

August 11, 2022

Karen Harbert  
President and CEO  
American Gas Association  
400 N. Capitol St., NW  
Washington, DC 20001  
via email at KHarbert@aga.org

Re: AMA Resolution 439, "Informing Physicians, Health Care Providers, and the Public that Cooking with a Gas Stove Increases Household Air Pollution and the Risk of Childhood Asthma"

Dear Ms. Harbert:

The American Gas Association requested that I review Resolution 439, "Informing Physicians, Health Care Providers, and the Public that Cooking with a Gas Stove Increases Household Air Pollution and the Risk of Childhood Asthma," which was recently adopted by the American Medical Association (AMA) House of Delegates (HOD) at its 2022 Meeting. I am a Principal at Gradient, an environmental and risk sciences consulting firm. My areas of expertise include toxicology and epidemiology, and their application in human health risk assessments. I have extensive experience evaluating health effects associated with air pollutants and conducting systematic review.<sup>1</sup> I am board-certified in toxicology, and a fellow of both the American College of Epidemiology and the Academy of Toxicological Sciences.

Resolution 439 presumes a causal relationship between the use of gas-fired residential cooking appliances and childhood asthma. The document that introduced this resolution<sup>2</sup> cites a very limited number of studies that are not representative of the broader body of scientific literature. As discussed more below, scientific studies addressing gas-fired residential cooking appliances and childhood asthma have significant limitations, including poor study quality, inadequate control of potential confounders, and potential sources of bias. As a result, these studies do not provide a reliable basis for causal inferences. We also note that the AMA resolution downplays the important role of ventilation for mitigating gas combustion-related and cooking-related air emissions.

## Epidemiology Evidence

The document that introduced the AMA Resolution points to findings from three epidemiology studies as supporting the linkage between gas cooking and increased risk of childhood asthma and severity, without acknowledging any of the significant study limitations or the studies' inconsistent findings. The first cited study is the Lin *et al.* (2013) meta-analysis, which combined and integrated the data from 41 epidemiology studies published between 1977 and 2013 of indoor NO<sub>2</sub> and gas cooking on asthma and wheeze in children. The Lin *et al.* (2013) study reported weak, statistically significant associations between gas cooking and

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<sup>1</sup> Some recent peer-reviewed publications include: Lynch, HN; Goodman, JE; Bachman, AN. 2021. "Lung physiology and controlled exposure study design." *J. Pharmacol. Toxicol. Methods* 112:107106. doi: 10.1016/j.vascn.2021.107106; Boomhower, SR; Long, CM; Li, W; Manidis, TD; Bhatia, A; Goodman, JE. 2021. "A Review and Analysis of Personal and Ambient PM<sub>2.5</sub> Measurements: Implications for Epidemiology Studies." *Inhal. Toxicol.* 204(Pt B):112019. doi: 10.1016/j.envres.2021.112019; Goodman, JE; Li, W; Cox, LA Jr. 2021. "Commentary: Using Potential Outcomes Causal Methods to Assess Whether Reductions in PM<sub>2.5</sub> Result in Decreased Mortality." *Global Epidemiol.* 3:100052. doi: 10.1016/j.gloepi.2021.100052; Prueitt, RL; Li, W; Edwards, L; Zhou, J; Goodman, JE. 2021. "Systematic Review of the Association Between Long-term Exposure to Fine Particulate Matter and Mortality." *Int. J. Environ. Health Res.* doi: 10.1080/09603123.2021.1901864.

<sup>2</sup> <https://www.ama-assn.org/system/files/a22-439.pdf>.

asthma and between indoor NO<sub>2</sub> and wheeze; however, there was no statistically significant increased risk of wheeze in relation to gas cooking or risk of asthma in relation to indoor NO<sub>2</sub>. This study had a number of important limitations, including heavy reliance on older cross-sectional study data and the use of data from a heterogeneous set of studies in terms of locations, home characteristics, and ventilation, without any assessment of study quality. Interestingly, one of the senior authors of the Lin *et al.* (2013) study, Dr. Bert Brunekreef, was also an author of a much larger epidemiology study of over half a million children that was published in the same year (2013) and "reported no association between gas cooking and lifetime asthma or current asthma in children when compared to children who lived in households that used electric stoves for cooking" (Wong *et al.*, 2013). This study not only included a far larger sample size than all of the studies combined in the Lin *et al.* (2013) study, but also adjusted for sex, region of the world, language, gross national income, maternal education, parental smoking, and six other subject-specific covariates. The AMA Resolution does not mention this much larger, contemporaneous study and its conflicting findings.

