Charge Questions for Bullet Point Responses

CASAC

December 13, 2018

Charge Question: Executive Summary

- The Executive Summary is intended to provide a concise synopsis of the key findings and conclusions of the PM ISA for a broad range of audiences.
- Please comment on the **clarity** with which the Executive Summary communicates the key information from the PM ISA.
- Please provide **recommendations on information that should be added** or information that should be **left for discussion** in the subsequent chapters of the PM ISA.

Clarity of Executive Summary

- The Executive Summary does a good job of clearly summarizing key information from the rest of the PM ISA.
- But, key information being summarized is itself unclear in crucial respects.
  - Vague, imprecise, and undefined terms
  - Conflation of estimated and true exposures
  - Conflation of different types of causes, effects, C-Rs
  - Ambiguity of 5 causality determination categories
- How information was selected for inclusion in the PM ISA is not always unclear.
- Reasons for excluding information not always clear
- How conflicting evidence was reconciled is often unclear

Clarity about effects

- poverty → exposure → risk
  - Model A: Risk = 0.1*poverty + 0.9*exposure + 1*poverty*exposure
  - exposure = 1*poverty
- *Controlled direct effect* of exposure on risk: hold poverty fixed at specified level
- *Natural direct effect:* hold poverty at actual levels
- *Total, direct, indirect, mediated* effects of poverty

Definitional ambiguity: Is exposure-risk association "causal" if it is 99% due to confounding?

- poverty → exposure → risk
  - Model A: Risk = 0.1*poverty + 0.9*exposure
  - Model B: Risk = 0.9*poverty + 0.1*exposure
  - exposure = 1*poverty
- (Direct effect/total effect) for effect of exposure on risk can be any number between 0 and 1
- Should all possibilities get the same qualitative categorical label?
  - Makes the label useless to decision-maker (VoI = 0)

Clarity about causes

- At present, “Causal” ≠ “Preventable”
  - Hill/IARC/WoE (“associational”) causality is not manipulative causality
  - Most people think that “causal” means manipulative causal, i.e., preventable or reducible by reducing exposure
  - This needs to be fixed
- At present, “causal” says nothing about how much or what fraction is *direct* causal
- Define “independent effect”
  - Risk = 0.1*Poverty + 0.2*Exposure + 1*Poverty*Exposure

Information to add to Executive Summary

- The key findings in the PM ISA (mainly, causality determinations for associations) do not identify whether or how much reducing PM exposures would reduce adverse human health effects.
- Add information on whether reducing PM exposures would reduce adverse human health effects
  - Which ones? (How much?) How do we know? How sure can we be? Observed in accountability studies?

Other things to fix/address

- Systematic review, explicit individual study quality criteria, explicit criteria for evidence synthesis and reconciliation
- LNT: Evidence of LNT based on *assumption* of no threshold is not evidence of LNT
- Measurement error does not necessarily usually lead to underestimates of health effects
- Model uncertainty should be characterized
- Measurement/estimation errors should be characterized and accounted for. Distinguish between estimated and true exposures.
- Revisit conclusions on mortality, lung cancer, cardiovascular, and neurolgical

Charge Question: Chapter 1

- Chapter 1 presents an integrated summary and the overall conclusions from the subsequent detailed chapters of the PM ISA and characterizes available scientific information on policy relevant issues. Please comment on the **usefulness and effectiveness of the summary** presentation.
- Please provide **recommendations on approaches that may improve the communication** of key findings to varied audiences **and the synthesis** of available information across subject areas. **What information should be added** or is more appropriate to **leave for discussion** in the subsequent detailed chapters?

Charge Question: Chapter 1

- Q: Please comment on the **usefulness and effectiveness of the summary** presentation.
- A: The summary is effective (good job)
- But, the summary is only as effective as the information being summarized
  - Mainly addresses C-R *associations*
  - Does not quantify whether or how much of the C-R associations could be *prevented* by reducing PM exposure alone (independent effects)
    - Crucial for informing policy deliberations and decisions

Charge Question: Chapter 1

- Q: Please comment on the **usefulness and effectiveness of the summary** presentation.

