64                 | 0.749 (0.683 ~ 0.822)  | 0.632 (0.576 ~ 0.694)  |
| 65 or older             | 0.458 (0.401 ~ 0.523)  | 0.501 (0.440 ~ 0.570)  |
| **Region**              |                        |                        |
| Urban                   | -                      | -                      |
| Rural                   | 1.028 (0.944 ~ 1.120)  | 1.148 (1.057 ~ 1.246)  |
| **Household income**    |                        |                        |
| Low                     | -                      | -                      |
| Mid-low                 | 0.883 (0.800 ~ 0.975)  | 0.848 (0.770 ~ 0.934)  |
| Mid-upper               | 0.912 (0.828 ~ 1.005)  | 0.958 (0.872 ~ 1.052)  |
| Upper                   | 0.809 (0.729 ~ 0.897)  | 0.758 (0.685 ~ 0.840)  |
| **Educational attainments** |                      |                        |
| Elementary or less      | -                      | -                      |
| Middle school           | 1.101 (0.970 ~ 1.250)  | 0.971 (0.858 ~ 1.099)  |
| High school             | 1.073 (0.959 ~ 1.200)  | 0.878 (0.786 ~ 0.980)  |
| College or more         | 1.177 (1.039 ~ 1.334)  | 0.774 (0.684 ~ 0.876)  |
| **Marital status**      |                        |                        |
| Living together         | -                      | -                      |
| Living apart            | 1.235 (0.799 ~ 1.907)  | 1.511 (1.002 ~ 2.279)  |
| Bereavement             | 1.148 (1.006 ~ 1.309)  | 1.064 (0.932 ~ 1.216)  |
| Divorce                 | 1.363 (1.109 ~ 1.675)  | 1.322 (1.083 ~ 1.613)  |
| Unmarried               | 0.982 (0.883 ~ 1.091)  | 1.135 (1.026 ~ 1.256)  |
| **Private Insurance**   |                        |                        |
| Yes                     | -                      | -                      |
| No                      | 1.085 (0.991 ~ 1.186)  | 1.207 (1.107 ~ 1.317)  |
| **Subjective oral health** |                      |                        |
| Very good               | -                      | -                      |
| Good                    | 1.037 (0.697 ~ 1.544)  | 0.936 (0.658 ~ 1.333)  |
| Medium                  | 1.868 (1.271 ~ 2.743)  | 1.249 (0.888 ~ 1.756)  |
| Poor                    | 4.704 (3.205 ~ 6.905)  | 2.307 (1.642 ~ 3.342)  |
| Very poor               | 7.782 (5.243 ~ 11.551) | 3.666 (2.581 ~ 5.206)  |
| **Regular oral examination** |                      |                        |
| No                      | -                      | -                      |
| Yes                     | 0.627 (0.578 ~ 0.680)  | 0.742 (0.685 ~ 0.804)  |

OR: odds ratio, CI: confidence interval, -: reference.

1By multiple logistic regression. 2By ordinal logistic regression.

Women’s higher perceived dental needs indicate that they fully utilize dental care services. Both perceived dental needs and objective dental needs decreased as age increased. In the unmet healthcare needs, the highest perceived dental needs were observed in patients in their 20s to 40s, with dental needs decreasing with increasing age. Thus, unmet dental needs should be reduced by performing preventive treatment such as using fluoride (e.g., water or salt fluoridation) and conducting repetitive oral health education regarding oral health and its cost-effectiveness even to children.

Particularly, objective dental needs in rural areas are slightly higher than in urban areas. Neighborhood socioeconomic status poses several risks on health. People living in areas that lack diverse social infrastructures may have difficulty accessing health care because of insufficient healthcare facilities and healthcare personnel in their area. Unmet dental needs of adults and children who live in rural areas are higher than those in urban areas because of regional vulnerabilities. Perceived dental needs and objective dental needs of the low-income groups were 1.20 times and 1.25 times higher than the high-income groups, respectively. That is, as income level increases, unmet dental needs significantly decrease.

Consistent to the results of the study by Kim et al., in the low-income groups, inability to undergo dental care due to financial constraints can be considered as objective dental needs. Patients who were college graduates or had advanced degrees had higher perceived dental needs and lower objective dental needs than those patients with elementary school or less educational level. It is considered that educational level has significant effects on the knowledge, attitudes, and behaviors on oral health. The higher the level of education, the higher the interest on oral health. That is, it appears that patients with higher educational level had higher perceived dental needs and lower objective dental needs due to regular oral examination resulting in early treatment than patients with lower educational level. Moreover, oral health education should be repeatedly conducted to individuals with low educational level as it affects the oral health of children and young people.

Regarding marital status, individuals living with a spouse showed the lowest objective dental needs among all the marital statuses. Generally, married individuals are healthier than the unmarried individuals because the interest or caring for a spouse influences him or her to keep sound and healthy. The result of the study based on...
the National Health Interview Survey suggests that married individuals are economically richer compared to unmarried individuals. Objective dental needs were higher in individuals with private insurance than in individuals with no private insurance. However, this study was not able to determine the effect of private insurance on the perceived dental needs of the individuals. However, in some studies, unmet dental needs of subjects without private insurance were higher (odds ratio, 1.6 ~ 3.5) than the unmet dental needs of subjects with private insurance. It is thought that such a difference resulted from not specifying the information on private insurance used for dental care in this study. Hence, determining the subjects with private dental insurance to assure the availability of private dental insurance scheme is required in future studies.

