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mobiCard
Mobility, related pollutions, and Cardiovascular health

Innovative epidemiological design based on wearable microsensors to monitor mobility and related environmental exposures to better assess cardiovascular risks

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Context

Cardiovascular diseases mainly include ischemic heart disease, stroke, high blood pressure, and heart failure. These diseases constitute, with around 19 million deaths per year, the leading cause of death in the world. The main controllable risk factors include smoking, lack of physical activity, and air pollution, the last two factors being directly linked to mobility. For instance, we contribute reduction of air quality by taking the car while we practice physical activity by bicycle. Noise and temperature can also be linked to mobility and cardiovascular health.
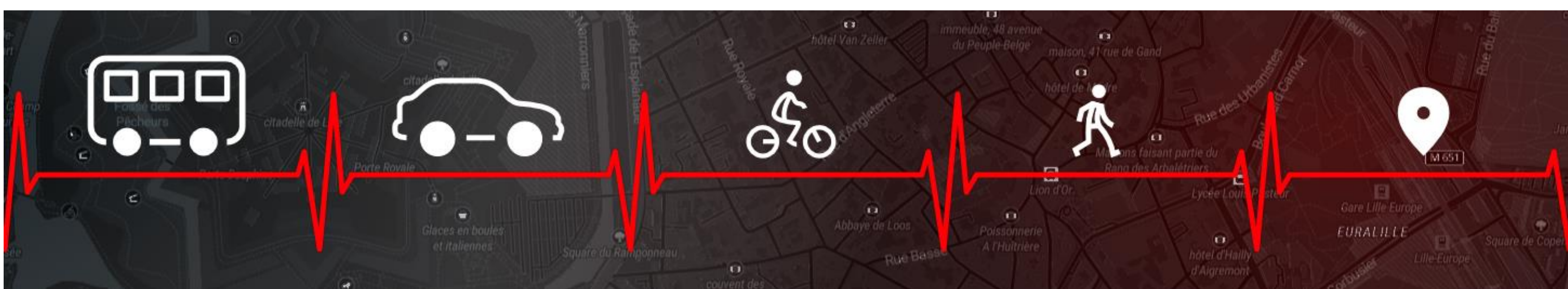
By mobility we mean the trips we make to go to work, do our shopping, reach our places of leisure... as well as the modes of transport we use: car, metro, walking, cycling... Our mobility has a high impact on our environmental exposure levels, and thus on our cardiovascular health. However, characterizing the interactions between various mobility-related exposures and their relationships with cardiovascular clinical parameters requires better understanding.

