



Epidemiological models - macro level model

Modelling and Simulation

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1 Introduction

The first aim is to determine the possibilities for determining the value of the effectiveness of various restrictive measures taken by the government of the Czech Republic for the period from September 1, 2020 till the last day of the project - December 7, 2020.

The second aim is to create a predictive model for determining the number of persons who have illness in the same time, persons who have been ill or otherwise have immunity (in the model, we proceed from the assumption that immunity is stable and guarantees the absence of recurrent disease for the duration of this study)

Used model contains different scenarios of quarantine precautions (using different types of lockdown). Based on simulations of this scenarios, influence of particular scenario is shown. As an experiment, theoretical scenarios from the article and current lockdown type in Czech Republic are analyzed.

1.1 Contributors

This project is solved by team of two students: Abramov Mikhail and Pavel Yadlouski.

1.2 Model validation

Results of theoretical scenarios simulation are compared with reference results from the article. The article by itself was subjected to critical analysis and minor formulas adjustments. Experiment with lockdown type in Czech Republic is compared with reality:)

2 Topic analysis

The necessary information to research this topic was found in scientific articles.

The base for a lot methods is SIR model. SIR¹ model is one of the simplest compartment methods. This method compares and three values:

1. **S** – the number of susceptible individuals
2. **I** – the number of infectious individuals.
3. **R** – the number of removed (and immune) or deceased individuals

¹https://en.wikipedia.org/wiki/Compartmental_models_in_epidemiology

2.1 Approaches

For more complex view of system behavior, our model extends basic SIR model with separating the number of recovered and deceased individuals into two variables and addition of auxiliary and state variables that represent hospital capacity, contacts, contacts with infected. As a result, there is a model of 4 stock variables. **[[TODO JUST DO IT]]**

2.2 Sources

Article with the mathematical model [1] for implementation is found in VUT online library ²

3 Concept model

4 Experiment

[[TODO Misha napishy suda]]

5 Conclusion

[[TODO Co se naucili]]

[[TODO Doporuceni]]

[[TODO Experiment with other country]]

²<https://www-sciencedirect-com.ezproxy.lib.vutbr.cz>

References

- [1] D. Ibarra-Vega. Lockdown, one, two, none, or smart. modeling containing covid-19 infection. a conceptual model. *Science of The Total Environment*, 730:138917, 2020.