BMJ Open

# Employment status and unmet dental care needs in South Korea: A population-based panel study



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|---|---|
| Journal: | *BMJ Open* |
| Manuscript ID | bmjopen-2018-022436 |
| Article Type: | Research |
| Date Submitted by the Author: | 03-Mar-2018 |
| Complete List of Authors: | Choi, Jaewoo; Busan Public Health Policy Institute, Public Health<br>Choi, Young; Yonsei University, Department of Public Health<br>Lee, Tae Hoon; Yonsei University, Department of Public Health<br>Lee, Hyo Jung; Yonsei University, Department of Public Health<br>Ju, Yeong-Jun; Yonsei University, Department of Public Health<br>Park, Eun-Cheol; Yonsei University College of Medicine, Department of Preventive Medicine and Institute of Health Services Research |
| Keywords: | employment status, unmet dental care needs, income disparity |
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# Employment status and unmet dental care needs in South Korea: A population-based panel study

Jae Woo Choi[1], Young Choi[2,3], Tae-Hoon Lee[2,3], Hyo Jung Lee[2,3], Yeong-Jun Ju[2,3], Eun-Cheol Park[3,4*]

[1]Busan Public Health Policy Institute, Busan, Korea

[2]Department of Public Health, Graduate School, Yonsei University, Seoul, Korea

[3]Institute of Health Services Research, Yonsei University College of Medicine, Seoul, Korea

[4]Department of Preventive Medicine, Yonsei University College of Medicine, Seoul, Korea

***Corresponding author: Eun-Cheol Park, MD, PhD**

Department of Preventive Medicine and Institute of Health Services Research, Yonsei University College of Medicine

50 Yonsei-ro, Seodaemun-gu, Seoul 120-752, Korea

Tel: 82-2-2188-1862/Fax: 82-2-392-8133

E-mail: ecpark@yuhs.ac

**Key Words:** employment status, unmet dental care needs, income disparity

**Word Count:** 3,127(excluding title page, references, figures)

# Abstract

Objectives: This study was designed to evaluate whether employment status is associated with the experience of unmet dental care needs.

Methods: 4,620 workers were retrieved from the Korea Health Panel data (2010-2013) and potential relationships were explored among income level, employment change, and unmet dental care needs.

Results: 17.3% of 4,620 people said they had failed at least once to have a dental treatment or checkup despite the needs. Precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than permanent workers (OR: 1.36, 1.40, respectively). In addition, low–income group were more 4.46 times likely to experience unmet dental care needs caused by economic burden than those with the highest income.

Conclusion: This disparity means that precarious workers and unemployed are more likely to face barriers in obtaining needed health services. Given the insecure employment status of low income people, meeting their needs for health care is an important consideration.


Key Words: employment status, unmet dental care needs, income disparity

**Strengths and limitations of this study**

1. **Strengths**

1) This study is significant because it is the first study to examine the association of economic status on unmet dental care needs among adults in South Korea using longitudinal panel data.

2. **Limitations**

1) We used self-reported questionnaires to identify subjects' experience of unmet dental care needs.
2) We did not control severity of dental care in our research.

# Ⅰ. Introduction

Korea achieved universal health insurance coverage just 12 years after its national health insurance system was implemented [1)]. However, people with national health insurance still are paying rather high out-of-pocket (OOP) payments. The proportion of total medical spending financed by the public sector is only 56%, which is lower than the OECD average (73%), and is the fourth lowest OECD level of spending after Chile (46%), USA (48%), and Mexico (51%) [2)]. Relatively low coverage on health insurance may result in unmet needs and this phenomenon is more likely to occur in dental care which is higher than OOP payment of health care. Rate of unmet dental care needs that experience unmet needs is very high in South Korea. Previous study on unmet dental care needs in South Korea showed that response rate of unmet dental care needs 24.5% [3)], Whereas study results of state of Wisconsin in US indicated that about 20.6% of total population experienced unmet dental care needs [4)]. In addition, Canadian study about immigrants living above 10 years in Canada showed that experience rate of unmet dental care needs 17.5% and the rate of 27 EU countries including Spain indicated 7.2% [5-7)].

The factors related to unmet health care needs among adults in previous studies are socioeconomic factors including income or education level and health status such as self-related health or mental health [8-12)]. In other words, low income or education groups are more likely to experience unmet health care needs than those with higher status. Although there are a few research of association between employment status and unmet needs, most of them examined unmet health care needs rather than dental care.

The rate of unmet health care needs occurred by economic burden among reason of unmet needs was higher among temporary or day workers. There are pretty a number of unemployed and precarious workers in Korea. The employment rate is 64% and precarious workers which have been described as temporary or day worker account for 34.2% of the total waged workers in Korea [13, 14)]. Their wage is only 51.7% of that of regular workers and employment status of them is very insecure [15)]. In addition, a few people who have failed to get a regular job opt to begin their own business rather than to get precarious position. As a result, there were more men who were self-employed than men who were paid workers (66.6% vs. 59%) in the Korea that is more than two times compared to other countries [16)]. A number of self-

employed people are exposed to danger of working poverty and belong to a low-income class. The income gap of them is comparatively serious compared to waged workers. There are fairly a number of unemployed, self-employed and precarious workers in Korea, and they are often expected to experience unmet needs for dental care.

This study aims to examine the impact of employment status on the experience of unmet dental care needs, using nationally representative panel data collected from 2010–2013.

# II. Methods

*Data*

We utilized data from the Korea Health Panel (KHP) 3rd–6th (2010–2013 year), which is conducted by the Korea Institute for Health & Social Affairs and the National Health Insurance Corporation. The KHP is a nationally representative sample of Korean individuals and their families that include data on demographic and socioeconomic characteristics, health status, access to health care, and private health insurance status. The KHP uses a stratified multistage probability sampling design according to region and residence in order to select nationwide subjects from the 2005 Korea Census [17].

*Study sample and design*

We excluded the 1st–2nd data of KHP (2008–2009 year) because the variable about unmet dental care needs did not be surveyed. This study included data from the 3rd wave in 2010. In the 3rd wave, 17,885 subjects completed the survey questionnaire. The baseline study subjects consisted of waged workers ≥19 years of age which did not experience unmet dental care needs. Subjects aged ≥61 years in 2010 were excluded so that all subjects in this study were <65 years old during the 3-year follow-up. After excluding subjects without follow-up or with any missing values, a total of 4,620 workers remained in this study. We defined employment status in first follow-up based on workers at baseline. If any one of workers at baseline loss his job in 2011, he is classified as unemployed. We considered change of employment status annually and examined the effect the employment status on the experience of unmet dental care needs during 2011 to 2013.

*Dependent variable*

The dependent variable of this study is whether respondents had an unmet dental care needs or not, thus they were asked, “Have you failed to receive dental care services even if there was a need for treatment or checkup over the past one year?” Also, ‘economic burden’, ‘no time to spare’, and ‘others’ were added to result variables for those who had experienced unmet healthcare needs.

*Independent variable*

Employment status was classified into four categories: full-time permanent, precarious, self-

employed, or unemployed. The KHP classified individuals as full-time permanent workers if all four of the following conditions were satisfied: (i) they were directly hired by their employers (not subcontracted or dispatched workers or self-employed workers without employees); (ii) they were full-time workers (not part-time workers); (iii) there was no fixed term in their employment contract (not temporary workers); and (iv) there was a high probability of maintaining their current job (having relatively little job insecurity and not a day laborer). Other than full-time permanent workers, waged workers hired by their employers were classified as precarious workers. The self-employed were defined as workers who managed their own business regardless of scale or carried out professional matter on their own responsibility. For the purpose of comparability with previous East Asian studies and consideration of different classification of employment status between countries, the self-employed were treated as having a different employment status. The unemployed were defined as those who had been waged workers at baseline in 2010 but lost employment by the time of the survey.

*Covariates*

In this study we used several covariates to control for demographic and socioeconomic characteristics and health status. Demographic characteristics included sex, age, marital status, and socioeconomic factors including education and income. The age groups were divided at 10-year intervals for measurement. Marital status was categorized into three:'Married,' 'single,' and 'divorced or separated'. Educational levels were categorized into three:'below elementary school,' 'middle or high school,' and 'above college'. Weighted total household income was divided into five: highest, high, middle, low, lowest. As a proxy for health status, we utilized self-rated health, stress, depression, disability, and chronic disease to control for the participant's health condition and health behavior, which can affect health care utilization. Finally, we used type of health insurance (national health insurance, medical aid) and existence of private insurance.

*Statistical analysis*

The frequency with which unmet dental care needs was incurred overall after accounting for demographic, socioeconomic, and health status was determined by Chi-square test. To identify factors associated with unmet dental care needs and, in particular, to examine the

relationship between employment status and unmet dental care needs, we used the GLIMMIX procedure because subjects in our study are measured repeatedly over time. The The odds ratio (OR) was calculated through the regression coefficient gained through the GLIMMIX procedure and presented with a 95% confidence interval (95% CI). The SAS 9.3 statistical package (Cary, NC, USA) was used for data analysis.

*Patient and Public Involvement statement*

Patients or Public were not involved in this study.

# Results

General characteristics at first follow–up (2011) of waged workers are shown in Table 1. 17.3% of 4,620 respondents aged between 20 and 61 said they had failed at least once to have a dental treatment or checkup despite the needs. People who have low education had a higher rate of unmet dental care needs compared to those who graduated college. Low–income group had a higher proportion of unmet dental care needs than higher income level. People who were divorced or separated had a higher rate of unmet dental care needs. People with negative self-related health and those having depression or stress were more likely to experience unmet dental care needs than those no having such diseases. People benefited from the medical aid program were more likely to experience unmet dental care needs than national health insurance. People who joined private insurance were less likely to experience unmet dental care needs than those who did not joined it. Precarious workers and self–employed were more likely to experience unmet dental care needs than full-time permanent workers. However, no significant relationship was observed between unmet dental care needs and sex, age, disability, chronic disease.

Table 2 shows self-reported reasons for unmet dental care needs according to employment status. Precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden. Whereas, permanent workers were more likely to experience unmet dental care needs caused by no time to spare.

After applying multivariate models adjusted for several covariates, the results for factors associated with unmet dental care needs are shown in Table 3. People who did not graduate elementary school had a higher risk of unmet dental care needs compared to those who graduated college (Odds ratio (OR): 1.35, 95% CI: 1.11-1.64). Low–income group were more 1.77 times likely to experience unmet dental care needs than those with higher income. People with negative self-rated health were more 2.19 times likely to experience unmet dental care needs than positive self-related health and those having stress or depression were more likely to experience unmet dental care needs than those no having such diseases (OR: 1.90, 1.69, respectively). People who joined private insurance had a more 1.15 times likely to experience unmet dental care needs than those who did not join

private insurance. Self-employed workers were more 1.18 times likely to experience unmet dental care needs than full-time permanent workers.

Table 4 shows factors associated with reason for unmet dental care needs according to employment status or income. In employment status, precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than permanent workers (OR: 1.36, 1.40, respectively). Whereas, precarious workers were less 0.73 times likely to experience unmet dental care needs caused by no time to spare than permanent workers. In income level, low–income group were more 4.46 times likely to experience unmet dental care needs caused by economic burden than those with the highest income. Whereas, middle–income group were less 0.74 times likely to experience unmet dental care needs caused by no time to spare than the highest income class.

# Ⅳ. Discussion

This study showed that experience rate of unmet dental care needs among adults in South Korea is about 17.3%. This experience rate is higher 3~4 times compared to Europe countries and means relatively low access to dental care. The high experience rate results from very low health insurance coverage in dental care services. Dental care service consists of high non-insured payments which government do not support and the non-insured payments is higher than general health care services. 2010 national health insurance coverage rate is about 62.7% in South Korea (pharmacy 71.6%, clinic 65.6%, and hospital 60.5%), whereas coverage rate of dental clinic and hospital is about 35.5, 25.5%, respectively [18]. In addition, the proportion of non-insured payment in OOP is about 43.2, 64.6%, respectively and this means much higher rate compared to other treatment services [3]. Fortunately, Korean government implemented to insure implant treatment that was non-insured service among senior citizens and plans to expand coverage rate of younger people. Based on this benefit strengthen, we suggest consistent coverage expansion in dental care by considering characteristics of treatment items.

We examined that the factors affecting unmet dental care needs are education, income, self-rated health, depression, stress, private insurance, and employment status. Significant results of socioeconomic status including education, income level and health status such as self-rated health, depression, stress are not intended to be limited to dental care. In other words, these results are similar to previous studies using a variety of design or time [19-27].

Our research showed that people who joined private insurance had a more 1.15 times likely to experience unmet dental care needs than those who did not join private insurance. People who have higher income or education level is more likely to join private insurance and this phenomenon is similar in other countries which operate public health system with supportive private insurance [28]. Although medical utilization of people joining private insurance is not higher than those uninsured by private insurance, it is possible to increase unmet needs by increasing health want. Unmet needs related to private insurance need to be examined in further study.

We examined difference of unmet dental care needs by employment status. Self-employed workers were more 1.18 times likely to experience unmet dental care needs than full-time

permanent workers and this phenomenon may result from characteristics of self-employed workers in South Korea. A few people who have failed to get a regular job opt to start their own business rather than to have a non-regular position. Thus, self-employed people take up more than 30% in the labor market that is more than two times higher compared to other countries. A substantial number of self-employed people belong to a low-income class and are exposed to the danger of working poverty. The income gap of them is relatively grave compared to waged workers [14].

We examined factors associated with reason for unmet dental care needs according to employment status or income. Precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than permanent workers and this result is similar to previous studies [29, 30]. This phenomenon is related to the fact which monthly wage of precarious about 52.2% of full-time permanent workers. 2015 monthly wage of permanent workers is about US$ 2,300 in South Korea, whereas the monthly wage of precarious workers is about US$ 1,200. It is crucial issue that wage of precarious workers is lower than minimum cost of living and this disparity may affect to reduce access to dental care precarious workers as well as unemployed people. These results share context that low–income group were more 4.46 times likely to experience unmet dental care needs caused by economic burden than those with the highest income. However, unmet dental care needs caused by other reasons showed different direction of significant level. For example, precarious workers and unemployed were lower likely to experience unmet dental care needs caused by no time to spare than permanent workers. This phenomenon attributes to longer working hours of full-time permanent workers compared to precarious workers. Actually, 2013 working hours of precarious workers account for about 75.5% of permanent workers.

This study is significant because it is the first study to examine the association of economic status on unmet dental care needs among adults in South Korea using longitudinal panel data. Although similar studies on this topic were conducted, all of them used cross-sectional design that possible inverse causality between employment status and unmet dental care needs are not reflected. This study's longitudinal design allows us to assess the stability and continuity of several attributes of a sample group by repeatedly observing the same participants. Another major strength of its longitudinal design is that cohort effects can be avoided because we

examined one group of individuals over time, rather than comparing several different groups that represent different ages and generations.

There were some limitations associated with our study. First, we used self-reported questionnaires to identify subjects' experience of unmet dental care needs. Nevertheless, some studies using subjective and objective methods have tended to give reasonably consistent results [31]. In addition, the follow-up period in the current study is relatively short compared with other studies. Second, we did not control severity of dental care in our research. Although severity of dental care including severe dental caries may affect medical access, we did not consider the factor in our model.

## Ⅴ. Conclusions

Our research showed precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than full-time permanent workers. In addition, low–income group were more likely to experience unmet dental care needs caused by economic burden than those with the highest income. This disparity means that they are more likely to face barriers in obtaining needed health services. Given the insecure employment status of low income people, meeting their needs for health care is an important consideration.

**A funding Statement**: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests:** The authors declare that they have no competing interests.

**Authors' contributions:** JWC, YC, HJL, YJJ and ECP designed the study concept, wrote the protocol and collected the data. HJL and YJJ conducted the analyses. All authors helped to draft the manuscript, read and approve the final manuscript. All authors had full access to all data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis. JWC and ECP are the study guarantors.

**Acknowledgements:** The English in this document has been checked by at least two professional editors, both native speakers of English.