According to this study, generally, the factors influencing perceived dental needs and objective dental needs were similar. In conclusion, efforts to strengthen dental health insurance and to prevent oral diseases have to be continued to reduce the unmet dental needs. Hence, it is necessary to improve the knowledge and attitudes of the individuals by providing proper information on the need for dental care and implementing the appropriate oral care to the medical consumers. Maintaining good health is not just an individual effort but a collaboration with the nation and society that recognize their co-responsibility and implement strategies and efforts to maintain the individuals’ health. Improvement in policies should be established to provide timely and appropriate healthcare services for the individuals. Using the oral health projects in schools, which is considered the most efficient strategy to improve an individual’s knowledge, attitudes, and behaviors on oral health, we suggest that dental health rooms should be established in elementary schools to improve oral health education and preventive treatment.

**Notes**

**Conflict of interest**

No potential conflict of interest relevant to this article was reported.

**Ethical approval**

The study was reviewed and approved by the Institutional Review Board of Eulji University (Seongnam, Korea), which also approved the secondary data analysis (approval No. EUIRB2016-32).

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**References**

1. Song KS, Lee JH, Rhim KH: Factors associated with unmet needs for health care. Korean Public Health Res 37: 131-140, 2011.
2. Kenney GM, McFeeters JR, Yee JY: Preventive dental care and unmet dental needs among low-income children. Am J Public Health 95: 1360-1366, 2005. https://doi.org/10.2105/AJPH.2004.056523
3. Schultz ST, Shenkin JD, Horowitz AM: Parental perceptions of unmet dental need and cost barriers to care for developmentally disabled children. Pediatr Dent 23: 321-325, 2001.
4. Kim HY, Lee SW, Cho SI, Patton LL, Ku Y: Associations between missing teeth with unmet needs and socioeconomic status among South Korean dentate government employees. J Public Health Dent 67: 174-178, 2007. https://doi.org/10.1111/j.1752-7325.2007.000018.x
5. Kang JH, Kim CW, Kim CS, Seo NK: Unmet dental care needs according to employment status. J Korean Acad Oral Health 39: 56-62, 2015. https://doi.org/10.11149/jkaoh.2015.39.1.56
6. Kim NH, Jeon JE, Chung WG, Kim DK: Social determinants related to the regional difference of unmet dental need in Korea. J Korean Acad Oral Health 36: 62-72, 2012.
7. Calzón Fernández S, Fernández Ajuria A, Martín JJ, Murphy MJ: The impact of the economic crisis on unmet dental care needs in Spain. J Epidemiol Community Health 69: 880-885, 2015. https://doi.org/10.1136/jech-2014-204493
8. Lewis C, Robertson AS, Phelps S: Unmet dental care needs among children with special health care needs: implications for the medical home. Pediatrics 116: e426-e431, 2005.
9. Skinner AC, Slifkin RT, Mayer ML: The effect of rural residence on dental unmet need for children with special health care needs. J Rural Health 22: 36-42, 2006. https://doi.org/10.1111/j.1748-0361.2006.00008.x

10. Lewis CW: Dental care and children with special health care needs: a population-based perspective. Acad Pediatr 9: 420-426, 2009. https://doi.org/10.1016/j.acap.2009.09.005

11. Mayer ML, Skinner AC, Slifkin RT: Unmet need for routine and specialty care: data from the National Survey of Children With Special Health Care Needs. Pediatrics 113: e109-e115, 2004. https://doi.org/10.1542/peds.113.2.e109

12. Caban-Martinez AJ, Lee DJ, Fleming LE, et al.: Dental care access and unmet dental care needs among U.S. workers: the National Health Interview Survey, 1997 to 2003. J Am Dent Assoc 138: 227-230, 2007. https://doi.org/10.14219/jada.archive.2007.0141

13. Korea Centers for Disease Control and Prevention: The Fifth Korea National Health and Nutrition Examination Survey (KNHANES V-3), 2012. Korea Centers for Disease Control and Prevention, Cheongju, 2012.

14. Sibley LM, Glazier RH: Reasons for self-reported unmet healthcare needs in Canada: a population-based provincial comparison. Healthc Policy 5: 87-101, 2009. https://doi.org/10.12927/hcpol.2009.20934

15. World Health Organization: Oral health priority action areas. Retrieved June 10, 2016, from http://www.who.int/oral_health/action/groups/en/index1.html

16. Pickett KE, Pearl M: Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. J Epidemiol Community Health 55: 111-122, 2001. https://doi.org/10.1136/jech.55.2.111

17. Voigtländer S, Berger U, Razum O: The impact of regional and neighbourhood deprivation on physical health in Germany: a multilevel study. BMC Public Health 10: 403, 2010. https://doi.org/10.1186/1471-2458-10-403

18. Maserejian NN, Tavares MA, Hayes C, Soncini JA, Trachtenberg FL: Rural and urban disparities in caries prevalence in children with unmet dental needs: the New England Children’s Amalgam Trial. J Public Health Dent 68: 7-13, 2008 http://dx.doi.org/10.1111/j.1752-7325.2007.00057.x

19. Wood RG, Goesling B, Avellar S: The effects of marriage on health: a synthesis of recent research evidence. Mathematica Policy Research Inc, Seattle, pp19-25, 2007.

20. Liu J, Probst JC, Martin AB, Wang JY, Salinas CF: Disparities in dental insurance coverage and dental care among US children: the National Survey of Children’s Health. Pediatrics 119 Suppl 1: S12-S21, 2007. https://doi.org/10.1542/peds.2006-2089D