Environmental Precision Medicine Research Discussion

Discussion Leaders
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While environment plays a major role in the underlying *causes* of all complex diseases (neurodegeneration, respiratory health, reproductive health etc), it's impact on treatment and disease progression is largely unstudied. In recent years, the concept of "Precision Medicine" (PM)– the individualization of medical treatments to the unique environmental and genetic background of each patient has emerged as a NIH priority. PM is not focused on the underlying *causes* of disease, but instead on the interactions between disease treatment/progression and a patient's genetic and/or environmental background. PM research requires a shift away from purely causal research questions towards research questions that inform treatment decisions. As an initial step towards PM, environmental health research must shift from only assessing the environment that *preceded* disease to assessing the contemporaneous environment that may be modifying disease progression or treatment effects. For example, a commonly cited example of genomic PM is the presence of a genetic variant that inhibits warfarin metabolism in patients with deep venous thrombosis (DVT) yet that common genetic variant plays no role in the development of a DVT. Similarly, a history of smoking will play no role in the treatment of an acute myocardial infarction. Environmental PM research will need to focus on environmental factors that occur in people *with existing chronic disease* and follow them longitudinally to inform PM treatment decisions. Millions of Americans have chronic diseases (Diabetes, Alzheimer's Disease, COPD, Asthma etc) which likely interact with environmental factors that alter treatment response or disease progression. The potential societal benefit is enormous. For example, there is a marked difference in rate of clinical progression in patients with Parkinson disease that is largely unexplained by genetic factors and there is some evidence that environmental factors, such as metal exposures, air pollution or other agents associated with neurotoxicity, may mediate disease progression. Studying a cohort of Parkinson's Disease patients longitudinally for neurotoxic exposures could reveal hidden causes of treatment failure or more rapid disease progression, incorporating environment into clinical decision making. Similarly, a diabetic patient exposed to obesogenic chemicals (e.g. phthalates) may differ in glucose control or weight gain over time compared to unexposed patients. If so, then measuring obesogenic compounds could one day aid clinicians in understanding why patients may respond differently to insulin treatment, and more importantly highlight environmental interventions that would improve care- at the individual level. There is a great deal of evidence, and reason to believe, that environment underlies much of the variability in disease progression and treatment. Indeed, even genetic diseases, such as cystic fibrosis(CF), are not independent of environment, as air pollution may impact CF lung function. In theory, studies investigating environmental modulation of human disease may even be easier to conduct. In these patients, exposures can be assessed contemporaneously with assessment of disease progression, and patients with diseases typically have higher participation rates than healthy individuals. Work in Clinical Environmental Research and Precision Medicine will also provide insights into health disparities related to diseases, as well as new links to community advocacy groups formed around chronic diseases. Finally, environment logically plays a role in response to treatment and/or disease progression and such work is clearly needed if we are to make precision medicine truly precise.