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COMMENTARY

There are good clinical, scientific, and social reasons to strengthen links between biomedical and environmental research

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Abstract

Clinical epidemiology rarely addresses biological, clinical, epidemiological, environmental, economic, and other social and scientific issues posed by environmental chemical contaminants such as endocrine-disrupting chemicals. There is a considerable gap between research and practice in clinical medicine and in environmental health. Organizations often fail to appreciate the human and economic costs of the diseases that environmental chemical contaminants contribute to cause. Also, the relative lack of attention to environmental causes of disease by researchers in medicine and clinical epidemiology cannot be explained just on scientific grounds. Many scientists have shown the virtues of integrative research. Knowledge on the causes of disease is often secondary in clinical practice, but in other instances, to help patients, clinicians tackle causes of diseases. We can better address how environmental contaminants influence negatively not just the occurrence of disease but its course. To do so, we can generate better evidence and strengthen the social conversation on environmental influences on all dimensions of health and disease.

Keywords: Endocrine disrupting chemicals (EDCs); Environmental chemical contaminants; Clinical epidemiology; Biomedical research; Policies; Medicine

Two articles in the Journal [1,2] are somewhat unusual contributions because *clinical epidemiology rarely addresses* the biological, clinical, epidemiological, environmental, economic, or other *social and scientific issues posed by chemical contaminants* such as endocrine disrupting chemicals (EDCs). But maybe this impression is factually wrong and environmental factors are more often addressed in clinical epidemiology than we think. EDCs and other environmental factors are relevant to clinical outcomes and deserve attention from this research community.

Similarly, and more broadly, we perceive a considerable *gap between research and practice in clinical medicine*, and *research and practice in environmental health*. Here, "practice" includes not just clinical care but also private (e.g., company-based) and public *policies* [3,4]. Fortunately, there are notable exceptions where clinicians and environmental health scientists are working collaboratively to tackle important clinical and public health problems. They include excellent work by numerous groups to improve both knowledge and professional activities [5]. Such evidence is used by some clinical organizations including the Endocrine Society, the International Federation of Gynecology and Obstetrics, and the American Academy of Pediatrics. The work of such groups integrates well environmental health into clinical practice and health policies.

Lee and Jacobs describe some methodological limitations and other challenges in human studies of EDCs [1]. We believe that these challenges, while remarkable and common in science, are not insurmountable. Numerous expert groups including the National Academy of Sciences [6], the World Health Organization and the United Nations Environment Programme [7], and experts with the Endocrine Society [8] have shown that—despite limitations—there is strong evidence that EDCs adversely affect human health and that *individual and social efforts can successfully prevent harms* [9,10]. The

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relative lack of attention to environmental causes of disease by many health professionals (and many as well in clinical epidemiology) cannot be explained on purely scientific grounds; it is largely due to socioeconomic and political biases [11]. Certainly, a vast number of social, economic, educational, environmental, public health, and clinical problems of relevance pose difficulties to solve [1]. Yet, to discard several types of human studies is not the way to go. A considerable amount of evidence shows the virtues of *integrative research* and the positive societal impact of *policies* that control human exposure to toxicants such as EDCs [3,4,11,12].

How can we address the gap between clinical medicine and environmental health? One way is for practitioners and researchers to acknowledge the political and socioeconomic forces that influence research and practice [5−11]: To mention just one set of issues, individuals and organizations often fail to appreciate and quantify the *human and economic costs of the diseases that environmental chemical contaminants contribute to cause* [2,5,13−15]. Worse, some organizations with vested interests in the *status quo* argue that there is insufficient evidence to link EDCs to any health effects. They pretend that there is no need to make changes in chemical regulation, production, marketing or use, and they employ similar strategies as the tobacco industry [16−19]. Nevertheless, it is easy to acknowledge that some environmental chemicals are creating legitimate benefits (for producers, individuals, society), whereas others cause avoidable harms [9]. The latter include human disease and suffering, loss of IQ points and of quality of life, health care expenditures, and environmental damage [2,5−10,13,14]. When we acknowledge such ambivalent realities, it becomes clearer that failure to act is not a feasible and moral choice.

