

Traffic-related air pollution and birth weight: the roles of noise, placental function, green space, physical activity, and socioeconomic status (FRONTIER)



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BACKGROUND

Available evidence has associated air pollution to impaired fetal growth; however, there are still substantial limitations in terms of the methods applied to assess exposure to air pollution, disentangling the role of co-exposures such as noise, and evaluating the modifiers, mediators, and mitigators of this association.

AIMS

FRONTIER aims to provide a robust and comprehensive evaluation of the impact of maternal exposure to traffic-related air pollution on fetal growth (Figure 1). Towards this aim, it will (i) disentangle the effects of noise; (ii) identify the relevant window(s) of exposure; (iii) evaluate its modification by socioeconomic status, stress, and physical activity; (iv) elucidate the role of placental function as an underlying mechanism; and (v) explore the potential of green spaces to mitigate it.

METHODS

WP1. Establishing the pregnancy cohort

The aim of this WP is to

- establish a new pregnancy cohort of 1000 pregnant women residing in Barcelona,
- characterize fetal growth by anthropometric measures at birth together with ultrasound-based trajectories of fetal development;
- characterize placental function applying Doppler ultrasound indicators; and
- obtaining covariate data

WP2. Lifestyle characterization

This WP aims at characterizing maternal time-activity patterns (by smartphones and personal physical activity monitors) and stress (by hair cortisol levels) during pregnancy.

WP3. Assessment of exposure to air pollution

We will assess exposure to NO₂, PM_{2.5}, PM_{2.5} light absorption, and PM_{2.5} Cu, Fe, and Zn. We will integrate objective data on time-activity patterns (WP2) with a hybrid modeling framework combining dispersion models (DM) and land use regression (LUR) models and campaigns of personal and home-outdoor air pollution monitoring to estimate exposure level and inhaled dose at the main microenvironments (i.e. home, workplace, and the commuting route between these two) for each study participant during each week of her pregnancy.

WP4. Characterization of noise exposure

The aim of this WP is to (i) measure ambient noise levels at home of each participant, (ii) estimate ambient noise levels at home, workplace, and commuting route, and (iii) characterize noise annoyance, sensitivity, and protections against noise.

WP5. Characterization of greenness/canopy

This WP aims to provide a detailed characterization of (i) greenness and (ii) tree canopy cover surrounding home address of each study participant and its nearest major road.

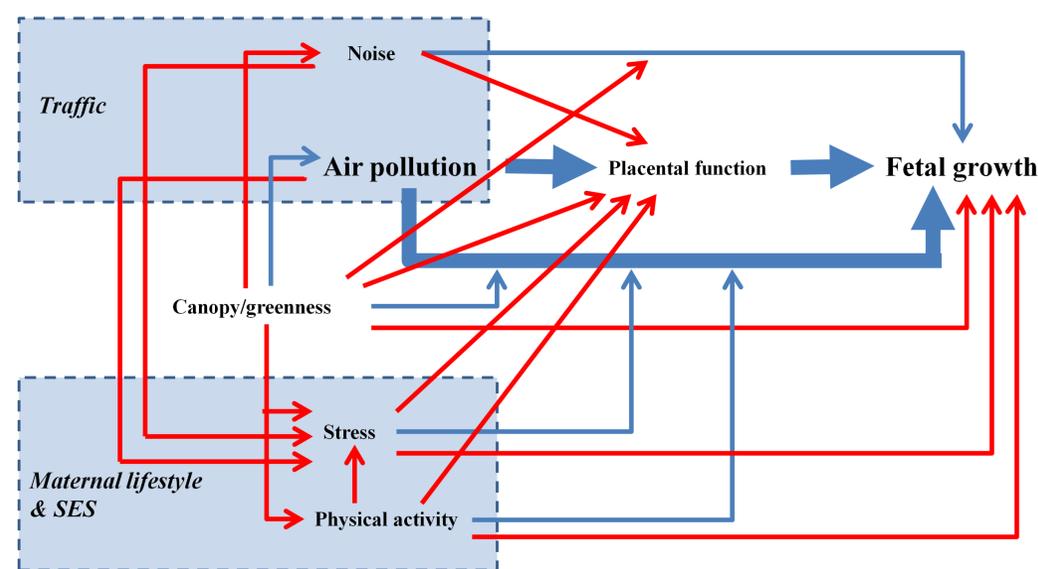
WP6. Statistical analyses

This WP aim to conduct analyses of different aspects of FRONTIER as described in Figure 1.

WP7. Management and Dissemination

This WP aims to coordinate, manage, and monitor all aspects of FRONTIER project while maximizing the integration of other WPs and disseminating the project findings.

Figure 1. Schematic representation of main (blue) and secondary (red) analyses.



Progress made

Between the last week of October 2018 and mid-January 2019 we accomplished the pilot phase of the recruitment and follow-up of participants. Since mid-January, we have started the formal recruitment and data collection phases. As of the second week of March, we have:

- enrolled and conducted first trimester data collection and home visits for 177 participants
- conducted third trimester data collection for 9 and home visits for 6 participants