**Data sharing statement:** No additional data are available.

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1. General characteristics at first follow-up (2011) of waged workers Unit: N, %

| Variables | Total | Unmet dental-care needs | | | | p-value |
|---|---|---|---|---|---|---|
| | | Yes | | No | | |
| Total | 4,620 | 801 | 17.3 | 3,819 | 82.7 | |
| Sex | | | | | | 0.675 |
| Men | 2,845 | 488 | 17.2 | 2,357 | 82.8 | |
| Women | 1,775 | 313 | 17.6 | 1,462 | 82.4 | |
| Age | | | | | | 0.120 |
| 20–29 | 292 | 43 | 14.7 | 249 | 85.3 | |
| 30–39 | 1,034 | 167 | 16.2 | 867 | 83.8 | |
| 40–49 | 1,686 | 285 | 16.9 | 1,401 | 83.1 | |
| ≥50 | 1,608 | 306 | 19.0 | 1,302 | 81.0 | |
| Education | | | | | | <0.001 |
| Below elementary school | 346 | 84 | 24.3 | 262 | 75.7 | |
| Middle or high school | 2,231 | 408 | 18.3 | 1,823 | 81.7 | |
| Above college | 2,043 | 309 | 15.1 | 1,734 | 84.9 | |
| Marital status | | | | | | <0.001 |
| Married | 3,611 | 631 | 17.5 | 2,980 | 82.5 | |
| Single | 730 | 102 | 14.0 | 628 | 86.0 | |
| Divorced or separated | 279 | 68 | 24.4 | 211 | 75.6 | |
| Income | | | | | | <0.001 |
| Q1 (Lowest) | 204 | 51 | 25.0 | 153 | 75.0 | |
| Q2 | 694 | 145 | 20.9 | 549 | 79.1 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Q3 | 1,093 | 207 | 18.9 | 886 | 81.1 | |
| Q4 | 1,311 | 226 | 17.2 | 1,085 | 82.8 | |
| Q5 (Highest) | 1,316 | 172 | 13.1 | 1,144 | 86.9 | |
| Self-rated health | | | | | | <0.001 |
| Good | 2,140 | 294 | 13.7 | 1,846 | 86.3 | |
| Normal | 1,815 | 380 | 20.9 | 1,435 | 79.1 | |
| Bad | 326 | 97 | 29.8 | 229 | 70.2 | |
| Depression | | | | | | <0.001 |
| Yes | 251 | 88 | 35.1 | 163 | 64.9 | |
| No | 4,030 | 683 | 16.9 | 3,347 | 83.1 | |
| Stress | | | | | | <0.001 |
| Always | 363 | 118 | 32.5 | 245 | 67.5 | |
| Often | 2,246 | 434 | 19.3 | 1,812 | 80.7 | |
| No | 1,667 | 218 | 13.1 | 1,449 | 86.9 | |
| Type of health insurance | | | | | | 0.032 |
| National health insurance | 4,531 | 778 | 17.2 | 3,753 | 82.8 | |
| Medical aid | 89 | 23 | 25.8 | 66 | 74.2 | |
| Private insurance | | | | | | 0.044 |
| Yes | 3,953 | 659 | 16.7 | 3,294 | 83.3 | |
| No | 657 | 132 | 20.1 | 525 | 79.9 | |
| Employment status | | | | | | <0.001 |
| Permanent | 1,902 | 278 | 14.6 | 1,624 | 85.4 | |
| Precarious | 1,221 | 237 | 19.4 | 984 | 80.6 | |

| | | | | | |
|---|---|---|---|---|---|
| Self-employed | 1,116 | 218 | 19.5 | 898 | 80.5 |
| Unemployed | 381 | 68 | 17.8 | 313 | 82.2 |

Table 2. Self-reported reasons for unmet dental-care needs according to employment status Unit: N, %

| Variable | Reason for unmet need | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total | Economic burden | | No time to spare | | Others[b] | |
| Total | 801 | 415 | 51.8 | 209 | 26.1 | 177 | 22.1 |
| Permanent | 278 | 98 | 35.3 | 106 | 38.1 | 74 | 26.6 |
| Precarious | 237 | 158 | 66.7 | 42 | 17.7 | 37 | 15.6 |
| Self-employed | 218 | 109 | 50.0 | 56 | 25.7 | 53 | 24.3 |
| Unemployed[a] | 68 | 50 | 73.5 | 5 | 7.4 | 13 | 19.1 |

[a]Unemployed group: unemployed, student, house worker, early retirement, sickness and injuries, others.

[b]Others: trivial symptoms, great distance from the health care facility, reduced mobility (difficult to visit for physical reasons), no one to babysit, lack of information as to where to go, no timely appointment, absence of a primary care physician, etc.

Table 3. Factors associated with unmet dental-care needs

| Variables | Unmet dental-care needs | | |
|---|---|---|---|
| | Adjusted OR | 95% CI | |
| Sex | | | |
| Men | 1.00 | | |
| Women | 0.95 | 0.86 | 1.06 |
| Age | | | |
| ≥50 | 1.00 | | |
| 40–49 | 1.03 | 0.92 | 1.16 |
| 30–39 | 1.11 | 0.95 | 1.29 |
| 20–29 | 1.10 | 0.82 | 1.48 |
| Education | | | |
| Above college | 1.00 | | |
| Middle or high school | 1.07 | 0.96 | 1.19 |
| Below elementary school | 1.35 | 1.11 | 1.64 |
| Marital status | | | |
| Married | 1.00 | | |
| Single | 1.17 | 0.98 | 1.41 |
| Divorced or separated | 0.79 | 0.67 | 1.03 |
| Self-rated health | | | |
| Good | 1.00 | | |
| Normal | 1.76 | 1.59 | 1.94 |
| Bad | 2.19 | 1.86 | 2.59 |

| | | | |
|---|---|---|---|
| Depression | | | |
| No | 1.00 | | |
| Yes | 1.69 | 1.42 | 2.01 |
| Stress | | | |
| No | 1.00 | | |
| Often | 1.39 | 1.26 | 1.55 |
| Always | 1.90 | 1.61 | 2.24 |
| Income | | | |
| Q5 (Highest) | 1.00 | | |
| Q4 | 1.20 | 1.05 | 1.38 |
| Q3 | 1.33 | 1.16 | 1.52 |
| Q2 | 1.51 | 1.29 | 1.76 |
| Q1 (Lowest) | 1.77 | 1.41 | 2.22 |
| Type of health insurance | | | |
| National health insurance | 1.00 | | |
| Medical aid | 1.17 | 0.86 | 1.60 |
| Private insurance | | | |
| No | 1.00 | | |
| Yes | 1.15 | 1.01 | 1.32 |
| Employment status | | | |
| Permanent | 1.00 | | |
| Precarious | 1.11 | 0.98 | 1.26 |
| Self-employed | 1.18 | 1.04 | 1.34 |

| | | | |
|---|---|---|---|
| Unemployed | 1.09 | 0.92 | 1.30 |

*Note.* OR, odds ratio; CI, confidence interval.

Table 4. Factors associated with reason for unmet dental care needs according to employment status or income

| Variables | Reason for unmet need | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Economic burden | | | No time to spare | | | Others | | |
| | OR[a] | 95% CI | | OR[a] | 95% CI | | OR[a] | 95% CI | |
| Employment status | | | | | | | | | |
| Permanent | 1.00 | | | 1.00 | | | 1.00 | | |
| Precarious | 1.36 | 1.14 | 1.61 | 0.83 | 0.67 | 1.04 | 1.03 | 0.79 | 1.34 |
| Self-employed | 1.18 | 0.99 | 1.41 | 1.12 | 0.91 | 1.37 | 1.44 | 0.13 | 1.83 |
| Unemployed | 1.40 | 1.16 | 1.76 | 0.42 | 0.28 | 0.64 | 1.55 | 1.12 | 2.15 |
| Income | | | | | | | | | |
| Q5 (Highest) | 1.00 | | | 1.00 | | | 1.00 | | |
| Q4 | 2.06 | 1.65 | 2.57 | 0.92 | 0.75 | 1.12 | 0.96 | 0.75 | 1.22 |
| Q3 | 2.93 | 2.35 | 3.64 | 0.74 | 0.59 | 0.94 | 0.85 | 0.65 | 1.10 |
| Q2 | 3.44 | 2.73 | 4.34 | 0.74 | 0.56 | 0.98 | 0.89 | 0.65 | 1.21 |
| Q1 (Lowest) | 4.46 | 3.33 | 5.99 | 0.67 | 0.40 | 1.14 | 0.58 | 0.32 | 1.04 |

*Note.* OR, odds ratio; CI, confidence interval.

[a]Adjusted for age, sex, education, marital status, disability, chronic disease, depression, stress, self-rated health, type of health insurance, private insurance

**STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology***

**Checklist for cohort, case-control, and cross-sectional studies (combined)**

| Section/Topic | Item # | Recommendation | Reported on page # |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | 1 |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 3 |
| Objectives | 3 | State specific objectives, including any pre-specified hypotheses | 4 |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | 5 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 5 |
| Participants | 6 | (*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up<br>*Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls<br>*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants | 5 |
| | | (*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed<br>*Case-control study*—For matched studies, give matching criteria and the number of controls per case | |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 5 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 5 |
| Bias | 9 | Describe any efforts to address potential sources of bias | 5 |
| Study size | 10 | Explain how the study size was arrived at | 5 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 6 |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | 6 |
| | | (*b*) Describe any methods used to examine subgroups and interactions | 6 |
| | | (*c*) Explain how missing data were addressed | 6 |
| | | (*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed<br>*Case-control study*—If applicable, explain how matching of cases and controls was addressed | 6 |

| | | | |
|---|---|---|---|
| | | *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy | |
| | | (*e*) Describe any sensitivity analyses | 6 |
| **Results** | | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 8 |
| | | (b) Give reasons for non-participation at each stage | |
| | | (c) Consider use of a flow diagram | |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 8 |
| | | (b) Indicate number of participants with missing data for each variable of interest | |
| | | (c) *Cohort study*—Summarise follow-up time (eg, average and total amount) | |
| Outcome data | 15* | *Cohort study*—Report numbers of outcome events or summary measures over time | 8 |
| | | *Case-control study*—Report numbers in each exposure category, or summary measures of exposure | |
| | | *Cross-sectional study*—Report numbers of outcome events or summary measures | |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 8 |
| | | (*b*) Report category boundaries when continuous variables were categorized | |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | 9 |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 10 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 12 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 10-11 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 10-11 |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 13 |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.
**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

# Employment status and unmet dental care needs in South Korea: A population-based panel study



| | |
|---|---|
| Journal: | *BMJ Open* |
| Manuscript ID | bmjopen-2018-022436.R1 |
| Article Type: | Research |
| Date Submitted by the Author: | 08-Aug-2018 |
| Complete List of Authors: | Choi, Jaewoo; Busan Public Health Policy Institute, Public Health<br>Choi, Young; Yonsei University, Department of Public Health<br>Lee, Tae Hoon; Yonsei University, Department of Public Health<br>Lee, Hyo Jung; Yonsei University, Department of Public Health<br>Ju, Yeong-Jun; Yonsei University, Department of Public Health<br>Park, Eun-Cheol; Yonsei University College of Medicine, Department of Preventive Medicine and Institute of Health Services Research |
| Primary Subject Heading: | Health services research |
| Secondary Subject Heading: | Occupational and environmental medicine |
| Keywords: | employment status, unmet dental care needs, income disparity |
| | |

# Employment status and unmet dental care needs in South Korea: A population-based panel study

Jae Woo Choi[1], Young Choi[2,3], Tae-Hoon Lee[2,3], Hyo Jung Lee[2,3], Yeong-Jun Ju[2,3], Eun-Cheol Park[3,4*]

[1]Busan Public Health Policy Institute, Busan, Korea

[2]Department of Public Health, Graduate School, Yonsei University, Seoul, Korea

[3]Institute of Health Services Research, Yonsei University College of Medicine, Seoul, Korea

[4]Department of Preventive Medicine, Yonsei University College of Medicine, Seoul, Korea

***Corresponding author: Eun-Cheol Park, MD, PhD**

Department of Preventive Medicine and Institute of Health Services Research, Yonsei University College of Medicine

50 Yonsei-ro, Seodaemun-gu, Seoul 120-752, Korea

Tel: 82-2-2188-1862/Fax: 82-2-392-8133

E-mail: ecpark@yuhs.ac

**Key Words:** employment status, unmet dental care needs, income disparity

**Word Count:** 3,127(excluding title page, references, figures)

# Abstract

Objectives: This study was designed to evaluate whether employment status is associated with the experience of unmet dental care needs.

Methods: 4,620 workers were retrieved from the Korea Health Panel data (2010-2013) and potential relationships were explored among income level, employment change, and unmet dental care needs.

Results: 17.3% of 4,620 people said they had failed at least once to have a dental treatment or checkup despite the needs. Precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than permanent workers (OR: 1.36, 1.40, respectively). In addition, low–income group were more 4.46 times likely to experience unmet dental care needs caused by economic burden than those with the highest income.

Conclusion: This disparity means that precarious workers and unemployed are more likely to face barriers in obtaining needed health services. Given the insecure employment status of low income people, meeting their needs for health care is an important consideration.


Key Words: employment status, unmet dental care needs, income disparity

**Strengths and limitations of this study**

1. **Strengths**

1) This study is significant because it is the first study to examine the association of economic status on unmet dental care needs among adults in South Korea using longitudinal panel data.

2. **Limitations**

1) We used self-reported questionnaires to identify subjects' experience of unmet dental care needs.
2) We did not control severity of dental care in our research.

# Ⅰ. Introduction

Korea achieved universal health insurance coverage just 12 years after its national health insurance system was implemented [1)]. However, people with national health insurance still are paying rather high out-of-pocket (OOP) payments. The proportion of total medical spending financed by the public sector is only 56%, which is lower than the OECD average (73%), and is the fourth lowest OECD level of spending after Chile (46%), USA (48%), and Mexico (51%) [2)]. Relatively low coverage on health insurance may result in unmet needs and this phenomenon is more likely to occur in dental care which is higher than OOP payment of health care. In Korea, benefit coverage of dental health services is low due to the relatively high medical expenses incurred by non-insured payment. Although Korean government has expanded coverage expansion policy for dental service, the level of out-of-payment is very high compared to other countries.

Rate of unmet dental care needs that experience unmet needs is very high in South Korea. Previous study on unmet dental care needs in South Korea showed that response rate of unmet dental care needs 24.5% [3)], Whereas study results of state of Wisconsin in US indicated that about 20.6% of total population experienced unmet dental care needs [4)]. In addition, Canadian study about immigrants living above 10 years in Canada showed that experience rate of unmet dental care needs 17.5% and the rate of 28 EU countries including Spain indicated 7.2% [5-7)].

The factors related to unmet health care needs among adults in previous studies are socioeconomic factors including income or education level and health status such as self-related health or mental health [8-12)]. In other words, low income or education groups are more likely to experience unmet health care needs than those with higher status. Although there are a few research of association between employment status and unmet needs, most of them examined unmet health care needs rather than dental care.

This study aims to examine the impact of employment status on the experience of unmet dental care needs, using nationally representative panel data collected from 2010–2013.

# II. Methods

*Study Model*

This study used the Anderson social behavioral model to analyze factors that affect unmet dental care needs. This model is widely used as a model for analyzing factors affecting unmet medical care. In the Anderson model, the factors that determine the individual's behavior related to the use of medical services are largely categorized as predisposing factors, enabling factors, and need factors, and their relevance to medical use is analyzed through regression analysis. Predisposing factors consist of social structure variables (sex, age, marital status), social structural variables (education level, occupation), and health Beliefs and attitudes. Enabling factors are the resources of individuals and communities that enable the use of medical care and include variables such as income, number of household members, type of health insurance, and whether to join private health insurance. Need factors are directly related to use of health services as disease factors related to the level of individual disability or illness. It mainly includes variables such as subjective health status, presence of chronic disease, and disability. In this study, the predisposing factors were sex, age, education level, marital status, employment status. Enabling factors were income level, type of health insurance, and private insurance. Needs factors were self-rated health, depression, and stress.

*Data*

We utilized data from the Korea Health Panel (KHP) 3rd–6th (2010–2013 year), which is conducted by the Korea Institute for Health & Social Affairs and the National Health Insurance Corporation. The KHP is a nationally representative sample of Korean individuals and their families that include data on demographic and socioeconomic characteristics, health status, access to health care, and private health insurance status. The KHP uses a stratified multistage probability sampling design according to region and residence in order to select nationwide subjects from the 2005 Korea Census [13)]. This study received ethical approval from the institutional review board of Yonsei University Graduate School of Public Health.

*Study sample and design*

We excluded the 1st–2nd data of KHP (2008–2009 year) because the variable about unmet dental care needs did not be surveyed. This study included data from the 3rd wave in

2010. In the 3rd wave, 17,885 subjects completed the survey questionnaire. The baseline study subjects consisted of waged workers ≥19 years of age which did not experience unmet unmet dental care needs. Subjects aged ≥61 years in 2010 were excluded so that all subjects subjects in this study were <65 years old during the 3-year follow-up. After excluding subjects without follow-up or with any missing values, a total of 4,620 workers remained in this study. We defined employment status at first follow-up based on workers at baseline. If any workers at baseline lost their job in 2011, he is classified as unemployed. We considered change of employment status annually and examined the effect the employment status on the experience of unmet dental care needs during 2011 to 2013.

*Dependent variable*

The dependent variable of this study is whether respondents had an unmet dental care needs or not, thus they were asked, "Have you failed to receive dental care services even if there was a need for treatment or checkup over the past one year?" Also, 'economic burden', 'no time to spare', and 'others' were added to result variables for those who had experienced unmet healthcare needs.

*Independent variable*

Employment status was classified into four categories: full-time permanent, precarious, self-employed, or unemployed. The KHP classified individuals as full-time permanent workers if all four of the following conditions were satisfied: (i) they were directly hired by their employers (not subcontracted or dispatched workers or self-employed workers without employees); (ii) they were full-time workers (not part-time workers); (iii) there was no fixed term in their employment contract (not temporary workers); and (iv) there was a high probability of maintaining their current job (having relatively little job insecurity and not a day laborer). Other than full-time permanent workers, waged workers hired by their employers were classified as precarious workers. The self-employed were defined as workers who managed their own business regardless of scale or carried out professional matter on their own responsibility. For the purpose of comparability with previous East Asian studies and consideration of different classification of employment status between countries, the self-employed were treated as having a different employment status. The unemployed were defined as those who had been waged workers at baseline in 2010 but lost employment by the time of the survey.