The common *absence of environmental health knowledge in clinical practice* may partly occur because *causes of disease are often secondary or unimportant* in clinical practice, at least in some clinical settings and institutions. For instance, in practice, oncologists usually focus on diagnosis and treatment and much less on etiology. Also, in medical sciences, evidence on pathophysiologic and therapeutic mechanisms is often imperfect, especially concerning EDCs and other environmental health matters. But we know that a complete understanding of *mechanisms* may not be necessary to act effectively in medicine, public health, and various other professions [12,20]. For example, knowing precisely how lead affects the developing brain and intelligence is not required to acknowledge that it does—as so much research shows—, nor is detailed mechanistic knowledge always needed to take action to control exposure. Decisions about whether to act on EDCs and other environmental contaminants should not be driven solely by the available evidence on mechanisms, but also by the severity of the consequences if precautionary action is not taken (e.g., by the ''costs of inaction'') [7−10,12,16,20].

In many instances, to help sick and healthy individuals, *clinicians do tackle causes of diseases*. Such causal processes very often interact at individual and contextual levels (e.g., harmful exposures to infectious and noninfectious agents and processes, working conditions, physical activity, diet, or other lifestyles and psychosocial stressors are often related to social structures and, hence, to living conditions in the family, school, work, or household) [12]. The main sources and pathways of exposure to and contamination by EDCs and other environmental chemical contaminants are the air, water, food, food contact materials, and other consumer goods (i.e., furniture, electronics, toys, cooking tools, cosmetics, etc.) [6−10,20,21]. A remarkable example of how these issues are evolving scientifically and socially—but *alas*, not yet much clinically—is the increasing awareness of and concern about the presence of plastic residues in human blood, urine, and stool [22,23]. Questions about these issues of environmental health are increasingly posed in clinical settings.

All previous issues notwithstanding, it would not be fair to only blame clinical habits, or public and private medical policies, for the current gap between research and practice in clinical and environmental sciences. We—notably, scholars in environmental health and clinical epidemiology—are probably failing to sufficiently consider how environmental contaminants influence negatively not only the causes and occurrence of disease but also its *course*, including response to treatment, quality of life, and survival [24]. ''To sufficiently consider'' how environmental contaminants negatively influence the disease course, we need to raise better evidence and to hold a more intense conversation among all parties involved in assessing and acting on environmental influences on all dimensions of health and disease. There are good scientific, clinical, and social reasons to do so.

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References

[1] Lee DH, Jacobs DR Jr. Can solid human evidence be identified about harms of endocrine disrupting chemicals (EDCs)? Key methodological issues. J Clin Epidemiol 2019;107:107−15.

