

# Acute Particulate Matter Exposure and Suicide in North East Asia: A Systematic Review

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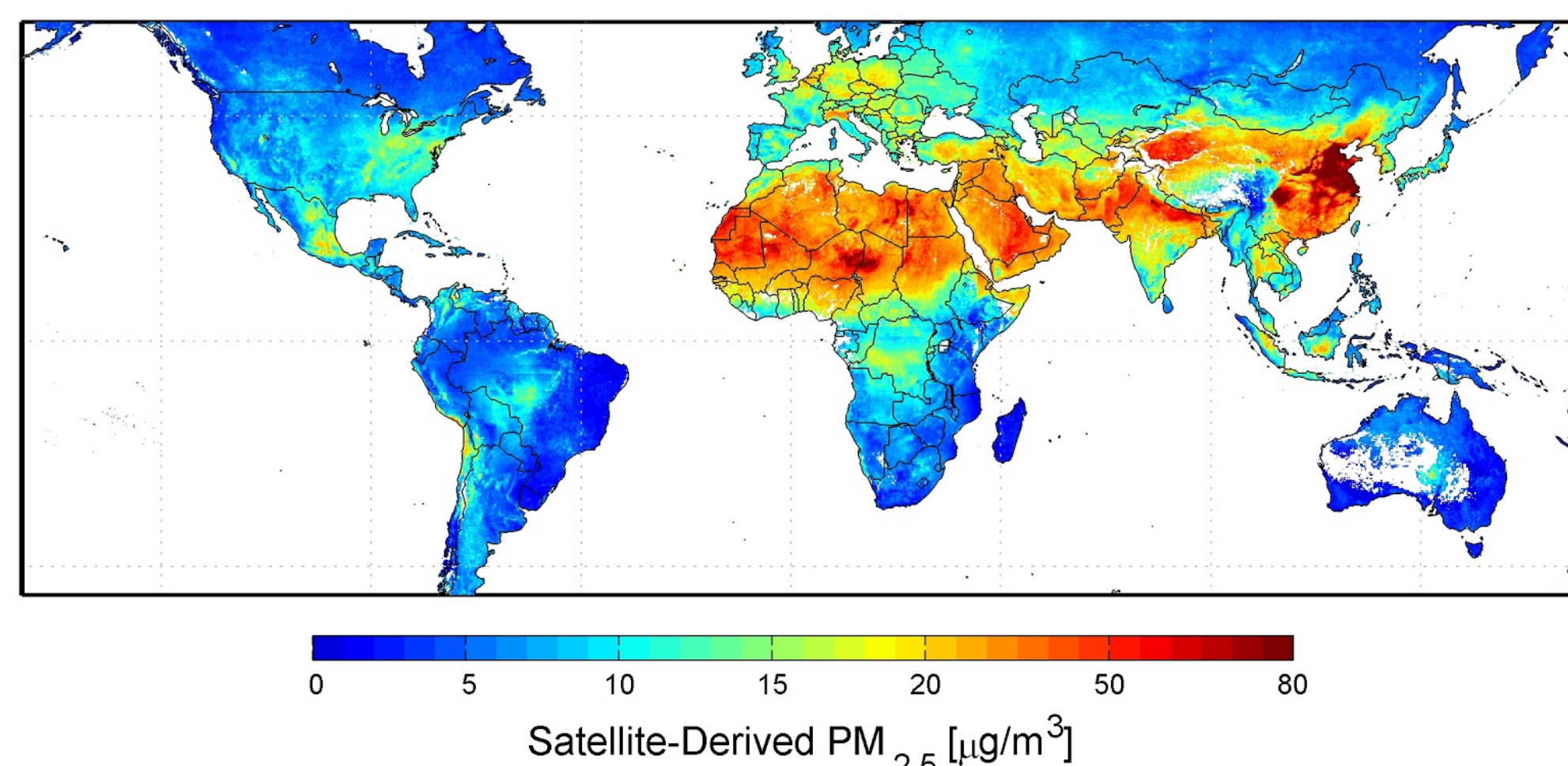
## Objective

The objective was to assess whether there is increased risk of suicide completions when persons in North East Asia are exposed to acute PM concentrations in the ambient air.

