

Chronic diseases and the environment

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ABSTRACT

The environment, conceived as the basis for a multicausal explanation of diseases, has a longer and more complex history than the debates between “environmentalists” and “reductionists” often suggests. These debates cannot be reduced to a diametric opposition between those (environmentalists) who take the multiplicity of “natural” or “social” factors into consideration when explaining the appearance and forms of diseases, and those who are disposed to find “the” cause in a single etiological agent (“the” germ). Interdisciplinary research between the life and social sciences remains to be done on the growing incidence and prevalence of chronic diseases, in order to better understand and prevent social health inequalities.

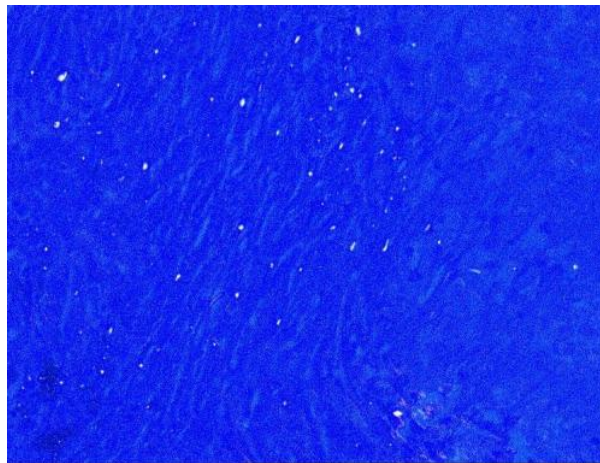


Photo credits: Marianne Kambouchner, anatomopathologist, Avicenne Hospital, AP-HP, Bobigny, France. Dust accumulation in pulmonary tissue seen through an optical microscope in polarized light. Birefringent particles signaling the patient’s exposure to air contaminants of a mineral nature.

A macro-epidemiological consensus

Since the Second World War, and especially the 1970s, an epidemiological analysis has emerged: a global shift toward the increasing incidence and prevalence of non-infectious and chronic diseases, which have surpassed infectious diseases in accounting for morbidity, mortality, and invalidity in the general population. This analysis has been updated regularly, especially with data from the Global Burden of Disease (GBD)—an epidemiological data-gathering effort unprecedented in scope—promoted by the Institute of Health Metrics and Evaluation (IHME) in Vancouver, an institution connected to both international organizations (World Health Organization, WHO) and private actors (Bill & Melinda Gates Foundation).

The growing role of what are known as “non-communicable diseases” in global epidemiological dynamics, captured by the model of the “epidemiological transition,” go hand in hand with the notion that determinants of human health should be sought in the “environment.” While the epidemiological transition offered a descriptive framework (for lack of an explanatory one), the “agent-host-environment” triad emerged as a *topos* in epidemiology. Medicine and epidemiology agree that numerous diseases (chronic ones in particular) cannot be reduced to a clear-cut causality. The diagram of a specific infectious agent—required and sufficient to explain a given disease—gave way to multicausality, with cancer representing a chronic disease for which the interaction of genetic, behavioral, and environmental factors was discussed early on (especially with regard to tobacco and alcohol).

The environment by default

Such a paradigm in epidemiology has often been interpreted as environmentalist, which is to say breaking with a Pasteurian “reductionism” that can purportedly be summed up by the pithy formula of “one germ, one disease.” The historiography of the last twenty years has shown that this opposition between two causal paradigms is partly exaggerated. It tends to minimize the genuine attention that the environment has long received in explaining states of health: during the early moments of hygienist thought and occupational medicine in the seventeenth and eighteenth centuries, during the founding stages of the epidemiological discipline in the first half of the nineteenth century, and even within bacteriology laboratories since the end of the same century.

