MODELLING AND CONTROL OF COVID-19 IN A BANK ENVIRONMENT

HU-MATHS-IN
Hungarian Service Network for Mathematics in Industry and Innovations

CHALLENGES

Health, demographic change and well-being

The Industrial Problem

Modeling epidemics hazard (COVID-19) in the workplace environment of OTP. Analyzing the effect of in-company policies and proposing a COVID-19 management strategy via understanding key features of the connectivity network of employees.

RISK MANAGEMENT AND HEALTHCARE

Research group

SZTE & ÓE Epidemiological Modeling Group

Epidemiological consulting and modeling, data analysis service to industrial partners.

Company

OTP Bank Risk Management

otpbank

Largest commercial bank in Hungary with over 25% market share.

SZÉCHENYI 2020
MAGYARORSZÁG KORMÁNYA
Európai Unió
Európai Strukturális és Beruházási Alapok
BEFEKTETÉS A JÖVŐBE

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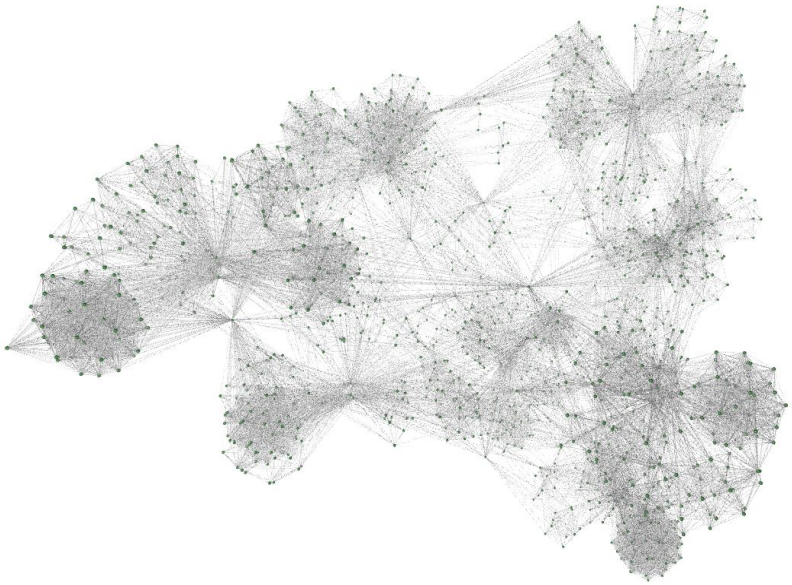
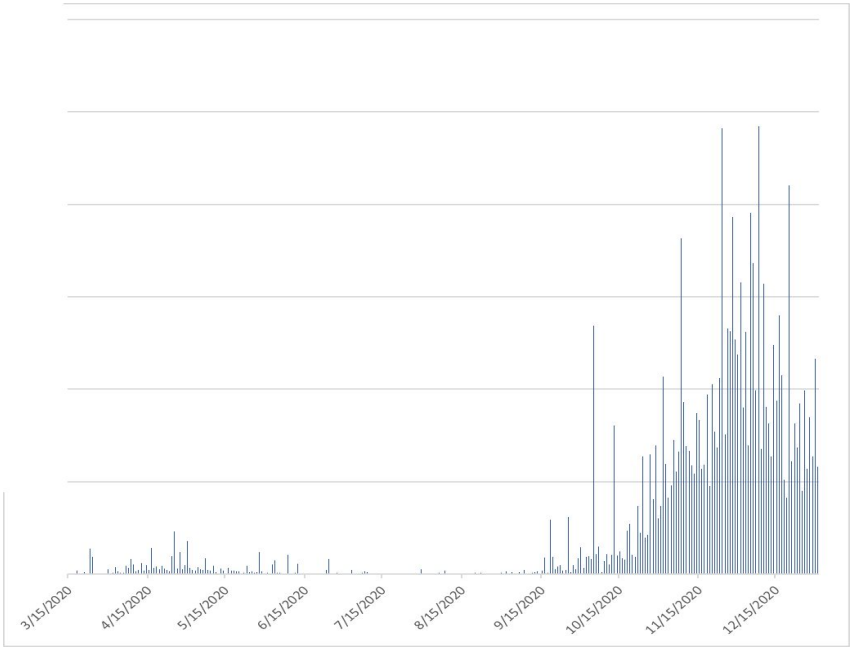
Challenges & Goals