Objectives

The MobiCard research project aims to better investigate the relationships between mobility-related exposures and cardiovascular clinical parameters, also considering underlying pathways.
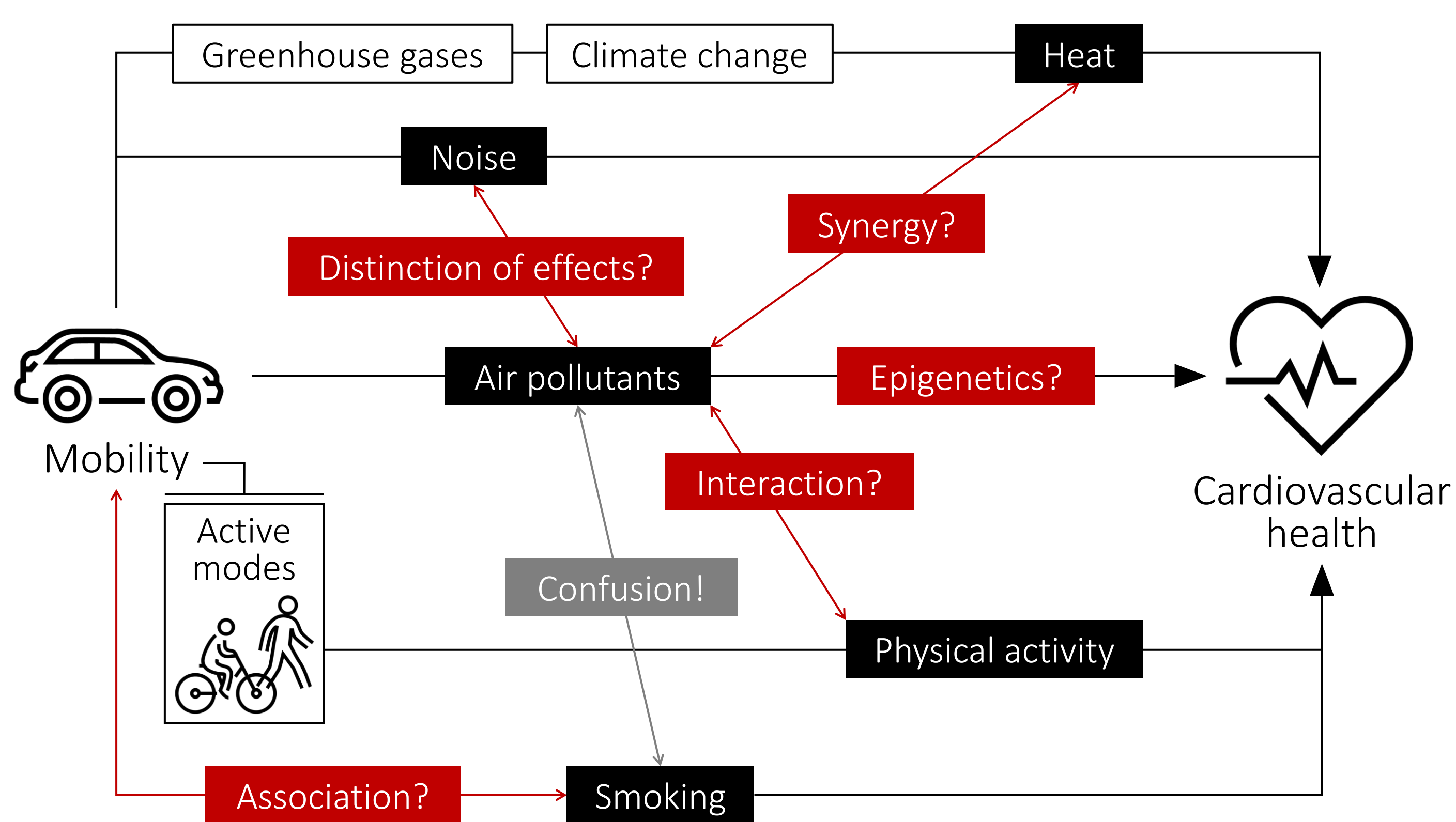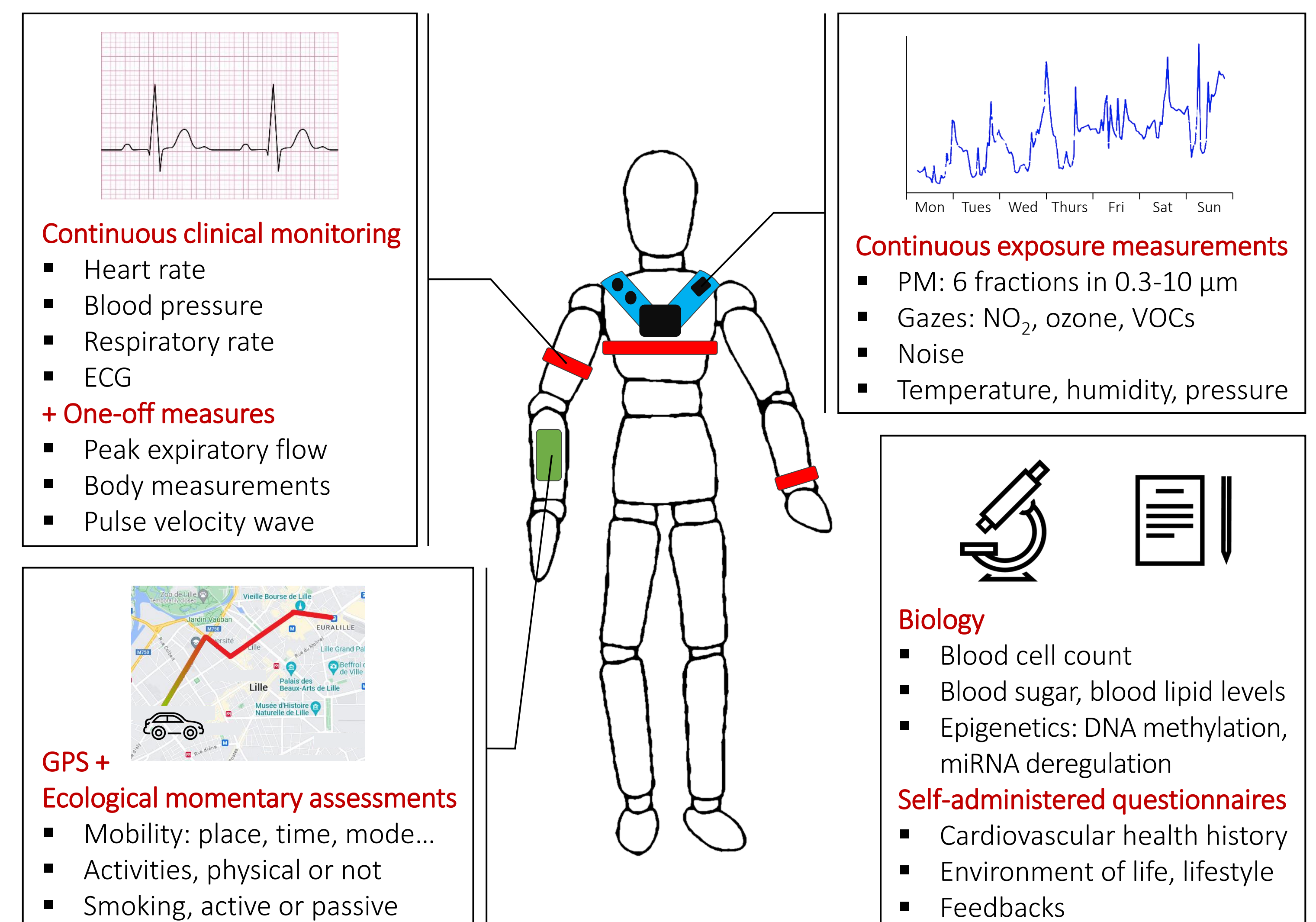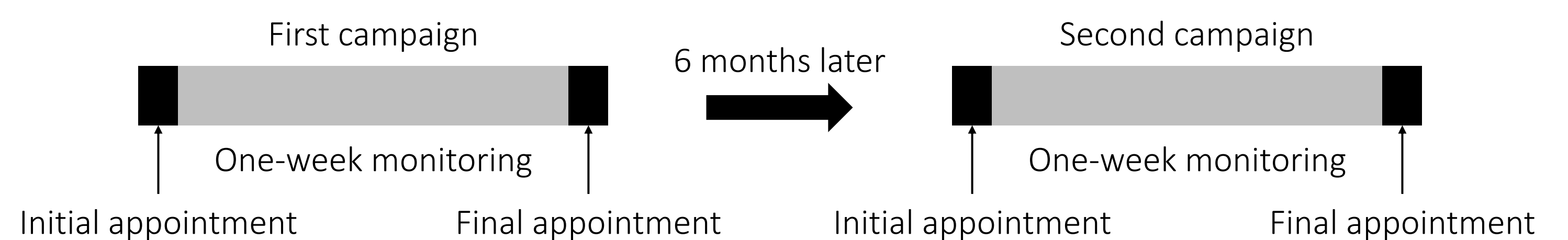
More specifically, MobiCard aims to:
- Study how mobility influences exposure levels to air pollutants (PM, NO_2, ozone, VOCs), noise, real and felt heat, physical activity and active and passive smoking.
- Study the associations of short-term and long-term exposures to these factors with clinical parameters such as heart rate, blood pressure, peak expiratory flow, and ECG.
- Study the interactions between exposures, and therefore the potential for modifying effects of the relationships with cardiovascular parameters.
- Investigate potential underlying mechanisms such as variations in epigenetics.