This discussion regarding the existence within the life sciences of an environmentalist approach to the causes of diseases is now accompanied by a theoretical proposal—the exposome—that lays claim to a considerable amount of novelty. As defined by Christopher P. Wild, the exposome is a systemic approach to the “exposures” to which the human organism is subject, in an effort to supplement the explanations provided by genomics regarding the incidence and development of chronic diseases. More precisely, the exposome includes three environmental aspects in explaining chronic diseases on the scale of a population. The “environment” to be studied consists not only of “external specific” agents (potentially toxic physical or chemical agents) and “general external” factors (the sociocultural, socioeconomic, and socioenvironmental characteristics of our health as measured by education level, standard of living, urban or rural residence, etc.), but also of elements and mechanisms internal to organisms (hormones, metabolism, oxidative stress, etc.) or hosted by it (microfungi, virus, bacteria, etc., which make up the “microbiota”). Understood as the “integration within the entire life of all the exposures that can influence human

health”—according to Article 1 of law 2016-41 for the modernization of our health system passed by the French Parliament in 2016, thereby giving the notion significant institutional resonance—the exposome appears to crown a vision of the environment as being decisive for health “by default.” In a simultaneously systemic and analytical approach, the environment consisting of agents and mechanisms both external and internal to the organism encompasses all of the non-genetic determinants of health status, for chronic diseases in particular.

In search of social and environmental health determinants

Such an approach to the environment offers prospects for collaboration between the life and social sciences, as well as numerous “specific external” environmental factors, and even more so “general external” ones, thereby offering a prime target for sociological or historical research efforts to produce a social epidemiology of the pathologies in question. Environment in these social components serves as a potential research area in its own right, and not just, by default, as the “non-genetic” portion of chronic diseases. Despite frequent evocations of interdisciplinarity, the research endeavours are rare, that would address the relations between the environment and chronic diseases by encompassing methods or disciplines such as molecular epidemiology (the leading discipline of exposome supporters), as well as sociological (quantitative and qualitative) field studies.

The challenges are reflected in at least two aspects. On the one hand, the exploitation of big data sometimes provides disappointing results. While a large share of mortality and morbidity is related, according to the WHO, to “modifiable environmental risks” (22% of the years of life lost due to disease, invalidity, or early mortality), less than 10% of this indicator’s variance with respect to cardiovascular diseases, chronic respiratory diseases, and diabetes can be explained by the sociodemographic status of individuals. In other words, translating the “environment” into social characteristics is still in its infancy for explaining the chronic diseases that have the largest impact on global mortality and morbidity. Further, the dominant formalization model in epidemiology uses variables, such as sex/gender and race in an instrumental way, as “black boxes” (Shim 2002) whose social and environmental content is yet to be discovered. The social specificities of professional and non-professional exposures remain to be explored more systematically, as does the income level of patients suffering from chronic pathologies. This research can hopefully reveal the explanatory factors for these diseases, as well as provide a social understanding of their occurrence and phenotypes, especially for those whose etiology remains undetermined (for example systemic and/or auto-immune diseases). Debiologizing what epidemiology rarely explores under the labels of “sex/gender” and “race”—or neglects to work through empirically (socioeconomic living and working conditions)—may shed light on the social and environmental components of chronic diseases, in an effort to better measure and prevent social health inequalities in populations characterized by homogeneous epidemiological regimes (“Northern” countries on the one hand, and “Southern” countries on the other), or between epidemiological regimes whose divergent trajectories between Northern (developed countries) and Southern countries (typically southern Africa) remains unexplained.

The shock of the COVID-19 pandemic gives new reasons to promote this socio-environmental epidemiology of diseases. Beyond the borderline between chronic and acute diseases, or between infectious and non-infectious diseases, the issues to be resolved are

indeed very similar. The main question is about discovering the social determinants (in the sense of ecological determinants) of the *variability* of pathologies. Even when the cause(s) of these diseases are known (as in the case of the SARS-CoV-2 virus for COVID-19), why does “being ill” take such different forms and levels of severity between men and women, “white” and “black” people, rich and poor, etc.?

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