Example: **1.4.1.5 Mortality**

- "Consistent with the conclusions of the 2009 PM ISA, more recently published scientific evidence reaffirms and further strengthens that there is a "*causal relationship*" between both short- and long-term PM2.5 exposure and total mortality. These causality determinations are based on the **consistency of findings across a large body of epidemiologic studies** and coherence among evidence from controlled human exposure, epidemiologic, and toxicological studies, as well as biological plausibility for respiratory and cardiovascular morbidity effects by which short- and long-term PM2.5 exposure could result in mortality."
- *Is it true? How sure are we?*

Example accountability study for black smoke (including PM2.5)

- Health Effects Institute (2013). Did the Irish Coal Bans Improve Air Quality and Health? HEI Update, Summer, 2013. http://pubs.healtheffects.org/getfile.php?u=929.
- **Greatly reducing ambient particulate air pollution** (by up to 70% and several dozen $\mu g/m^3$) in Ireland **was not found to reduce all-cause or cardiovascular mortality rates** after > 10 years
- Strong, consistent, coherent etc. historical associations between levels of PM in air and levels of all-cause and cardiovascular mortality were due to coincident historical trends.
  - See also Dockery DW, Rich DQ, Goodman PG, Clancy L, Ohman-Strickland P, George P, Kotlov T; HEI Health Review Committee. Effect of air pollution control on mortality and hospital admissions in Ireland. Res Rep Health Eff Inst. 2013 Jul;(176):3-109.
  - "An extension of the bituminous coal ban across Ireland would help in reducing the levels of PM2.5 in ambient air" https://www.epa.ie/pubs/epasub/EPA%20Response%20on%20Smoky%20Coal%20Regs%20Consultation.pdf

Example of causal mediation study for PM10

- Health Effects Institute (2016) https://www.healtheffects.org/system/files/ZiglerRR187-Statement.pdf. "Contrary to expectations, their **analysis suggested a reduction, on average, in mortality even in areas where their analyses reported that PM10 was not causally affected**. The authors suggested that the observed causal effect of nonattainment designation on mortality, in the absence of a strong associative effect for PM10, may be due to causal pathways other than the one involving reduction of PM10. However, they suggested their results provide evidence that PM10 played a causal role in the reduction of hospitalization for respiratory disease, but again, not for cardiovascular disease. As the authors noted, all of the estimates from these analyses were accompanied by substantial uncertainty, indicated by **broad posterior 95% confidence intervals that included zero.** As a result, the HEI Health Review Committee thought the investigators generally overstated the average causal effects of nonattainment designation and the role of PM10 in this study." See also Zigler CM, Kim C, Choirat C, Hansen JB, Wang Y, Hund L, Samet J, King G, Dominici F; HEI Health Review Committee. Causal Inference Methods for Estimating Long-Term Health Effects of Air Quality Regulations. Res Rep Health Eff Inst. 2016 May;(187):5-49.

Example of natural experiments for short-term PM2.5-mortality association

- Zhou M, He G, Fan M, Wang Z, Liu Y, Ma J, Ma Z, Liu J, Liu Y, Wang L, Liu Y. Smog episodes, fine particulate pollution and mortality in China. Environ Res. 2015 Jan;136:396-404. doi: 10.1016/j.envres.2014.09.038. This study examined the impacts on mortality rates of prolonged and severe smog episodes (PM2.5 hourly peak concentrations over 800 μg/m^3) in China in 2013, finding that "**Without any meteorological control, the smog episodes are positively and statistically significantly associated with mortality in 5 out of 7 districts/ counties.** However, the findings are sensitive to the meteorological factors. **After controlling for temperature, humidity, dew point and wind, the statistical significance disappears in all urban districts.** In contrast, the smog episodes are consistently and statistically significantly associated with **higher total mortality and mortality from cardiovascular/respiratory diseases in the two rural counties**." This study, and others like it, provide evidence of **substantial geographic heterogeneity** in estimated PM2.5-mortality associations.

Example of natural experiment for short-term PM2.5-mortality association

- Zu K, Tao G, Long C, Goodman J, Valberg P. Long-range fine particulate matter from the 2002 Quebec forest fires and daily mortality in Greater Boston and New York City. Air Qual Atmos Health. 2016; 9:213-221. This study concluded that "**substantial short-term elevation in PM2.5 concentrations from forest fire smoke were not followed by increased daily mortality in Greater Boston or New York** City."

3-year PM2.5-mortality association at county level

Epidemiology. 2007 Jul;18(4):416-23.

Trends in air pollution and mortality: an approach to the assessment of unmeasured confounding.

Janes H[1], Dominici F, Zeger SL.

