

Zitationshinweis
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Complexity in epidemiological data

>> One of the most iconic features of the Corona pandemic was the dashboard. The catchy graphical representation of epidemiological data suggested to users a scientific and objective view of what was happening with the infection. In a sense, one found oneself in the role of the pilot in the pandemic cockpit on the screen.

Precisely because they are so easy to grasp, these kinds of representations of infections proved to be a double-edged sword. Visualisations are a proven means of depicting complex data as faithfully as possible, depending on the purpose, or of making it more usable through simplification. However, a prerequisite for this is that the addressee understands the underlying theory and phenomenology in order to be able to utilise the information presented to him. As a doctor, just think of an ECG or ultrasound image, which remains a closed book for the patient.

In order to understand the observed system (infection, cardiovascular system, nuclear reactor ...) and ideally to be able to control it, one needs an adequate mental model. Otherwise, any attempt to control the system turns into haphazard trial and error and, in the worst case, produces disastrous results. Particularly dangerous are situations where a system behaves paradoxically and hardly reacts or even reacts counterintuitively to control impulses. For example, a pilot must know that if he is flying too slowly ‚behind the power curve‘, he must not pull up the nose of the aircraft just then to initiate a climb - in the worst case, the aircraft will fall to the ground like a stone after a stall.

The mental model for interpreting epidemiological data remained extremely simple most of the time during the pandemic. It essentially involved the (exponential) extrapolation of trends and an instantaneous, linear cause-and-effect model - more contacts, more infections and so on. Now, as is often the case, this model is not entirely wrong in a narrowly defined context, but it does have its limitations. If additional factors (time, space, environmental influences, host characteristics, etc.) are taken into account, the result is a complex dynamic that can be systematically misunderstood if one does not have sufficiently granular data and, above all, an adequate understanding of the theory. Granular data alone, of course, is not a solution to this challenge; unfiltered fine-grained information can also mislead.

Such misunderstandings abounded in the course of the pandemic, and they contributed - probably avoidably - to debate polarisation and suboptimal governance. The transmission protection of Covid vaccinations may serve as an example. When 2G regulations were introduced at the end of 2021, a supposed confirmation was quickly found in current epidemiological data, for example in the study by Maier et al. (1).

In the summer of 2022, the situation had reversed; the figures of the RKI showed a negative vaccination effectiveness. The reaction of the RKI was remarkably helpless and tight-lipped: first, the vaccine effectiveness was simply cut off at zero and the negative values were explained away as an ‚expression of statistical uncertainty‘ when asked by the ‚Welt‘ (2). With the relevant theoretical and empirical knowledge (3), one would not have been surprised. On the basis of early available foreign data on vaccine effectiveness and epidemiological textbook knowledge, it was foreseeable that covid infections prevented by vaccination in the short term would have to be ‚made up‘ with low or negative vaccine effectiveness, but with the advantage of a significantly reduced risk of severe courses. Therefore, the medium-term failure of 2G regulations could be anticipated from the beginning. Admittedly, this was initially only the theoretical expectation, but it could have been validated and refined with the help of unbiased data and appropriate analysis, e.g. by considering the cumulative risk of infection and excluding previous infections as a confounding factor.

Collateral damage of the knowledge slalom: social stigmatisation and discord caused by 2G and, finally, problems of justification in the face of new, only apparently surprising data.

Why such aberrations? It would be too simplistic to attribute misperceptions of the pandemic years to wishful thinking alone, or even to a deliberate agenda. It seems more likely that several factors interacted in a self-reinforcing way. In the specific case, these include:

1. insufficient awareness of the inherent dynamics of the system with the ‚swing of the pendulum‘ in vaccine effectiveness
2. a narrowed focus on selective data on transmission protection in the face of rising infection figures, ignoring the dimension of ‚time‘.
3. ignoring available data from abroad
4. data from Germany distorted by test criteria, which made it difficult to correct misconceptions and further develop our understanding of infection dynamics.

Only a systematic debriefing can establish exactly why, as often criticised, high-quality epidemiological data was often missing in Germany or why wrong conclusions were drawn from available, often biased data. In this context, one must also think beyond surveillance instruments and improved technical solutions (digitalisation). Seroprevalence studies such as MusPAD or Immunbridge or the cluster analysis of Covid risk factors to determine vaccination prioritisation by the STIKO show: In principle, there is no lack of scientific competence and technical possibilities for generating and analysing meaningful epidemiological data. The question is therefore: Is Germany‘s data problem rather hiding a deficit in the collective understanding of the situation? For the lessons learned from the pandemic, one should not be satisfied with simple answers. <<

1: Maier, B.F., et al. Germany‘s fourth COVID-19 wave was mainly driven by the unvaccinated. Commun Med 2, 116 (2022). https://doi.org/10.1038/s43856-022-00176-7
2: https://www.welt.de/politik/deutschland/plus240002833/Corona-Die-vielen-Ungereimtheiten-bei-den-Impfdaten-des-RKI.html
3: Dürr, H.-P., Eichner, M.: „Corona-Pandemie: Zukunfts-Überlegungen aus der Sicht epidemiologischer Modellierung“ in: „Monitor Versorgungsforschung“ (02/22), S. 57-63. http://doi.org/10.24945/MVF.02.22.1866-0533.2393