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Environmental pollution in Mongolia: Effects across the lifespan

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Mongolia has undergone rapid urbanization and significant economic expansion since 1991, when the country emerged from Soviet domination. It is a vast country mostly comprising open steppe, desert and mountain ranges and in the open country is one of the cleanest places on earth. However, Ulaanbaatar, the capital city lies on a high altitude plateau in a bowl surrounded by mountains, which in the winter months is subject to atmospheric inversion. The population of Ulaanbaatar is just over 1 million, about 40% of whom live in apartment homes, while the remaining 60% still live in the traditional nomadic round felt tents called Gers or houses in surrounding ger areas. Because of the extremely cold temperatures in the winter months (-40°F is a common daily low), heating is a major issue. Most Gers and houses in ger areas in Ulaanbaatar are heated by burning coal in traditional Ger stoves, which are actually designed to burn Yak dung or wood out on the Steppe. Air pollution has recently become a very serious public health problem in Ulaanbaatar with ground level air pollution, measured in terms of particulate matter (PM), >200 times WHO safety guidelines. Measurements carried out in Ulaanbaatar from November 17 to 28 have shown a maximum daily concentration of $600\ \mu\text{g}/\text{m}^3$ (PM10) and $350\ \mu\text{g}/\text{m}^3$ (PM2.5) with maximum hourly concentrations exceeding 1300 (PM2.5) and 2500 (PM10) $\mu\text{g}/\text{m}^3$. These levels vastly exceed the Mongolian target average daily concentrations of 50 (PM2.5) and 100 (PM10) $\mu\text{g}/\text{m}^3$.

We measured markedly (3-fold) elevated ambient and expired carbon monoxide (CO) levels in Mongolian school children in the summer months in Ulaanbaatar, compared to school children studied in a rural Aimag on the open steppe (Dashdendev et al., 2011). Importantly the lung function of the children on the steppe was significantly better than those living in Ulaanbaatar. So we concluded that the level of urban air pollution in the capital city is clearly having an adverse impact on the pulmonary health of urban Mongolian children. Since the Ger stove is not needed for heating in the summer months, we speculated that the summer pollution relates more to vehicular emissions. Vehicular traffic has increased dramatically throughout Mongolia, but particularly in Ulaanbaatar over the last decade. Many of these privately owned vehicles are second hand models that lack catalytic converters.

We speculate that this level of urban pollution in winter and summer is adversely affecting the pulmonary as well as other aspects of health of the Mongolian population across the lifespan. However, because $>50\%$ of the Mongolian population is under 25 years of age, the impact will disproportionately fall upon children and young women of child bearing age.

Similar patterns of adverse health risk such as asthma, obesity and autism in proximity to freeways and major roads have previously been well documented by us and our colleagues in Los Angeles, CA.

In this issue of Environmental Research, collaborating public health researchers from Taiwan and Mongolia correlated SO₂ and NO₂ levels in Ulaanbaatar with land use patterns. They conclude that SO₂ and NO₂ concentrations are very high in Ulaanbaatar, especially in the winter, and that this can be explained by several land use variables, including proximity to the Ger areas, the city center, the main roads, and the city power plants, which lie upwind. These findings are a productive step towards identifying sources of air pollutants that can be targeted for regulatory interventions.

There is therefore clearly an urgent need for environmental health research and implementation of an air pollution reduction program in Mongolia. This need has been increasingly recognized in recent years in position papers by the Mongolian Government and the Mongolian scientific community, wherein the respiratory environmental health cost of pollution has been conservatively estimated as 4% of GDP.

Some preliminary successes in policy implementation were funded by the Millennium Challenge Account for the distribution of 20,000 modern, efficient heating and cooking stoves for Gers. This is a step in the right direction, however, much more remains to be done to understand the dimensions of the pollution problem in Ulaanbaatar and to abate vehicular, industrial and domestic pollution levels back to the pristine steppe it once was.

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