Abstract

We propose a method for diagnosing confounding bias under a model that links a spatially and temporally varying exposure and health outcome. We decompose the association into orthogonal components, corresponding to distinct spatial and temporal scales of variation. If the model fully controls for confounding, the exposure effect estimates should be equal at the different temporal and spatial scales. We show that the overall exposure effect estimate is a weighted average of the scale-specific exposure effect estimates. We use this approach to estimate the **association between monthly averages of fine particles (PM2.5) over the preceding 12 months and monthly mortality rates in 113 US counties from 2000 to 2002.** We decompose the association between PM2.5 and mortality into 2 components: (1) the association between "national trends" in PM2.5 and mortality; and (2) the association between "local trends," defined as county-specific deviations from national trends. This second component provides evidence as to **whether counties having steeper declines in PM2.5 also have steeper declines in mortality relative to their national trends.** We find that the exposure effect estimates are different at these 2 spatiotemporal scales, which raises concerns about confounding bias. We believe that the association between trends in PM2.5 and mortality at the national scale is more likely to be confounded than is the association between trends in PM2.5 and mortality at the local scale**. If the association at the national scale is set aside, there is little evidence of an association between 12-month exposure to PM2.5 and mortality**

7-year PM2.5-mortality association

J Am Stat Assoc. 2011;106(494):396-406. doi: 10.1198/jasa.2011.ap09392. Epub 2012 Jan 24.

An Approach to the Estimation of Chronic Air Pollution Effects Using Spatio-Temporal Information.

Greven S[1], Dominici F[2], Zeger S[3].

Abstract

There is substantial observational evidence that long-term exposure to particulate air pollution is associated with premature death in urban populations. Estimates of the magnitude of these effects derive largely from cross-sectional comparisons of adjusted mortality rates among cities with varying pollution levels. Such estimates are potentially confounded by other differences among the populations correlated with air pollution, for example, socioeconomic factors. An alternative approach is to study covariation of particulate matter and mortality across time within a city, as has been done in investigations of short-term exposures. In either event, observational studies like these are subject to confounding by unmeasured variables. Therefore the ability to detect such confounding and to derive estimates less affected by confounding are a high priority. In this article, we describe and apply a method of decomposing the exposure variable into components with variation at distinct temporal, spatial, and time by space scales, here focusing on the components involving time. Starting from a proportional hazard model, we derive a Poisson regression model and estimate two regression coefficients: the "global" coefficient that measures the association between national trends in pollution and mortality; and the "local" coefficient, derived from space by time variation, that measures the association between location-specific trends in pollution and mortality adjusted by the national trends. Absent unmeasured confounders and given valid model assumptions, the scale-specific coefficients should be similar; substantial differences in these coefficients constitute a basis for questioning the model. We derive a backfitting algorithm to fit our model to very large spatio-temporal datasets. We apply our methods to the **Medicare Cohort Air Pollution Study (MCAPS),** which includes individual-level information on time of death and age on a population of **18.2 million for the period 2000-2006. Results based on the global coefficient indicate a large increase in the national life expectancy for reductions in the yearly national average of $PM_{2.5}$. However, this coefficient based on national trends in $PM_{2.5}$ and mortality is likely to be confounded** by other variables trending on the national level. Confounding of the local coefficient by unmeasured factors is less likely, although it cannot be ruled out. **Based on the local coefficient alone, we are not able to demonstrate any change in life expectancy for a reduction in $PM_{2.5}$.** We use additional survey data available for a subset of the data to investigate sensitivity of results to the inclusion of additional covariates, but both coefficients remain largely unchanged.

10-year PM2.5-mortality association

Environ Int. 2017 Sep;106:257-266. doi: 10.1016/j.envint.2017.06.001.

Effects of climate and fine particulate matter on hospitalizations and deaths for heart failure in elderly: A population-based cohort study.

Vanasse A[1], Talbot D[2], Chebana F[3], Bélanger D[4], Blais C[5], Gamache P[6], Giroux JX[7], Dault R[8], Gosselin P[9].

Abstract

BACKGROUND: There are limited data on **the effects of climate and air pollutant exposure on heart failure (HF) within taking into account individual and contextual variables**.

