Elucidating the interplay of COVID-19 epidemic and social dynamics via Internet media in Germany

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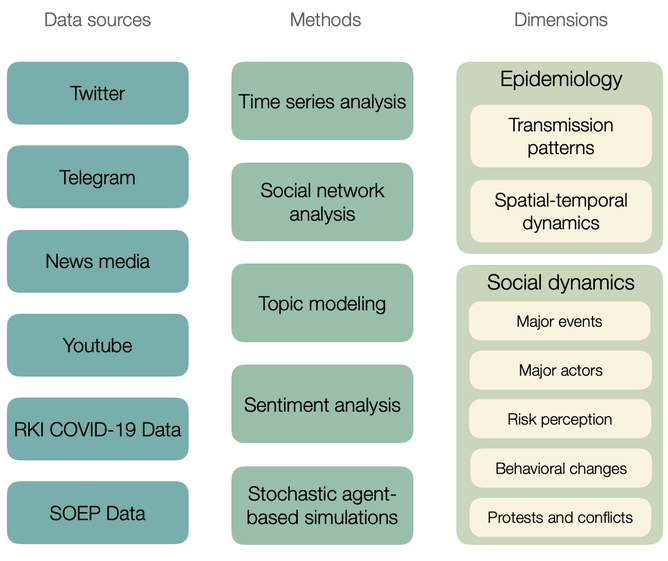
Summary

Our goal is to leverage Internet media sources (secondary document analysis) to understand the driving mechanisms behind COVID-19-related social dynamics and how they interact with the epidemic with focus on vaccines:

- How does society perceive the epidemic and the available vaccines? What topics do users mention in relation to vaccine discourse? What is the sentiment of the messages?
- Which are the most important communities spreading the information about the vaccines? What are the characteristics of the information spread [1-3]?
- What kind of vaccine adverse events (AE) do users mention? How are those correlated with official databases [4]?
- What are the conflicting lines on compulsory vaccinations? What is the structural and dynamic ”digital footprint” of protest?

Data Processing and Methods



As a proof of concept we consider the following case studies:

1. **Time series of AE** The weekly intensity of searched queries of Topic ”Thrombosis” in Google for various countries using vector vaccines in their roll-outs.
2. **Network of vaccination hashtags*** We have reconstructed hashtag networks in German language with primary hashtag #Impfung (1,160,941) in the first half of 2021.
3. **Network of users engaged in discourse on Berlin Protest*** We have reconstructed retweets networks in German language with #b0108 (92,474) for demonstration on August 1st, 2020 in Berlin [1].

* Networks or graphs – mathematical objects consisting of vertices (nodes) and edges (links) connecting them – represent a valuable and ubiquitous approach describing various complex system phenomena. In our study a data record was a tweet with metadata.

Outlook

We have just started our project, but we could already state that:

- Infodemiology **is very useful** in understanding social dynamics during the pandemic [1-3] by quantifying dynamics of interest (demand and supply of content) and discourse patterns. It plays a supplementary role to standard tools such as surveys (see Sections 2 and 3 for network representation of the discourse) and allows for the analysis in real time.
- Infosurveillance **could be useful** for public health decision makers in some specific areas such as understanding vaccine safety profiles [4] (see example 1 AE popularity time series).

