



## **Quantification of sleep disturbance by nighttime temperature rise for assessment by DALY**

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Insomnia is the most common symptom in the midsummer according the previous survey in Japan. More than 50% of the respondents experienced insomnia while the respondents who experienced heat stroke were less than 10%. However, quantification of sleep disturbance is rare and its damage tends to be disregarded. We aimed at assessing damage of sleep disturbance due to nighttime temperature increase by disability-adjusted life year (DALY) in order to evaluate with the same index as other diseases including heat stroke.

A questionnaire for quality of daily sleep was developed based on Pittsburgh Sleep Quality Index (PSQI). PSQI is a self-rated questionnaire which assesses sleep quality over 1-month time interval. Its global score corresponds to the diagnosis of the doctor. The PSQI global score > 5 distinguishes good and poor sleepers. Our developed questionnaire adopted the same items including PSQI questionnaire, but its target period was changed from the past month to the previous day.

Sleep disturbance was surveyed by the above questionnaire. The respondents were more than 500 adults living in the central Tokyo. The survey period was September 2006. Outdoor air temperatures at 0000 LST were used as a thermal index for sleep disturbance. The minimum temperature was 19.8 degree C and the maximum temperature was 28.9 degree C during the survey period.

The relationship between our developed sleep index's global score and the nighttime temperature was analyzed with the smoothing spline regression. The analysis showed that the threshold temperature, where poor sleepers begin to increase, was 23.9 degree C. The obtained regression equation was applied to the past 40-year nighttime temperature increase in Tokyo. It is found that the ratio of poor sleepers was increased by 0.48% in the past 40 years in Tokyo, which has 9 million residents and less than 5,000 patients transported due to heat stroke per year.