*Covariates*

In this study we used several covariates to control for demographic and socioeconomic characteristics and health status. Demographic characteristics included sex, age, marital status, and socioeconomic factors including education and income. The age groups were divided at 10-year intervals for measurement. Marital status was categorized into three:'Married,' 'single,' and 'divorced or separated'. Educational levels were categorized into three:'below elementary school,' 'middle or high school,' and 'above college'. Weighted total household income was divided into five: highest, high, middle, low, lowest. As a proxy for health status, we utilized self-rated health, stress, depression, disability, and chronic disease to control for the participant's health condition and health behavior, which can affect health care utilization. Finally, we used type of health insurance (national health insurance, medical aid) and existence of private insurance.

*Statistical analysis*

The frequency with which unmet dental care needs was incurred overall after accounting for demographic, socioeconomic, and health status was determined by Chi-square test. To identify factors associated with unmet dental care needs and, in particular, to examine the relationship between employment status and unmet dental care needs, we used the GLIMMIX procedure because subjects in our study are measured repeatedly over time. The odds ratio (OR) was calculated through the regression coefficient gained through the GLIMMIX procedure and presented with a 95% confidence interval (95% CI). The SAS 9.3 statistical package (Cary, NC, USA) was used for data analysis.

*Patient and Public Involvement statement*

Patients or Public were not involved in this study.

## Results

This study utilized longitudinal data which is repeatedly measured and constructed for 24,616 people in 2008. First year (2010) response rate of data utilized by in this study is 80.6% and the main reasons for decreasing response rate are death, response refusal etc. Table 1 shows General characteristics at first follow–up (2011) of waged workers. 17.3% of 4,620 respondents aged between 20 and 61 said they had failed at least once to have a dental treatment or checkup despite the needs. People who have low education, low–income group, people who were divorced, people with negative self-related health and those having depression or stress people who joined private insurance scheme, precarious workers and self–employed were more likely to experience unmet dental care needs. However, no significant relationship was observed between unmet dental care needs and sex, age, disability, chronic disease, and type of health insurance.

Table 2 shows self-reported reasons for unmet dental care needs according to employment status. Precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden. Whereas, permanent workers and self-employed were more likely to experience unmet dental care needs caused by no time to spare.

After applying multivariate models adjusted for several covariates, the results for factors associated with unmet dental care needs are shown in Table 3. People who did not graduate elementary school had a higher risk of unmet dental care needs compared to those who graduated college (Odds ratio (OR): 1.35, 95% CI: 1.11-1.64). Low–income group were more 1.77 times likely to experience unmet dental care needs than those with higher income. People with negative self-rated health were more 2.19 times likely to experience unmet dental care needs than positive self-related health and those having stress or depression were more likely to experience unmet dental care needs than those no having such diseases (OR: 1.90, 1.69, respectively). People who joined private insurance scheme had a more 1.15 times likely to experience unmet dental care needs than those who did not join private insurance. Self-employed workers were more 1.18 times likely to experience unmet dental care needs than full-time permanent workers.

Table 4 shows factors associated with reason for unmet dental care needs according to employment status or income. In employment status, precarious workers and unemployed

were more likely to experience unmet dental care needs caused by economic burden than permanent workers (OR: 1.36, 1.40, respectively). Whereas, precarious workers were less 0.73 times likely to experience unmet dental care needs caused by no time to spare than permanent workers. In income level, low–income group were more 4.46 times likely to experience unmet dental care needs caused by economic burden than those with the highest income. Whereas, middle–income group were less 0.74 times likely to experience unmet dental care needs caused by no time to spare than the highest income class.

# Ⅳ. Discussion

This study showed that experience rate of unmet dental care needs among adults in South Korea is about 17.3%. This experience rate is higher 3~4 times compared to Europe countries and means relatively low access to dental care. The high experience rate results from very low health insurance coverage in dental care services. Dental care service consists of high non-insured payments which government do not support and the non-insured payments is higher than general health care services. 2010 national health insurance coverage rate is about 62.7% in South Korea (pharmacy 71.6%, clinic 65.6%, and hospital 60.5%), whereas coverage rate of dental clinic and hospital is about 35.5, 25.5%, respectively [14]. In addition, the proportion of non-insured payment in OOP is about 43.2, 64.6%, respectively and this means much higher rate compared to other treatment services [3]. Fortunately, Korean government implemented to insure implant treatment that was non-insured service among senior citizens and plans to expand coverage rate of younger people. Based on this benefit strengthen, we suggest consistent coverage expansion in dental care by considering characteristics of treatment items.

We examined that the factors affecting unmet dental care needs are education, income, self-rated health, depression, stress, private insurance, and employment status. Especially, there is no interaction employment status and income. In other words, income and employment status independently affect unmet dental needs. Significant results of socioeconomic status including education, income level and health status such as self-rated health, depression, stress are not intended to be limited to dental care. These results are similar to previous studies using a variety of design or time [15-23].

Our research showed that people who joined private insurance scheme were 1.15 times more likely to experience unmet dental care needs than those who did not join private insurance. People who have higher income or education level is more likely to join private insurance and this phenomenon is similar in other countries which operate public health system with supportive private insurance [24]. Although medical utilization of people joining private insurance is not higher than those uninsured by private insurance, it is possible to increase unmet needs by increasing health want. Unmet needs related to private insurance need to be examined in further study.

We examined difference of unmet dental care needs by employment status. Self-employed workers were more 1.18 times likely to experience unmet dental care needs than full-time permanent workers and this phenomenon may result from characteristics of self-employed workers in South Korea. A few people who have failed to get a regular job opt to start their own business rather than to have a non-regular position. Self-employed people take up more than 30% in the labor market in Korea. A substantial number of self-employed people belong to a low-income class and are exposed to the danger of working poverty. The income gap of them is relatively grave compared to waged workers [25].

We examined factors associated with reason for unmet dental care needs according to employment status or income. Precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than permanent workers and this result is similar to previous studies [26, 27]. This phenomenon is related to the fact which monthly wage of precarious about 52.2% of full-time permanent workers. 2015 monthly wage of permanent workers is about US$ 2,300 in South Korea, whereas the monthly wage of precarious workers is about US$ 1,200. It is crucial issue that wage of precarious workers is lower than minimum cost of living and this disparity may affect to reduce access to dental care precarious workers as well as unemployed people. These results share context that low–income group were 4.46 times more likely to experience unmet dental care needs caused by economic burden than those with the highest income. However, unmet dental care needs caused by other reasons showed different direction of significant level. For example, precarious workers and unemployed were lower likely to experience unmet dental care needs caused by no time to spare than permanent workers. This phenomenon attributes to longer working hours of full-time permanent workers compared to precarious workers. Actually, 2013 working hours of precarious workers account for about 75.5% of permanent workers.

This study is significant because it is the first study to examine the association of economic status on unmet dental care needs among adults in South Korea using longitudinal panel data. Although similar studies on this topic were conducted, all of them used cross-sectional design that possible inverse causality between employment status and unmet dental care needs are not reflected. This study's longitudinal design allows us to assess the stability and continuity of several attributes of a sample group by repeatedly observing the same participants. Another major strength of its longitudinal design is that cohort effects can be avoided because we

examined one group of individuals over time, rather than comparing several different groups that represent different ages and generations.

There were some limitations associated with our study. First, we used self-reported questionnaires to identify subjects' experience of unmet dental care needs. Nevertheless, some studies using subjective and objective methods have tended to give reasonably consistent results [28]. In addition, the follow-up period in the current study is relatively short compared with other studies. Second, we did not control severity of patient's dental status in our research. Although severity of dental status including severe dental caries may affect medical access, we did not consider the factor in our model. Third, temporal bias could exist in this study results. Finally, definition of unemployment in this study is different with the definition of International Labor Organization (actively seeking work). But, we cannot grasp whether they actively seek job or not due to data limitation.

# Ⅴ. Conclusions

Our research showed precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than full-time permanent workers. In addition, low–income group were more likely to experience unmet dental care needs caused by economic burden than those with the highest income. This disparity means that they are more likely to face barriers in obtaining needed health services. Given the insecure employment status of low income people, meeting their needs for health care is an important consideration.

**A funding Statement**: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests:** The authors declare that they have no competing interests.

**Authors' contributions:** JWC, YC, HJL, YJJ and ECP designed the study concept, wrote the protocol and collected the data. THL, HJL and YJJ conducted the analyses. All authors helped to draft the manuscript, read and approve the final manuscript. All authors had full access to all data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis. JWC and ECP are the study guarantors.

**Acknowledgements:** The English in this document has been checked by at least two professional editors, both native speakers of English.

**Data sharing statement:** No additional data are available.

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Table 1. General characteristics at first follow-up (2011) of waged workers Unit: N, %

| Variables | Total | Unmet dental-care needs | | | | Rao-Scott chi-square (p-value) |
|---|---|---|---|---|---|---|
| | | Yes | | No | | |
| Total | 4,620 | 801 | 17.3 | 3,819 | 82.7 | |
| Sex | | | | | | 0.35(0.555) |
| Men | 2,845 | 488 | 17.2 | 2,357 | 82.8 | |
| Women | 1,775 | 313 | 17.6 | 1,462 | 82.4 | |
| Age | | | | | | 4.00(0.261) |
| 20–29 | 292 | 43 | 14.7 | 249 | 85.3 | |
| 30–39 | 1,034 | 167 | 16.2 | 867 | 83.8 | |
| 40–49 | 1,686 | 285 | 16.9 | 1,401 | 83.1 | |
| ≥50 | 1,608 | 306 | 19.0 | 1,302 | 81.0 | |
| Education | | | | | | 14.67(<0.001) |
| Below elementary school | 346 | 84 | 24.3 | 262 | 75.7 | |
| Middle or high school | 2,231 | 408 | 18.3 | 1,823 | 81.7 | |
| Above college | 2,043 | 309 | 15.1 | 1,734 | 84.9 | |
| Marital status | | | | | | 9.24(0.009) |
| Married | 3,611 | 631 | 17.5 | 2,980 | 82.5 | |
| Single | 730 | 102 | 14.0 | 628 | 86.0 | |
| Divorced or separated | 279 | 68 | 24.4 | 211 | 75.6 | |
| Income | | | | | | 27.92(<0.001) |
| Q1 (Lowest) | 204 | 51 | 25.0 | 153 | 75.0 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Q2 | 694 | 145 | 20.9 | 549 | 79.1 | |
| Q3 | 1,093 | 207 | 18.9 | 886 | 81.1 | |
| Q4 | 1,311 | 226 | 17.2 | 1,085 | 82.8 | |
| Q5 (Highest) | 1,316 | 172 | 13.1 | 1,144 | 86.9 | |
| Self-rated health | | | | | | 64.09(<0.001) |
| Good | 2,140 | 294 | 13.7 | 1,846 | 86.3 | |
| Normal | 1,815 | 380 | 20.9 | 1,435 | 79.1 | |
| Bad | 326 | 97 | 29.8 | 229 | 70.2 | |
| Depression | | | | | | 58.40(<0.001) |
| Yes | 251 | 88 | 35.1 | 163 | 64.9 | |
| No | 4,030 | 683 | 16.9 | 3,347 | 83.1 | |
| Stress | | | | | | 73.09(<0.001) |
| Always | 363 | 118 | 32.5 | 245 | 67.5 | |
| Often | 2,246 | 434 | 19.3 | 1,812 | 80.7 | |
| No | 1,667 | 218 | 13.1 | 1,449 | 86.9 | |
| Type of health insurance | | | | | | 3.25(0.072) |
| National health insurance | 4,531 | 778 | 17.2 | 3,753 | 82.8 | |
| Medical aid | 89 | 23 | 25.8 | 66 | 74.2 | |
| Private insurance | | | | | | 4.04(0.044) |
| Yes | 3,953 | 659 | 16.7 | 3,294 | 83.3 | |
| No | 657 | 132 | 20.1 | 525 | 79.9 | |
| Employment status | | | | | | 14.00(0.002) |
| Permanent | 1,902 | 278 | 14.6 | 1,624 | 85.4 | |

| | | | | | |
|---|---|---|---|---|---|
| Precarious | 1,221 | 237 | 19.4 | 984 | 80.6 |
| Self-employed | 1,116 | 218 | 19.5 | 898 | 80.5 |
| Unemployed | 381 | 68 | 17.8 | 313 | 82.2 |

Table 2. Self-reported reasons for unmet dental-care needs according to employment status Unit: N, %

| Variable | Reason for unmet need | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total | Economic burden | | No time to spare | | Others[a] | |
| Total | 4,620 | 415 | 9.0 | 209 | 4.5 | 177 | 3.8 |
| Permanent | 1,902 | 98 | 5.2 | 106 | 5.6 | 74 | 3.9 |
| Precarious | 1,221 | 158 | 12.9 | 42 | 3.4 | 37 | 3.0 |
| Self-employed | 1,116 | 109 | 9.8 | 56 | 5.0 | 53 | 4.7 |
| Unemployed | 381 | 50 | 13.1 | 5 | 1.3 | 13 | 3.4 |

[a]Others: trivial symptoms, great distance from the health care facility, reduced mobility (difficult to visit for physical reasons), no one to babysit, lack of information as to where to go, no timely appointment, absence of a primary care physician, etc.

Table 3. Factors associated with unmet dental-care needs

| Variables | Unmet dental-care needs | | |
|---|---|---|---|
| | Adjusted OR | 95% CI | |
| Sex | | | |
| Men | 1.00 | | |
| Women | 0.95 | 0.86 | 1.06 |
| Age | | | |
| ≥50 | 1.00 | | |
| 40–49 | 1.03 | 0.92 | 1.16 |
| 30–39 | 1.11 | 0.95 | 1.29 |
| 20–29 | 1.10 | 0.82 | 1.48 |
| Education | | | |
| Above college | 1.00 | | |
| Middle or high school | 1.07 | 0.96 | 1.19 |
| Below elementary school | 1.35 | 1.11 | 1.64 |
| Marital status | | | |
| Married | 1.00 | | |
| Single | 1.17 | 0.98 | 1.41 |
| Divorced or separated | 0.79 | 0.67 | 1.03 |
| Self-rated health | | | |
| Good | 1.00 | | |
| Normal | 1.76 | 1.59 | 1.94 |
| Bad | 2.19 | 1.86 | 2.59 |

| | | | |
|---|---|---|---|
| Depression | | | |
| No | 1.00 | | |
| Yes | 1.69 | 1.42 | 2.01 |
| Stress | | | |
| No | 1.00 | | |
| Often | 1.39 | 1.26 | 1.55 |
| Always | 1.90 | 1.61 | 2.24 |
| Income | | | |
| Q5 (Highest) | 1.00 | | |
| Q4 | 1.20 | 1.05 | 1.38 |
| Q3 | 1.33 | 1.16 | 1.52 |
| Q2 | 1.51 | 1.29 | 1.76 |
| Q1 (Lowest) | 1.77 | 1.41 | 2.22 |
| Type of health insurance | | | |
| National health insurance | 1.00 | | |
| Medical aid | 1.17 | 0.86 | 1.60 |
| Private insurance | | | |
| No | 1.00 | | |
| Yes | 1.15 | 1.01 | 1.32 |
| Employment status | | | |
| Permanent | 1.00 | | |
| Precarious | 1.11 | 0.98 | 1.26 |
| Self-employed | 1.18 | 1.04 | 1.34 |

| | | | |
|---|---|---|---|
| Unemployed | 1.09 | 0.92 | 1.30 |

*Note.* OR, odds ratio; CI, confidence interval.

Table 4. Factors associated with reason for unmet dental care needs according to employment status or income

| Variables | Reason for unmet need | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Economic burden | | | No time to spare | | | Others | | |
| | OR[a] | 95% CI | | OR[a] | 95% CI | | OR[a] | 95% CI | |
| Employment status | | | | | | | | | |
| Permanent | 1.00 | | | 1.00 | | | 1.00 | | |
| Precarious | 1.36 | 1.14 | 1.61 | 0.83 | 0.67 | 1.04 | 1.03 | 0.79 | 1.34 |
| Self-employed | 1.18 | 0.99 | 1.41 | 1.12 | 0.91 | 1.37 | 1.44 | 0.13 | 1.83 |
| Unemployed | 1.40 | 1.16 | 1.76 | 0.42 | 0.28 | 0.64 | 1.55 | 1.12 | 2.15 |
| Income | | | | | | | | | |
| Q5 (Highest) | 1.00 | | | 1.00 | | | 1.00 | | |
| Q4 | 2.06 | 1.65 | 2.57 | 0.92 | 0.75 | 1.12 | 0.96 | 0.75 | 1.22 |
| Q3 | 2.93 | 2.35 | 3.64 | 0.74 | 0.59 | 0.94 | 0.85 | 0.65 | 1.10 |
| Q2 | 3.44 | 2.73 | 4.34 | 0.74 | 0.56 | 0.98 | 0.89 | 0.65 | 1.21 |
| Q1 (Lowest) | 4.46 | 3.33 | 5.99 | 0.67 | 0.40 | 1.14 | 0.58 | 0.32 | 1.04 |

*Note.* OR, odds ratio; CI, confidence interval.

