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Opinion “Understanding Epidemics - Steps Towards a Theoretical Epidemiology”

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Abstract

Due to the author’s context commitment, epidemiology is understood as a central subfield of public health and medicine. It provides data and models for understanding population’s health risks and thus providing orientation and action for public health. The corona pandemic in particular has shown us many options but also needs for improvement of data-driven epidemiological modelling as it implies difficulties at interpretation compared to explanatory concept-oriented modeling. The modelling was also conceptually quite one-dimensional, using mainly medical data and largely ignoring psychosocial aspects. In addition, the fixation on quantitative observations has led to the neglect of patients’ voices and even the experiences of medical staff. As a result, and because of these shortcomings, public health regulations were likely to be suboptimal and associated with numerous adverse side effects. This has been demonstrated for some countries in Europe, especially Germany.

This paper suggests that greater emphasis should be placed on explicitly testing hypotheses, constructs and theories of epidemics, which could lead to a field called “theoretical epidemiology”. In this context, four fundamental aspects should be taken into account.

Transdisciplinarity - an extended epistemology is required

Data-driven evidence production depends essentially on the quality of the data, especially if they are collected in a country where an epidemic is developing. In addition, a requirement for a valid picture of an epidemic is that qualitative data have to be included, for example by interviewing patients, their relatives and, of course, medical professionals working in all components of the health system, from the outpatient unit to the intensive care unit. Looking to environmental science and management non-academic stakeholders are seen as an important additional source of insights in this field. This group of persons should be included constitutively, at least in acute epidemic conditions. This approach, in which scientists work together with everyday stakeholders of their respective problems, is called “transdisciplinarity” as a kind of vertical interdisciplinarity [1]. Suffice it to say that horizontal interdisciplinarity between different academic fields committed to a certain health problem should also be able to communicate across the board, from mathematics and physics to (clinical) medicine, sociology and economics. However, this attempt also requires sophistication in knowledge integration [2].

In practice, epidemiological research is dominated by data, mathematics and calculations. The mathematical core is very often referred to as “theoretical epidemiology”. However, if this is compared with theoretical physics or theoretical sociology, it becomes clear that mathematics is mainly an efficient language. Mathematics is efficient through abstract formulations and conceptualizations, as can be easily understood by looking at the development of Newtonian physics: concepts such as forces or mass or acceleration can be symbolized by F, m and a, and these variables can be related to each other by an equation: $F=m*a$. This equation is conceptually based on pre-mathematical considerations about the notion of acceleration. Physics teaches us also that weather dynamics cannot be understood by data alone but needs principles of thermodynamics.

This insight in the history of scientific knowledge production means for epidemiology that theoretical concept-oriented considerations could be fruitful for advances in the understanding of epidemics [3].

Social / Human ecology - conceptual framework for empirical research

Here it is emphasized that epidemiology, because its epistemic object are people, is essentially a social science and therefore needs a social science foundation. In other words, the specialty of social epidemiology should be the core field of epidemiology. Much is known about the influence of social class and milieu on the chance of staying healthy and on the risk of becoming ill. The spatial segregation of these health-related opportunities and risks has been acknowledged since decades by the specific approach of "social/human ecology". The relevance of "environment" as an explanatory group of variables has also been captured by the three-factor infection epidemiological model ("epidemiological triad"), which goes back to John Snow [4]. In line with this view, the well-known socio-ecological "rainbow model" [5] is a helpful multifactorial conceptual framework for a better understanding of public health issues, and it should be combined with the epidemiological triad model for infectious diseases. A more detailed epidemiological theory is connected with Nancy Krieger's "eco-social model", which provides an integrative but differentiated conceptual framework that helps to understand and evaluate given datasets, and which also allows for a comprehensive design of empirical studies. The relevant aspects are [6]: "Societal and ecological context; life-course and historical generation; spatiotemporal scales and levels of analysis; pathogenesis; and diverse forms of inequitable relationships within and between countries, including in relation to political economy, racism, class, sex, and sexuality."

These examples, as fragments of a theory of population health and disease, require knowledge integration in order to obtain a comprehensive theory and model of epidemics, which can also be differentiated into multifactorial models, depending on the specific problem to be studied and controlled by public health perspectives.

Systems science - thinking in connections

In view of these two issues, mentioned above, there is a danger that a large amount of singular facts will emerge that must be evaluated in terms of the causal networks that determine their respective states and (interactive) processes. This intellectual challenge was overcome in environmental science by the study "The Limits to Growth" by the researchers around Jay W. Forrester [7]. In the meantime, we have more than 50 years of experience with the successful application and testing of the basic model and can therefore recommend this modeling method [8]. Against this background, a conceptual multi-level model of the corona pandemic can be proposed, which could guide research in a more appropriate way [9].

Institutional requirements

Looking at these pillars of solid and innovative theoretical epidemiology, it becomes clear that cross-sectional institutions are needed. They can be set up at agile universities, but also by private foundations. Not only the interdisciplinary integration should be promoted, but also the exchange with experts from practice, patients and citizens.

These institutions could develop a necessary culture of transdisciplinarity.

Conclusion

The corona pandemic has taught us a lot about fundamental options for improvement in pandemic science and management, which also could have a positive impact on self-determined health behavior and cooperation of citizens. This should finally encourage us to rethink the relationship between science and society.

References

1. Klein JT, Grossenbacher-Mansuy W, Häberli R, Bill A, Scholz RW, et al. (eds). Transdisciplinarity: Joint Problem Solving among Science, Technology, and Society. An Effective Way for Managing Complexity. Springer, Basel. 2001.
2. Tretter F and Marcum J. Medical Corona Science: Philosophical and systemic issues: Re-thinking medicine? On the epistemology of Corona medicine. Journal of Evaluation in Clinical Practice. 2023; 29(3): 405-414.
3. Pfaff H, Schmitt J. The Organic Turn: Coping With Pandemic and Non-pandemic Challenges by Integrating Evidence-, Theory-, Experience-, and Context-Based Knowledge in Advising Health Policy. Frontiers in public health: 1607. 2021.
4. CDC 2024. Lesson 1 Understanding the Epidemiologic Triangle through Infectious. Disease. https://www.cdc.gov/healthyschools/bam/teachers/documents/epi_1_triangle.pdf
5. Dahlgren G, Whitehead M. The Dahlgren-Whitehead model of health determinants: 30 years on and still chasing rainbows. Public Health. 2021; 199: 20-24. doi: 10.1016/j.puhe.2021.08.009.
6. Krieger N. Theoretical frameworks and cancer inequities. In: Vaccarella S, Lortet-Tieulent J, Saracci R, Conway DI, Straif K, Wild CP, editors. Reducing social inequalities in cancer: evidence and priorities for research. Lyon (FR): International Agency for Research on Cancer. 2019; 8. https://www.ncbi.nlm.nih.gov/books/NBK566181/pdf/Bookshelf_NBK566181.pdf
7. Meadows DH, et al. The Limits to Growth. New York: Universe Books. 1972.
8. Meadows DH. Thinking in Systems: A Primer. Chelsea Green. 2008.
9. Tretter F, Peters E, Sturmberg J, Bennett J, Voit E, et al. Perspectives of (/memorandum for) systems thinking on COVID-19 pandemic and pathology. Journal of Evaluation in Clinical Practice. 2022. doi: 10.1111/jep.13772. Epub ahead of print.