Authors: A.H.P. Luijben, J. Hoekstra, A. Ruijsbroek
Contact: Guus.Luijben@rivm.nl

National Institute for Public Health and the Environment
Ministry of Health, Welfare and Sport

Towards modeling health effects of urban densification

Summary

The premise is that densifying a municipality will affect the health of its residents. To investigate how the future health of residents depends on the policy choices made when densifying, a system dynamics model was developed.

A pilot version of the model was developed in interaction with experts in the fields of health, environment and spatial planning. Using three scenarios of densification of a sub-district of a municipality, the change in the health of residents was examined.

Conclusion of the project was that system dynamics modeling contributes to the understanding of the dynamics of densification and the possibilities to influence the effects on health. Possible additions to the model were identified. Additional interaction with stakeholders and experts will be needed to improve the understanding of specific health effects of densification.

Introduction

The aim of this project is to develop a method to answer a municipality's complex question: how to make informed choices about city densification in a way that mental health of residents will not be damaged or even will be improved.

Problem Statement

- In the next 10 years many new houses will be built in the Dutch sub-district we study.
- It is expected that the construction of many new houses will lead to densification: more people will live in this sub-district.
- Densification will change the living environment of the inhabitants of the sub-district.
- The living environment can impact the mental health of resident both positively and negatively via the exposure to environmental factors.
- We do not yet know exactly how the mechanisms work in urban densification, since it probably sets different mechanisms in motion that may interact with one another.

Reference mode
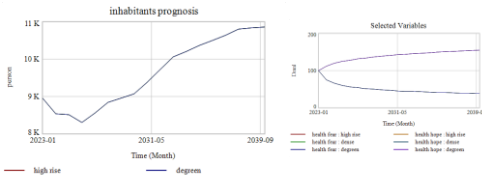
Figure 1: : Prognosis of the number of inhabitants, by year.

Figure 2: : feared and wished change in future population health, by year.

Methods

- GMB workshops -> CLDs
  - Environment and planning experts
  - Public health experts
- Municipality spatial planning experts
- Simulation model
  - Vensim
- Parameter values and scenarios
  - Literature
  - Experts
  - Access database (ODBC connection)

Three scenarios

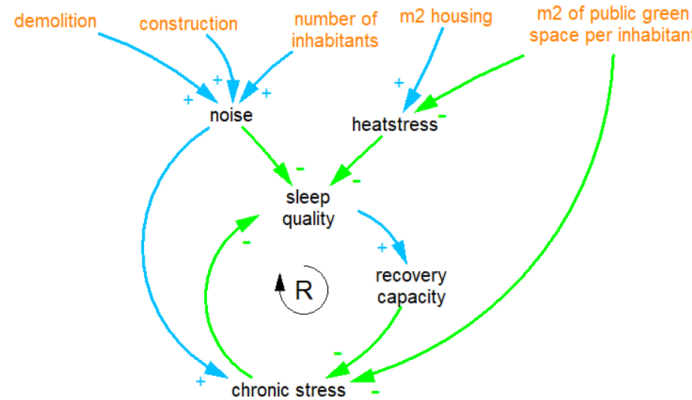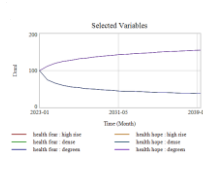|	
Degreen:	50% more houses, instead of public green space
Dense:	Demolish large houses; replace with smaller houses
High rise:	Build higher

Model

Figure 3: simplified CLD based on the CLD created with groups of experts on health and environment

Figure 4: Simplified version of the model, variables that are modeled as stocks in the simulation model are indicated by a box.

Results

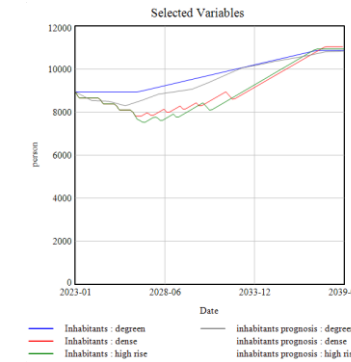

Figure 5: The number of inhabitants over time, according to three scenarios and the prognosis
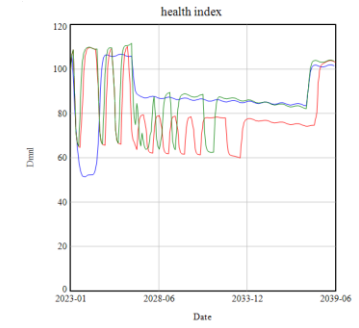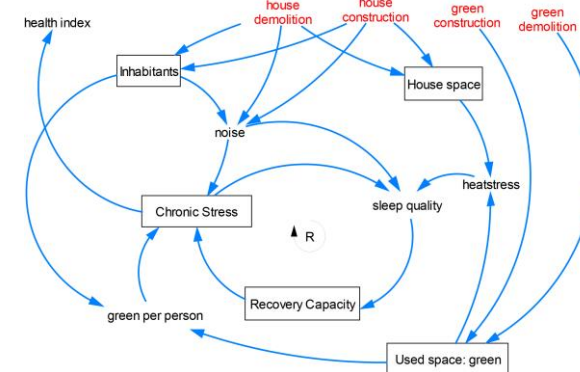

Figure 6: Health index over time, in three scenarios

Disussion

To match the information used in making policy choices, we based the model on the municipality's classification of space use. In retrospect, this made the model very detailed and made studying its behavior difficult.

In a subsequent iteration, simplification of the model is needed on the one hand, and, on the other hand, expansion with additional factors (such as social cohesion, for example), and more precise modeling of the health part is desirable.

Conclusions

We have demonstrated that it is possible to develop a system dynamics model that can inform policy choices.

System dynamics modeling contributes to the understanding of the dynamics of densification and the possibilities to influence the effects on health.

Possible additions to the model were identified. Additional interaction with stakeholders and experts will be needed to improve the understanding of specific health effects of densification.