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Changing the trend: a systems approach to complex urban population health

The paper by Ana V. Diez Roux brings an important realization to the surface: as researchers using counterfactual approaches to understand disease causality, many of us are totally unhappy with the end results of all the energy applied to “isolating the ‘independent’ effect of specific factors”, very limited in dealing with the main public health problems in such complex settings as cities and megalopolises. Obesity, cardiovascular disease, and diabetes, the main health problems in most urban populations, are resistant to public health interventions, despite our in-depth knowledge of numerous factors, ranging from the cellular level to socioeconomic determinants^{1,2}. It is high time we acknowledge the limits of some of our favorite tools in order to bring something new to the research, in the hopes of discovering how, where, when, and which interventions can change the trend.

Systems thinking brings new breath to the recognition that in urban health we are not dealing with isolated factors that add up to cause disease, but as summarized by Ana, as an intrinsically complex situation with multiple levels of organization, heterogeneity, dependencies, and

feedback. Related to (and as a consequence of) this complexity, I would explicitly include dynamic stability in the description of complex systems' characteristics³, as one of the main aspects of unmovable disease trends cited above. Related to the same dynamic stability and inherent complexity, applying pressure at the right points – fulcrums – can bring down a complex system. Exploring scenarios based on either agent-based or full-fledged dynamic models is certainly a powerful tool for finding such fulcrums.

The paper emphasizes an important point in using such techniques: *“A major challenge in developing these dynamic conceptual models is setting the bounds and including only the elements fundamental to understanding the process at hand”*. Any mathematical or statistical model is limited to a few components. Simplification is not merely an option, but an absolute imperative. Thus, what is the gain in this approach if we are still constrained by very limited simulations? I think that the answer lies in the paper as well. The *“systems approaches to urban health problems (perhaps the most important implication) is the development of conceptual models of the processes...”* I agree entirely, without the parenthesis, and not as “perhaps”, but certainly. The orthodoxy in approaching all epidemiological problems by looking for “isolating” and “controlling” measures of association has produced a conservative way of thinking, thereby limiting scientific creativity. And I must say that scientific rigor is not exclusive to mathematical or other quantitative approaches.

Take obesity as an example. We need to be bold enough to include all aspects besides individual and neighborhood characteristics, such as green spaces or food availability. Not excluding those, of course, but including other main players such as the food industry and its ultra-processed foods, soft drink advertising that sells happiness, and externalization of costs from the resulting obesity to the entire society. All of those have been tackled in one paper or another. Integrating all this knowledge to devise a comprehensive intervention is what we need in these times of millions of articles published every year. Rigorously designing this system may allow us to: (i) devise studies addressing specific questions, (ii) chose appropriate parts of the system for computational, dynamic, or statistical models, and (iii) propose public health interventions⁴. However, building such a model is extremely difficult. Our training as epidemiologists is limited, and we do not usually access the literature from cybernetics and systems thinking. Besides, changing our approach to a scientific problem can be as hard as exercising or dieting⁵.

The main advantage of this approach is “bringing action back to epidemiology”, placing the improvement of population health in complex urban settings at the center of our collective thinking⁶. Admitting complexity (and perplexity). The challenge is to build bridges between researchers and policymakers, between public health and city planning, changing the question from “what is the isolated effect?” to “what for?” Just asking ourselves which actions are possible, involving from the beginning the people in charge of making it all possible, will highlight the theoretical system's limits, one of the challenges identified in the paper. We truly need to address the deep meaning of the systems approach, and not merely replace one technique with another. I see it as a paradigm shift. Thanks, Ana, for sharing such powerful ideas again.

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