- To assess the external force of infection
- To carry out large-scale stochastic modeling of disease transmission
- To evaluate the efficacy of interventions in transmission mitigation
- To identify the central nodes in a network with respect to disease spread





Large-scale connection network | External force of infection

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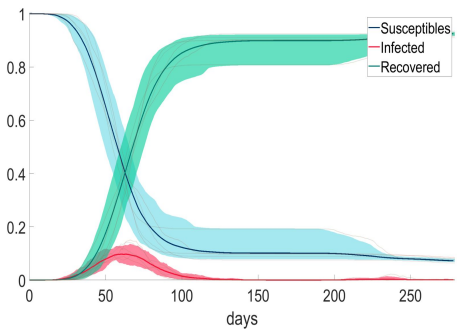
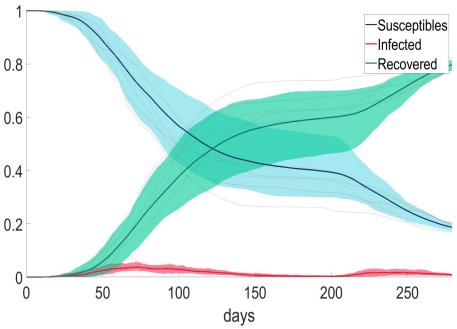
Mathematical and computational methods and techniques applied

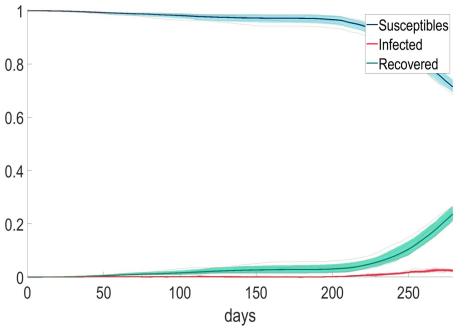
- The environmental risk of COVID-19 infection was estimated using age- and sex-specific infection fatality ratios (IFR) and Hungarian mortality data
- Using data analytics, we constructed the employee connection network of the industrial partner
- We designed a stochastic network model tailored to COVID-19
- The centrality analysis was carried out in R using the CINNA package
- The disease spread was modeled using a custom-made temporal Gillespie algorithm adapted to dynamic changes both in the network and in transmission rates
- The major software components were implemented based on the EoN package for Python



Unmitigated epidemic



Effect of a single measure



Effect of combined measures

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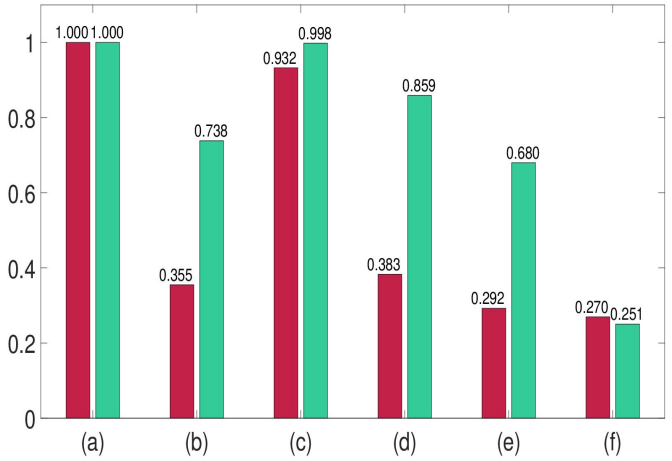
Results & Benefits to the company

- High-resolution model of the employee connection network of the company
- Successful application of a temporal Gillespie method for large-scale, real-life networks
- Individual efficacy assessment of intervening measures
- Justification of the combination and scale of interventions
- Identification of central nodes with respect to disease transmission



Relative comparison of containment strategies

We provided a framework for assessing the benefits of interventions from a risk-management perspective