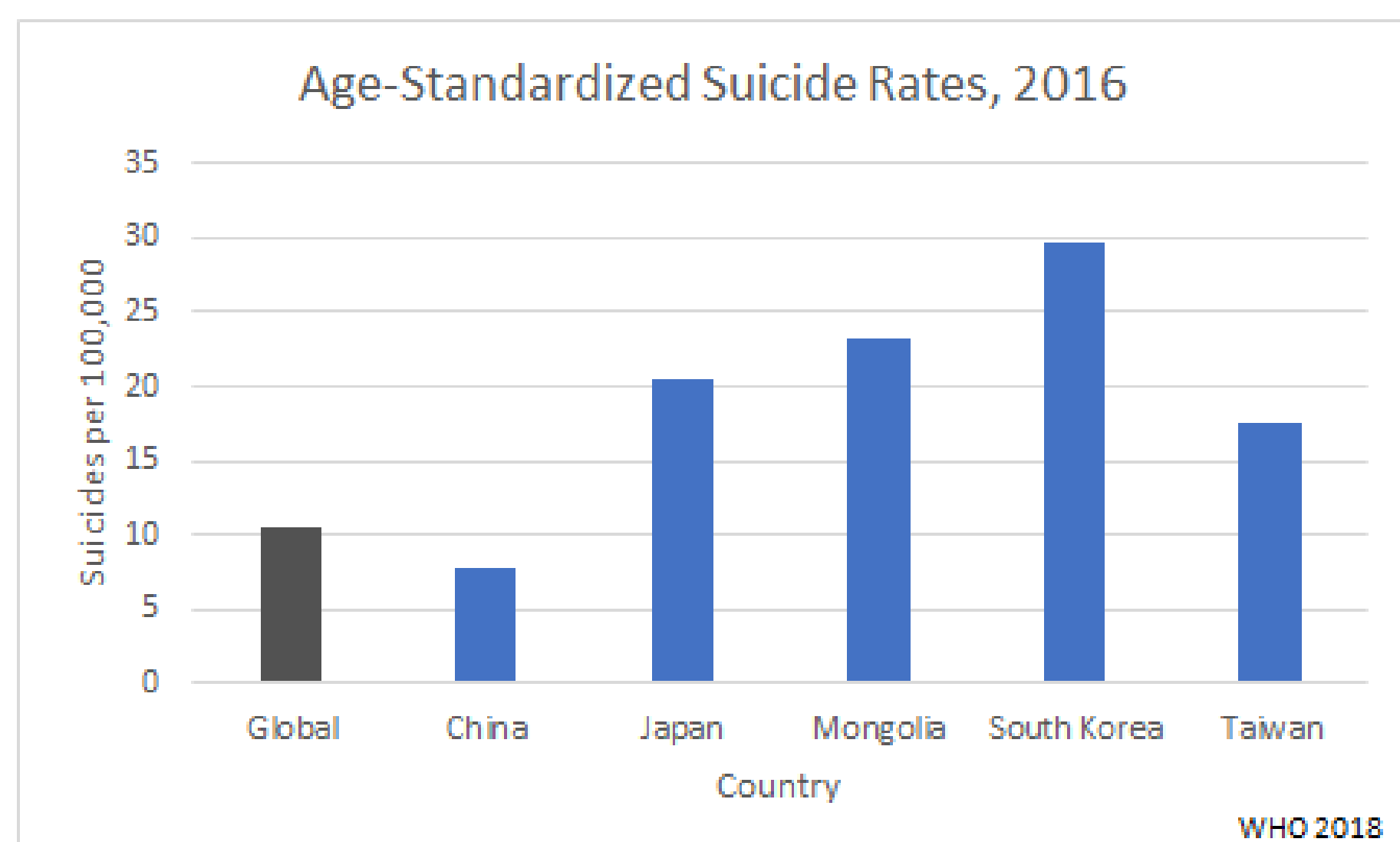
## Background

**Exposure.** Particulate matter (PM) is a form of air pollution that is comprised of a mixture of solid particles and liquid droplets. PM can be both human-caused and natural. PM<sub>10</sub> and PM<sub>2.5</sub> are PM that are 10 microns and 2.5 microns in aerodynamic diameter across or smaller, respectively. PM<sub>2.5</sub> is small enough to enter the blood stream of a human after inhalation.

