

**Author Response**

## Environmental Air Pollution and the Risk of Osteoporosis and Bone Fractures

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Dear Editor,

We thank the correspondent for the letter on our study regarding the health-related quality of life (HR-QoL) of patients with chronic obstructive pulmonary disease (COPD) and air pollution in Korea. The letter brought up the problem that air pollution exerts adverse effects not only on respiratory diseases such as COPD, but also on osteoporosis and bone fractures. Osteoporosis is well known as one of the major comorbidities of COPD, and both diseases are associated with systemic inflammation. In our study, we did not employ specific clinical conditions (e.g., the severity of COPD) as an outcome; instead, we used HR-QoL because we thought that a comprehensive measure was required to assess the impacts of air pollution, which is intimately involved in daily life. In the previous study conducted in Mongolia, various domains of HR-QoL, including the score regarding "pain," were associated with respiratory function and the use of smoke-rich household fuels such as coal in the winter months [1], whereas there was no significant association between air pollution and the "pain" score of QoL in the study in Korea. Although the mechanism underlying the relationships between air pollution and the pathogenesis of

pain remain unclear, we speculate that inflammation or oxidative stress induced by exposure to severe air pollution might cause musculoskeletal problems. The author referred to reports that patients with osteoporosis and bone fractures experienced significantly impaired HR-QoL, as is the case for COPD patients as well, and discussed the relationships between the etiology of osteoporosis and air pollution. In addition to cardiorespiratory diseases and osteoporosis, air pollution has been suggested to be associated with wide variety of health statuses such as rheumatoid arthritis [2], obesity [3], children's health [4], and mental health [5]. These aspects of health status might also be associated with the deterioration of individuals' perceptions of well-being.

As the author pointed out, the incidence of osteoporosis and bone fracture is expected to be elevated in Asian countries because the risk of osteoporosis increases with age, and Asian countries will experience widespread population aging in the coming decades. Therefore, further study is required to estimate the risk of osteoporosis and bone fractures attributable to air pollution. Additionally, public health officials of Asian countries need to develop plans to improve air quality in order to suppress the increase in the burden of diseases, such as COPD and osteoporosis, that are associated both with population aging and air pollution.

Received: June 4, 2018 Accepted: June 20, 2018

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**CONFLICT OF INTEREST**

The authors have no conflicts of interest associated with the material presented in this paper.

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