Methods

The originality of the MobiCard project, and also its greatest strength, is to propose individual, continuous and simultaneous measurements of mobility, related exposures, and clinical parameters.

MobiCard is an observational monocentric population-based prospective cohort study, carried out within the Lille conurbation (France) and designed to allow the recruitment of 400 participants in 2 years. The inclusion criteria are: to be of legal age (18+), to be a resident of the Lille conurbation, and to have a good command of French (native or C1/C2).

Continuous clinical monitoring
- Heart rate
- Blood pressure
- Respiratory rate
- ECG

+ One-off measures
- Peak expiratory flow
- Body measurements
- Pulse velocity wave

Continuous exposure measurements
- PM: 6 fractions in 0.3-10 µm
- Gazes: NO_2, ozone, VOCs
- Noise
- Temperature, humidity, pressure

GPS +
Ecological momentary assessments
- Mobility: place, time, mode...
- Activities, physical or not
- Smoking, active or passive

Biology
- Blood cell count
- Blood sugar, blood lipid levels
- Epigenetics: DNA methylation, miRNA deregulation

Self-administered questionnaires
- Cardiovascular health history
- Environment of life, lifestyle
- Feedbacks

Each participant will be offered a one-week monitoring with wearable microsensors and connected devices. Two appointments, at the start and at the end of the follow-up, are planned at the Lille University Hospital. The initial appointment will allow to equip the participant and to collect written consent while the final one will be organized to get back all the equipment and the volunteer's feedback as well as to perform anthropometric measurements and blood and urine collection. A similar monitoring campaign will be carried out 6 months later to assess the risks related to long-term exposure.

Expected Results

MobiCard should clarify the relationships between variations over time in mobility-related exposure levels and cardiovascular clinical parameters and provide a better understanding of how mobility modalities can modify these associations.

Timeline

01.01.2023 — Design + Funding + Ethics
01.01.2025 — Monitoring (first campaign)
01.01.2027 — Statistical analysis
01.07.2025 — Monitoring (second campaign)
01.07.2027