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Insights from life course epidemiology

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Integrative models of disease etiology have recognized the importance of the individual's social and physical environment in shaping vulnerability to disease across the lifespan.¹ Empirical demonstrations of the ways in which the social determinants of health act synergistically with physiological vulnerability remains an essential challenge in understanding health development, disease pathways and the identification of high-risk populations. Stein et al. address this challenge by analyzing data from the National Health Interview Surveys (NHIS) on parent-rated child health and health care utilization.² They report that children characterized as having either “social” or “biomedical” risks “were significantly more likely to be in poorer health and to have high utilization than children with neither type of risk, but that children with both types of risk were substantially more likely to have poorer health and health care use than with either risk alone.”^{2,p.XX} As they point out, this finding has important implications for structuring the care of children with a history of both adverse environmental exposures and medical problems.

Stein et al.'s study adds to the literature another example of the “multiple causality” of disease. More importantly, it provides evidence that by age 12, children with the highest risk of disease have established histories of both social and medical burden. These are fundamental concepts of the emerging field of life course epidemiology, which addresses the unraveling and accumulation of disease etiology beginning early in life, and extending throughout the human life span. The value of this approach lies in the potential for identifying risks for disease at the beginning of the etiologic process when intervention will have a much greater and longer-lasting public health impact than attempting to reverse pathology.³ The models in life course epidemiology posit specific ways in which risk factors are related (and inter-related) to health outcomes over the life course. These models are: 1) *latency* (including the concepts of critical and sensitive periods); 2) *accumulation*; and 3) *pathway*, or “chains of risk,” models.⁴ Briefly, the latency model is one in which an exposure early in the life course, particularly during a sensitive period (i.e., a period during which a developmental process is occurring or developmental milestone is typically reached), is associated with a health outcome after some period of time. The accumulation model describes a situation in which the degree of exposure over the life course predicts the magnitude of response. Finally, the pathway model posits that events early in the life course are associated with health outcomes later in life through a series of intervening risks. Life course models are not mutually exclusive—a combination of models might be applied to any given problem—but the public health and public policy implications of each model often differ.⁵

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At least two of these models might be applied to Stein et al. Their results are consistent with the accumulation model, as they concluded that “there is a cumulative relationship between social and biomedical risks” and child health.^{2,p.XX} While the number of risk factors present was associated with increasingly worse health outcomes, we are concerned that analyzing these risks solely in terms of their cumulative effects may obscure important associations between them, and therefore points for potential intervention. Thus, a pathway model could also have been applied to the same data, as illustrated in figure 1. It is often difficult to apply such a model in the context of a crosssectional study, yet in the NHIS, many of the dimensions of risk that were analyzed have a clear temporal precedence to the outcomes of parent-rated health and health care utilization. As seen in the figure, quantifying the magnitude of the several pathways could yield important information on intervention points for preventing poor health.

Stein et al.'s conclusions imply that there are synergistic effects between social and biomedical risk factors: that the effects of one are amplified in the presence of the other.⁶ Additional work to further understand the nature of the synergies that exist between “social” and “biomedical” risks requires applying statistical models that can distinguish between risk factors that have additive effects on health from those that have interactive effects. This distinction is important because intervening on risk factors that have additive (i.e., “independent”) effects on health would only be expected to reduce the risk of disease that is associated with that risk factor alone; on the other hand, the effectiveness of interventions designed to target risk factors with interactive effects will either be amplified or diminished depending on the presence or absence of the interacting variables.

Where Stein, et al, add new information is illustrating the effect of these two types of risk on the use of health services. Generally, life course epidemiology studies have not considered the consequences of multiple risks on the demand on health and social service systems. These results suggest the need for additional investigations into what proportion of this expensive care may be reduced by better management in “medical home” settings, and what resources may be needed to optimize the health of children with social and health burdens.⁷

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Figure 1.
Conceptual model of the associations between “social” and “biomedical” risks for poor child health.