[a]Adjusted for age, sex, education, marital status, disability, chronic disease, depression, stress, self-rated health, type of health insurance, private insurance

**STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology***

**Checklist for cohort, case-control, and cross-sectional studies (combined)**

| Section/Topic | Item # | Recommendation | Reported on page # |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | 1 |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 3 |
| Objectives | 3 | State specific objectives, including any pre-specified hypotheses | 4 |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | 5 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 5 |
| Participants | 6 | (*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up<br>*Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls<br>*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants | 5 |
| | | (*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed<br>*Case-control study*—For matched studies, give matching criteria and the number of controls per case | |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 5 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 5 |
| Bias | 9 | Describe any efforts to address potential sources of bias | 5 |
| Study size | 10 | Explain how the study size was arrived at | 5 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 6 |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | 6 |
| | | (*b*) Describe any methods used to examine subgroups and interactions | 6 |
| | | (*c*) Explain how missing data were addressed | 6 |
| | | (*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed<br>*Case-control study*—If applicable, explain how matching of cases and controls was addressed | 6 |

| | | | |
|---|---|---|---|
| | | *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy | |
| | | (*e*) Describe any sensitivity analyses | 6 |
| **Results** | | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 8 |
| | | (b) Give reasons for non-participation at each stage | |
| | | (c) Consider use of a flow diagram | |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 8 |
| | | (b) Indicate number of participants with missing data for each variable of interest | |
| | | (c) *Cohort study*—Summarise follow-up time (eg, average and total amount) | |
| Outcome data | 15* | *Cohort study*—Report numbers of outcome events or summary measures over time | 8 |
| | | *Case-control study*—Report numbers in each exposure category, or summary measures of exposure | |
| | | *Cross-sectional study*—Report numbers of outcome events or summary measures | |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 8 |
| | | (*b*) Report category boundaries when continuous variables were categorized | |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | 9 |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 10 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 12 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 10-11 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 10-11 |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 13 |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

# Employment status and unmet dental care needs in South Korea: A population-based panel study



| | |
|---|---|
| Journal: | *BMJ Open* |
| Manuscript ID | bmjopen-2018-022436.R2 |
| Article Type: | Research |
| Date Submitted by the Author: | 07-Dec-2018 |
| Complete List of Authors: | Choi, Jaewoo; Yonsei University<br>Choi, Young; Yonsei University, Department of Public Health<br>Lee, Tae Hoon; Yonsei University, Department of Public Health<br>Lee, Hyo Jung; Yonsei University, Department of Public Health<br>Ju, Yeong-Jun; Yonsei University, Department of Public Health<br>Park, Eun-Cheol; Yonsei University College of Medicine, Department of Preventive Medicine and Institute of Health Services Research |
| Primary Subject Heading: | Health services research |
| Secondary Subject Heading: | Occupational and environmental medicine |
| Keywords: | employment status, unmet dental care needs, income disparity |
| | |

# Employment status and unmet dental care needs in South Korea: A population-based panel study

Jae Woo Choi[1], Young Choi[2,3], Tae-Hoon Lee[2,3], Hyo Jung Lee[2,3], Yeong-Jun Ju[2,3], Eun-Cheol Park[3,4*]

[1]College of Pharmacy, Yonsei Institute of Pharmaceutical Sciences, Yonsei University, Incheon, Korea

[2]Department of Public Health, Graduate School, Yonsei University, Seoul, Korea

[3]Institute of Health Services Research, Yonsei University College of Medicine, Seoul, Korea

[4]Department of Preventive Medicine, Yonsei University College of Medicine, Seoul, Korea

***Corresponding author: Eun-Cheol Park, MD, PhD**

Department of Preventive Medicine and Institute of Health Services Research, Yonsei University College of Medicine

50 Yonsei-ro, Seodaemun-gu, Seoul 120-752, Korea

Tel: 82-2-2188-1862/Fax: 82-2-392-8133

E-mail: ecpark@yuhs.ac

**Key Words:** employment status, unmet dental care needs, income disparity

**Word Count:** 3,127(excluding title page, references, figures)

# Abstract

Objectives: This study was designed to evaluate whether employment status is associated with the experience of unmet dental care needs.

Methods: 4,620 workers were retrieved from the Korea Health Panel data (2010-2013) and potential relationships were explored among income level, employment change, and unmet dental care needs.

Results: 17.3% of 4,620 people said they had failed at least once to have a dental treatment or checkup despite the needs. Precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than permanent workers (OR: 1.36, 1.40, respectively). In addition, low–income group were more 4.46 times likely to experience unmet dental care needs caused by economic burden than those with the highest income.

Conclusion: This disparity means that precarious workers and unemployed are more likely to face barriers in obtaining needed health services. Given the insecure employment status of low income people, meeting their needs for health care is an important consideration.


Key Words: employment status, unmet dental care needs, income disparity

**Strengths and limitations of this study**

1. **Strengths**

1) This study is significant because it is the first study to examine the association of economic status on unmet dental care needs among adults in South Korea using longitudinal panel data.

2. **Limitations**

1) We used self-reported questionnaires to identify subjects' experience of unmet dental care needs.
2) We did not control severity of dental care in our research.

# Ⅰ. Introduction

Korea achieved universal health insurance coverage just 12 years after its national health insurance system was implemented [1]. However, people with national health insurance still are paying rather high out-of-pocket (OOP) payments. The proportion of total medical spending financed by the public sector is only 56%, which is lower than the OECD average (73%), and is the fourth lowest OECD level of spending after Chile (46%), USA (48%), and Mexico (51%) [2]. Relatively low coverage on health insurance may result in unmet needs and this phenomenon is more likely to occur in dental care which is higher than OOP payment of health care. In Korea, benefit coverage of dental health services is low due to the relatively high medical expenses incurred by non-insured payment. Although Korean government has expanded coverage expansion policy for dental service, the level of out-of-payment is very high compared to other countries.

Rate of unmet dental care needs that experience unmet needs is very high in South Korea. Previous study on unmet dental care needs in South Korea showed that response rate of unmet dental care needs 24.5% [3], Whereas study results of state of Wisconsin in US indicated that about 20.6% of total population experienced unmet dental care needs [4]. In addition, Canadian study about immigrants living above 10 years in Canada showed that experience rate of unmet dental care needs 17.5% and the rate of 28 EU countries including Spain indicated 7.2% [5-7].

The factors related to unmet health care needs among adults in previous studies are socioeconomic factors including income or education level and health status such as self-related health or mental health [8-12]. In other words, low income or education groups are more likely to experience unmet health care needs than those with higher status. Although there are a few research of association between employment status and unmet needs, most of them examined unmet health care needs rather than dental care.

This study aims to examine the impact of employment status on the experience of unmet dental care needs, using nationally representative panel data collected from 2010–2013.

# Ⅱ. Methods

*Study Model*

This study used the Anderson social behavioral model to analyze factors that affect unmet dental care needs. This model is widely used as a model for analyzing factors affecting unmet medical care. In the Anderson model, the factors that determine the individual's behavior related to the use of medical services are largely categorized as predisposing factors, enabling factors, and need factors, and their relevance to medical use is analyzed through regression analysis. Predisposing factors consist of social structure variables (sex, age, marital status), social structural variables (education level, occupation), and health Beliefs and attitudes. Enabling factors are the resources of individuals and communities that enable the use of medical care and include variables such as income, number of household members, type of health insurance, and whether to join private health insurance. Need factors are directly related to use of health services as disease factors related to the level of individual disability or illness. It mainly includes variables such as subjective health status, presence of chronic disease, and disability. In this study, the predisposing factors were sex, age, education level, marital status, employment status. Enabling factors were income level, type of health insurance, and private insurance. Needs factors were self-rated health, depression, and stress.

*Data*

We utilized data from the Korea Health Panel (KHP) 3rd–6th (2010–2013 year), which is conducted by the Korea Institute for Health & Social Affairs and the National Health Insurance Corporation. The KHP is a nationally representative sample of Korean individuals and their families that include data on demographic and socioeconomic characteristics, health status, access to health care, and private health insurance status. The KHP uses a stratified multistage probability sampling design according to region and residence in order to select nationwide subjects from the 2005 Korea Census [13]. This study received ethical approval from the institutional review board of Yonsei University Graduate School of Public Health.

*Study sample and design*

We excluded the 1st–2nd data of KHP (2008–2009 year) because the variable about unmet dental care needs was not included in the survey. This study included data from the 4th wave

in 2011. In the 4th wave (2011), 17,035 subjects completed the survey questionnaire. The study subjects consisted of waged workers ≥19 years of age and excluded those who did experience unmet dental care needs in 3rd wave (2010). Subjects aged ≥62 years in 2011 were excluded so that all subjects in this study were <65 years old during the 3-year follow-up. After excluding subjects without follow-up or with any missing values, a total of 4,620 workers remained in this study. We defined employment status at baseline (2011) and if any workers in 2010 lost their jobs in baseline, they are classified as unemployed. We considered change of employment status annually and examined the effect the employment status on the experience of unmet dental care needs during 2011 to 2013.

*Dependent variable*

The dependent variable of this study is whether respondents had an unmet dental care needs or not, thus they were asked, "Have you failed to receive dental care services even if there was a need for treatment or checkup over the past one year?" Also, 'economic burden', 'no time to spare', and 'others' were added to result variables for those who had experienced unmet healthcare needs.

*Independent variable*

Employment status was classified into four categories: full-time permanent, precarious, self-employed, or unemployed. The KHP classified individuals as full-time permanent workers if all four of the following conditions were satisfied: (i) they were directly hired by their employers (not subcontracted or dispatched workers or self-employed workers without employees); (ii) they were full-time workers (not part-time workers); (iii) there was no fixed term in their employment contract (not temporary workers); and (iv) there was a high probability of maintaining their current job (having relatively little job insecurity and not a day laborer). Other than full-time permanent workers, waged workers hired by their employers were classified as precarious workers. The self-employed were defined as workers who managed their own business regardless of scale or carried out professional matter on their own responsibility. For the purpose of comparability with previous East Asian studies and consideration of different classification of employment status between countries, the self-employed were treated as having a different employment status. The unemployed were defined as those who had been waged workers at baseline in 2010 but lost employment by the time of the survey.

*Covariates*

In this study we used several covariates to control for demographic and socioeconomic characteristics and health status. Demographic characteristics included sex, age, marital status, and socioeconomic factors including education and income. The age groups were divided at 10-year intervals for measurement. Marital status was categorized into three: 'Married,' 'single,' and 'divorced or separated'. Educational levels were categorized into three: 'below elementary school,' 'middle or high school,' and 'above college'. Weighted total household income was divided into five: highest, high, middle, low, lowest. As a proxy for health status, we utilized self-rated health, stress, depression, disability, and chronic disease to control for the participant's health condition and health behavior, which can affect health care utilization. Finally, we used type of health insurance (national health insurance, medical aid) and existence of private insurance.

*Statistical analysis*

The frequency with which unmet dental care needs was incurred overall after accounting for demographic, socioeconomic, and health status was determined by Rao-Scott Chi-square test. To identify factors associated with unmet dental care needs and, in particular, to examine the relationship between employment status and unmet dental care needs, we used the GLIMMIX procedure because subjects in our study are measured repeatedly over time. The odds ratio (OR) was calculated through the regression coefficient gained through the GLIMMIX procedure and presented with a 95% confidence interval (95% CI). The SAS 9.3 statistical package (Cary, NC, USA) was used for data analysis.

*Patient and Public Involvement statement*

Patients or Public were not involved in this study.

# Ⅲ. Results

This study utilized longitudinal data which is repeatedly measured and constructed for 24,616 people in 2008. First year (2010) response rate of data utilized by in this study is 80.6% and the main reasons for decreasing response rate are death, response refusal etc. Table 1 shows General characteristics at first follow–up (2011) of waged workers. 17.3% of 4,620 respondents aged between 20 and 61 said they had failed at least once to have a dental treatment or checkup despite the needs. People who have low education, low–income group, people who were divorced, people with negative self-related health and those having depression or stress people who joined private insurance scheme, precarious workers and self–employed were more likely to experience unmet dental care needs. However, no significant relationship was observed between unmet dental care needs and sex, age, disability, chronic disease, and type of health insurance.

Table 2 shows self-reported reasons for unmet dental care needs according to employment status. Precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden. Whereas, permanent workers and self-employed were more likely to experience unmet dental care needs caused by having no time to spare.

After applying multivariate models adjusted for several covariates, the results for factors associated with unmet dental care needs are shown in Table 3. People who did not graduate elementary school had a higher risk of unmet dental care needs compared to those who graduated college (Odds ratio (OR): 1.35, 95% CI: 1.11-1.64). Low–income group were more 1.77 times likely to experience unmet dental care needs than those with higher income. People with negative self-rated health were more 2.19 times likely to experience unmet dental care needs than positive self-related health and those having stress or depression were more likely to experience unmet dental care needs than those no having such diseases (OR: 1.90, 1.69, respectively). People who joined private insurance scheme were 1.15 times more likely to experience unmet dental care needs than those who did not join private insurance. Self-employed workers were more 1.18 times likely to experience unmet dental care needs than full-time permanent workers.

Table 4 shows factors associated with reason for unmet dental care needs according to employment status or income. In employment status, precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than permanent workers (OR: 1.36, 1.40, respectively). Whereas, precarious workers were 0.73 times likely to experience unmet dental care needs caused by having no time to spare than permanent workers. In income level, low–income group were 4.46 times more likely to experience unmet dental care needs caused by economic burden than those with the highest income. Whereas, middle–income group were 0.74 times likely to experience unmet dental care needs caused by having no time to spare than the highest income class.

# Ⅳ. Discussion

This study showed that the rate of unmet dental care needs experienced by adults in South Korea is about 17.3%. This rate is higher 3~4 times compared to Europe countries and means relatively low access to dental care. The high rate results from very low health insurance coverage in dental care services. The non-insured payments which government does not support of dental care services is higher than general health care services. 2010 national health insurance coverage rate is about 62.7% in South Korea (pharmacy 71.6%, clinic 65.6%, and hospital 60.5%), whereas coverage rates of dental clinics and hospitals are about 35.5, 25.5%, respectively [14]. In addition, the proportion of non-insured payment (numerator) in OOP (denominator) is about 43.2, 64.6%, respectively and this indicates a much higher rate compared to other treatment services [3]. Fortunately, the Korean government has implemented a policy to insure implant treatments, which were previously not insured among senior citizens and plans to expand coverage rate of younger people. Based on this strengthening of benefit, we suggest consistent coverage expansion in dental care by considering characteristics of treatment items.

We identified the factors affecting unmet dental care needs to be education, income, self-rated health, depression, stress, private insurance, and employment status. In particular, there is no interaction between employment status and income. In other words, income and employment status independently affect unmet dental needs. The significant results linking socioeconomic status - including education and income level - to health status indicators - such as self-rated health, depression, stress - are not confined to dental care outcomes. These results are similar to previous studies using a variety of design or time [15-23].

Our research showed that people who joined private insurance scheme were 1.15 times more likely to experience unmet dental care needs than those who did not join private insurance. People who have higher levels of income or education are more likely to join private insurance and this phenomenon is similar in other countries which operate public health care system with supportive private insurance [24]. Although medical utilization of people joining private insurance is not higher than those uninsured by private insurance, it is possible to increase unmet needs by relative high want for health. Unmet needs related to private

insurance need to be examined in further study.

We examined difference of unmet dental care needs by employment status. Self-employed workers were more 1.18 times likely to experience unmet dental care needs than full-time permanent workers and this phenomenon may result from characteristics of self-employed workers in South Korea. A few people who have failed to get a regular job opt to start their own business rather than to have a non-regular position. Self-employed people comprise more than 30% of the labor market in Korea. A substantial number of self-employed people belong to a low-income class and are exposed to the danger of working poverty [25].

We examined factors associated with reason for unmet dental care needs according to employment status or income. Precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than permanent workers and this result is similar to previous studies [26, 27]. This phenomenon is related to the fact that the monthly wages of precarious workers are about 52.2% of full-time permanent workers. In 2015, the average monthly wage of permanent workers was about US$ 2,300 in South Korea, whereas the monthly wage of precarious workers is about US$ 1,200. It is a crucial issue is that the average wage of precarious workers is lower than minimum cost of living and this disparity may have the effect of reducing access to dental care by precarious workers as well as unemployed people. A similar issue is that the low–income group was 4.46 times more likely to experience unmet dental care needs caused by economic burden than those with the highest income. However, unmet dental care needs caused by other reasons were also significant, but in the opposite direction. For example, precarious workers and unemployed were less likely to experience unmet dental care needs caused by having no time to spare than permanent workers. This phenomenon may be attributable to their longer working hours of full-time permanent workers compared to precarious workers. In fact, the average working hours of precarious workers in 2013 were about 75.5% of those of permanent workers.

This study is significant because it is the first study to examine the association of economic status on unmet dental care needs among adults in South Korea using longitudinal panel data. Although similar studies on this topic were conducted, all of them used cross-sectional design that possible inverse causality between employment status and unmet dental care needs are not reflected. This study's longitudinal design allows us to assess the stability and continuity of several attributes of a sample group by repeatedly observing the same participants.

