Commentary: Reconsidering the Role of Context in Diabetes Prevention

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A substantial gap remains between what we know about type 2 diabetes prevention and our ability to apply that knowledge in socially disadvantaged populations at highest risk. This gap results, in part, from a lack of integration between epidemiologic science and social psychology theory, particularly regarding the intersections of stress, self-regulatory health behaviors, and the biological mechanisms underlying the development of diabetes. In this commentary, we describe the utility of a theoretical framework that focuses on the intersection of biological, psychosocial, and environmental contexts as they apply to diabetes disparities, and how such a framework could inform a translational research agenda to reorient prevention efforts to address these inequalities. Such reorientation is needed to ensure that the implementation of prevention efforts does not inadvertently widen diabetes disparities. *Ethn Dis.*2017; 27(1):63-68; doi:10.18865/ed.27.1.63.

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Introduction

The direct and indirect costs of diabetes are staggering. Costs in the United States alone are $245 billion annually.[1] Approximately 9.3% of US adults currently have diabetes, a number that has more than doubled since the 1990s and is projected to continue to increase.[1] An additional one-third of US adults have pre-diabetes.[1] Non-Hispanic Blacks (12.6%), Hispanics (11.8%), Native Americans/Alaskan Natives (16.1%), and Asians (8.4%) have substantially higher prevalence of diabetes relative to non-Hispanic Whites (7.1%).[1] Socioeconomic status (SES) is also inversely related to diabetes risk, and SES gradients have widened in the past 30 years.[1]

Diabetes Disparities in Context

A substantial gap remains between what we know about diabetes prevention and our ability to translate that knowledge into meaningful improvements for populations with the highest risk. With the broad adoption of geographical information systems (GIS) technologies, and the growing evidence that "place" matters, it has become possible to visualize these inequalities in new ways that are relevant to closing the translation gap.[2]

As a result of residential segregation, non-Hispanic Blacks are more likely to live in neighborhood contexts that both increase exposure to stressors (ie, crime, poverty, housing instability) and constrain opportunities to self-regulate when faced with stress.[3,4] However, racial differences in diabetes among groups living in the same types of neighborhoods are strongly attenuated and in some cases eliminated,[4,5] demonstrating the influence of context in explaining variability in diabetes risk in the population. Figure 1 illustrates this influence by showing the distribution of non-Hispanic Black patients aged ≥50 years with pre-diabetes seen at a large, urban primary care clinic in Richmond, Virginia (our community) over a 12-month period in 2012/13, overlaid with neighborhood (2010 Census tract) poverty levels. Similar situations are repeated across the US: diabetes risk is concentrated in low-SES contexts.[2,4-6]

While prior work has noted the importance of environmental context for addressing disparities[4-6] and there are broad calls to develop place-based interventions, there is a lack of theo-

