1. The disease burden of injuries in Belgium
The impact of injuries on population health is underestimated because comprehensive overviews of the entire severity spectrum of injuries are scarce. According to the Global Burden of Disease study, Injuries are considered to be responsible for about 10% of the total health losses in Belgium. Major categories include falls, road injuries, and self-harm. The injury surveillance pyramid in Belgium consists of general practitioner visits, emergency department visits, hospital discharges, and deaths. A complication of developing disease models for injuries, is that a mapping needs to be made of cause-of-injury (e.g., car accident) and nature-of-injury (e.g., femur fracture). The aim of this thesis will be to explore available information on injuries in Belgium, along the injury surveillance pyramid. Injury Disability-Adjusted Life Years will be quantified by combining years of life lost from mortality and years lived with disability, estimated through injury-specific disease models. The methods will build on the work done within the context of the Global Burden of Disease study.

2. Comparative risk assessment of hypertension in Belgium
Hypertension is associated with several cardiovascular diseases, leading to significant health losses in the Belgian population. In 2018, Sciensano conducted a health examination survey in which the blood pressure of 1000 individuals was measured. So far, however, this information has not yet been translated into population attributable fractions, allowing the calculation of hypertension attributable disease burden. Nonetheless, information on the disease burden of hypertension in Belgium would be of significant value to policy-makers. The aims of this thesis would therefore be to 1) calculate population attributable fractions for hypertension associated disease incidence and mortality, based on the Health Examination Survey; 2) calculate hypertension attributable disease burden by combining the results from the first objective with disease data; and 3) quantify the health impact of plausible mitigation scenarios.

3. Comparative risk assessment of air pollution in Belgium
Air pollution is associated with several chronic diseases, leading to significant health losses in the Belgian population. Data on modelled air quality in Belgium for multiple pollutants are available from the RIO-IFDM model. In addition, in the context of the Belgian Health Examination Survey, black carbon has been measured in urine samples, as a biomarker for individual exposure to air pollutants. To date, however, these data have not been used to quantify the disease burden of air pollution, even though such information would be of significant value to policy-makers. The aims of this thesis would therefore be to 1) calculate population attributable fractions for air pollution associated disease incidence and mortality, by integrating exposure data with relative risk functions; 2) calculate air pollution attributable disease burden by combining the results from the first objective with disease data; and 3) quantify the health impact of plausible mitigation scenarios.
4. Causes of death in Belgium, 2020-2050
Effective health policy planning requires information on the health status of the population. While information on the past and current health status is easier to obtain, information on future health trends are more relevant for policy makers. In recent years, there has therefore been an increased interest in the development of trend analyses and forecasting. These methods allow extrapolating current trends into the future, providing insights in how the future health status would look like if the current situation would be maintained. They also provide a basis for exploring alternative future scenarios, simulating the effects of possible changes in risk factors or the introduction of clinical innovations. To date, however, the application of such models to support health policy in Belgium has been limited. The aims of this thesis would therefore be to 1) explore the methods currently used in epidemiology for trend analyses and forecasting; 2) develop a framework for projecting causes of death in Belgium; and 3) apply the framework to project causes of death in Belgium over the period 2020-2050.

5. Trends and impacts of obesity in Belgium, 2020-2050: an agent-based microsimulation model
Excess weight status is one of the primary metabolic risk factors for non-communicable diseases. In Belgium, as in many high-income countries, average BMI has continuously increased over the past decades among both children and adults. Despite the increasing attention at the international level, there is currently no national nutrition and physical activity health plan in Belgium. More than ever, the further development and implementation of evidence-based health policies for the prevention of excessive weight gain therefore requires proactive policy support. While information on the past and current levels of excess weight status are easier to obtain, information on future trends are more relevant for policy makers. In recent years, there has therefore been an increased interest in the development of trend analyses and forecasting. These methods allow extrapolating current trends into the future, providing insights in how the future health status would look like if the current situation would be maintained. They also provide a basis for exploring alternative future scenarios, simulating the effects of possible prevention measures. To date, however, such models have not yet been applied to support health policy in Belgium. The aims of this thesis would therefore be to 1) explore the methods currently used in epidemiology for trend analyses and forecasting; 2) develop an agent-based microsimulation framework for projecting trends and impacts of excess weight status in Belgium; and 3) apply the framework to project trends and impacts of excess weight status in Belgium over the period 2020-2050.
6. Spatial distribution of smoking attributable mortality in Belgium
Tobacco use is associated with several non-communicable diseases, leading to significant health losses in
the Belgian population. Since 1997, the Belgian Health Interview Surveys regularly collect data on
tobacco use in Belgium. Recently, this information has been translated into population attributable
fractions, allowing the calculation of tobacco attributable deaths. In a next step, we want to explore the
spatial distribution of smoking attributable mortality in Belgium. This information would be of significant
value for local health policy-making. The aims of this thesis would therefore be to 1) extrapolate HIS
smoking data to municipality level; 2) obtain cause-of-death statistics at municipality level; and 3)
calculate smoking attributable mortality at municipality level by combining the results from the first
two objectives.

7. Empirical evaluation of the impact of multimorbidity on health-related
quality of life
Health-related quality of life (HRQOL) as measured by the EQ-5D questionnaire is an important
component in disease burden assessments and health economic evaluations. However, when taking a
disease perspective, HRQOL measurement may be complicated by multimorbidity. Different models,
including the additive, maximum and multiplicative model, have been proposed to combine disease-
specific HRQOL measurements into a multimorbid HRQOL estimate; however, empirical validation of
these models so far remains lacking. The aim of this thesis would therefore be to 1) describe
multimorbidity in the Health Interview Survey, and 2) compare the observed HRQOL for multimorbid
health states with theoretical HRQOL estimates obtained using the additive, maximum, and
multiplicative model.