Another major strength of its longitudinal design is that cohort effects can be avoided because we examined one group of individuals over time, rather than comparing several different groups that represent different ages and generations.

There were some limitations associated with our study. First, we used self-reported questionnaires to identify subjects' experience of unmet dental care needs. Nevertheless, some studies using subjective and objective methods have tended to give reasonably consistent results [28]. In addition, the follow-up period in the current study is relatively short compared with other studies. Second, we did not control severity of patient's dental status in our research. Although severity of dental status including severe dental caries may affect medical access, we did not consider the factor in our model. Third, temporal bias could exist in this study results. Finally, the definition of unemployment in this paper differs from that of the International Labour Organization (actively seeking work). But, the questions in the survey used do not separately identify those who are actively seeking work. Also, unemployed group in this study may include retirees, student, permanently sick and others not normally considered as part of the unemployed. But, we cannot grasp the information due to data limitation.

# Ⅴ. Conclusions

Our research showed precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than full-time permanent workers. In addition, low–income group were more likely to experience unmet dental care needs caused by economic burden than those with the highest income. This disparity means that they are more likely to face barriers in obtaining needed health services. Given the insecure employment status of low income people, meeting their needs for health care is an important consideration.

**A funding Statement**: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests:** The authors declare that they have no competing interests.

**Authors' contributions:** JWC, YC, HJL, YJJ and ECP designed the study concept, wrote the protocol and collected the data. THL, HJL and YJJ conducted the analyses. All authors helped to draft the manuscript, read and approve the final manuscript. All authors had full access to all data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis. JWC and ECP are the study guarantors.

**Acknowledgements:** The English in this document has been checked by at least two professional editors, both native speakers of English.

**Data sharing statement:** No additional data are available.

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Table 1. General characteristics at first follow-up (2011) of waged workers Unit: N, %

| Variables | Total | Unmet dental-care needs | | | | Rao-Scott chi-square (p-value) |
|---|---|---|---|---|---|---|
| | | Yes | | No | | |
| Total | 4,620 | 801 | 17.3 | 3,819 | 82.7 | |
| Sex | | | | | | 0.35(0.555) |
| Men | 2,845 | 488 | 17.2 | 2,357 | 82.8 | |
| Women | 1,775 | 313 | 17.6 | 1,462 | 82.4 | |
| Age | | | | | | 4.00(0.261) |
| 20–29 | 292 | 43 | 14.7 | 249 | 85.3 | |
| 30–39 | 1,034 | 167 | 16.2 | 867 | 83.8 | |
| 40–49 | 1,686 | 285 | 16.9 | 1,401 | 83.1 | |
| ≥50 | 1,608 | 306 | 19.0 | 1,302 | 81.0 | |
| Education | | | | | | 14.67(<0.001) |
| Below elementary school | 346 | 84 | 24.3 | 262 | 75.7 | |
| Middle or high school | 2,231 | 408 | 18.3 | 1,823 | 81.7 | |
| Above college | 2,043 | 309 | 15.1 | 1,734 | 84.9 | |
| Marital status | | | | | | 9.24(0.009) |
| Married | 3,611 | 631 | 17.5 | 2,980 | 82.5 | |
| Single | 730 | 102 | 14.0 | 628 | 86.0 | |
| Divorced or separated | 279 | 68 | 24.4 | 211 | 75.6 | |
| Income | | | | | | 27.92(<0.001) |
| Q1 (Lowest) | 204 | 51 | 25.0 | 153 | 75.0 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Q2 | 694 | 145 | 20.9 | 549 | 79.1 | |
| Q3 | 1,093 | 207 | 18.9 | 886 | 81.1 | |
| Q4 | 1,311 | 226 | 17.2 | 1,085 | 82.8 | |
| Q5 (Highest) | 1,316 | 172 | 13.1 | 1,144 | 86.9 | |
| Self-rated health | | | | | | 64.09(<0.001) |
| Good | 2,140 | 294 | 13.7 | 1,846 | 86.3 | |
| Normal | 1,815 | 380 | 20.9 | 1,435 | 79.1 | |
| Bad | 326 | 97 | 29.8 | 229 | 70.2 | |
| Depression | | | | | | 58.40(<0.001) |
| Yes | 251 | 88 | 35.1 | 163 | 64.9 | |
| No | 4,030 | 683 | 16.9 | 3,347 | 83.1 | |
| Stress | | | | | | 73.09(<0.001) |
| Always | 363 | 118 | 32.5 | 245 | 67.5 | |
| Often | 2,246 | 434 | 19.3 | 1,812 | 80.7 | |
| No | 1,667 | 218 | 13.1 | 1,449 | 86.9 | |
| Type of health insurance | | | | | | 3.25(0.072) |
| National health insurance | 4,531 | 778 | 17.2 | 3,753 | 82.8 | |
| Medical aid | 89 | 23 | 25.8 | 66 | 74.2 | |
| Private insurance | | | | | | 4.04(0.044) |
| Yes | 3,953 | 659 | 16.7 | 3,294 | 83.3 | |
| No | 657 | 132 | 20.1 | 525 | 79.9 | |
| Employment status | | | | | | 14.00(0.002) |
| Permanent | 1,902 | 278 | 14.6 | 1,624 | 85.4 | |

| | | | | | |
|---|---|---|---|---|---|
| Precarious | 1,221 | 237 | 19.4 | 984 | 80.6 |
| Self-employed | 1,116 | 218 | 19.5 | 898 | 80.5 |
| Unemployed | 381 | 68 | 17.8 | 313 | 82.2 |

Table 2. Self-reported reasons for unmet dental-care needs according to employment status

Unit: N, %

| Variable | Reason for unmet need | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total | Economic burden | | No time to spare | | Others[a] | |
| Total | 4,620 | 415 | 9.0 | 209 | 4.5 | 177 | 3.8 |
| Permanent | 1,902 | 98 | 5.2 | 106 | 5.6 | 74 | 3.9 |
| Precarious | 1,221 | 158 | 12.9 | 42 | 3.4 | 37 | 3.0 |
| Self-employed | 1,116 | 109 | 9.8 | 56 | 5.0 | 53 | 4.7 |
| Unemployed | 381 | 50 | 13.1 | 5 | 1.3 | 13 | 3.4 |

[a]Others: trivial symptoms, great distance from the health care facility, reduced mobility (difficult to visit for physical reasons), no one to babysit, lack of information as to where to go, no timely appointment, absence of a primary care physician, etc.

Table 3. Factors associated with unmet dental-care needs

| Variables | Unmet dental-care needs | | |
|---|---|---|---|
| | Adjusted OR | 95% CI | |
| Sex | | | |
| Men | 1.00 | | |
| Women | 0.95 | 0.86 | 1.06 |
| Age | | | |
| ≥50 | 1.00 | | |
| 40–49 | 1.03 | 0.92 | 1.16 |
| 30–39 | 1.11 | 0.95 | 1.29 |
| 20–29 | 1.10 | 0.82 | 1.48 |
| Education | | | |
| Above college | 1.00 | | |
| Middle or high school | 1.07 | 0.96 | 1.19 |
| Below elementary school | 1.35 | 1.11 | 1.64 |
| Marital status | | | |
| Married | 1.00 | | |
| Single | 1.17 | 0.98 | 1.41 |
| Divorced or separated | 0.79 | 0.67 | 1.03 |
| Self-rated health | | | |
| Good | 1.00 | | |
| Normal | 1.76 | 1.59 | 1.94 |
| Bad | 2.19 | 1.86 | 2.59 |

| | | | |
|---|---|---|---|
| Depression | | | |
| No | 1.00 | | |
| Yes | 1.69 | 1.42 | 2.01 |
| Stress | | | |
| No | 1.00 | | |
| Often | 1.39 | 1.26 | 1.55 |
| Always | 1.90 | 1.61 | 2.24 |
| Income | | | |
| Q5 (Highest) | 1.00 | | |
| Q4 | 1.20 | 1.05 | 1.38 |
| Q3 | 1.33 | 1.16 | 1.52 |
| Q2 | 1.51 | 1.29 | 1.76 |
| Q1 (Lowest) | 1.77 | 1.41 | 2.22 |
| Type of health insurance | | | |
| National health insurance | 1.00 | | |
| Medical aid | 1.17 | 0.86 | 1.60 |
| Private insurance | | | |
| No | 1.00 | | |
| Yes | 1.15 | 1.01 | 1.32 |
| Employment status | | | |
| Permanent | 1.00 | | |
| Precarious | 1.11 | 0.98 | 1.26 |
| Self-employed | 1.18 | 1.04 | 1.34 |

| | | | |
|---|---|---|---|
| Unemployed | 1.09 | 0.92 | 1.30 |

*Note.* OR, odds ratio; CI, confidence interval.

Table 4. Factors associated with reason for unmet dental care needs according to employment status or income

| Variables | Reason for unmet need | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Economic burden | | | No time to spare | | | Others | | |
| | OR[a] | 95% CI | | OR[a] | 95% CI | | OR[a] | 95% CI | |
| Employment status | | | | | | | | | |
| Permanent | 1.00 | | | 1.00 | | | 1.00 | | |
| Precarious | 1.36 | 1.14 | 1.61 | 0.83 | 0.67 | 1.04 | 1.03 | 0.79 | 1.34 |
| Self-employed | 1.18 | 0.99 | 1.41 | 1.12 | 0.91 | 1.37 | 1.44 | 0.13 | 1.83 |
| Unemployed | 1.40 | 1.16 | 1.76 | 0.42 | 0.28 | 0.64 | 1.55 | 1.12 | 2.15 |
| Income | | | | | | | | | |
| Q5 (Highest) | 1.00 | | | 1.00 | | | 1.00 | | |
| Q4 | 2.06 | 1.65 | 2.57 | 0.92 | 0.75 | 1.12 | 0.96 | 0.75 | 1.22 |
| Q3 | 2.93 | 2.35 | 3.64 | 0.74 | 0.59 | 0.94 | 0.85 | 0.65 | 1.10 |
| Q2 | 3.44 | 2.73 | 4.34 | 0.74 | 0.56 | 0.98 | 0.89 | 0.65 | 1.21 |
| Q1 (Lowest) | 4.46 | 3.33 | 5.99 | 0.67 | 0.40 | 1.14 | 0.58 | 0.32 | 1.04 |

*Note.* OR, odds ratio; CI, confidence interval.

[a]Adjusted for age, sex, education, marital status, disability, chronic disease, depression, stress, self-rated health, type of health insurance, private insurance

1

**STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology***

**Checklist for cohort, case-control, and cross-sectional studies (combined)**

| Section/Topic | Item # | Recommendation | Reported on page # |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | 1 |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 3 |
| Objectives | 3 | State specific objectives, including any pre-specified hypotheses | 4 |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | 5 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 5 |
| Participants | 6 | (*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up<br>*Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls<br>*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants | 5 |
| | | (*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed<br>*Case-control study*—For matched studies, give matching criteria and the number of controls per case | |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 5 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 5 |
| Bias | 9 | Describe any efforts to address potential sources of bias | 5 |
| Study size | 10 | Explain how the study size was arrived at | 5 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 6 |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | 6 |
| | | (*b*) Describe any methods used to examine subgroups and interactions | 6 |
| | | (*c*) Explain how missing data were addressed | 6 |
| | | (*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed<br>*Case-control study*—If applicable, explain how matching of cases and controls was addressed | 6 |

| | | | |
|---|---|---|---|
| | | *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy | |
| | | (*e*) Describe any sensitivity analyses | 6 |
| **Results** | | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 8 |
| | | (b) Give reasons for non-participation at each stage | |
| | | (c) Consider use of a flow diagram | |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 8 |
| | | (b) Indicate number of participants with missing data for each variable of interest | |
| | | (c) *Cohort study*—Summarise follow-up time (eg, average and total amount) | |
| Outcome data | 15* | *Cohort study*—Report numbers of outcome events or summary measures over time | 8 |
| | | *Case-control study*—Report numbers in each exposure category, or summary measures of exposure | |
| | | *Cross-sectional study*—Report numbers of outcome events or summary measures | |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 8 |
| | | (*b*) Report category boundaries when continuous variables were categorized | |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | 9 |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 10 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 12 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 10-11 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 10-11 |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 13 |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

# Employment status and unmet dental care needs in South Korea: A population-based panel study



| | |
|---|---|
| Journal: | *BMJ Open* |
| Manuscript ID | bmjopen-2018-022436.R3 |
| Article Type: | Research |
| Date Submitted by the Author: | 30-Jan-2019 |
| Complete List of Authors: | Choi, Jaewoo; Yonsei University<br>Choi, Young; Yonsei University, Department of Public Health<br>Lee, Tae Hoon; Yonsei University, Department of Public Health<br>Lee, Hyo Jung; Yonsei University, Department of Public Health<br>Ju, Yeong-Jun; Yonsei University, Department of Public Health<br>Park, Eun-Cheol; Yonsei University College of Medicine, Department of Preventive Medicine and Institute of Health Services Research |
| Primary Subject Heading: | Health services research |
| Secondary Subject Heading: | Occupational and environmental medicine |
| Keywords: | employment status, unmet dental care needs, income disparity |
| | |

# Employment status and unmet dental care needs in South Korea: A population-based panel study

Jae Woo Choi[1], Young Choi[2,3], Tae-Hoon Lee[2,3], Hyo Jung Lee[2,3], Yeong-Jun Ju[2,3], Eun-Cheol Park[3,4*]

[1]College of Pharmacy, Yonsei Institute of Pharmaceutical Sciences, Yonsei University, Incheon, Korea

[2]Department of Public Health, Graduate School, Yonsei University, Seoul, Korea

[3]Institute of Health Services Research, Yonsei University College of Medicine, Seoul, Korea

[4]Department of Preventive Medicine, Yonsei University College of Medicine, Seoul, Korea

***Corresponding author: Eun-Cheol Park, MD, PhD**

Department of Preventive Medicine and Institute of Health Services Research, Yonsei University College of Medicine

50 Yonsei-ro, Seodaemun-gu, Seoul 120-752, Korea

Tel: 82-2-2188-1862/Fax: 82-2-392-8133

E-mail: ecpark@yuhs.ac

**Key Words:** employment status, unmet dental care needs, income disparity

**Word Count:** 3,127(excluding title page, references, figures)

# Abstract

Objectives: This study was designed to evaluate whether employment status is associated with the experience of unmet dental care needs.

Methods: 4,620 workers were retrieved from the Korea Health Panel data (2010-2013) and potential relationships were explored among income level, employment change, and unmet dental care needs.

Results: 17.3% of 4,620 people said they had failed at least once to have a dental treatment or checkup despite the needs. Precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than permanent workers (OR: 1.36, 1.40, respectively). In addition, low–income group were more 4.46 times likely to experience unmet dental care needs caused by economic burden than those with the highest income.

Conclusion: This disparity means that precarious workers and unemployed are more likely to face barriers in obtaining needed health services. Given the insecure employment status of low income people, meeting their needs for health care is an important consideration.


Key Words: employment status, unmet dental care needs, income disparity

**Strengths and limitations of this study**

1. **Strengths**

1) This study is significant because it is the first study to examine the association of economic status on unmet dental care needs among adults in South Korea using longitudinal panel data.

2. **Limitations**

1) We used self-reported questionnaires to identify subjects' experience of unmet dental care needs.
2) We did not control severity of dental care in our research.

# Ⅰ. Introduction

Korea achieved universal health insurance coverage just 12 years after its national health insurance system was implemented [1]. However, people with national health insurance still are paying rather high out-of-pocket (OOP) payments. The proportion of total medical spending financed by the public sector is only 56%, which is lower than the OECD average (73%), and is the fourth lowest OECD level of spending after Chile (46%), USA (48%), and Mexico (51%) [2]. Relatively low coverage on health insurance may result in unmet needs and this phenomenon is more likely to occur in dental care which is higher than OOP payment of health care. In Korea, benefit coverage of dental health services is low due to the relatively high medical expenses incurred by non-insured payment. Although Korean government has expanded coverage expansion policy for dental service, the level of out-of-payment is very high compared to other countries.

Rate of unmet dental care needs that experience unmet needs is very high in South Korea. Previous study on unmet dental care needs in South Korea showed that response rate of unmet dental care needs 24.5% [3], Whereas study results of state of Wisconsin in US indicated that about 20.6% of total population experienced unmet dental care needs [4]. In addition, Canadian study about immigrants living above 10 years in Canada showed that experience rate of unmet dental care needs 17.5% and the rate of 28 EU countries including Spain indicated 7.2% [5-7].

The factors related to unmet health care needs among adults in previous studies are socioeconomic factors including income or education level and health status such as self-related health or mental health [8-12]. In other words, low income or education groups are more likely to experience unmet health care needs than those with higher status. Although there are a few research of association between employment status and unmet needs, most of them examined unmet health care needs rather than dental care.

This study aims to examine the impact of employment status on the experience of unmet dental care needs, using nationally representative panel data collected from 2010–2013.

