Popular science summary of the PhD thesis

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Title of the PhD thesis	Mobility traces for epidemiological modeling
PhD school/Department	DTU Compute

Science summary

The spread of infectious diseases and the health risks posed by pollution exposure are deeply shaped by how people move and interact. Yet, for many years, epidemiological research relied mainly on static residential information rather than on how people actually move through space and time in their daily lives.

The widespread use of mobile phones has transformed this landscape.
Digital mobility traces now provide large-scale data on human movement and social mixing, offering new possibilities to improve epidemic forecasting and environmental risk assessment. However, despite their rapid adoption, especially during the COVID-19 pandemic, important questions remain: How informative are these data? When do they truly improve predictions? And what biases do they introduce?

This thesis systematically evaluates both the strengths and the limitations of mobile-phone mobility traces in epidemiology. First, it examines how widely used mobility indicators relate to epidemic dynamics, showing that their predictive value is limited and depends on different factors such as spatial resolution, and time period. Second, it investigates how missing data in individual mobility trajectories can influence epidemic analyses, highlighting that data gaps may systematically affect estimates of disease spread and require careful methodological handling. Finally, it assesses the role of mobility in environmental risk evaluation, showing that approaches based solely on residential location can misrepresent pollution exposure, while mobility-informed estimates provide a more dynamic picture of exposure patterns and potential inequalities.

Together, these findings provide a more principled foundation for using mobility data in public health research. By clarifying both their informational value and their inherent biases, this work supports more robust, transparent, and responsible use of digital mobility traces in epidemiological modeling and environmental risk assessment.

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