

# RISK FACTORS FOR ADVERSE BIRTH OUTCOMES: THE MACE PILOT

Asharam K<sup>1</sup>, Naidoo R<sup>1</sup>, Muttoo S<sup>1</sup>, Mason J<sup>2</sup>

<sup>1</sup>Discipline of Occupational and Environmental Health and School of Mathematics,

<sup>2</sup>Statistics and Computer Science, University of KwaZulu-Natal

**BACKGROUND:** Environmental exposures may be risk factors for adverse birth outcomes (ABO) affecting the health of the newborn.

**AIMS:** To describe risk factors among mothers with and without adverse birth outcomes in Mother and Child in the Environment (MACE) Birth cohort study with a focus on oxides of nitrogen (NO<sub>x</sub>).

**METHODS:** Pregnant females were selected from the public sector ante-natal clinics in the industrialised south Durban and North Durban areas (n=575). Women were selected in their first trimester, interviewed and followed-up and data on birth outcomes obtained. Exposure to NO<sub>x</sub> was characterized through passive sampling and land use regression models.

**RESULTS:** The mean NO<sub>x</sub> levels over the summer and winter seasons 11.2 µg/m<sup>3</sup> and 45.3 µg/m<sup>3</sup> respectively. Prevalence low birthweight was 18.30%, gestational age (<32weeks) 1.58%, and low apgar at 1 minute and 5 minute 1.9% and 1.39% respectively, with overall ABO, 22.96%. Of those with ABO, 3.48% were married, compared to 10.26% with normal outcomes (p=0.75). Outcomes did not vary significantly for HIV status, marital status or education. In a subset of 102 participants the predicted mean levels of NO<sub>x</sub> was 28.1 µg/m<sup>3</sup> (normal outcomes) and 30.2 µg/m<sup>3</sup> (ABO). Higher exposure to NO<sub>x</sub> resulted in an odds ratio of 2.4 (95% confidence interval: 0.2-35.3) for ABO, and a 2.2g loss in birthweight per µg/m<sup>3</sup> increase in exposure. Cigarette smoking, NO<sub>x</sub> exposure and positive HIV status showed a reduction in anthropometric assessments.

**CONCLUSION:** The findings of the subset analyzed provides modest support that NO<sub>x</sub> adversely influences birthweight. The study identified other non-obstetric, non-HIV risk factors for ABO. Analysis is underway for the remainder of the 473 participants.

## **TRANSFORMATION FOCUS IN A NUTSHELL**

Pregnancy and birth cohort studies provide one of the most powerful research methods for medical and social research. Data collected about the growth and development of children, from *in utero* through to early childhood can be used to determine which biological and environmental factors can be associated with the health and optimal development of the foetus, infant and child.

## **KEY COMPONENTS OF THE EVIDENCE BASED RESEARCH**

- This longitudinal birth cohort study aims to examine the effects of environmental influences on the health and development of a cohort of women attending ante-natal clinics in the South Durban Basin, compared to a cohort of women from the less industrially polluted community north of the city.
- Priority outcomes will be indicators of respiratory development, as well as adverse respiratory outcomes.
- Risk factors to be investigated will include ambient and indoor pollution, dietary impacts, particularly reduced intake of antioxidants, genetic polymorphisms, epigenetic changes and adverse birth outcomes.

## **BENEFITS TO ETHEKWINI MUNICIPALITY**

- The Mother and Child in the Environment (MACE) study has the advantage of repeated measures of specific environmental exposures, collection of biological specimens over time, and comprehensive clinical outcomes assessment.
- This will contribute to a wealth of information on specific environmental triggers and critical time windows of susceptibility.
- Additionally, an African population will, for the first time, be evaluated in a study of environmental epigenomics.
- This is also the first birth cohort in the Ethekekwini Municipality

## **EXPANDED SUMMARY**

Understanding the reasons behind the profile of this and other non-communicable childhood respiratory disorders allows for the development of appropriate interventions. A birth cohort with well defined health outcomes, measuring a multiple of factors at different stages of development, including biochemical, genetic, epigenetic and environmental factors can provide such an understanding. We have completed an pilot study, which investigated genetic and biochemical inflammatory markers among pregnant women (n=100), while assessing their exposure to key pollutants. This proof of concept study, although lacking power to address associations, suggested that those mothers exposed to industrial pollution have differential levels of biochemical inflammatory markers compared to those without such exposure.

The industrial basin in south Durban provides an opportunity to investigate these associations. The Durban south industrial basin (DSIB) is a complex mix of heavy industry and residential communities with high levels of community organisation, there has been a substantial focus by researchers, academics and the media on the prevalence of poor health outcomes as well as levels of ambient air pollution

(Matookane et al, 2002). These have included, both published and unpublished studies, a large number of media reports, community organisation reports and commissioned reports (governmental, corporate and non-governmental). Studies have been conducted looking at exposure-health outcomes relationships, as well as documenting the environmental pollution patterns in the Basin. Studies among the communities in this area suggest that children of school-going age are at a higher risk for asthma and other respiratory outcomes, when compared to children of similar age and socio-economic status from less polluted northern communities within the city (eThekweni Health, 2007; Kistnasamy and Knapp, 1992; Nriagu et al, 1999; Kistnasamy et al., 2008; Naidoo et al., 2012)

This longitudinal birth cohort study aims to examine the effects of environmental influences on the health and development of a cohort of women attending ante-natal clinics in the South Durban Basin, compared to a cohort of women from the less industrially polluted community north of the city. Priority outcomes will be indicators of respiratory development, as well as adverse respiratory outcomes. Risk factors to be investigated will include ambient and indoor pollution, dietary impacts, particularly reduced intake of antioxidants, genetic polymorphisms, epigenetic changes and adverse birth outcomes. Additionally, the proposed investigation will address the hypothesis that asthma risk may be influenced by environmentally induced epigenetic changes. This is cutting edge research which is gaining momentum in the USA and UK, but still in its infancy in Africa. We will determine if factors, such as environmental pollution, nutrition and genetic polymorphisms may interact to result in adverse outcomes such as low birth weight, intra-uterine growth retardation and premature births, in a population of pregnant females from communities with high levels of industrial environmental pollution, compared to pregnant females without such exposures, but with similar socio-economic status.