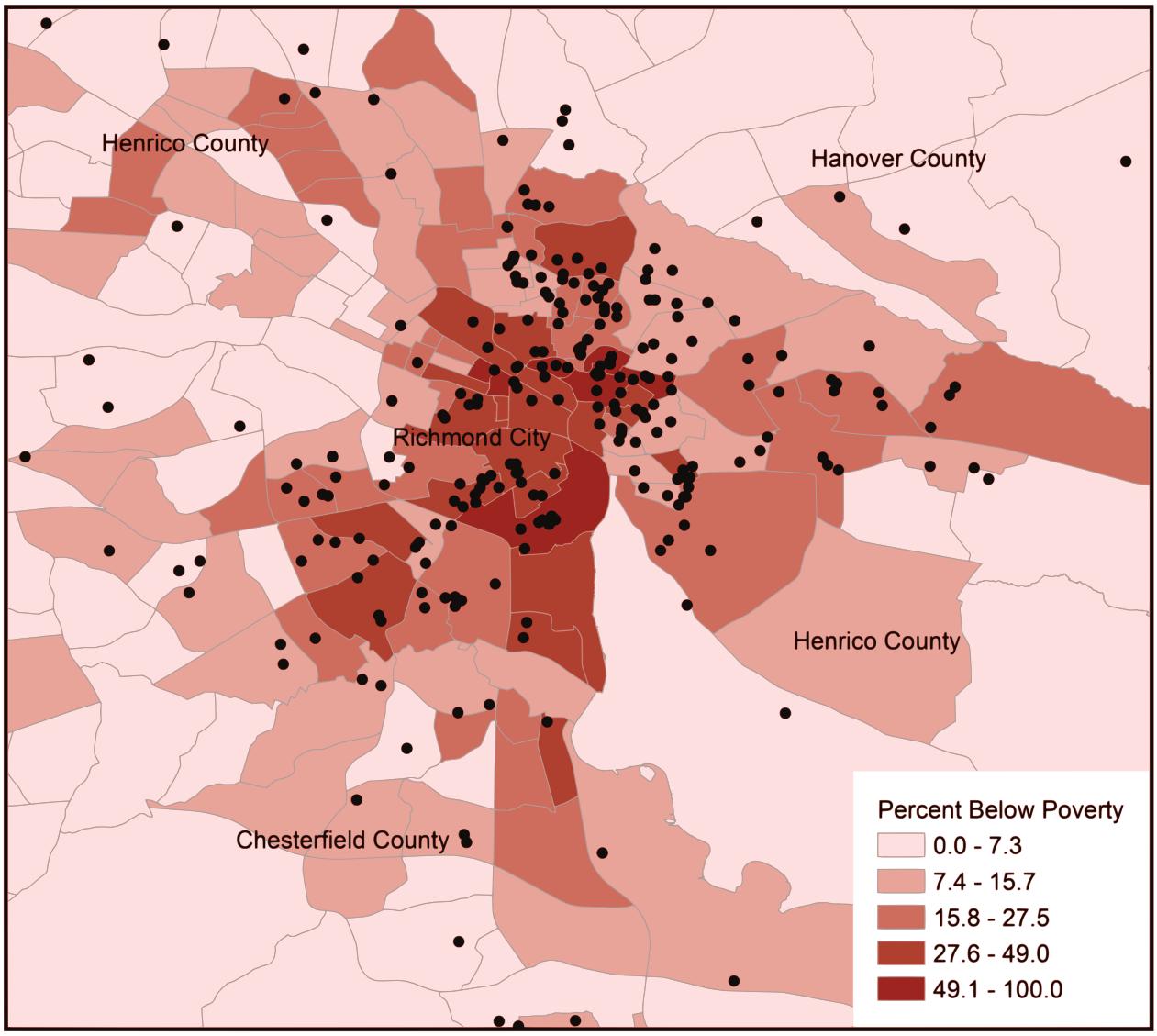

Figure 1. Diabetes risk in context: neighborhood poverty among African Americans with pre-diabetes in Richmond, Virginia
Note: Geographic distribution of African Americans at high-risk of type 2 diabetes by 2010 Census poverty level.

retical guidance as to how to understand persons "in" place: that is, how individual and environmental factors operate together. Studies that use GIS methods to objectively examine environmental context (eg, walkability, availability of grocery stores and fast food outlets)[2,7] repeatedly find that these types of attributes are not strongly associated with development of diabetes. A recent study examined both objectively assessed (eg, density of food outlets per square mile) and subjectively assessed (eg, perceived availability of fresh fruits/vegetables) aspects of the built environment, and found that only the latter were predictive of incident diabetes.[2] This suggests that it is not the case that we can address disparities by solely intervening on the environment. Moreover, it points to the need to consider why subjective perceptions of environmental context are related to diabetes at all, and how this might relate to social disparities in risk.

The Translation Gap

Researchers have estimated that only 20% of the variance in health outcomes is attributable to ele-

ments of health care; the remaining 80% reflects "social and environmental influences."[8] Efforts to address diabetes disparities must come to terms with these influences.

The Diabetes Prevention Program (DPP) and related trials have demonstrated that health behavior change (ie, adopting a low-calorie diet, increasing physical activity) substantially reduces short-term risk of type 2 diabetes,[9] with more modest reductions long-term,[10] even among racial/ethnic minorities. However, implementations of the DPP in community settings have generated only modest weight loss even in the short-term, and there is no compelling evidence that these programs meaningfully reduce the incidence of diabetes, especially in populations most at risk.[11-13] A 2015 review notes that: "…we know little about successful community-based interventions for racial and ethnic minorities. Although the participants in the DPP were racially and ethnically diverse, the majority of participants in nearly all of the community-based studies… were White, non-Hispanic, and primarily female."[13] Parallel to this, leaders in the field have noted that many current translation efforts are "limited in scope and applicability, underemphasizing the value of context"[14] and that research conducted in "diverse and low-resource settings" is needed.[8]

There is a lack of theoretical guidance as to how to understand persons "in" place: that is, how individual and environmental factors operate together.

The Value of Context in Diabetes Prevention

What is the value of context in diabetes prevention? Racial/ethnic and socioeconomic health disparities do not emerge solely at the level of individual behaviors; rather, they originate at the intersection of environmental, psychosocial, and biological contexts.[15] Few empirical studies have high-quality data across these levels of exposures, particularly among high-risk populations (eg, racial/ethnic minorities; individuals with low SES; individuals residing in low SES neighborhoods), to test diverse hypotheses about this intersection. The need to address this gap has prompted several important research efforts; these include the Healthy Aging in Neighborhoods of Diversity across the Lifespan cohort,[16] the Exploring Health Disparities in Integrated Communities Study,[17] and the Healthy Environments Partnership.[6] A common thread of these efforts is attention to both the inputs and consequences of core social determinants of health, specifically racial segregation and neighborhood SES. While these types of studies have provided important new information regarding the complexities of persons "in" place, the specific mechanisms underlying the emergence and persistence of diabetes disparities remain unclear. In addition, there is a limited evidence base that specifically addresses leverage points for behavior change in socially disadvantaged contexts. Indeed, context can also be conceptualized as theoretical context, ie, the need to situate hypotheses about the origins of health disparities within an empirically grounded framework. Frameworks play an essential role in forming research questions, selecting assessment tools, generating analytic plans, and guiding interpretation of results – including reconciling unexpected findings.[18,19]