[2] Attina TM, Malits J, Naidu M, Trasande L. Racial/ethnic disparities in disease burden and costs related to exposure to endocrine disrupting chemicals in the US: an exploratory analysis. J Clin Epidemiol 2019;108:34−43.
[3] European Environment Agency. Late lessons from early warnings: science, precaution, innovation. In: EEA report No 1/2013. Copenhagen: European Environment Agency; 2013. Available at http://www.eea.europa.eu/publications/late-lessons-2. Accessed December 26, 2018.
[4] Espina C, Porta M, Schüz J, Hernández-Aguado I, Percival RV, Dora C, et al. Environmental and occupational interventions for primary prevention of cancer: a cross-sectorial policy framework. Environ Health Perspect 2013;121:420−6.
[5] Porta M. Human contamination by environmental chemical pollutants: can we assess it more properly? Prev Med 2012;55:560−2.
[6] National Academies of Sciences, Engineering, and Medicine. Application of systematic review methods in an overall strategy for evaluating low-dose toxicity from endocrine active chemicals. Washington, DC: The National Academies Press; 2017.
[7] World Health Organization. State of the science of endocrine disrupting chemicals - 2012. In: An assessment of the state of the science of endocrine disruptors prepared by a group of experts for the United Nations Environment Programme (UNEP) and WHO. Geneva: WHO/UNEP; 2013.
[8] Gore AC, Chappell VA, Fenton SE, Flaws JA, Nadal A, Prins GS, et al. EDC-2: the endocrine society's second scientific statement on endocrine-disrupting chemicals. Endocr Rev 2015;36:E1−150.
[9] Porta M. Vive más y mejor reduciendo tóxicos y contaminantes ambientales. Barcelona: Grijalbo Penguin Random House; 2018.
[10] Trasande L. Sicker, fatter, poorer: The urgent threat of hormone-disrupting chemicals to our health and future. and what we can do about it. New York: Houghton, Mifflin, Harcourt; 2019.
[11] Porta M, Hernández-Aguado I, Lumbreras B, Crous-Bou M. 'Omics' research, monetization of intellectual property and fragmentation of knowledge: can clinical epidemiology strengthen integrative research? J Clin Epidemiol 2007;60:1220−5.
[12] Porta M, Greenland S, Hernán M, dos Santos Silva I, Last M, editors. A dictionary of epidemiology. 6th ed. New York: Oxford University Press; 2014.
[13] Trasande L, Zoeller RT, Hass U, Kortenkamp A, Grandjean P, Myers JP, et al. Estimating burden and disease costs of exposure to endocrine-disrupting chemicals in the European Union. J Clin Endocrinol Metab 2015;100:1245−55.
[14] Legler J, Fletcher T, Govarts E, Porta M, Blumberg B, Heindel JJ, et al. Obesity, diabetes, and associated costs of exposure to endocrine-disrupting chemicals in the European Union. J Clin Endocrinol Metab 2015;100:1278−88.
[15] Marraudino M, Bonaldo B, Farinetti A, Panzica G, Ponti G, Gotti S. Metabolism disrupting chemicals and alteration of neuroendocrine circuits controlling food intake and energy metabolism. Front Endocrinol 2019;9:766.
[16] Bergman A, Becher G, Blumberg B, Bjerregaard P, Bornman R, Brandt I, et al. Manufacturing doubt about endocrine disrupter science − a rebuttal of industry-sponsored critical comments on the UNEP/WHO report "State of the Science of Endocrine Disrupting Chemicals 2012". Regul Toxicol Pharmacol 2015;73:1007−17.
[17] Trasande L, Vandenberg LN, Bourguignon JP, Myers JP, Slama R, Vom Saal F, et al. Peer-reviewed and unbiased research, rather than 'sound science', should be used to evaluate endocrine-disrupting chemicals. J Epidemiol Community Health 2016;70:1051−6.
[18] Trasande L, Attina T, Skakkebaek NE, Juul A, Porta M, Soto AM, et al. Endocrine disruptors: refereed science to guide action on EDCs. Nature 2016;536:30.
[19] Greenland S. Transparency and disclosure, neutrality and balance: shared values or just shared words? J Epidemiol Community Health 2012;66:967−70.
[20] Zoeller RT, Bergman A, Becher G, Bjerregaard P, Bornman R, Brandt I, et al. The path forward on endocrine disruptors requires focus on the basics. Toxicol Sci 2016;149:272.
[21] Muncke J, Myers JP, Scheringer M, Porta M. Food packaging and migration of food contact materials: will epidemiologists rise to the neotoxic challenge? J Epidemiol Community Health 2014;68:592−4.
[22] Koch HM, Rüther M, Schütze A, Conrad A, Pälmke C, Apel P, et al. Phthalate metabolites in 24-h urine samples of the German Environmental Specimen Bank (ESB) from 1988 to 2015 and a comparison with US NHANES data from 1999 to 2012. Int J Hyg Environ Health 2017;220(2 Pt A):130−41.
[23] Haug LS, Sakhi AK, Cequier E, Casas M, Maitre L, Basagaña X, et al. In-utero and childhood chemical exposome in six European mother-child cohorts. Environ Int 2018;121(Pt 1):751−63.
[24] Høyer AP, Jørgensen T, Brock JW, Grandjean P. Organochlorine exposure and breast cancer survival. J Clin Epidemiol 2000;53:323−30.