OBJECTIVES: We measured the lag effects of temperature, relative humidity, atmospheric pressure and fine particulate matter ($PM_{2.5}$) on hospitalizations and deaths for HF in elderly diagnosed with this disease on a **10-year period in the province of Quebec, Canada.**

METHODS: Our population-based cohort study included 112,793 elderly diagnosed with HF between 2001 and 2011. Time dependent Cox regression models approximated with pooled logistic regressions were used to evaluate the 3- and 7-day lag effects of daily temperature, relative humidity, atmospheric pressure and $PM_{2.5}$ exposure on HF morbidity and mortality controlling for several individual and contextual covariates.

RESULTS: Overall, 18,309 elderly were hospitalized and 4297 died for the main cause of HF. We observed an increased risk of hospitalizations and deaths for HF with a decrease in the average temperature of the 3 and 7days before the event. **An increase in atmospheric pressure in the previous 7 days was also associated with a higher risk of having a HF negative outcome, but no effect was observed in the 3-day lag model. No association was found with relative humidity and with $PM_{2.5}$ regardless of the lag period.**

CONCLUSIONS: Lag effects of temperature and other meteorological parameters on HF events were limited but present. Nonetheless, preventive measures should be issued for elderly diagnosed with HF considering the burden and the expensive costs associated with the management of this disease.

PM2.5-AMI association, decade

Comparison of transient associations of air pollution and AMI hospitalisation in two cities of Alberta, Canada, using a case-crossover design

Xiaoming Wang, Warren Kindzierski, Padma Kaul

Abstract

Objective To investigate reproducibility of outcomes for short-term associations between ambient air pollutants and acute myocardial infarction (AMI) hospitalisation in 2 urban populations.

Design Using a time-stratified design, we conducted independent case-crossover studies of AMI hospitalisation events over the period **1999–2010** in the geographically close and demographically similar cities of Calgary and Edmonton, Alberta, Canada. Patients with his/her first AMI hospitalisation event were linked with air pollution data from the National Ambient Pollution Surveillance database and meteorological data from the National Climatic Data Center database. Patients were further divided into subgroups to examine adjusted pollution effects. Effects of pollution levels with 0–3-day lag were modelled using conditional logistic regression and adjusted for daily average ambient temperature, dew point temperature and wind speed. **Setting** Population-based studies in Calgary/Edmonton. **Participants** 12 066/10 562 first-time AMI hospitalisations in Calgary/Edmonton. **Main outcome measures** Association (adjusted OR) between daily ambient air pollution levels and hospitalisation for AMI. **Results** Among 600 potential air pollution effect variables investigated for the Calgary (Edmonton) population, only 1.17% (0.67%) was statistically significant by using the traditional 5% criterion. None of the effect variables were reproduced in the 2 cities, despite their geographic closeness (within 300 km of each other), and demographic and air pollution similarities.

Conclusions Comparison of independent investigations of the effect of air pollution on risk of AMI hospitalisation in Calgary and Edmonton, Alberta, indicated that **none of the air pollutants investigated—CO, NO, NO_2, O_3 and particulate matter ($PM_{2.5}$)—showed consistent positive associations with increased risk of AMI hospitalisation.**

Charge Question: Chapter 1

- Please provide **recommendations on approaches that may improve the communication** of key findings to varied audiences **and the synthesis** of available information across subject areas. **What information should be added** or is more appropriate to **leave for discussion** in the subsequent detailed chapters?

Information to add to ISA

- Accountability studies
- Causal mediation studies and analyses
- Natural experiments and quasi-experiments
- Inflammation toxicology for lung and cardiovascular
  - Inflammasome biology
- Socioeconomic drivers and trends
- Co-morbidity and co-pollutant drivers and trends

Information to add to ISA

- Study selection criteria
- Individual study quality evaluation criteria
  - Internal validity (soundness)
  - External validity (generalization)
  - Unverified assumptions in design, analysis, interpretation
  - Methods review
- Synthesis and conflict resolution criteria
- Systematic review results

Charge Question: Chapter 2

- To what extent is the information presented in Chapter 2 regarding **sources, chemistry, and measurement and modeling of ambient concentrations** of PM **clearly and accurately conveyed and appropriately characterized?**
- Please comment on the extent to which available **information on the spatial and temporal trends of ambient PM concentrations at various scales** has been adequately and accurately described.

Charge Question: Chapter 3

- Chapter 3 describes scientific information on **exposure to ambient PM** and **implications for epidemiologic studies**. To what extent is the discussion on **methodological considerations for exposure measurement and modeling** clearly and accurately conveyed and appropriately characterized?
- Please comment on the extent to which the discussion regarding exposure assessment and the **influence of exposure error on effect estimates in epidemiologic studies** of the health effects of PM has been **adequately and accurately described**.

