

# Global Health Day

## The Global Surveillance Project: Persistence and Transmission of SARS-CoV-2 in Western Europe

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**Background:** The COVID-19 global pandemic has severely impacted Western Europe. The varying severity between countries is likely explained by differences in prevention efforts in the form of public health policy and subsequent adherence, as well as socio-cultural, climate, and population characteristics. The second wave of the COVID-19 pandemic is currently breaching the borders of Europe, and public health surveillance is necessary to inform policy and guide leaders. Existing surveillance explains past transmissions obscuring shifts in the pandemic, increases in infection rates, and the persistence in the transmission of COVID-19. Objectives The goal of this study is to provide advanced surveillance metrics for COVID-19 transmission that account for shifts in the pandemic week over week, speed, acceleration, jerk and persistence, in order to better understand each country's risk for explosive growth. Existing surveillance, coupled with our dynamic metrics of transmission, will provide novel metrics to measure the transmission of disease and inform health policy to control the pandemic.

**Methods:** Using a longitudinal trend analysis study design, we extracted 47-50 days of COVID data from public health registries. We use an empirical difference equation to measure the daily number of cases in Europe as a function of the prior number of cases, the level of testing, and weekly shift variables based on a dynamic panel model that was estimated using the generalized method of moments (GMM) approach by implementing the Arellano-Bond estimator in R.

**Results:** The countries with the largest COVID caseloads and infection rates also had positive acceleration and jerk as well as large 7-day persistence rates. The UK, Spain and Belgium had the highest number of observed cases during the first two weeks of October at 11,993, 9,530, and 4,236 during week one, and their infection rate increased in week 2. Speed mirrored infection rates in that speed increased between Oct 1 and Oct 14 in Belgium from 29.90 to 60.96, Czech Republic from 29.70 to 53.19, and the Netherlands from 22.60 to 36.12 over two weeks. These increases are consistent with a second wave. Belgium, Czech Republic, and the Netherlands had the largest acceleration during the week of 10/8-10/14, with increases to 7.53, 5.18, and 2.35. Belgium and the Czech Republic had positive jerk during weeks one and two, meaning the acceleration rate was increasing week over week.

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**Conclusions:** These dynamic data suggest that the second wave of the COVID-19 pandemic has breached European borders. Belgium, Czech Republic, and the Netherlands, in particular, are at risk for rapid expansion in the transmission of COVID-19. An examination of the European region suggests that there was an increase in caseload of COVID-19 between October 1 and October 14. Moreover, the rates of jerk, which were negative for Europe at the beginning of the month, reversed course and became positive, along with increases of speed and acceleration. Finally, the 7-day persistence rate during the second week was larger than the first week. In combination, these indicators suggest the second wave of the COVID-19 pandemic occurred between weeks 1 and 2 of October.

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