# Ⅱ. Methods

*Study Model*

This study used the Anderson social behavioral model to analyze factors that affect unmet dental care needs. This model is widely used as a model for analyzing factors affecting unmet medical care. In the Anderson model, the factors that determine the individual's behavior related to the use of medical services are largely categorized as predisposing factors, enabling factors, and need factors, and their relevance to medical use is analyzed through regression analysis. Predisposing factors consist of social structure variables (sex, age, marital status), social structural variables (education level, occupation), and health Beliefs and attitudes. Enabling factors are the resources of individuals and communities that enable the use of medical care and include variables such as income, number of household members, type of health insurance, and whether to join private health insurance. Need factors are directly related to use of health services as disease factors related to the level of individual disability or illness. It mainly includes variables such as subjective health status, presence of chronic disease, and disability. In this study, the predisposing factors were sex, age, education level, marital status, employment status. Enabling factors were income level, type of health insurance, and private insurance. Needs factors were self-rated health, depression, and stress.

*Data*

We utilized data from the Korea Health Panel (KHP) 3rd–6th (2010–2013 year), which is conducted by the Korea Institute for Health & Social Affairs and the National Health Insurance Corporation. The KHP is a nationally representative sample of Korean individuals and their families that include data on demographic and socioeconomic characteristics, health status, access to health care, and private health insurance status. The KHP uses a stratified multistage probability sampling design according to region and residence in order to select nationwide subjects from the 2005 Korea Census [13]. This study received ethical approval from the institutional review board of Yonsei University Graduate School of Public Health.

*Study sample and design*

We excluded the 1st–2nd data of KHP (2008–2009 year) because the variable about unmet dental care needs was not included in the survey. This study included data from the 4th wave

in 2011. In the 4th wave (2011), 17,035 subjects completed the survey questionnaire. The study subjects consisted of waged workers ≥19 years of age and excluded those who did experience unmet dental care needs and workers (permanent or precarious or self-employed) in 3rd wave (2010). Subjects aged ≥62 years in 2011 were excluded so that all subjects in this study were <65 years old during the 3-year follow-up. After excluding subjects without follow-up or with any missing values, a total of 4,620 workers remained in this study. We examined the effect the employment status on the experience of unmet dental care needs during 2011 to 2013.

*Dependent variable*

The dependent variable of this study is whether respondents had an unmet dental care needs or not, thus they were asked, "Have you failed to receive dental care services even if there was a need for treatment or checkup over the past one year?" Also, 'economic burden', 'no time to spare', and 'others' were added to result variables for those who had experienced unmet healthcare needs.

*Independent variable*

Employment status was classified into four categories: full-time permanent, precarious, self-employed, or unemployed. The KHP classified individuals as full-time permanent workers if all four of the following conditions were satisfied: (i) they were directly hired by their employers (not subcontracted or dispatched workers or self-employed workers without employees); (ii) they were full-time workers (not part-time workers); (iii) there was no fixed term in their employment contract (not temporary workers); and (iv) there was a high probability of maintaining their current job (having relatively little job insecurity and not a day laborer). Other than full-time permanent workers, waged workers hired by their employers were classified as precarious workers. The self-employed were defined as workers who managed their own business regardless of scale or carried out professional matter on their own responsibility. For the purpose of comparability with previous East Asian studies and consideration of different classification of employment status between countries, the self-employed were treated as having a different employment status. The unemployed were defined as those who lost a job in 2011 among workers in 2010.

*Covariates*

In this study we used several covariates to control for demographic and socioeconomic

characteristics and health status. Demographic characteristics included sex, age, marital status, and socioeconomic factors including education and income. The age groups were divided at 10-year intervals for measurement. Marital status was categorized into three: 'Married,' 'single,' and 'divorced or separated'. Educational levels were categorized into three: 'below elementary school,' 'middle or high school,' and 'above college'. Weighted total household income was divided into five: highest, high, middle, low, lowest. As a proxy for health status, we utilized self-rated health, stress, depression, disability, and chronic disease to control for the participant's health condition and health behavior, which can affect health care utilization. Finally, we used type of health insurance (national health insurance, medical aid) and existence of private insurance.

*Statistical analysis*

The frequency with which unmet dental care needs was incurred overall after accounting for demographic, socioeconomic, and health status was determined by Rao-Scott Chi-square test. To identify factors associated with unmet dental care needs and, in particular, to examine the relationship between employment status and unmet dental care needs, we used the GLIMMIX procedure because subjects in our study are measured repeatedly over time. The odds ratio (OR) was calculated through the regression coefficient gained through the GLIMMIX procedure and presented with a 95% confidence interval (95% CI). The SAS 9.3 statistical package (Cary, NC, USA) was used for data analysis.

*Patient and Public Involvement statement*

Patients or Public were not involved in this study.

# Ⅲ. Results

This study utilized longitudinal data which is repeatedly measured and constructed for 24,616 people in 2008. First year (2010) response rate of data utilized by in this study is 80.6% and the main reasons for decreasing response rate are death, response refusal etc. Table 1 shows General characteristics at first follow–up (2011) of waged workers. 17.3% of 4,620 respondents aged between 20 and 61 said they had failed at least once to have a dental treatment or checkup despite the needs. People who have low education, low–income group, people who were divorced, people with negative self-related health and those having depression or stress people who joined private insurance scheme, precarious workers and self–employed were more likely to experience unmet dental care needs. However, no significant relationship was observed between unmet dental care needs and sex, age, disability, chronic disease, and type of health insurance.

Table 2 shows self-reported reasons for unmet dental care needs according to employment status. Precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden. Whereas, permanent workers and self-employed were more likely to experience unmet dental care needs caused by having no time to spare.

After applying multivariate models adjusted for several covariates, the results for factors associated with unmet dental care needs are shown in Table 3. People who did not graduate elementary school had a higher risk of unmet dental care needs compared to those who graduated college (Odds ratio (OR): 1.35, 95% CI: 1.11-1.64). Low–income group were more 1.77 times likely to experience unmet dental care needs than those with higher income. People with negative self-rated health were more 2.19 times likely to experience unmet dental care needs than positive self-related health and those having stress or depression were more likely to experience unmet dental care needs than those no having such diseases (OR: 1.90, 1.69, respectively). People who joined private insurance scheme were 1.15 times more likely to experience unmet dental care needs than those who did not join private insurance. Self-employed workers were more 1.18 times likely to experience unmet dental care needs than full-time permanent workers.

Table 4 shows factors associated with reason for unmet dental care needs according to employment status or income. In employment status, precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than permanent workers (OR: 1.36, 1.40, respectively). Whereas, precarious workers were 0.73 times likely to experience unmet dental care needs caused by having no time to spare than permanent workers. In income level, low–income group were 4.46 times more likely to experience unmet dental care needs caused by economic burden than those with the highest income. Whereas, middle–income group were 0.74 times likely to experience unmet dental care needs caused by having no time to spare than the highest income class.

# Ⅳ. Discussion

This study showed that the rate of unmet dental care needs experienced by adults in South Korea is about 17.3%. This rate is higher 3~4 times compared to Europe countries and means relatively low access to dental care. The high rate results from very low health insurance coverage in dental care services. The non-insured payments which government does not support of dental care services is higher than general health care services. 2010 national health insurance coverage rate is about 62.7% in South Korea (pharmacy 71.6%, clinic 65.6%, and hospital 60.5%), whereas coverage rates of dental clinics and hospitals are about 35.5, 25.5%, respectively [14]. In addition, the proportion of non-insured payment (numerator) in OOP (denominator) is about 43.2, 64.6%, respectively and this indicates a much higher rate compared to other treatment services [3]. Fortunately, the Korean government has implemented a policy to insure implant treatments, which were previously not insured among senior citizens and plans to expand coverage rate of younger people. Based on this strengthening of benefit, we suggest consistent coverage expansion in dental care by considering characteristics of treatment items.

We identified the factors affecting unmet dental care needs to be education, income, self-rated health, depression, stress, private insurance, and employment status. In particular, there is no interaction between employment status and income. In other words, income and employment status independently affect unmet dental needs. The significant results linking socioeconomic status - including education and income level - to health status indicators - such as self-rated health, depression, stress - are not confined to dental care outcomes. These results are similar to previous studies using a variety of design or time [15-23].

Our research showed that people who joined private insurance scheme were 1.15 times more likely to experience unmet dental care needs than those who did not join private insurance. People who have higher levels of income or education are more likely to join private insurance and this phenomenon is similar in other countries which operate public health care system with supportive private insurance [24]. Although medical utilization of people joining private insurance is not higher than those uninsured by private insurance, it is possible to increase unmet needs by relative high want for health. Unmet needs related to private

insurance need to be examined in further study.

We examined difference of unmet dental care needs by employment status. Self-employed workers were more 1.18 times likely to experience unmet dental care needs than full-time permanent workers and this phenomenon may result from characteristics of self-employed workers in South Korea. A few people who have failed to get a regular job opt to start their own business rather than to have a non-regular position. Self-employed people comprise more than 30% of the labor market in Korea. A substantial number of self-employed people belong to a low-income class and are exposed to the danger of working poverty [25].

We examined factors associated with reason for unmet dental care needs according to employment status or income. Precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than permanent workers and this result is similar to previous studies [26, 27]. This phenomenon is related to the fact that the monthly wages of precarious workers are about 52.2% of full-time permanent workers. In 2015, the average monthly wage of permanent workers was about US$ 2,300 in South Korea, whereas the monthly wage of precarious workers is about US$ 1,200. It is a crucial issue is that the average wage of precarious workers is lower than minimum cost of living and this disparity may have the effect of reducing access to dental care by precarious workers as well as unemployed people. A similar issue is that the low–income group was 4.46 times more likely to experience unmet dental care needs caused by economic burden than those with the highest income. However, unmet dental care needs caused by other reasons were also significant, but in the opposite direction. For example, precarious workers and unemployed were less likely to experience unmet dental care needs caused by having no time to spare than permanent workers. This phenomenon may be attributable to their longer working hours of full-time permanent workers compared to precarious workers. In fact, the average working hours of precarious workers in 2013 were about 75.5% of those of permanent workers.

This study is significant because it is the first study to examine the association of economic status on unmet dental care needs among adults in South Korea using longitudinal panel data. Although similar studies on this topic were conducted, all of them used cross-sectional design that possible inverse causality between employment status and unmet dental care needs are not reflected. This study's longitudinal design allows us to assess the stability and continuity of several attributes of a sample group by repeatedly observing the same participants.

Another major strength of its longitudinal design is that cohort effects can be avoided because we examined one group of individuals over time, rather than comparing several different groups that represent different ages and generations.

There were some limitations associated with our study. First, we used self-reported questionnaires to identify subjects' experience of unmet dental care needs. Nevertheless, some studies using subjective and objective methods have tended to give reasonably consistent results [28]. In addition, the follow-up period in the current study is relatively short compared with other studies. Second, we did not control severity of patient's dental status in our research. Although severity of dental status including severe dental caries may affect medical access, we did not consider the factor in our model. Third, temporal bias could exist in this study results. Finally, the definition of unemployment in this paper differs from that of the International Labour Organization (actively seeking work). Unemployed group in this study may include student, permanently sick and others not normally considered as part of the unemployed (out of work). But, we cannot grasp the information due to data limitation.

# Ⅴ. Conclusions

Our research showed precarious workers and unemployed were more likely to experience unmet dental care needs caused by economic burden than full-time permanent workers. In addition, low–income group were more likely to experience unmet dental care needs caused by economic burden than those with the highest income. This disparity means that they are more likely to face barriers in obtaining needed health services. Given the insecure employment status of low income people, meeting their needs for health care is an important consideration.

**A funding Statement**: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

**Competing interests:** The authors declare that they have no competing interests.

**Authors' contributions:** JWC, YC, HJL, YJJ and ECP designed the study concept, wrote the protocol and collected the data. THL, HJL and YJJ conducted the analyses. All authors helped to draft the manuscript, read and approve the final manuscript. All authors had full access to all data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis. JWC and ECP are the study guarantors.

**Acknowledgements:** The English in this document has been checked by at least two professional editors, both native speakers of English.

**Data sharing statement:** No additional data are available.

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Table 1. General characteristics at first follow-up (2011) of waged workers Unit: N, %

| Variables | Total | Unmet dental-care needs | | | | Rao-Scott chi-square (p-value) |
|---|---|---|---|---|---|---|
| | | Yes | | No | | |
| Total | 4,620 | 801 | 17.3 | 3,819 | 82.7 | |
| Sex | | | | | | 0.35(0.555) |
| Men | 2,845 | 488 | 17.2 | 2,357 | 82.8 | |
| Women | 1,775 | 313 | 17.6 | 1,462 | 82.4 | |
| Age | | | | | | 4.00(0.261) |
| 20–29 | 292 | 43 | 14.7 | 249 | 85.3 | |
| 30–39 | 1,034 | 167 | 16.2 | 867 | 83.8 | |
| 40–49 | 1,686 | 285 | 16.9 | 1,401 | 83.1 | |
| ≥50 | 1,608 | 306 | 19.0 | 1,302 | 81.0 | |
| Education | | | | | | 14.67(<0.001) |
| Below elementary school | 346 | 84 | 24.3 | 262 | 75.7 | |
| Middle or high school | 2,231 | 408 | 18.3 | 1,823 | 81.7 | |
| Above college | 2,043 | 309 | 15.1 | 1,734 | 84.9 | |
| Marital status | | | | | | 9.24(0.009) |
| Married | 3,611 | 631 | 17.5 | 2,980 | 82.5 | |
| Single | 730 | 102 | 14.0 | 628 | 86.0 | |
| Divorced or separated | 279 | 68 | 24.4 | 211 | 75.6 | |
| Income | | | | | | 27.92(<0.001) |
| Q1 (Lowest) | 204 | 51 | 25.0 | 153 | 75.0 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Q2 | 694 | 145 | 20.9 | 549 | 79.1 | |
| Q3 | 1,093 | 207 | 18.9 | 886 | 81.1 | |
| Q4 | 1,311 | 226 | 17.2 | 1,085 | 82.8 | |
| Q5 (Highest) | 1,316 | 172 | 13.1 | 1,144 | 86.9 | |
| Self-rated health | | | | | | 64.09(<0.001) |
| Good | 2,140 | 294 | 13.7 | 1,846 | 86.3 | |
| Normal | 1,815 | 380 | 20.9 | 1,435 | 79.1 | |
| Bad | 326 | 97 | 29.8 | 229 | 70.2 | |
| Depression | | | | | | 58.40(<0.001) |
| Yes | 251 | 88 | 35.1 | 163 | 64.9 | |
| No | 4,030 | 683 | 16.9 | 3,347 | 83.1 | |
| Stress | | | | | | 73.09(<0.001) |
| Always | 363 | 118 | 32.5 | 245 | 67.5 | |
| Often | 2,246 | 434 | 19.3 | 1,812 | 80.7 | |
| No | 1,667 | 218 | 13.1 | 1,449 | 86.9 | |
| Type of health insurance | | | | | | 3.25(0.072) |
| National health insurance | 4,531 | 778 | 17.2 | 3,753 | 82.8 | |
| Medical aid | 89 | 23 | 25.8 | 66 | 74.2 | |
| Private insurance | | | | | | 4.04(0.044) |
| Yes | 3,953 | 659 | 16.7 | 3,294 | 83.3 | |
| No | 657 | 132 | 20.1 | 525 | 79.9 | |
| Employment status | | | | | | 14.00(0.002) |
| Permanent | 1,902 | 278 | 14.6 | 1,624 | 85.4 | |

| | | | | | |
|---|---|---|---|---|---|
| Precarious | 1,221 | 237 | 19.4 | 984 | 80.6 |
| Self-employed | 1,116 | 218 | 19.5 | 898 | 80.5 |
| Unemployed | 381 | 68 | 17.8 | 313 | 82.2 |

Table 2. Self-reported reasons for unmet dental-care needs according to employment status

Unit: N, %

| Variable | Reason for unmet need | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total | Economic burden | | No time to spare | | Others[a] | |
| Total | 4,620 | 415 | 9.0 | 209 | 4.5 | 177 | 3.8 |
| Permanent | 1,902 | 98 | 5.2 | 106 | 5.6 | 74 | 3.9 |
| Precarious | 1,221 | 158 | 12.9 | 42 | 3.4 | 37 | 3.0 |
| Self-employed | 1,116 | 109 | 9.8 | 56 | 5.0 | 53 | 4.7 |
| Unemployed | 381 | 50 | 13.1 | 5 | 1.3 | 13 | 3.4 |

[a]Others: trivial symptoms, great distance from the health care facility, reduced mobility (difficult to visit for physical reasons), no one to babysit, lack of information as to where to go, no timely appointment, absence of a primary care physician, etc.