The other two studies cited by AMA in support of the resolution, Belanger *et al.* (2013) and Kile *et al.* (2014), are both cross-sectional epidemiology studies. Cross-sectional studies, by design, cannot be relied on for making causal inferences because they cannot assess temporality (*i.e.*, whether exposure preceded the observed effect). Cross-sectional studies also do not capture disease development or risk and are limited to capturing only disease prevalence. This study type is especially susceptible to several different kinds of bias; for example, the Belanger *et al.* (2013) study is potentially affected by information bias (due to the reporting of asthma outcomes by parents as opposed to medical professionals), model misspecification bias (due to the highly subjective measurement of asthma severity), and selection bias (due to selective study participation). The Kile *et al.* (2014) study also relied upon parental recall for information on both exposure and study outcomes and is thus susceptible to information bias. Moreover, Kile *et al.* (2014) did not rely on any indoor NO<sub>2</sub> measurement data and could not quantitatively evaluate the relationship between gas stove emissions, ventilation practices, and respiratory outcomes.

## **Emissions**

The AMA Resolution makes the claim that the "use of a gas stove increases household air pollution." While it is true that there are combustion emissions from gas-fired cooking appliances, it is also the case that cooking activities themselves (*e.g.*, baking, frying, sautéing various types of food) are sources of air emissions and that cooking with electric appliances is thus also a source of household air pollution.

With respect to increases in indoor NO<sub>2</sub>, the AMA Resolution claims that such increases "are significantly higher in homes with gas stoves than homes with electric stoves," citing measurements from the Belanger *et al.* (2006) and Mullen *et al.* (2016) studies. NO<sub>2</sub> measurements from these studies indicate that long-term (6- to 14-day) average concentrations are higher in homes with gas stoves than homes with electric stoves, but the levels are not significant from a health-based standpoint, as they fall below the US Environmental Protection Agency (US EPA) National Ambient Air Quality Standards for NO<sub>2</sub> that are protective of respiratory health effects (US EPA, 2016, 2017).

## **Ventilation**

Ventilation plays an important role in mitigating gas combustion-related and cooking-related air emissions. Yet, the AMA Resolution does not consider this and provides no details on the effectiveness of different ventilation practices, such as outdoor-vented kitchen range hood fans. Instead, the document introducing the AMA Resolution focused on findings from a modeling-based simulation study (Logue *et al.*, 2014) that assumes no usage of exhaust ventilation hoods, rather than the findings from the same study showing how air quality impacts can be "mitigated substantially" with usage of vented exhaust hoods. Other measurement-based studies, including the Singer *et al.* (2017) study conducted by researchers at Lawrence

Berkeley National Laboratory, as well as the study by Dobbin *et al.* (2018) conducted by researchers at Health Canada, National Research Council Canada, and Lawrence Berkeley National Laboratory, have demonstrated the important role of vented kitchen range exhaust for reducing both kitchen and whole-house air emissions concentrations.

## Conclusion

AMA should understand the strengths and limitations of the documents upon which Resolution 439 is based in order to make a more informed decision. Neither the AMA Resolution itself, nor the document introducing it, provide a well-balanced review of research findings, acknowledge the conflicting evidence, or address key issues affecting the interpretation of these studies, including study quality, study limitations, and the inconsistency of study findings. As discussed in this letter, due to significant limitations, the available studies do not provide a reliable scientific basis for AMA to make causal inferences regarding the relationship between the use of gas-fired residential cooking appliances and childhood asthma.

Sincerely,

GRADIENT

A handwritten signature in black ink, appearing to read "Julie Goodman". The signature is fluid and cursive, with a long horizontal stroke at the end.

Julie E. Goodman, Ph.D., DABT, FACE, ATS  
Principal

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## References

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