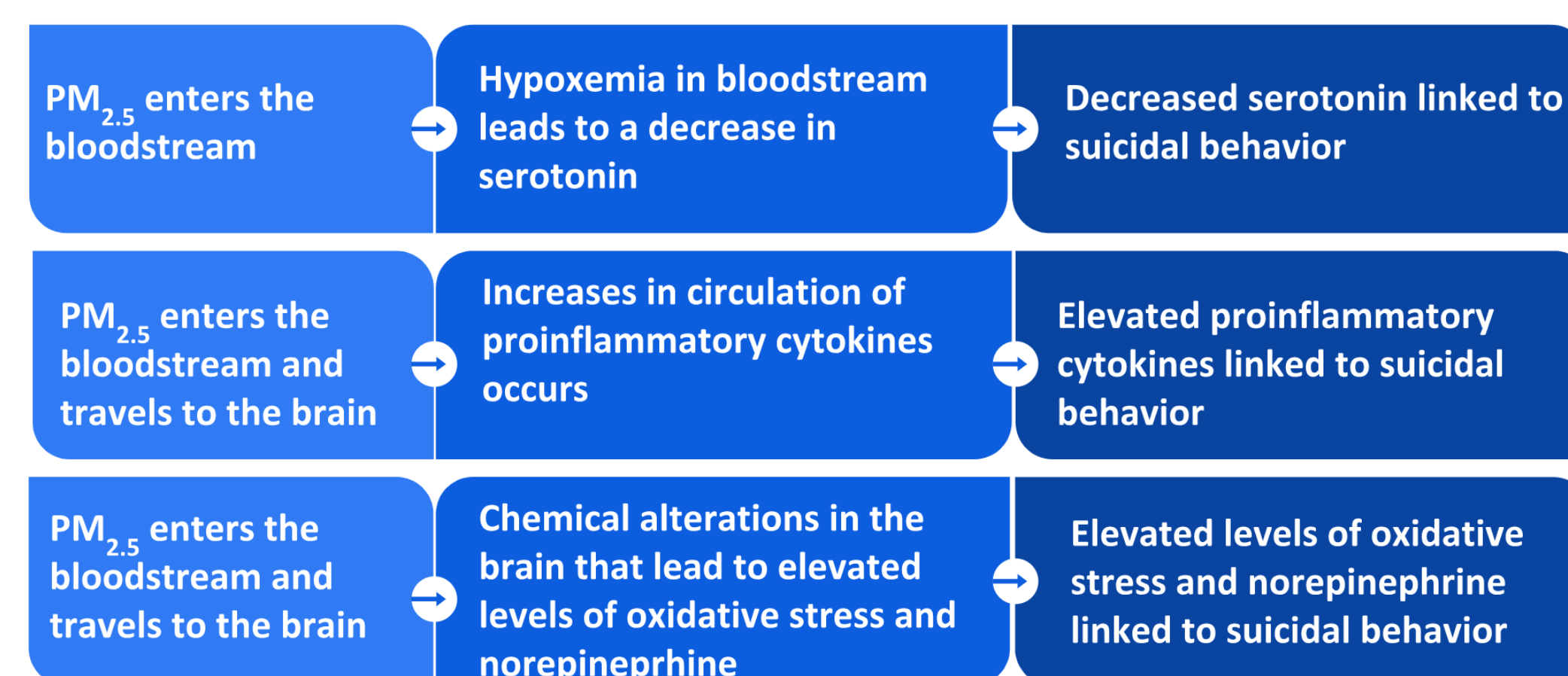
**Particulate Matter and North East Asia.** 76% of population living in areas that exceed the World Health Organization's PM<sub>2.5</sub> first interim target Air Quality Guideline annual average of 35 µg/m<sup>3</sup> live in North East Asia (Image: Dalhousie University).



**Outcome.** Suicide is a complex issue, with suicidal behavior hypothesized to be a result of interactions between individual psychological, sociological, and environmental factors. As seen in the figure below the suicide rates in this region are typically higher than the global average.



## Biological Plausibility



## Methods

I conducted a systematic literature review regarding acute particulate matter exposure and subsequent suicide deaths in North East Asia. I searched articles published up to October 31, 2018, and included original studies that measured concentrations of particulate matter that was ten microns across or smaller, measured suicidal deaths, and were conducted in North East Asia. I evaluated the individual risk of bias for each study, as well as risk of bias across studies, quality of the evidence, and strength of the evidence according to the Navigation Guide systematic review methodology.



**Population.** Residents of the countries included in North East Asia which are China, Japan, Mongolia, South Korea, and Taiwan.

**Exposure.** Acute concentrations of PM<sub>10</sub>. Acutely high concentrations include periods of at least a one interquartile (IQR) increase in ambient concentration.

**Comparator.** The comparator is the same region during times when there are non-elevated concentrations of PM<sub>10</sub>.

**Outcome.** Suicide completions are defined in the *International Classification of Diseases (ICD)* as intentional self-harm mortality, which is purposely self-inflicted poisoning or injury suicide.

