Reviewer’s report

Title: Low concentrations of fine particle air pollution and mortality in the Canadian Community Health Survey Cohort

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Reviewer: Susan Pacheco

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The impact of low concentrations of PM air pollution on mortality in the Canadian Community Health Survey-Mortality cohort.

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Journal: Environmental Health

SUMMARY

This is a thorough, well developed study exploring the effect of low levels of particulate matter (PM) 2.5 in non-accidental mortality, utilizing health data from the Canadian Community Health Survey (CCHS). The researchers' goal was to determine the shape of the concentration-response curve for non-accidental mortality in the context of exposure to low levels of particulate matter (PM)2.5, utilizing updated and more inclusive data from the CCHS-Mortality (CCHS-M), cohort and adjusting for socio-economical, behavioral and ecological factors.

To address these questions the researchers utilized data from consenting individuals included in the CCHS cohort (2000-2012). These data were linked to mortality records (Derived Record Repository, 2000-2016), and postal codes data, and was later used to calculate the association between exposure to PM2.5 and non-accidental mortality. Besides adjusting for socio-economical, behavioral and ecological covariates, the analysis included potential effect of the presence of NO2, O3 and Ox, and data from the Canadian Marginalization Index (i.e., material deprivation, residential instability, dependency and ethnic concentration). The analysis for PM2.5 comprised a three-year moving average with a one-year lag. Cox proportional hazards model was used to estimate hazard ratios for non-accidental mortality data and PM2.5 exposures. The concentration-response curve for PM2.5 and mortality was calculated using a Shape Constrained Health Impact Function (SCHIF) model.

After linkage analysis and incorporation of exclusion criteria, 4,452,700 person-years from 452,651 individuals, with variable follow up times were identified. There were 50,700 deaths from non-accidental causes at low average PM2.5 levels. PM2.5 was associated to an 11%
increase in non-accidental mortality per 10ug/m3. Mortality rates were lower for immigrants, non-indigenous population, married individuals, those with university degrees and employment. When adjusted by behavioral, ecological and socio-economic covariates, the hazard ratio increased from .96 to 1.11. When behavioral covariates were added to a model adjusted for socio-economic covariates alone, the hazards ratio increased from 1.05 to 1.09. Interestingly, analysis with the behavioral covariates added to a model adjusted both for socio-economic and ecological covariates, lowered the hazard ratio from 1.13 to 1.11. The hazard ratios obtained were similar to that found in US and other global cohorts. When analyzed with other pollutants (i.e., NO2, O3), the hazard ratio for PM2.5 exposure decreased. The hazard ratio was higher for males, those under 65 and non-immigrants. The shape of the curve relating PM2.5 and non-accidental mortality displayed a supra-linear dose-response curve.

General Comments:

This manuscript is well developed and the analysis performed by the researchers is systematic and comprehensive. The article is not innovative since, as stated by the researchers, the study expands previous research published by the authors' group in 2016 (Pinault et al. Environmental Health (2016) 15:18), utilizing the Canadian Community Health Survey, by including: "additional years of follow-up to 2016, improvements in the resolution of PM.5 exposure (approximately 1 km2 grid), annual residential history from 1981 to 2016 for all cohort members from a linkage to postal code records, time-varying ecological covariates, inclusion of immigrants to Canada and an improved linkage between survey respondents and death records". Likewise, although new for the the CCHS cohort, the supra-linear concentration response curve observed at low levels of PM2.5 and risk of non-accidental mortality has been previously described in other studies.

Nevertheless, with its large study population (4,452,700 person-years from 452,651 individual) and inclusion of socio-economical, behavioral and ecological covariates, the study adds strength to already published data stating the hazardous health effects of exposure to PM2.5, at levels in compliance with the regulations of the Canadian Ambient Air Quality Standards and the US National Ambient Air Quality Standards. This information is important for the implementation of public health measures to tackle PM2.5 pollution, in particular due to the supra-linear dose response curve.

Specific Comments and Suggestions:

Abstract and Introduction:
The purpose of the study stated in the 'abstract's background' (page2), and the general background in the body of the manuscript, (pages 3-4) should be similar. As written, the abstract only mentions as purpose the use of the Canadian Community Health Survey-Mortality cohort in the analysis of the concentration-response curve for individuals exposed to low levels of PM2.5, (P2#21-22). In contrast, the background section in the body of the manuscript lists 6 items (P4#11-17), under an update of the Canadian Community Health Survey-Mortality cohort in addition to the examination of the shape of the concentration-response curve.

Methodology:

No concerns

Results and discussion:

The tables are well constructed and self-explanatory. Figure 1 is very helpful for understanding the methodology.

The discussion would benefit from inclusion of data from non-CCHS based studies. In addition, the authors should attempt to explain some of the results included in the discussion (e.g. the reason for the 2% decrease in hazard ratios caused by the inclusion of behavioral covariates in a model adjusted for socioeconomic and ecological covariates, the attenuating effect of O3 and NO2 in PM2.5 hazard rations), and contrast the with other published studies.

The relevance of the public health implications of the results, including the supra-linear shape of the concentration-response curve, should be stressed in the discussion. For example, the health benefits resulting from the implementation of air pollution control measures in China did not correlate with the extent of air quality improvements. Some of the discrepancy was felt to be related to the concentration-response function between mortality and PM2.5 (Yixuan Zheng et al 2017 Environ. Res. Lett. 12 114020).

Suggest to mention the cause of mortality for the 50,700 non-accidental deaths.

Level of interest

Please indicate how interesting you found the manuscript:

An article of importance in its field

Quality of written English

Please indicate the quality of language in the manuscript:

Acceptable
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