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## **The way ahead: where next for research into obesogenic environments?**

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The SPOTLIGHT project was a collaboration across thirteen partners from eight countries over four years. The overall aim of the project was to investigate individual and contextual determinants of obesity, and identify effective approaches to obesity prevention that target these determinants at multiple levels <sup>1</sup>. The project included five research-based work packages, one of which, the focus of this supplement, investigated relations between social and physical environmental factors associated with obesity-related behaviours and weight status.

The project generated significant learning on interpreting associations between environment and behaviour, and for understanding the complexity of studying determinants of adult obesity. Moreover, the European context provided a valuable added dimension as a result of both the differences between the countries in which the research took place, and their similarities. The systematic reviews on the built <sup>2</sup> and social environment <sup>3</sup> demonstrated the heterogeneity within the existing literature. A systematic review of virtual audit tools demonstrated the feasibility and reliability of using this novel approach for assessing the built environment <sup>4</sup>. Building on the learning from the systematic reviews we developed and validated a protocol for assessing obesity-related characteristics of the built environment using Google Street View <sup>5</sup>. Combined with a neighbourhood survey across 60 urban areas in five European study countries, we gathered a wealth of data on neighbourhood environments, neighbourhood perceptions, obesity-related behaviours and health outcomes. The SPOTLIGHT study has thus provided a range of insights, from the different ways in which people perceive the boundaries of their residential neighbourhoods, to improved understanding of the relations between social capital, diet, physical activity, sedentary behaviour, and perceptions of the environment. The project also allowed for methodological developments such as the use of multiple factor and hierarchical clustering analyses to identify neighbourhood patterns, and comparison of methodological approaches for analysing social capital at neighbourhood level.

However, it was challenging not only to construct a survey instrument that would reliably measure all the different factors we were interested in, but also

to ensure that the instrument would be applicable across the different contexts found in five European countries. Despite putting a great deal of effort into constructing a questionnaire that was easy to understand and available both online and in hard copy, and sending carefully targeted invitations and multiple reminders, our overall response rate remained low (around 10% overall). This is a common and growing problem for population level surveys; a large, well-designed longitudinal study in the UK that had aimed to recruit 60,000 women was recently cancelled after only 249 people signed up in the first six months <sup>6</sup>.

Perhaps the greatest learning from the project came from the ways in which we grappled with the challenges of making sense of the complex set of relations that link the environments where people live with the ways in which they respond to those environments. Our home neighbourhoods, along with the places where we work, study, shop, travel and spend the rest of our time have complex influences on our behaviour, with multiple factors acting in different ways, on different people, in different contexts. These factors only rarely follow a simple linear causal chain in which a single determinant is directly associated with a single outcome.

The UK Foresight project characterised obesity as an output from a complex adaptive system <sup>7</sup>, and there is growing recognition of the need to consider the multifactorial complexity of the influences upon our dietary and physical activity behaviours <sup>8</sup>. A greater appreciation of systems theory, and the use of system models, can help to overcome some of the challenges of this type of research <sup>9</sup>. However, we may not be able fully to elucidate the complex processes determining obesity using epidemiological study designs such as large population based studies or natural experiments, or using standard measurement tools such as self-report questionnaires, so while they have to suffice for now, in due course we will also have to develop new methodological approaches, including those based on our increasing digital connectedness <sup>10</sup>.

New tools and methods should help provide a better understanding of how, why, where and when obesity thrives, and how we can most effectively support the development of policy and practice to respond to these factors. These novel approaches will need to take account of physical, political, economic and socio-cultural environments <sup>11</sup>, and the ways in which they interact within a complex system, and translate this learning into improvements in health and equity across society to meet the challenge of obesity.

### **Conflicts of interest: none**

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