**Data Sources.** I searched the databases Scopus, PubMed, and Proquest using the search terms. I did not limit my search by language or initial publication date. I did my initial search on September 25, 2018 and updated my search on October 31, 2018, to identify any new studies. I also hand-searched references of included studies, and review papers on the topic of air pollution and suicide.

## Results

Rating the Quality of Evidence	
Initial Rating of human evidence = "Moderate"	
Category	Downgrades
Risk of Bias	-1
Indirectness	0
Inconsistency	0
Imprecision	0
Publication Bias	0
Upgrades	
Large Magnitude of Effect	0
Dose-Response Relationship	0
Confounding Minimizes Effect	1
<b>Overall Quality of Evidence</b>	<b>Moderate</b>

Rating the Strength of Evidence	
Quality of the Body of Evidence	Moderate
Direction of the Effect Estimate	Generally null or positive association for dose-response
Confidence in Effect Estimates	Some significant findings were found for dose-response
Other Attributes	None
<b>Overall Strength of Evidence</b>	<b>Limited</b>

Risk of Bias	Kim, 2010	Yang, 2011	Kim, 2015	Ng, 2016	Lin, 2016	Kim, 2018	Lee, 2018	Min, 2018
Study Design	Low	Low	Low	Low	Low	Low	Low	Low
Exposure Assessment	Low	Low	Low	Low	Low	Low	Low	Low
Environmental Confounding	Low	Low	Low	Low	Low	Low	Low	Low
Human Confounding	Low	Low	Low	Low	Low	Low	Low	Low
Detection of Outcome	Low	Low	Low	Low	Low	Low	Low	Low
Reporting	Low	Low	Low	Low	Low	Low	Low	Low
Conflict of Interest	Low	Low	Low	Low	Low	Low	Low	Low

Low	Low
Probably Low	Low
Probably High	Low
High	Low

## Conclusions

I concluded that there was limited evidence to suggest that acute exposure to ambient particulate matter was associated with increased suicide. Evidence could be improved in the future by more carefully assessing exposure, and controlling for chronic disease confounding.

## Papers Reviewed

Kim, C, Jung, SH, Kang, DR, Kim, HC, Moon, KT, Hur NW, Shin, DC, Suh, I. 2010. Ambient particulate Matter as a Risk Factor for Suicide.

Kim Y, Kim H, Honda Y, Guo YL, Chen BY, Woo JM, Ebi KL. 2015. Suicide and Ambient Temperature in East Asian Countries: A Time-Stratified Case-Crossover Analysis.

Kim Y, Ng CFS, Chung Y, Kim H, Honda Y, Guo YL, Lim YH, Chen BY, Page LA, Hashizume M. 2018. Air Pollution and Suicide in 10 Cities in Northeast Asia: A Time-Stratified Case-Crossover Analysis.

Lee, H, Myung, W, Kim DK. 2018. Ambient air pollution and completed suicide in 26 South Korean cities: Effect modification by demographic and socioeconomic factors

Lin GZ, Li L, Song YF, Zhou YX, Shen SQ, Ou CQ. 2016. The impact of ambient air pollution on suicide mortality: a case-crossover study in Guangzhou China.

Min J, Kim H, Min K. 2018. Long-term exposure to air pollution and the risk of suicide death: A population-based cohort study.

Ng CFS, Stickley A, Konishi S, Watanabe C. 2016. Ambient air pollution and suicide in Tokyo, 2001-2011.

Yang AC, Tsai SJ, Huang NE. 2011. Decomposing the association of completed suicide with air pollution, weather, and unemployment data at different time scales.

## Poster References

van Donkeleer, A. 2010. Global satellite- map of PM2.5 averaged 2001-2006. *Dalhousie University*. <https://www.nasa.gov/topics/earth/features/health-sapping.html>

World Health Organization (WHO). 2018. Age-standardized suicide rates (per 100,000 population). [http://www.who.int/gho/mental\\_health/suicide\\_rates/en/](http://www.who.int/gho/mental_health/suicide_rates/en/)

Pandey GN. 2013. Biological basis of suicide and suicidal behavior. *Bipolar disorders* 15(5):524-541.

Guxens M, Sunyer J. 2012. A review of epidemiological studies on neuropsychological effects of air pollution. *Swiss Medical Weekly*. 141.

Lin GZ, Li L, Song YF, Zhou YX, Shen SQ, Ou CQ. 2016. The impact of ambient air pollution on suicide mortality: a case-crossover study in Guangzhou China. *Environmental Health* 15(1):90.

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