Causal effect of poverty on frequent dental pain among US adults: Modified treatment policy approach

Upul Cooray1, Kenji Takeuchi1,2, Sakura Kiuchi1,3, Taro Kusama1,2, Jun Aida4 and Ken Osaka1

1 Department of International and Community Oral Health, Tohoku University Graduate School of Dentistry, Sendai, Japan

Address: 4-1, Seiryo-machi, Aoba-ku, Sendai, Miyagi, 980-8575, Japan

2 Division for Regional Community Development, Liaison Center for Innovative Dentistry, Graduate School of Dentistry, Tohoku University, Sendai, Japan

Address: 4-1, Seiryo-machi, Aoba-ku, Sendai, Miyagi, 980-8575, Japan

3 Frontier Research Institute for Interdisciplinary Sciences, Tohoku University, Sendai, Japan

Address: 6-3 Aramaki-Aza-Aoba, Aoba-ku, Sendai, 980-8578 Japan

4 Department of Oral Health Promotion, Graduate School of Medical and Dental Sciences, Tokyo Medical and Dental University, Tokyo, Japan

Address: 1-5-45 Yushima, Bunkyo-ku, Tokyo, 113-8549 Japan

Background

The association between economic disadvantage and adverse oral health outcomes is well known. However, evidence based on causal inference is scarce. We aimed to estimate the causal effect of poverty on dental pain experience among the United States (US) adults.

Methods

Three cycles (2012-2018) of the National Health and Nutrition Examination Survey (NHANES) was used in this cross-sectional analysis. Dentate participants aged 21 to 70 years were included. Self-reported frequent dental pain (very often or fairly often) was the outcome. Poverty-income ratio (PIR) was the exposure (range 0-5). Modified treatment policies were employed to define causal effects by shifting the PIR of individuals’ based on their observed PIR level. Corresponding statistical parameters were estimated with doubly-robust targeted minimum loss-based estimation (TMLE), adjusted for wide range of covariates. Causal odds ratios (OR) and 95% confidence intervals (95%CI) were calculated by contrasting multiple PIR shift scenarios.

Results

Prevalence of frequent dental pain was 8.7% in the study population. A 10%, 25%, and 50% improvement of PIR among participants who are below the poverty line were associated with 6% (OR[95%CI]= 0.94[0.90-0.98]), 7% (OR[95%CI]=0.93[0.89-0.97]), and 8% (OR[95%CI]=0.92[0.88-0.96]) reduction in likelihood of frequent dental pain, respectively. Shift of all below poverty line participants’ PIR to 1.0 (no poverty scenario) was associated with 10%(OR[95%CI]=0.90[0.86-0.95]) less dental pain. Finally, a 16%(OR[95%CI]=0.84[0.77-0.90]) reduction in dental pain was observed when all participants below median PIR was shifted to median PIR (i.e. 2.18).

Conclusions

Poverty has a clear robust dose-response effect on prevalence of frequent dental pain among US adults.

Word count 250/---