



Does Smoke From Biomass Fuel Contribute to Anemia in Pregnant Women in Nagpur, India? a Cross-Sectional Study

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Scholarly Report submitted in partial fulfillment of the MD Degree at Harvard Medical School

Date: 1 December 2015

Student Name: Charlotte M. Page

Scholarly Report Title: Does Smoke from Biomass Fuel Contribute to Anemia in Pregnant Women in Nagpur, India? A Cross-Sectional Study

Mentor Name(s) and Affiliations: Patricia L. Hibberd, MD, PhD, Division of Global Health, Massachusetts General Hospital for Children, Boston, MA, USA

Collaborators, with Affiliations: Archana Patel, MD, PhD, Lata Medical Research Foundation, Nagpur, Maharashtra, India

ABSTRACT

Title: Does smoke from biomass fuel contribute to anemia in pregnant women in Nagpur, India?
A cross-sectional study

Charlotte M. Page, Archana Patel, Patricia L. Hibberd

Background: Anemia affects upwards of 50% of pregnant women in developing countries and is associated with adverse outcomes for mother and child. We hypothesized that exposure to smoke from biomass fuel – which is widely used for household energy needs in resource-limited settings – could exacerbate anemia in pregnancy, possibly as a result of systemic inflammation.

Objective: To evaluate whether exposure to smoke from biomass fuel (wood, straw, crop residues, or dung) as opposed to clean fuel (electricity, liquefied petroleum gas, natural gas, or biogas) is an independent risk factor for anemia in pregnancy, classified by severity.

Methods: A secondary analysis was performed using data collected from a rural pregnancy cohort (N=12,782) in Nagpur, India in 2011-2013 as part of the NIH-funded Maternal and Newborn Health Registry Study. Multinomial logistic regression was used to estimate the effect of biomass fuel vs. clean fuel use on anemia in pregnancy, controlling for maternal age, body mass index, education level, exposure to household tobacco smoke, parity, trimester when hemoglobin was measured, and receipt of prenatal iron and folate supplements.

Results: The prevalence of any anemia (hemoglobin < 11 g/dl) was 93% in biomass fuel users and 88% in clean fuel users. Moderate-to-severe anemia (hemoglobin < 10 g/dl) occurred in 53% and 40% of the women, respectively. Multinomial logistic regression showed higher relative risks of mild anemia in pregnancy (hemoglobin 10-11 g/dl; RRR = 1.38, 95% CI = 1.19-1.61) and of moderate-to-severe anemia in pregnancy (RRR = 1.79, 95% CI = 1.53-2.09) in biomass fuel vs. clean fuel users, after adjusting for covariates.

Conclusion: In our study population, exposure to biomass smoke was associated with higher risks of mild and moderate-to-severe anemia in pregnancy, independent of covariates.

STUDENT ROLE

Design: My Harvard mentor, Dr. Hibberd, conceived the objective for the project, namely, to determine whether exposure to biomass smoke is an independent risk factor for anemia in pregnancy. Since the project was a secondary data analysis, the instruments for data collection were already established. Dr. Hibberd and I jointly decided how to define anemia (using WHO definitions) and how to classify fuels as biomass fuels or clean fuels. I performed a literature review on anemia in pregnancy, identifying reported risk factors, and then determined for which of these factors we had data.

Execution/analysis: As a secondary data analysis, the execution and analysis of the project were one and the same. I performed this stage of the project with support from Dr. Hibberd and our collaborator in India, Dr. Patel. I did so primarily while working at the Lata Medical Research Foundation, the organization in Nagpur, India that collects the data used for my project. I visited a number of health facilities around Nagpur where the data is collected, which gave me the opportunity to speak with nurses who record the data and physicians who oversee data collection. These visits gave me a better understanding of the data.

I performed the analysis using the statistical software STATA, which I taught myself to use as I went along. Much of my time analyzing the data was spent selecting the optimal statistical model. I did so by reading the literature, testing the various models with my data, and consulting with Dr. Hibberd and with statisticians from Nagpur and Harvard.

Writing: I prepared all the figures, tables, and text of the manuscript, and then Drs. Hibberd and Patel edited them. Dr. Hibberd selected *PLoS ONE* as the journal to which to submit our manuscript. I served as the corresponding author during the submission process. When the manuscript was returned for revisions, Dr. Hibberd advised me on what revisions to make and how to compose a rebuttal letter.

CITATION

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