Analysis of the COVID-19 Pandemic in Germany

Giacomo De Nicola, Cornelius Fritz, Felix Günther,
Göran Kauermann, Helmut Küchenhoff, Marc Schneble
(COVID-19 Data Analysis Group@LMU)

08.07.2020, 16.00 (c.t.)

Online via Zoom
(Meeting-ID: 913-2473-4411; Password: StatsCol20)

Analysis of the COVID-19 Pandemic in Bavaria: Nowcasting and change point analysis

Felix Günther[1,2], **Helmut Küchenhoff**[1], Andreas Bender[1], Michael Höhle[3]

[1] Statistical Consulting Unit StaBLab, LMU Munich

[2] Department of Genetic Epidemiology, University of Regensburg

[3] Department of Mathematics, Stockholm University

In order to assess the current dynamics of an epidemic, it is essential to collect information on the daily number of newly infected cases. Delays between disease onset and case reporting hamper our ability to understand the dynamics of an epidemic if we only consider the number of daily reported cases.

In the first part of the talk we present a nowcasting strategy that can be used to adjust daily case counts for occurred-but-not-yet-reported-events. The basic idea of nowcasting is to estimate the reporting delay based on observations where both, the symptom onset and the reporting date are known. Our approach is based on a model developed by Höhle and an der Heiden (2014). We use a hierarchical Bayesian model that considers changes in the reporting delay distribution over time and day of the week. Through a data cooperation with the LGL Bavaria, results are updated and made publically available daily (corona.stat.uni-muenchen.de) and give useful information about the current state of the pandemic.

In the second part of the talk, we discuss a change point analysis of the course of the pandemic in Bavaria and in Germany using daily data of counts of newly infected cases between Feb, 16th and May, 1st. We use a segmented Poisson regression model with exponential link allowing for 4 change points (Muggeo (2003)). The change points can be compared to the timing of the implementation of governmental measures against disease spread, but a causal interpretation is highly problematic. We compare our results with other approaches, e.g. Dehning et al. (2020) and analyses from other countries.

References:

Dehning, J., Zierenberg, J., Spitzner, F. P., Wibral, M., Neto, J. P., Wilczek, M., and Priesemann, V. (2020). Inferring change points in the spread of COVID-19 reveals the effectiveness of interventions. *Science*.

Höhle, M. and an der Heiden, M. (2014). Bayesian Nowcasting during the STEC O104:H4 Outbreak in Germany, 2011. *BIOMETRICS*, 70(4):993–1002.

Muggeo, V. (2003). Estimating regression models with unknown break-points. *Statistics in Medicine*, 22(19):3055–3071.

Nowcasting Fatal COVID-19 Infections on a Regional Level in Germany

Marc Schneble[1], Giacomo De Nicola[1], Göran Kauermann[1], Ursula Berger[2]

[1] Department of Statistics, LMU Munich

[2] Institute for Medical Information Processing, Biometry, and Epidemiology, LMU Munich

We analyse the temporal and regional structure in mortality rates related to COVID-19 infections. We relate the fatality date of each deceased patient to the corresponding day of registration of the infection, leading to a nowcasting model which allows us to estimate the number of present-day infections that will, at a later date, prove to be fatal. The numbers are broken down to the district level in Germany. Given that death counts generally provide more reliable information on the spread of the disease compared to infection counts, which inevitably depend on testing strategy and capacity, the proposed model and the presented results allow to obtain reliable insight into the current state of the pandemic in Germany.

Surveillance of COVID-19 Infections through Now- and Forecasting on a Regional Level

Giacomo De Nicola[1], Marc Schneble[1], Göran Kauermann[1], Ursula Berger[2]

Governments around the world have mobilized and continue to act to contain and mitigate the spread of COVID-19. The rapidly evolving situation compels officials and executives to continuously adapt policies and modulate social distancing measures depending on the current state of the events. In this context, it is crucial for policymakers to have a firm grasp on what the current state of the pandemic is as well as to have an idea of how the infective situation is going to unfold in the next days. We provide a stable tool for monitoring current infection levels as well as predicting infectious behaviour in the immediate future at the regional level. We accomplish this through nowcasting of cases that have not yet been reported as well as through forecasting of future infections. This is done by means of statistical modelling. We apply our model to German data, for which our focus lies in explaining and predicting infectious behaviour by district, age-group and gender. We hope this tool will aid in shedding light on the dynamics of the pandemic, and help policymakers in taking informed decisions to contain the spread.

On the Interplay of Regional Mobility, Social Connectedness, and the Spread of COVID-19 in Germany

Cornelius Fritz, Göran Kauermann

(Department of Statistics, LMU Munich)

Since the primary mode of respiratory virus transmission is person-to-person interaction, we should reconsider physical social interaction patterns to mitigate the number of people infected with COVID-19. While non-pharmaceutical interventions (NPI) had an evident impact on the national mobility patterns, only the relative regional mobility behaviour given the nationwide dynamic enables an unbiased look at the effect of human mobility on the spread of COVID-19. In this paper we therefore investigate the impact of regional human mobility patterns and social connectivity on the weekly rate of new infections in Germany between March 3rd and June 15th, 2020. We use data derived from Facebook activities and the results confirm that reduced social activity lowers the infection rate, accounting for regional and temporal patterns. The extend of social distancing has a negative effect and our results underpin that the geographic as well as the social position affects the incidence of COVID-19 in Germany.