Table 3. Factors associated with unmet dental-care needs

| Variables | Unmet dental-care needs | | |
|---|---|---|---|
| | Adjusted OR | 95% CI | |
| Sex | | | |
| Men | 1.00 | | |
| Women | 0.95 | 0.86 | 1.06 |
| Age | | | |
| ≥50 | 1.00 | | |
| 40–49 | 1.03 | 0.92 | 1.16 |
| 30–39 | 1.11 | 0.95 | 1.29 |
| 20–29 | 1.10 | 0.82 | 1.48 |
| Education | | | |
| Above college | 1.00 | | |
| Middle or high school | 1.07 | 0.96 | 1.19 |
| Below elementary school | 1.35 | 1.11 | 1.64 |
| Marital status | | | |
| Married | 1.00 | | |
| Single | 1.17 | 0.98 | 1.41 |
| Divorced or separated | 0.79 | 0.67 | 1.03 |
| Self-rated health | | | |
| Good | 1.00 | | |
| Normal | 1.76 | 1.59 | 1.94 |
| Bad | 2.19 | 1.86 | 2.59 |

| | | | |
|---|---|---|---|
| Depression | | | |
| No | 1.00 | | |
| Yes | 1.69 | 1.42 | 2.01 |
| Stress | | | |
| No | 1.00 | | |
| Often | 1.39 | 1.26 | 1.55 |
| Always | 1.90 | 1.61 | 2.24 |
| Income | | | |
| Q5 (Highest) | 1.00 | | |
| Q4 | 1.20 | 1.05 | 1.38 |
| Q3 | 1.33 | 1.16 | 1.52 |
| Q2 | 1.51 | 1.29 | 1.76 |
| Q1 (Lowest) | 1.77 | 1.41 | 2.22 |
| Type of health insurance | | | |
| National health insurance | 1.00 | | |
| Medical aid | 1.17 | 0.86 | 1.60 |
| Private insurance | | | |
| No | 1.00 | | |
| Yes | 1.15 | 1.01 | 1.32 |
| Employment status | | | |
| Permanent | 1.00 | | |
| Precarious | 1.11 | 0.98 | 1.26 |
| Self-employed | 1.18 | 1.04 | 1.34 |

| | | | |
|---|---|---|---|
| Unemployed | 1.09 | 0.92 | 1.30 |

*Note.* OR, odds ratio; CI, confidence interval.

Table 4. Factors associated with reason for unmet dental care needs according to employment status or income

| Variables | Reason for unmet need | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Economic burden | | | No time to spare | | | Others | | |
| | OR[a] | 95% CI | | OR[a] | 95% CI | | OR[a] | 95% CI | |
| Employment status | | | | | | | | | |
| Permanent | 1.00 | | | 1.00 | | | 1.00 | | |
| Precarious | 1.36 | 1.14 | 1.61 | 0.83 | 0.67 | 1.04 | 1.03 | 0.79 | 1.34 |
| Self-employed | 1.18 | 0.99 | 1.41 | 1.12 | 0.91 | 1.37 | 1.44 | 0.13 | 1.83 |
| Unemployed | 1.40 | 1.16 | 1.76 | 0.42 | 0.28 | 0.64 | 1.55 | 1.12 | 2.15 |
| Income | | | | | | | | | |
| Q5 (Highest) | 1.00 | | | 1.00 | | | 1.00 | | |
| Q4 | 2.06 | 1.65 | 2.57 | 0.92 | 0.75 | 1.12 | 0.96 | 0.75 | 1.22 |
| Q3 | 2.93 | 2.35 | 3.64 | 0.74 | 0.59 | 0.94 | 0.85 | 0.65 | 1.10 |
| Q2 | 3.44 | 2.73 | 4.34 | 0.74 | 0.56 | 0.98 | 0.89 | 0.65 | 1.21 |
| Q1 (Lowest) | 4.46 | 3.33 | 5.99 | 0.67 | 0.40 | 1.14 | 0.58 | 0.32 | 1.04 |

*Note.* OR, odds ratio; CI, confidence interval.

[a]Adjusted for age, sex, education, marital status, disability, chronic disease, depression, stress, self-rated health, type of health insurance, private insurance

1

**STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology***

**Checklist for cohort, case-control, and cross-sectional studies (combined)**

| Section/Topic | Item # | Recommendation | Reported on page # |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | 1 |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 3 |
| Objectives | 3 | State specific objectives, including any pre-specified hypotheses | 4 |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | 5 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 5 |
| Participants | 6 | (*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up<br>*Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls<br>*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants | 5 |
| | | (*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed<br>*Case-control study*—For matched studies, give matching criteria and the number of controls per case | |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 5 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 5 |
| Bias | 9 | Describe any efforts to address potential sources of bias | 5 |
| Study size | 10 | Explain how the study size was arrived at | 5 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 6 |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | 6 |
| | | (*b*) Describe any methods used to examine subgroups and interactions | 6 |
| | | (*c*) Explain how missing data were addressed | 6 |
| | | (*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed<br>*Case-control study*—If applicable, explain how matching of cases and controls was addressed | 6 |

| | | | |
|---|---|---|---|
| | | *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy | |
| | | (*e*) Describe any sensitivity analyses | 6 |
| **Results** | | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 8 |
| | | (b) Give reasons for non-participation at each stage | |
| | | (c) Consider use of a flow diagram | |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 8 |
| | | (b) Indicate number of participants with missing data for each variable of interest | |
| | | (c) *Cohort study*—Summarise follow-up time (eg, average and total amount) | |
| Outcome data | 15* | *Cohort study*—Report numbers of outcome events or summary measures over time | 8 |
| | | *Case-control study*—Report numbers in each exposure category, or summary measures of exposure | |
| | | *Cross-sectional study*—Report numbers of outcome events or summary measures | |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 8 |
| | | (*b*) Report category boundaries when continuous variables were categorized | |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | 9 |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 10 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 12 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 10-11 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 10-11 |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 13 |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

# Employment status and unmet dental care needs in South Korea: A population-based panel study

| | |
|---|---|
| Journal: | *BMJ Open* |
| Manuscript ID | bmjopen-2018-022436.R4 |
| Article Type: | Research |
| Date Submitted by the Author: | 28-Feb-2019 |
| Complete List of Authors: | Choi, Jaewoo; Yonsei University, Pharmacy; Dongseo University, Health Administration<br>Choi, Young; Ajou University, Department of Preventive Medicine and Public Health<br>Lee, Tae Hoon; Health Insurance Review and Assessment Service<br>Lee, Hyo Jung; Yonsei University, Department of Public Health<br>Ju, Yeong-Jun; Ajou University, Department of Preventive Medicine and Public Health<br>Park, Eun-Cheol; Yonsei University, Department of Preventive medicine |
| Primary Subject Heading: | Health services research |
| Secondary Subject Heading: | Occupational and environmental medicine |
| Keywords: | employment status, unmet dental care needs, income disparity |
| | |

# Employment status and unmet dental care needs in South Korea: A population-based panel study

Jae Woo Choi[1], Young Choi[2], Tae-Hoon Lee[3], Hyo Jung Lee[4], Yeong Jun Ju[2], Eun-Cheol Park[5*]

[1]College of Pharmacy, Yonsei Institute of Pharmaceutical Sciences, Yonsei University, Incheon, South Korea

[1] Department of Health Administration, Dongseo University, Busan, South Korea

[2]Department of Preventive Medicine and Public Health, Ajou University School of Medicine, Suwon, South Korea

[3]HIRA Research Institute, Health Insurance Review and Assessment Service, Wonju, South Korea

[4]Department of Public Health, Graduate School, Yonsei University, Seoul, South Korea

[5]Department of Preventive Medicine, Yonsei University College of Medicine, Seoul, South Korea

***Corresponding author: Eun-Cheol Park, MD, PhD**

Department of Preventive Medicine and Institute of Health Services Research, Yonsei University College of Medicine

50 Yonsei-ro, Seodaemun-gu, Seoul 120-752, Korea

Tel: 82-2-2188-1862/Fax: 82-2-392-8133

E-mail: ecpark@yuhs.ac

**Key Words:** employment status, unmet dental care needs, income disparity

**Word Count:** 3,041 (excluding title page, references, figures)

# Abstract

Objectives: This study was designed to evaluate whether employment status is associated with the experience of unmet dental care needs.

Methods: A total of 4,620 workers were retrieved from Korea Health Panel data (2010-2013), and potential relationships were explored among their income levels, changes in employment, and unmet dental care needs.

Results: Among the 4,620 workers, 17.3% said they had failed at least once to get dental treatment or checkup, despite their needs. Precarious workers and those not in employment were more likely to experience unmet dental care needs due to economic burden compared to permanent workers (OR: 1.36, 1.40, respectively). In addition, people in low–income group were 4.46 times more likely to experience unmet dental care needs caused by economic burden, compared to those with the highest income.

Conclusion: This disparity means that precarious workers and those not in employment are more likely to face barriers in obtaining needed health services. Given the insecure employment status of low income people, meeting their healthcare needs is an important consideration.


Key Words: employment status, unmet dental care needs, income disparity

**Strengths and limitations of this study**

1. **Strengths**

1) This was the first study to examine the association between economic status and unmet dental care needs among adults in South Korea using longitudinal panel data.

2. **Limitations**

1) We used self-reported questionnaires to identify subjects' experience of unmet dental care needs.
2) We did not control severity of dental care in our research.

# Ⅰ. Introduction

South Korea achieved universal health insurance coverage just 12 years after its national health insurance system was implemented [1]. However, people with national health insurance are still paying rather high amount of out-of-pocket (OOP) payments. The proportion of total medical spending financed by the public sector in South Korea is only 56% of the country's population, which is lower than the OECD average (73%). Furthermore, South Korea had the fourth lowest level of spending out of OECD nations after Chile (46%), USA (48%), and Mexico (51%) [2]. Relatively low coverage by health insurance may result in unmet needs, and this phenomenon is more likely to occur in dental care which often requires higher OOP payments than those for regular healthcare. In South Korea, the coverage benefit of dental care services is low due to the relatively high medical expenses incurred by non-insured payment. Although the South Korean government has expanded coverage expansion policy for dental service, the level of OOP payments is very high compared to those of other countries.

The rate of unmet dental care needs is very high in South Korea. A previous study on unmet dental care needs in South Korea showed that response rate of unmet dental care needs was 24.5% of the entire population[3], whereas results from another study performed in the U.S. state of Wisconsin indicated that about 20.6% of the total population experienced unmet dental care needs [4]. In addition, a Canadian study on immigrants living more than 10 years in Canada showed that the experience rate of unmet dental care needs was 17.5%, and the rate of 28 EU countries, including Spain, was 7.2% [5-7].

The factors related to unmet healthcare needs among adults in previous studies were socioeconomic factors, such as income or education levels, and health status, including self-related health or mental health [8-12]. In other words, low income or education groups were more likely to experience unmet healthcare needs than those with higher income or education status. Although there has been some studies that reported on the association between employment status and unmet needs, most of them examined unmet healthcare needs, rather than dental care.

The current study aimed to examine the impact of employment status on the experience of unmet dental care needs, using nationally representative panel data collected from 2010–2013.

## Ⅱ. Methods

*Study model*

This study used the Anderson social behavioral model to analyze factors that affect unmet dental care needs. This model is widely used as a model for analyzing factors that affect unmet medical care. In the Anderson model, the factors that determine an individual's behavior related to the use of medical services are largely categorized as predisposing factors, enabling factors, and need factors, and their relevance to medical use is analyzed through regression analysis. Predisposing factors consist of social structure variables (sex, age, marital status), social structural variables (education level, occupation), and health beliefs and attitudes. Enabling factors are the resources of individuals and communities that enable the use of medical care, and these include variables such as income, number of household members, type of health insurance, and existence of private health insurance. Need factors are directly related to the use of health services, and disease factors are related to the level of individual disability or illness. It mainly includes variables such as subjective health status, presence of chronic disease, and disability. In this study, the predisposing factors were sex, age, education level, marital status, and employment status. Enabling factors were income level, type of health insurance, and private insurance. Needs factors were self-rated health, depression, and stress.

*Data*

We utilized data from the Korea Health Panel (KHP) 3rd–6th (2010–2013 year), which was conducted by the Korea Institute for Health & Social Affairs and National Health Insurance Corporation. KHP is a nationally representative sample of South Korean individuals and their families, and it includes data on subjects' demographic and socioeconomic characteristics, health status, access to healthcare, and private health insurance status. KHP uses a stratified multistage probability sampling design according to region and residence, in order to select

nationwide subjects from the 2005 Korea Census[13]. This study received ethical approval from the institutional review board of Yonsei University Graduate School of Public Health.

*Study sample and design*

We excluded the 1st–2nd data of KHP (2008–2009 year), since the variable of unmet dental care needs was not included in the survey. This study included data from the 4th wave in 2011. In the 4th wave (2011), a total of 17,035 subjects completed the survey questionnaire. The study subjects consisted of waged workers ≥19 years of age, and excluded those who did experience unmet dental care needs. Subjects aged ≥62 years in 2011 were also excluded to ensure that all subjects in this study were <65 years old during the 3-year follow-up. After excluding subjects without follow-up or those with any missing values, a total of 4,620 workers remained in this study. We examined the effect employment status on the experience of unmet dental care needs from 2011 to 2013.

*Dependent variable*

Dependent variable of this study was whether or not the respondents had an unmet dental care. Therefore, they were asked, "Did you ever fail to receive dental care services over the past year, even when there was a need for treatment or checkup?" Also, economic burden, no time to spare, and others were added as result variables for those who had experienced unmet healthcare needs.

*Independent variable*

Employment status was classified into four categories: full-time permanent, precarious, self-employed, or those not in employment. KHP classified individuals as full-time permanent workers if all four of the following conditions were satisfied: (i) they were directly hired by their employers (not subcontracted or dispatched workers, or self-employed workers without employees); (ii) they were full-time workers (not part-time workers); (iii) there was no fixed term in their employment contract (not temporary workers); and (iv) there was a high probability of maintaining their current job (having relatively little job insecurity, and not a day laborer). Other than full-time permanent workers, waged workers hired by their employers were classified as precarious workers. Self-employed were defined as workers

who managed their own business regardless of scale, or carried out professional matter under their own responsibility. For the purpose of comparability with previous East Asian studies and consideration of different classification of employment status between countries, self-employed were treated as having a different employment status. Those not in employment were defined as those who stopped working in 2011 out of workers in 2010.

*Covariates*

In this study, we used several covariates to control for demographic and socioeconomic characteristics, as well as health status. Demographic characteristics included sex, age, marital status, and socioeconomic factors, including education and income. The age groups were divided in 10-year intervals for measurement. Marital status was categorized into married, single, and divorced or separated. Educational levels were categorized into below elementary school, middle or high school, and above college. Weighted total household income was divided into five levels: highest, high, middle, low, and lowest. As a proxy for health status, we utilized self-rated health, stress, depression, disability, and chronic disease to control for the participant's health condition and health behavior that can affect healthcare utilization. Finally, we used type of health insurance (national health insurance, medical aid) and existence of private insurance.

*Statistical analysis*

The overall frequency of situations where unmet dental care needs incurred, after accounting for demographic, socioeconomic, and health status, was determined by Rao-Scott Chi-square test. To identify factors associated with unmet dental care needs and, in particular, to examine the relationship between employment status and unmet dental care needs, we used the GLIMMIX procedure since subjects in our study were measured repeatedly over time. Odds ratio (OR) was calculated using the regression coefficient gained through the GLIMMIX procedure, and presented with a 95% confidence interval (95% CI). SAS 9.3 statistical package (Cary, NC, USA) was used for data analysis.

*Patient and public involvement statement*

Patients or the public were not involved in this study.

# Ⅲ. Results

This study utilized longitudinal data that was repeatedly measured and constructed for 24,616 people in 2008. First-year (2010) response rate of data utilized in this study was 80.6%, and the main reasons for decreasing response rate were death, response refusal, etc. Table 1 shows general characteristics at first follow–up (2011) of waged workers. Out of 4,620 respondents aged between 20 and 61 years, 17.3% said they had failed at least once to have dental treatment or checkup, despite their needs. People who had low education, as well as the low-income group, people who were divorced, people with negative self-related health, and those with depression or stress who joined private insurance scheme, precarious workers, and self–employed were more likely to experience unmet dental care needs. However, no significant relationship was observed between unmet dental care needs and sex, age, disability, chronic disease, and type of health insurance.

Table 2 shows self-reported reasons for unmet dental care needs according to employment status. Precarious workers and those not in employment were more likely to experience unmet dental care needs caused by economic burden. On the other hand, permanent workers and self-employed were more likely to experience unmet dental care needs due to having no time to spare.

After applying multivariate models adjusted for several covariates, the results for factors associated with unmet dental care needs are shown in Table 3. People who did not graduate elementary school had a higher risk of unmet dental care needs compared to those who graduated from college (odds ratio (OR): 1.35, 95% CI: 1.11-1.64). Low–income group was 1.77 times more likely to experience unmet dental care needs than those with higher income. People with negative self-rated health were 2.19 times more likely to experience unmet dental care needs than those with positive self-related health, and people with stress or depression were more likely to experience unmet dental care needs than those who did not have such conditions (OR: 1.90, 1.69, respectively). People who joined private insurance scheme were 1.15 times more likely to experience unmet dental care needs than those who did not join private insurance. Self-employed workers were 1.18 times more likely to experience unmet dental care needs than full-time permanent workers.

Table 4 shows the factors associated with reason for unmet dental care needs according to employment status or income. In employment status, precarious workers and those not in employment were more likely to experience unmet dental care needs caused by economic burden, compared to permanent workers (OR: 1.36, 1.40, respectively). On the other hand, precarious workers were 0.73 times more likely to experience unmet dental care needs due to having no time to spare, compared to permanent workers. In terms of income level, low–income group were 4.46 times more likely to experience unmet dental care needs caused by economic burden than those with the highest income. Meanwhile, middle–income group was 0.74 times more likely to experience unmet dental care needs caused by having no time to spare, compared to the highest income class.

