



Indoor air pollution from solid fuels and risk of low birth weight and stillbirth



World Health
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Report from a symposium held at the
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Executive summary

Introduction

Around half of the world's population still relies on solid fuels for everyday energy needs, 2.4 billion on biomass (wood, animal dung, crop wastes) and 0.6 billion on coal. These fuels are typically used indoors or in partly enclosed cooking areas, burnt in poorly vented, inefficient stoves, and leading to very high levels of exposure to smoke which contains products of incomplete combustion. Most heavily exposed are women of child-bearing age and young children. Women usually continue with their domestic and cooking role throughout pregnancy, so the developing foetus is also indirectly exposed. Studies of urban air pollution and environmental tobacco smoke (ETS) have shown that several combustion pollutants – including carbon monoxide and small particles – are linked to adverse pregnancy outcomes; still births and low birth weight. These pollutants are also prominent in smoke from solid fuel used in developing country homes, so there is good reason to expect that this exposure may also impact on pregnancy outcomes in these settings. This report summarises the evidence linking such exposure to low birth weight (LBW) and stillbirth, as reviewed in a symposium held at ISEE 2005 in Johannesburg.

Methods

Representatives of research groups which have carried out recent studies of biomass smoke pollution and LBW and/or stillbirth in developing countries were invited to present their findings at the symposium. In addition, recent work on ambient air pollution and LBW from the state of California was also represented. Key issues for future studies were identified. Following the symposium, a preliminary literature review was conducted using PubMed: combining exposure and outcome terms yielded 190 studies, of which 44 were retained as relevant for review of abstracts. This, together with further contact with researchers in the field, provided only one new study which is included in this review. Data has been extracted, and quality assessed by one author (NB).

Results

(i) Low birth weight

Five studies are included: one cross-sectional survey, two cohort studies, one case-control study and one randomised controlled trial. Differences in exposure were expressed as biomass vs. clean fuel for four studies, and biomass in open fires vs. ventilated (chimney) stoves in one. The timing of birth weight measurement varied between

studies, and only two assessed gestational age. For *mean birth weight*, the range of differences for 'high' vs. 'low' exposure across four studies were from 59 to 175 gm lower weight with the higher exposure. All estimates were adjusted, and three were statistically significant. For % *LBW* (defined as <2,500 gm), one study reported an adjusted odds ratios (OR) for high exposure vs. low exposure of 1.74 (95% CI: 1.2, 2.5), one an unadjusted OR of 1.26 (0.77, 2.05), and another OR of 1.20 for term LBW ($p<0.05$) and 1.50 for pre-term LBW ($p<0.05$) but results from multivariate analysis were not reported and are presumed non-significant. There was no evidence of statistical heterogeneity among these estimates as all 95% confidence intervals overlap.

(ii) Stillbirth

Three studies are included, one case control, one cross-sectional survey, and one cohort. Two obtained information on stillbirths from health records and interviews, the other relied on recall at interview (1). For all three studies, differences in exposure were expressed as biomass vs. cleaner fuel. All adjusted for confounding, with odds ratios for high exposure vs. low exposure ranging from 1.44 to 1.90. All three estimates were statistically significant, and again there was no evidence of statistical heterogeneity among these estimates as all 95% confidence intervals overlap.

(iii) Ambient air pollution studies

A recent ambient (outdoor) pollution study carried out in California found an adjusted odds ratio of 1.26 (1.03, 1.50) for high vs. low $PM_{2.5}$ exposure during pregnancy, among singleton births of 40 weeks gestation. This exposure difference was associated with a mean difference in birth weight of -36 gm (95% CI: -16.5, -55.8). No independent effect of CO on birth weight was seen. $PM_{2.5}$ exposure was also associated with a small increase in the risk of pre-term birth (OR = 1.15, 95% CI: 1.07, 1.24), again with no independent effect of CO exposure.

Conclusion

This review has found consistent impacts of solid fuel smoke exposure on both LBW and stillbirth. Although the body of evidence is still relatively small, these findings are consistent with studies on exposure to outdoor air pollution and ETS. The ISEE symposium concluded that a modest number of additional, high quality studies of the adverse pregnancy outcomes are required, paying particular attention to assessment of exposure and gestational age. It was concluded that, if the risk estimates are confirmed by further studies, since high proportions of pregnant women are exposed to solid fuel

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