Simulating worker absenteeism by economic sector during influenza pandemics and implications for economic impact

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Introduction

- Indirect costs of infectious disease epidemics are often far greater than financial losses associated with direct costs, such as treatment and response costs
- Worker absenteeism:
  - Large driver of outbreak-related economic loss
  - Reduces productivity and precipitates business failures
  - Often neglected due to quantification uncertainties and limited observational data
- Enterprise Risk Management should include preparations for this potential loss

Methods

- Tool developed to estimate risk of worker absenteeism rates during influenza pandemics
- Statistical model constructed to predict absenteeism rates using CDC monthly lab-confirmed flu incidence/mortality and national survey data on worker absence (BLS)
- Industry-specific data were analysed to estimate the relative contribution to absenteeism by economic sector
- Absenteeism estimated as a function of Incidence, Mortality, and Sentiment
- Fitted absenteeism model is applied to global outbreak simulations to estimate temporal dynamics of pandemic-induced absenteeism rates

Results & Conclusions

- Simulation based on 2009 H1N1 pandemic produces 4% absenteeism (US) during peak epi-week, comparable to historical reports
- Simulation based on 1918-like pandemic produces 27% absenteeism (US) during peak epi-week, though comparable historical reports unavailable
- Absenteeism trends observed in reported data by economic sector
- Education and health sectors demonstrate highest absenteeism rates
- Methods can be expanded to additional locations across the globe with cultural trends in absenteeism and sentiment
- Absenteeism models can help quantification of potential indirect economic costs of epidemics
- Insurance mechanisms can be created based on such probabilistic models which inform likelihood of reaching an established threshold of absenteeism prior to payout

References

- Thanner et al. (2011) Understanding estimated worker absenteeism rates during an influenza pandemic.
Global Preparedness for the Next Pandemic

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Current methods for assessing country preparedness typically rely on self-assessment and focus almost exclusively on public health metrics. However, the ability to detect, communicate, and respond during epidemics have complex enabling requirements beyond the health sector.

We developed an epidemic preparedness index (EPI) that rates and ranks 188 countries by ability to detect, communicate, and respond to epidemics. We incorporated data produced by international organizations, including WHO and the World Bank. We performed validation based on WHO outbreak reporting, vaccination during the 2009 influenza pandemic, and MERS case-fatality ratios.

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EPI consists of a global relative ranking of countries on a 0-100 unit-less scale, which for further analyses were categorized into five clusters using the k-means technique. Highest EPIs were identified in Western Europe, North America, Australia. Lowest EPIs were identified in Western and Central Africa, Western Asia, and Southeast Asia (Figure 2). A high variation of GDP was observed within each EPI cluster (Figure 3). Better EPI score showed statistically significant correlation with faster outbreak reporting times, greater vaccine coverage during the 2009 influenza pandemic, and lower case-fatality ratios for MERS.

EPI considers a range of capacities beyond the health sector and removes self-reporting biases. Variation in the EPI indicates opportunity to improve global preparedness. The EPI can be used in infectious disease modeling studies to account for differences in country-level response. Future enhancements include adding intra-country variation and disease specificity. A comprehensive understanding of epidemic risk will enable governments and organizations to make informed decisions about preparedness planning and mitigation strategies. Such strategies could include epidemic risk insurance (see box below).

Epidemic Risk Insurance: Use Case for the Preparedness

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We strive to make the world more resilient to epidemics.