Wastewater-based epidemiology dashboard for research of COVID-19 in Saxony

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Abstract:

The COVID-19 pandemic has had unprecedented health and economic impacts worldwide. Various fields of science approached this topic to better understand the pandemic's spread characteristics and provide a factual base for non-pharmaceutical interventions. One of the interesting non-invasive methodologies, wastewater epidemiology, looks for the correlation between the outcomes of the wastewater-based PCR analysis and the epidemiological situation in their catchment (e.g., Bogler et al., 2020; Farkas et al., 2020). This approach may efficiently predict the outbreak in the endemic phase when the conventional testing is usually underrated. Therefore a visual analytical tool may be beneficial for observing the spatiotemporal correlations of the wastewater indicators and the focal incidence levels. However, based on the analysis of existing tools (Naughton et al., 2021), most dashboards integrating wastewater indicators do not use information about geographical space at all, or the functionality of the map component is limited to the identification of the particular wastewater plant.

In the where2test project (www.where2test.de), we established a scalable operational data store (ODS) to automatically collect, store and integrate heterogeneous epidemiology-related data for various administrative levels of several European countries, focusing primarily on the region of Saxony. The project includes various activities, including spatiotemporal analyses (Mertel et al., 2022), epidemiological models and applications (Davoodi et al., 2022), and forecasts. In this paper, we present a prototype of an interactive dashboard to explore the correlation between the local incidence as estimated by conventional testing and the wastewater-based PCR indicators (cT values) in Saxony. Another goal of this application is to focus on the geospatial aspect of these data.

The top part of the dashboard features an interactive timeline linked to a multidimensional heatmap. Here, the user can navigate in time and explore the correlation between the epidemiological situation of the neighborhood of the wastewater plants (defined by the temporal distance) and the cT indicators in time. For the week selected in the timeline, the user can observe the spatial context within the Saxonian municipalities on the map below. The map allows interaction with the single municipalities and all the wastewater plants integrated with our ODS to access detailed information and additional charts. In the future, we plan to integrate more metrics and parameters that may be beneficial for exploring spatiotemporal inference. Our scalable infrastructure also easily allows the integration of more wastewater plants. The application is available on www.where2test.de/wastewater from August 2022.

Figure 1: A prototype of the Wastewater-based epidemiology dashboard.
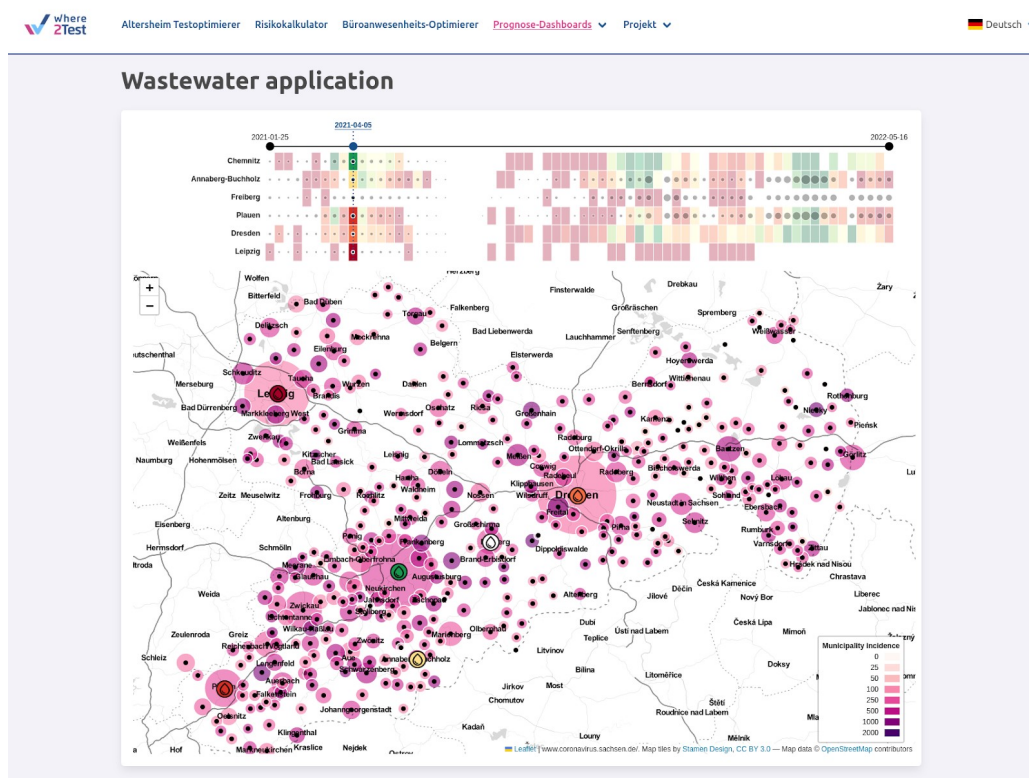
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