Peer Review Report

Review Report on Associations between gender gaps in life expectancy, air pollution, and urbanization: A global assessment with Bayesian spatiotemporal modeling

Original Article, Int J Public Health

EVALUATION

Q 1   Please summarize the main findings of the study.

The authors presented an analysis of gender-gap life expectancy (GGLE) and sought to understand the relationship between air pollution or urbanization of GGLE while employing a spatial-temporal Bayesian model. Overall they found persistent GGLE, where females on average live longer, and evidence of positive relationships with increased fine-particulate matter exposure and urbanization on GGLE. These estimated relationships differed across region.

Q 2   Please highlight the limitations and strengths.

Strengths include applying Bayesian spatial-temporal model that will likely help to account for difference due to unmeasured confounding. Furthermore, their data spanning a nearly 60-year period allows for a long-term study of differences. Limitations include possible measurement error in many of the covariates as well as outcome data as well as lack of additional important confounding economic, meteorological, and other environmental differences.

Q 3   Please provide your detailed review report to the authors. The editors prefer to receive your review structured in major and minor comments. Please consider in your review the methods (statistical methods valid and correctly applied (e.g. sample size, choice of test), is the study replicable based on the method description?), results, data interpretation and references. If there are any objective errors, or if the conclusions are not supported, you should detail your concerns.

Major comments:
* It seems a bit of a stretch that the spatial random effects are constant over time. The onset of globalization may have induced a range of changes to the spatial correlations of GGLE as well as other confounders both controlled for or not. This is partially accounted for with the temporal random effects (e.g., b0 and b1i), but these also assume a linear trend that may or may not be shared by neighboring countries. It would be worthwhile to consider this and also informative to report the combined effects of s+b0+b1 at several time points (1960, 1980, 2010, for example) to provide a better view of how the spatial-temporal variations change over time.
* Can the authors comment more on measurement error for PM2.5: specifically, is there any validity measure and how might error influence results?
* Why were all covariates log transformed? Obviously, this allows for a specific interpretation (1% increase in PM corresponds to x% change in GGLE). However, it also assumes a specific type of multiplicative relationship, which may or may not make sense. This is partially reinforced through the differing region-specific effects saying that the proposed relationship changes at different levels of the covariate. Can the authors comment on this relationship and if/why this particular exposure-response relationship is made?

Minor comments
* The authors have found relationships for both PM2.5 and urbanization with GGLE. These are interesting findings and more discussion should be made on the possible biological mechanisms (PM2.5) or social factors (urbanization) that may related to GGLE.

* Are there historical reasons that GGLE may change directions in EU and NA? It seems this finding could use additional context.

PLEASE COMMENT

Q 4 **Is the title appropriate, concise, attractive?**

The title is "gender-specific associations ...", however the primary analysis and discussion in the manuscript is regarding gender gap life expectancy. Moreover, many of the significant findings are restricted to GGLE and I think including this phrase (GGLE) in the title would be more appropriate.

Q 5 **Are the keywords appropriate?**

Yes. "Air pollution" may be a bit of a stretch as they only consider a single air pollutant (fine particulate matter).

Q 6 **Is the English language of sufficient quality?**

Yes

Q 7 **Is the quality of the figures and tables satisfactory?**

Yes.

Q 8 **Does the reference list cover the relevant literature adequately and in an unbiased manner?)**

I believe so

QUALITY ASSESSMENT

Q 9 **Originality**

Q 10 **Rigor**

Q 11 **Significance to the field**

Q 12 **Interest to a general audience**

Q 13 **Quality of the writing**

Q 14 **Overall scientific quality of the study**

REVISION LEVEL

Q 15 **Please make a recommendation based on your comments:**

Major revisions.