# Ⅳ. Discussion

This study showed that 17.3% of the South Korean population experienced unmet dental care needs. This rate is about 3~4 times higher than those of European countries, meaning people in South Korea have relatively low access to dental care. The high rate results from very low health insurance coverage in dental care services. Non-insured payments, which includes costs that the government does not support such as dental care services, is higher than payments for general healthcare services. In 2010, the national health insurance coverage rate was about 62.7% in South Korea (pharmacy 71.6%, clinic 65.6%, hospital 60.5%), whereas coverage rates of dental clinics and hospitals were about 35.5% and 25.5%, respectively [14]. In addition, the proportion of non-insured payment (numerator) in OOP (denominator) was about 43.2% and 64.6%, respectively, which was a much higher rate compared to other treatment services[3]. Fortunately, the South Korean government has implemented a policy to insure dental implant treatments, which were previously not insured among senior citizens, and plans to expand coverage rate for younger people as well. Based on such improvement of benefits, we suggest consistent coverage expansion in dental care by considering the characteristics of treatment criteria.

We identified the factors affecting unmet dental care needs as following: education, income, self-rated health, depression, stress, private insurance, and employment status. In particular, we found no interaction between employment status and income. In other words, income and employment status independently affect unmet dental needs. The significant results linking socioeconomic status, including education and income levels, to health status indicators, such as self-rated health, depression, and stress, were not confined to dental care outcomes. These results were similar to those of previous studies using various designs or study periods[15-23].

Our research showed that people who joined private insurance scheme were 1.15 times more likely to experience unmet dental care needs than those who did not join private insurance. People who had higher levels of income or education were more likely to join private insurance, and this phenomenon was similar to other countries that operate public healthcare systems with supportive private insurance[24]. Although medical utilization of people joining private insurance was not higher compared to those not insured by private insurance, it is

possible to increase unmet needs by relatively high desire for healthcare. Unmet needs related to private insurance must be examined further in future research.

We examined the difference of unmet dental care needs by employment status. Self-employed workers were 1.18 times more likely to experience unmet dental care needs than full-time permanent workers, and this phenomenon may have resulted from characteristics of self-employed workers in South Korea. A few people who failed to get a regular job opted to start their own business rather than looking for a non-regular position. Self-employed people comprise more than 30% of the entire labor market in South Korea. A substantial number of self-employed people belong to low-income class, and they are exposed to the danger of working in poverty[25].

We examined the factors associated with reason for unmet dental care needs according to employment status or income. Precarious workers and those not in employment were more likely to experience unmet dental care needs caused by economic burden than permanent workers, and this result was similar compared to previous studies[26, 27]. Such phenomenon is related to the fact that the monthly wages of precarious workers were about 52.2% of wages earned by full-time permanent workers. In 2015, the average monthly wage of permanent workers was about US$2,300 in South Korea, whereas the monthly wage of precarious workers was about US$1,200. It is a crucial issue is that the average wage of precarious workers is lower than minimum cost of living, and this disparity may have the effect of reducing access to dental care for precarious workers and those not in employment. A similar issue is that low–income group was 4.46 times more likely to experience unmet dental care needs due to economic burden than those with the highest income. Meanwhile, unmet dental care needs caused by other reasons were also significant, but in the opposite direction. For example, precarious workers and those not in employment were less likely to experience unmet dental care needs caused by having no time to spare than permanent workers. This phenomenon may be due to the longer working hours of full-time permanent workers compared to precarious workers. In fact, the average working hours of precarious workers in 2013 were about 75.5% of those of permanent workers.

This study is significant in that it was the first study to examine the association of economic status on unmet dental care needs among adults in South Korea using longitudinal panel data. Although similar studies on this topic have been conducted, all of them used cross-sectional

design, and the possible inverse causality between employment status and unmet dental care needs were not reflected. This study's longitudinal design allowed us to assess the stability and continuity of several attributes of a sample group by repeatedly observing the same participants. Another major strength of this study's longitudinal design was that cohort effects can be avoided since we examined one group of individuals over time, rather than comparing several different groups that represent different ages and generations.

Our study also had some limitations. First, we used self-reported questionnaires to identify subjects' experience of unmet dental care needs. Nevertheless, some studies using subjective and objective methods tended to give reasonably consistent results[28]. In addition, the follow-up period in the current study was relatively short compared to other studies. Second, we did not control severity of patient's dental status in our research. Although severity of dental status may affect the subject's access to medical care, we did not consider this factor in our model. Third, temporal bias could exist in our study results.

# Ⅴ. Conclusions

Our research showed that precarious workers and those not in employment were more likely to experience unmet dental care needs due to economic burden than full-time permanent workers. In addition, low–income group were more likely to experience unmet dental care needs caused by economic burden than those with the highest income. This disparity indicates that certain people are more likely to face barriers in obtaining the health services they need. Given the insecure employment status of low income people, meeting their needs for healthcare may be an important thing to consider.

**Funding statement**: This research received no specific grant from any funding agency in the public, commercial, or non-profit sectors.

**Competing interests:** The authors declare to have no competing interests.

**Authors' contributions:** JWC, YC, HJL, YJJ and ECP designed the study concept, wrote the protocol and collected the data. THL, HJL and YJJ conducted the analyses. All authors helped to draft the manuscript, in addition to reading and approving the final manuscript. All authors had full access to all data (including statistical reports and tables) in the study, and can take responsibility for the integrity of data and the accuracy of data analysis. JWC and ECP were the study guarantors.

**Acknowledgements:** The quality of English in this paper has been checked by at least two professional editors, both of whom are native English speakers.

**Data sharing statement:** No additional data are available.

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Table 1. General characteristics at first follow-up (2011) of waged workers Unit: N, %

| Variables | Total | Unmet dental care needs | | | | Rao-Scott chi-square (p-value) |
|---|---|---|---|---|---|---|
| | | Yes | | No | | |
| Total | 4,620 | 801 | 17.3 | 3,819 | 82.7 | |
| Sex | | | | | | 0.35(0.555) |
| Men | 2,845 | 488 | 17.2 | 2,357 | 82.8 | |
| Women | 1,775 | 313 | 17.6 | 1,462 | 82.4 | |
| Age (years) | | | | | | 4.00(0.261) |
| 20–29 | 292 | 43 | 14.7 | 249 | 85.3 | |
| 30–39 | 1,034 | 167 | 16.2 | 867 | 83.8 | |
| 40–49 | 1,686 | 285 | 16.9 | 1,401 | 83.1 | |
| ≥50 | 1,608 | 306 | 19.0 | 1,302 | 81.0 | |
| Education | | | | | | 14.67(<0.001) |
| Below elementary school | 346 | 84 | 24.3 | 262 | 75.7 | |
| Middle or high school | 2,231 | 408 | 18.3 | 1,823 | 81.7 | |
| Above college | 2,043 | 309 | 15.1 | 1,734 | 84.9 | |
| Marital status | | | | | | 9.24(0.009) |
| Married | 3,611 | 631 | 17.5 | 2,980 | 82.5 | |
| Single | 730 | 102 | 14.0 | 628 | 86.0 | |
| Divorced or separated | 279 | 68 | 24.4 | 211 | 75.6 | |
| Income | | | | | | 27.92(<0.001) |
| Q1 (Lowest) | 204 | 51 | 25.0 | 153 | 75.0 | |
| Q2 | 694 | 145 | 20.9 | 549 | 79.1 | |
| Q3 | 1,093 | 207 | 18.9 | 886 | 81.1 | |
| Q4 | 1,311 | 226 | 17.2 | 1,085 | 82.8 | |
| Q5 (Highest) | 1,316 | 172 | 13.1 | 1,144 | 86.9 | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Self-rated health | | | | | | 64.09(<0.001) |
| Good | 2,140 | 294 | 13.7 | 1,846 | 86.3 | |
| Normal | 1,815 | 380 | 20.9 | 1,435 | 79.1 | |
| Bad | 326 | 97 | 29.8 | 229 | 70.2 | |
| Depression | | | | | | 58.40(<0.001) |
| Yes | 251 | 88 | 35.1 | 163 | 64.9 | |
| No | 4,030 | 683 | 16.9 | 3,347 | 83.1 | |
| Stress | | | | | | 73.09(<0.001) |
| Always | 363 | 118 | 32.5 | 245 | 67.5 | |
| Often | 2,246 | 434 | 19.3 | 1,812 | 80.7 | |
| No | 1,667 | 218 | 13.1 | 1,449 | 86.9 | |
| Type of health insurance | | | | | | 3.25(0.072) |
| National health insurance | 4,531 | 778 | 17.2 | 3,753 | 82.8 | |
| Medical aid | 89 | 23 | 25.8 | 66 | 74.2 | |
| Private insurance | | | | | | 4.04(0.044) |
| Yes | 3,953 | 659 | 16.7 | 3,294 | 83.3 | |
| No | 657 | 132 | 20.1 | 525 | 79.9 | |
| Employment status | | | | | | 14.00(0.002) |
| Permanent | 1,902 | 278 | 14.6 | 1,624 | 85.4 | |
| Precarious | 1,221 | 237 | 19.4 | 984 | 80.6 | |
| Self-employed | 1,116 | 218 | 19.5 | 898 | 80.5 | |
| Those not in employment | 381 | 68 | 17.8 | 313 | 82.2 | |

Table 2. Self-reported reasons for unmet dental care needs according to employment status Unit: N, %

| Variable | Reason for unmet need | | | | | | |
|---|---|---|---|---|---|---|---|
| | Total | Economic burden | | No time to spare | | Others[a] | |
| Total | 4,620 | 415 | 9.0 | 209 | 4.5 | 177 | 3.8 |
| Permanent | 1,902 | 98 | 5.2 | 106 | 5.6 | 74 | 3.9 |
| Precarious | 1,221 | 158 | 12.9 | 42 | 3.4 | 37 | 3.0 |
| Self-employed | 1,116 | 109 | 9.8 | 56 | 5.0 | 53 | 4.7 |
| Those not in employment | 381 | 50 | 13.1 | 5 | 1.3 | 13 | 3.4 |

[a]Others: Trivial symptoms, great distance from healthcare facility, reduced mobility (difficult to visit for physical reasons), no one to babysit, lack of information as to where to go, no timely appointment, absence of a primary care physician, etc.

Table 3. Factors associated with unmet dental care needs

| Variables | Unmet dental care needs | | |
|---|---|---|---|
| | Adjusted OR | 95% CI | |
| Sex | | | |
| Men | 1.00 | | |
| Women | 0.95 | 0.86 | 1.06 |
| Age (years) | | | |
| ≥50 | 1.00 | | |
| 40–49 | 1.03 | 0.92 | 1.16 |
| 30–39 | 1.11 | 0.95 | 1.29 |
| 20–29 | 1.10 | 0.82 | 1.48 |
| Education | | | |
| Above college | 1.00 | | |
| Middle or high school | 1.07 | 0.96 | 1.19 |
| Below elementary school | 1.35 | 1.11 | 1.64 |
| Marital status | | | |
| Married | 1.00 | | |
| Single | 1.17 | 0.98 | 1.41 |
| Divorced or separated | 0.79 | 0.67 | 1.03 |
| Self-rated health | | | |
| Good | 1.00 | | |
| Normal | 1.76 | 1.59 | 1.94 |
| Bad | 2.19 | 1.86 | 2.59 |

| | | | |
|---|---|---|---|
| Depression | | | |
| No | 1.00 | | |
| Yes | 1.69 | 1.42 | 2.01 |
| Stress | | | |
| No | 1.00 | | |
| Often | 1.39 | 1.26 | 1.55 |
| Always | 1.90 | 1.61 | 2.24 |
| Income | | | |
| Q5 (Highest) | 1.00 | | |
| Q4 | 1.20 | 1.05 | 1.38 |
| Q3 | 1.33 | 1.16 | 1.52 |
| Q2 | 1.51 | 1.29 | 1.76 |
| Q1 (Lowest) | 1.77 | 1.41 | 2.22 |
| Type of health insurance | | | |
| National health insurance | 1.00 | | |
| Medical aid | 1.17 | 0.86 | 1.60 |
| Private insurance | | | |
| No | 1.00 | | |
| Yes | 1.15 | 1.01 | 1.32 |
| Employment status | | | |
| Permanent | 1.00 | | |
| Precarious | 1.11 | 0.98 | 1.26 |
| Self-employed | 1.18 | 1.04 | 1.34 |

| | | | |
|---|---|---|---|
| Those not in employment | 1.09 | 0.92 | 1.30 |

*Note:* OR, odds ratio; CI, confidence interval.

Table 4. Factors associated with reason for unmet dental care needs according to employment status or income

| Variables | Reason for unmet need | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Economic burden | | | No time to spare | | | Others | | |
| | OR[a] | 95% CI | | OR[a] | 95% CI | | OR[a] | 95% CI | |
| Employment status | | | | | | | | | |
| Permanent | 1.00 | | | 1.00 | | | 1.00 | | |
| Precarious | 1.36 | 1.14 | 1.61 | 0.83 | 0.67 | 1.04 | 1.03 | 0.79 | 1.34 |
| Self-employed | 1.18 | 0.99 | 1.41 | 1.12 | 0.91 | 1.37 | 1.44 | 0.13 | 1.83 |
| Those not in employment | 1.40 | 1.16 | 1.76 | 0.42 | 0.28 | 0.64 | 1.55 | 1.12 | 2.15 |
| Income | | | | | | | | | |
| Q5 (Highest) | 1.00 | | | 1.00 | | | 1.00 | | |
| Q4 | 2.06 | 1.65 | 2.57 | 0.92 | 0.75 | 1.12 | 0.96 | 0.75 | 1.22 |
| Q3 | 2.93 | 2.35 | 3.64 | 0.74 | 0.59 | 0.94 | 0.85 | 0.65 | 1.10 |
| Q2 | 3.44 | 2.73 | 4.34 | 0.74 | 0.56 | 0.98 | 0.89 | 0.65 | 1.21 |
| Q1 (Lowest) | 4.46 | 3.33 | 5.99 | 0.67 | 0.40 | 1.14 | 0.58 | 0.32 | 1.04 |

*Note:* OR, odds ratio; CI, confidence interval.

[a]Adjusted for age, sex, education, marital status, disability, chronic disease, depression, stress, self-rated health, type of health insurance, private insurance.

1

**STROBE 2007 (v4) checklist of items to be included in reports of observational studies in epidemiology***

**Checklist for cohort, case-control, and cross-sectional studies (combined)**

| Section/Topic | Item # | Recommendation | Reported on page # |
|---|---|---|---|
| **Title and abstract** | 1 | (*a*) Indicate the study's design with a commonly used term in the title or the abstract | 1 |
| | | (*b*) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| **Introduction** | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 3 |
| Objectives | 3 | State specific objectives, including any pre-specified hypotheses | 4 |
| **Methods** | | | |
| Study design | 4 | Present key elements of study design early in the paper | 5 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 5 |
| Participants | 6 | (*a*) *Cohort study*—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up<br>*Case-control study*—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls<br>*Cross-sectional study*—Give the eligibility criteria, and the sources and methods of selection of participants | 5 |
| | | (*b*) *Cohort study*—For matched studies, give matching criteria and number of exposed and unexposed<br>*Case-control study*—For matched studies, give matching criteria and the number of controls per case | |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 5 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 5 |
| Bias | 9 | Describe any efforts to address potential sources of bias | 5 |
| Study size | 10 | Explain how the study size was arrived at | 5 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 6 |
| Statistical methods | 12 | (*a*) Describe all statistical methods, including those used to control for confounding | 6 |
| | | (*b*) Describe any methods used to examine subgroups and interactions | 6 |
| | | (*c*) Explain how missing data were addressed | 6 |
| | | (*d*) *Cohort study*—If applicable, explain how loss to follow-up was addressed<br>*Case-control study*—If applicable, explain how matching of cases and controls was addressed | 6 |

| | | | |
|---|---|---|---|
| | | *Cross-sectional study*—If applicable, describe analytical methods taking account of sampling strategy | |
| | | (*e*) Describe any sensitivity analyses | 6 |
| **Results** | | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 8 |
| | | (b) Give reasons for non-participation at each stage | |
| | | (c) Consider use of a flow diagram | |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 8 |
| | | (b) Indicate number of participants with missing data for each variable of interest | |
| | | (c) *Cohort study*—Summarise follow-up time (eg, average and total amount) | |
| Outcome data | 15* | *Cohort study*—Report numbers of outcome events or summary measures over time | 8 |
| | | *Case-control study*—Report numbers in each exposure category, or summary measures of exposure | |
| | | *Cross-sectional study*—Report numbers of outcome events or summary measures | |
| Main results | 16 | (*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 8 |
| | | (*b*) Report category boundaries when continuous variables were categorized | |
| | | (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | 9 |
| **Discussion** | | | |
| Key results | 18 | Summarise key results with reference to study objectives | 10 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 12 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 10-11 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 10-11 |
| **Other information** | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 13 |

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.
**Note:** An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.