References

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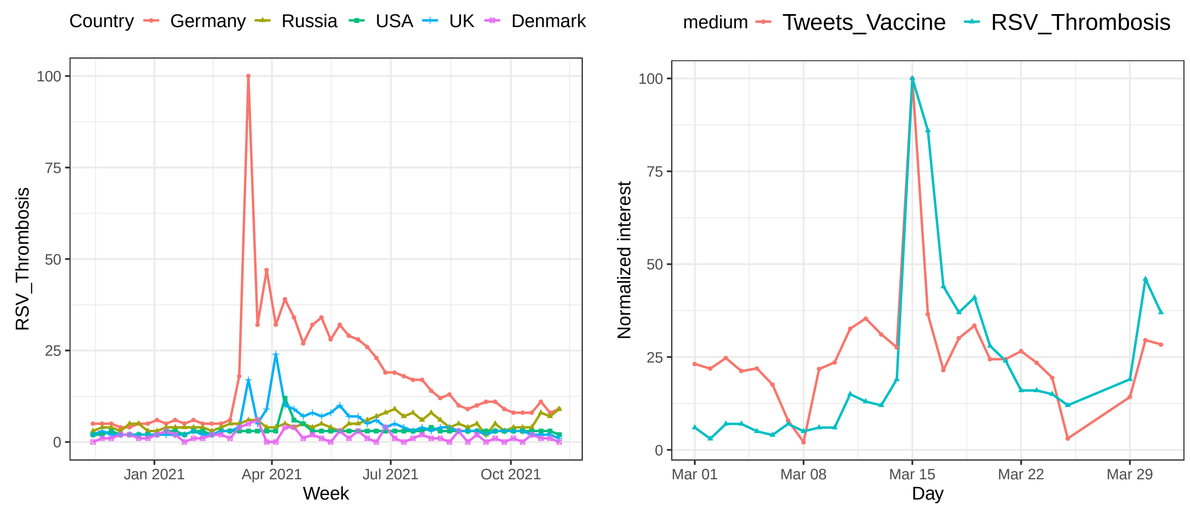
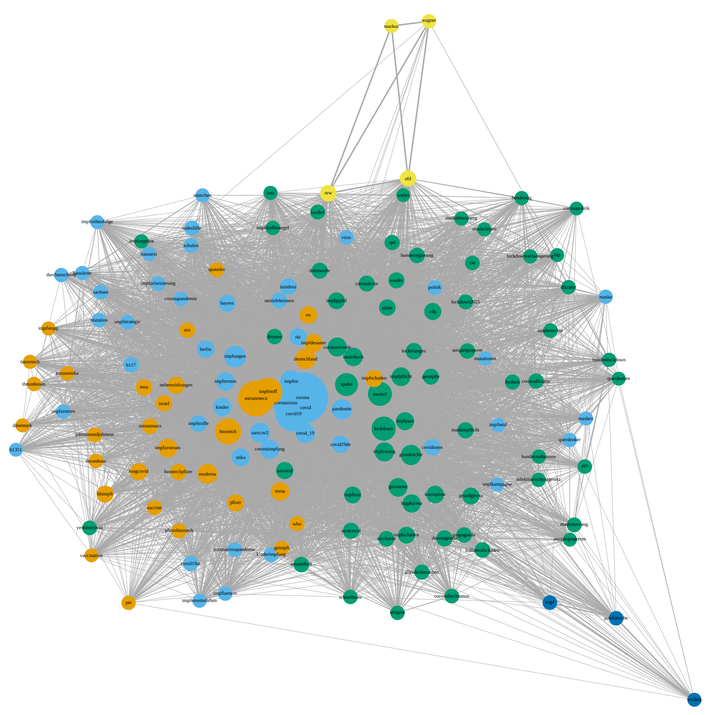
1. Time series of interest in AE (Thrombosis)

Weekly relative search volume (RSV) on Google in Germany and other Countries (Left) during 2021. The intensity of the vaccination related topics at various media platforms during March 2021 (Right). Time series were normalized to 100 by the maximal RSV value (by default) and number of posts on Twitter.



Motivated by syndrome analysis on the Internet [2] we have compared the demand for information on Thrombosis, known rare AE of vector vaccines registered in the EU as well as AE in other vector vaccines which are not registered in the EU. We can see, that the interest in Thrombosis measured by weekly RSV on Google in Germany is one/two order of magnitude greater than in other countries although the number of administered doses of vector vaccines per capita in selected states were of the same order of magnitude at least in spring 2021 (from 3% to 30%). The peak was exactly on the 15th March 2021 when Paul Ehrlich Institute recommended a halt for AstraZeneca vaccine, the same as in tweets volume on Twitter.

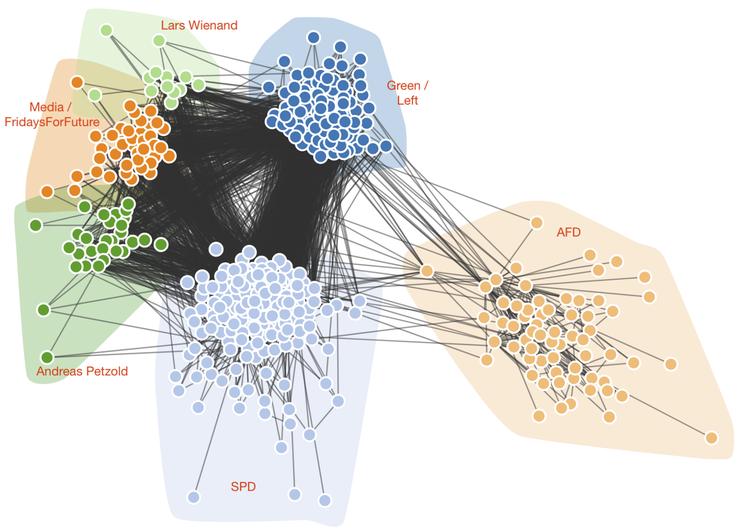
2. Network of vaccination hashtags



Cognitive map of vaccine discourse on German Twitter – a co-occurrence network of hashtags. Louvain algorithm for community detection was used and node color denotes the community it belongs to. Node size corresponds to frequency of occurrence in the data-set. Biontech is the 5th most commonly used hashtag - which is unique to Germany, while most of the world is more likely to associate Pfizer with Comirnaty vaccine. Communities: Green - Politics and Media as well as Querdenker and Antivaxxers; Orange - directly vaccine-related issues; Blue - Epidemiology.

3. Retweet network of protesters

Louvain algorithm for community detection was used and node color denotes the community it belongs to. We observe a mosaic pattern in German protests when representatives of AfD party as well as the SPD and the Green parties were connected on the retweet network during 01.08.2020 Berlin protests with hashtag #b0108 [1].



We found a pronounced high connectivity pattern between far-left and far-right communities implying the possibility that left-wing activists could sympathize with (e.g. some liberal greens and potentially antivaxxers) community.

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