Environmental Pollution and Health Impact in China

Guang-Hui Dong

School of Public Health
Sun Yat-sen University
donghh5@mail.sysu.edu.cn

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Structure

- **Background:** Environmental Pollution Conditions in China
- **Section 1:** Air Pollution and Health Impact
- **Section 2:** Water Pollution and Health Impact
- **Section 3:** Soil Pollution and Health Impact
China-Economic Power Country

the China-led international development bank

With the rapid economic development, China has become the world’s second-largest economy.
According to the reports of World Health Organization, the number of cancer patients and deaths in Chinese due to lungs, stomach, and liver diseases accounted for 30%, 40%, and 50% of the global total, respectively. One culprit behind these figures is reportedly the deteriorating environmental pollution.
Air Pollution in China
Most Chinese Cities Substantially Exceed WHO, Chinese Air Quality Guidelines

### 2014 Annual Mean PM$_{2.5}$ Levels in 30 Chinese Capital Cities of Province

<table>
<thead>
<tr>
<th>City</th>
<th>2014 Annual Mean PM$_{2.5}$ Levels (μg/m$^3$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haikou</td>
<td>60</td>
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<tr>
<td>Lasa</td>
<td>70</td>
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<td>Fuzhou</td>
<td>80</td>
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<td>Kunming</td>
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<td>Yinchuan</td>
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<tr>
<td>Guiyang</td>
<td>110</td>
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<td>Guangzhou</td>
<td>120</td>
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<td>Nanning</td>
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<td>Huhehaote</td>
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<td>Shanghai</td>
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<td>Xining</td>
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<td>Chongqing</td>
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<td>Hangzhou</td>
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<td>Lanzhou</td>
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<td>Changchun</td>
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<td>Shenyang</td>
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<td>Taiyuan</td>
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<td>Nanjing</td>
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<td>Hefei</td>
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<td>Wulumuqi</td>
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<td>Chengdu</td>
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<td>Wuhan</td>
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<td>Beijing</td>
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<td>Tianjin</td>
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<tr>
<td>Zhengzhou</td>
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<td>Xian</td>
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<tr>
<td>Jinan</td>
<td>340</td>
</tr>
<tr>
<td>Shijiazhuang</td>
<td>350</td>
</tr>
</tbody>
</table>

**WHO Guideline:** 10 μg/m$^3$

**China Standard:** 35 μg/m$^3$
Nov 8, 2015  Shenyang city
Hour PM$_{2.5}$ = 1400 $\mu$g/m$^3$

How danger is our ambient air?
Risk Factors for Chinese Disease Burden

Ambient Air Pollution

Relationship: Exposure and Effects

The non-linear relationship indicates that the results from the developed countries may be not suitable for Chinese population.

Non-Linear Relationship

- Developed Countries
- Greater Rake Ratio
- Smaller slope
- 40 μg/m³
- 100 μg/m³
- PM$_{2.5}$ concentrations
- China

Developed Countries

Greater Rake Ratio

Smaller slope

40 μg/m³

100 μg/m³

PM$_{2.5}$ concentrations

China
As we all know, respiratory system is the direct target organ for air pollution attack, however, studies from the developed countries reported that the first to show the effect of the air pollution damage is the circulatory system. 

Sensitivity: Respiratory$<$circulatory

China Four Cities Study: PM$_{10}$ increase per 10µg/m$^3$

Mortality for Respiratory Diseases
RR: 1.67 (1.60-1.74)

Mortality for Cardiovascular Diseases
RR: 1.23 (1.19-1.26)

Dong et al. *Respiration* 2012; 84:360-368
Air Pollution and Lung Cancer

**EHP: 2014; 122:906-911.**

A recent meta-analysis based on 18 studies reported that a 10 μg/m³ increase of PM$_{2.5}$ resulted to a 9% risk excess for lung cancer, meaning a 9-point scale for cancer-causing risk.

PM$_{2.5}$ with a 10μg/m³ increase
RR: 1.09 (95%CI: 1.04-1.14)

PM$_{10}$ with a 10μg/m³ increase
RR: 1.08 (95%CI: 1.00-1.17)


Using TSP to estimate the PM$_{2.5}$
China Four Cities Study: PM$_{10}$ and Lung Cancer

HR per each 10 μg/m$^3$ = 1.65, 95% CI, 1.52–1.79 for PM$_{10}$

Larger than the results from IACR (RR=1.08)

EHP: Under Review
Toxic Effects of Main Components in PM

The ability of PM to cause adverse health: size, shape, concentrations, components.

There are thousands of chemicals and metals contained in PM. If the particle matters contains greater toxic contents, the PM may induce greater effects on human health.
In 2012, one study assessed the associations between air pollution and mortality in 17 cities of China. As shown in this figure, according to the harm degree of air pollution on mortality, Guangzhou ranked the first among the 17 cities.
For example, compared with other cities, the PBDEs levels in PM in Guangzhou city was about four-fold higher than that in Beijing. So, this may be one reason for the large degree of health impact in residents from southern China.
Water pollution also has become another serious problem in China. More than 50 percent of rivers and lakes in China are severely polluted. Lots of Chinese still live on polluted water, although the government has invested heavily in water pollution treatment and control.
Also, evidences have reported that in China, around 90% of the water in the cities of China is polluted, and as of 2013, half a billion Chinese had no access to safe drinking water.

Recently, a five-year survey completed by the Chinese Academy of Geological Sciences in 2010 reported that 44% of shallow underground water in the North China, which covers Hebei, Henan, Shandong, Beijing and Tianjin, suffer pollution to different degrees.
Some news have reported the associations between water pollution and cancer village, recently. For example, as shown in this figure, in a small village in southern Guangdong Province, more than 40 people have died of cancer in barely 10 years.

An investigation showed that the drinking water piped from four wells failed to meet national standards, could be a possible cause of the sicknesses.
A recent report has found that some 16 percent of the soil on the Chinese mainland is polluted.

China government is now facing the problem: "strengthen the protection of farmland and provide high-quality and secure food for people."
Soil Pollution and Health Impact

Many heavy metals and POPs in soil could shift among biological populations via biological concentration and magnification, leading to excessive accumulation among the higher trophic level of the food chain.
Summary

China is now suffering from serious environmental pollution caused by economic development, which is becoming a suitable study site providing an ideal opportunity to evaluate the effects of environmental pollution including air pollution, water pollution, and soil pollution on human health.
Representative Papers in Recent 3 Years

• Air pollution associated hypertension and increased blood pressure may be reduced by breastfeeding in Chinese children: The Seven Northeastern Cities Chinese Children's Study. *International Journal of Cardiology* 2014; 176:956-961. (IF=6.175)

• Does obesity amplify the association between ambient air pollution and increased blood pressure and hypertension in adults? Findings from the 33 Communities Chinese Health Study. *International Journal of Cardiology* 2013; 168(5):e148-e150. (IF=6.175)


• Association between long-term air pollution and increased blood pressure and hypertension in China. *Hypertension* 2013; 61(3):578-584. (IF=7.632)

• Serum polyfluoroalkyl concentrations, asthma outcomes, and immunological markers in a case-control study of Taiwanese children. *Environmental Health Perspective* 2013; 121(4):507-513. (IF=7.260)


Thanks Much for your attention!