**LEICESTER LIFESTYLE AND HEALTH RESEARCH GROUP**

**The role of 24-hour behaviours and environmental exposures in optimising outcomes of diabetes in pregnancy.**

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**Section 2 – *Project Information***

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| **Project Title** | **The role of 24-hour behaviours and environmental exposures in optimising outcomes of diabetes in pregnancy.** |
| **Project Summary**  |
| Diabetes in pregnancy affects 20 million women/year internationally and is associated with suboptimal maternal and neonatal outcomes, which are more common in women from under-represented groups. Interventions to improve outcomes are urgently needed but it is unclear whether targeting population-level exposures (environment) or individual exposures (24-hour behaviours) is most likely to be effective. In non-pregnant adults with diabetes, lifestyle modifications influencing 24-hour behaviours such as sleep, sitting, stepping, sweating, and strengthening result in improved glycaemia and clinical outcomes, but this has not been assessed in pregnancy. *Aim:* To assess the relationship between environmental exposures, 24-hour behaviours and outcomes in pregnant women with diabetes*Objectives*:1: To assess the effect of environmental factors upon outcomes in pregnancy in women with and without diabetes. 2: To assess 24-hour behaviours in women with type 1 and type 2 diabetes in pregnancy using wearable technologies, and how these behaviours differ by environmental factors, gestation, socioeconomic status and ethnicity. 3: To investigate the ideal 24-hour behaviour profile to optimise glycaemia and/or clinical outcomes in women with diabetes in pregnancy. *Data sources:*Data from the “Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries across the UK” (MBRRACE-UK) dataset will be used to assess population-level associations between environment and outcomes (objective 1), which can be assessed in more detail (objectives 2-3) using 24-hour behaviour data from a new observational study, Diabetes in pregnancy Optimising Maternal and Infant Outcomes (DOMINO). Data will be collected on habitual diet and meal timing, physical activity, sedentary time and sleep (accelerometry), medications and glycaemia (continuous glucose monitoring). *Methods*: The student will use cutting-edge statistical models that account for the complexities inherent in within-day modelling. Distributed lag non-linear models (DLNMs) account for multiple lagged exposures (e.g. temperature, previous 7 days). The student will use a new extension to DLNMs, recently developed at Leicester, to estimate within-day effects from daily disease counts. Subsequently, DLNMs and machine learning methods will be used to analyse multiresolution data on physical activity, sedentary time and sleep (accelerometry), environmental exposures, medications and glycaemia (continuous glucose monitoring).*Expected outcomes and impact:* This PhD programme will provide a comprehensive understanding of the role of 24-hour behaviours (such as sleep, sitting, stepping, sweating) in the context of diabetes in pregnancy and how these are influenced by individual and environmental factors. This work has broader implications for both maternal and child health, potentially addressing inequalities and shaping future clinical guidelines. ​**Project Highlights:**

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| 1.  | This studentship will provide comprehensive and novel data on the role of 24-hour behaviours in the management of diabetes in pregnancy, embedded in a large multicentre observational study of 800 women with type 1 or type 2 diabetes in pregnancy (DOMINO).  |
| 2.  | This studentship will collect quantitative data on the effect of ethnicity and socioeconomic deprivation upon 24-hour behaviours, potentially providing new opportunities to improve outcomes in women from under-represented groups.  |
| 3.  | Work with experts in environmental and maternal epidemiology to develop novel statistical models to account for complexities in epidemiological and environmental data. |

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| **References** |
| Murphy HR, Howgate C, O'Keefe J, Myers J, Morgan M, Coleman MA, et al. Characteristics and outcomes of pregnant women with type 1 or type 2 diabetes: a 5-year national population-based cohort study. Lancet Diabetes Endocrinol. 2021;9(3):153-64. Feig DS, Donovan LE, Corcoy R, Murphy KE, Amiel SA, Hunt KF, et al. Continuous glucose monitoring in pregnant women with type 1 diabetes (CONCEPTT): a multicentre international randomised controlled trial. Lancet. 2017;390(10110):2347-59.Misra S, Ke C, Srinivasan S, Goyal A, Nyriyenda MJ, Florez JC, et al. Current insights and emerging trends in early-onset type 2 diabetes. Lancet Diabetes Endocrinol. 2023;11(10):768-82.Sattar N, Rawshani A, Franzén S, Svensson AM, Rosengren A, McGuire DK, et al. Age at Diagnosis of Type 2 Diabetes Mellitus and Associations With Cardiovascular and Mortality Risks. Circulation. 2019;139(19):2228-37.Covenant A, Yates T, Rowlands AV, Dempsey PC, Edwardson CL, Hall AP, Davies MJ, Henson J. Replacing sedentary time with sleep and physical activity: associations with physical function and wellbeing in Type 2 diabetes. Diabetes Res Clin Pract. 2024 Oct 5;217:111886. doi: 10.1016/j.diabres.2024.111886. Epub ahead of print. PMID: 39369857.Henson J, Covenant A, Hall AP, Herring L, Rowlands AV, Yates T, Davies MJ. Waking Up to the Importance of Sleep in Type 2 Diabetes Management: A Narrative Review. Diabetes Care. 2024 Mar 1;47(3):331-343. doi: 10.2337/dci23-0037. PMID: 38394635.Gasparrini A. Distributed Lag Linear and Non-Linear Models in R: The Package dlnm. J Stat Softw. 2011 Jul;43(8):1-20. PMID: 22003319. |