Charge Question: Chapter 4

- Chapter 4 characterizes scientific evidence on the dosimetry of PM.
- To what extent does the **discussion clearly and accurately convey the dosimetry of inhaled PM** and the processes of deposition, clearance, retention, and translocation?

Charge Question: Chapters 5-11

- Please comment on the **identification, evaluation** and **characterization** of the available **scientific evidence** from epidemiologic, controlled human exposure, toxicological and associated human exposure and atmospheric sciences studies and the **application of information** from these studies **to inform causality determinations** for **human health** outcomes.

Charge Question: Chapters 5-11

- Chapters 5 – 11 present assessments of the health effects associated with short-term and long-term exposure to PM. The discussion is organized by PM size fraction, exposure duration, broad health effects (e.g., asthma, ischemic heart disease, etc.), and scientific discipline.
- Please comment on the **characterization of the evidence** within these chapters.

Charge Question: Chapters 5-11

- Please comment on the portrayal and discussion of the **biological plausibility** evidence presented at the outset of Chapters 5 – 11 and the extent to which: (1) the organization adequately captures the **current state of the science with respect to potential pathways** by which PM could impart health effects, and (2) as currently constructed, **inform causality determinations.**

Chapter 12

- Chapter 12 evaluates scientific information and presents conclusions on factors that may contribute to **specific populations or life stages being at increased risk** of a PM-related health effect.
- Please comment on the extent to which the **available scientific evidence from epidemiologic, controlled human exposure, and toxicological studies been integrated to inform conclusions** on populations and/or lifestages potentially at increased risk of a PM-related health effect.
- **Is there information available on other key factors** that is not included in the draft PM ISA that inform differential risk that should be added?

Chapter 13

- Please comment on the identification, evaluation and characterization of the **available scientific evidence** from studies of PM on **non-ecological welfare effects** of visibility impairment, climate, and materials and the application of information from these studies, as presented in Chapter 13, **to inform causality determinations** and **uncertainty characterizations** for these welfare outcomes.

Overarching Charge Question 1

- What **scientific evidence has been developed** since the last review to indicate if the current primary and/or secondary **NAAQS need to be revised** or if an **alternative level or form** of these standards **is needed** to protect public health and/or public welfare?
- Please recommend to the Administrator **any new NAAQS or revisions** of existing criteria and standards as may be appropriate.
- In providing advice, please consider a **range of options for standard setting**, in terms of indicators, averaging times, form, and levels for any alternative standards,
- along with a description of the **alternative underlying interpretations of the scientific evidence** and **risk/exposure information** that might support such alternative standards and that could be considered by the Administrator in making NAAQS decisions.

Overarching Charge Question 2

- Are there **areas in which additional knowledge is required** to appraise the adequacy and basis of existing, new, or revised NAAQS?
- Please describe the **research efforts** necessary to provide the required information

Overarching Charge Question 3

- What is the **relative contribution** to air pollution concentrations of **natural as well as anthropogenic activity**?
- In providing advice on any recommended NAAQS levels, please discuss **relative proximity to peak background levels**.

Overarching Charge Question 4

- Please advise the Administrator of any **adverse public health, welfare, social, economic, or energy effects** which may result from various strategies for attainment and maintenance of such NAAQS.

Overarching Charge Question 5

- Do key studies, analyses, and assessments which may inform the Administrator's decision to revise the NAAQS **properly address or characterize uncertainty and causality?**
- Are there appropriate criteria to ensure **transparency** in the evaluation, assessment, and characterization of key scientific evidence for this review?

Thanks!

Dictionary
ti·ger team
noun
1.a team of specialists in a particular field brought together to work on specific tasks.
Translations, word origin, and more definitions
Feedback
Web results
Tiger team - Wikipedia

https://en.wikipedia.org/wiki/Tiger_team
A **tiger team** is a diversified group of experts brought together for a single project, need, or event. They are usually assigned to investigate, solve, build, or recommend possible solutions to unique situations or
problems. History · Security · Government · Examples
What is a Tiger Team Approach? - Trextel

https://trextel.com/what-is-a-tiger-team-approach-how-to-successfully-launch-technol...
Aug 15, 2017 - A **tiger team** is a highly skilled group of people who are tenacious about problem solving. Learn about their role in accelerating technology ...