Using Theory to Drive Empirical Research on Diabetes Disparities

There are numerous theoretical frameworks employed by public health researchers to conceptualize the processes that lead to disparities. One framework that has particular relevance to understanding the role of context in the emergence of disparities in diabetes is the Environmental Affordances (EA) Model.[20] This model organizes how environmental context (eg, neighborhood attributes) intersects with both psychosocial context (eg, stress exposure, self-regulatory behaviors) and biological context (eg, neuroendocrine and metabolic systems) to produce disparities. It centers on the role of behavioral self-regulation (ie, coping) in the context of stress as a means to explain racial/ethnic differences in mental and physical health. A main tenet of this framework is that apparent racial/ethnic differences in health largely

represent the culmination of differences in environmental opportunities (ie, stressors and resources) and affordances (ie, constraints and contexts) that correlate with race. As a result of fundamental determinants of population health, such as socioeconomic status and residential segregation,[3] non-Hispanic Blacks and non-Hispanic Whites in the US rarely share the same environmental contexts.[17] Thus, they are exposed to different ends of the distribution of stressors both in in terms of quantity (ie, number of events) and quality (ie, the same type of negative life event, eg, being fired from a job, is more likely to lead to a cascade of other negative life events) because of differences in environmental affordances and constrained environmental opportunities for Blacks relative to Whites.

Emerging research indicates that we should adopt a more nuanced approach to investigating how stress and health behaviors intersect with diabetes risk

Unlike many social stress theories, the EA Model is heavily informed by empirical biological findings from both animal and human studies to generate hypotheses about the ways that stress and self-regulatory behaviors, within context, intersect to differentially impact mental and physical health. While stress is a hypothesized contributor to disparities in diabetes,[21] empirical support for this notion is mixed for two reasons: first, there is a lack of high-quality data on the biological mechanisms thought to underlie this relationship; and second, little attention has been given to the role of self-regulatory (ie, coping) behaviors that are prompted in response to stress. Some of these self-regulatory behaviors reduce risk of diabetes (eg, exercise, social support) while others increase diabetes risk (eg, tobacco and alcohol use, eating foods high in fat and sugar).

Emerging research indicates that we should adopt a more nuanced approach to investigating how stress and health behaviors intersect with diabetes risk. For example, a recent study found that normoglycemic women randomized to consume high-sugar beverages over a 2-week period had a blunted cortisol response and reported less psychological distress to a laboratory stressor as compared with women randomized to consume aspartame-sweetened beverages, suggesting a negative feedback loop between glucose consumption and stress reactivity.[22] Consistent with this, individuals with type 2 diabetes have reduced glucocorticoid responsivity to laboratory stressors relative to normoglycemic individuals.[23] These stress-coping behaviors appear to be conserved. Rats randomized to high fat/calorie chow vs regular chow not only consume more calories after a stressor, they produce less corticotropin releasing hormone in response to that stressor.[24] Parallel findings have been reported for other health behaviors, including tobacco, alcohol, and exercise.[20]

Broadening the Discussion beyond Diabetes-Related Distress

These experimental studies lead us to reconsider these health-harming behaviors (eg, foods high in fat and sugar, alcohol, tobacco) as also potential self-regulatory stress coping strategies that have tangible biological implications for both diabetes and mental well-being. The relevance of these experimental laboratory studies to the real-world is illustrated by qualitative research, which has consistently found that health behavior change can itself become a source of stress in low-resource contexts. In a recent study of racial/ethnic minorities with diabetes living in low-income neighborhoods, respondents felt they needed to make trade-offs between eating "comfort" foods that reduced feelings of psychological distress vs taking on additional stress of trying to adhere to a healthy diet.[25] In another, respondents endorsed taking a "diabetic holiday" (ie, eating food they enjoyed despite knowing that it would raise their sugar) in order to get a mental release.[26]

Taken together, a growing body of research is consistent with the notion that in high stress, low resource contexts, individuals are more likely to face what can be conceptualized as a zero-sum contest between (short-term) mental health and (long-term) physical health, with self-regulatory health behaviors at the center. The

way these processes influence social disparities in diabetes can only be understood through empirical work that explicitly interrogates social and environmental context (eg, residential segregation, neighborhood socioeconomic status).[3,6,16]

Implications for Reconceptualizing Health Behavior Change in Low-Resource Contexts

Although clinical practice guidelines note the relevance of stress and coping in diabetes prevention and self-management,[27] this is often compartmentalized as a sub-component of a larger behavior change program, disconnected from the neurobiology of stress and behaviors. For example, while the National DPP curriculum has a component on managing stress, it is relegated to session 15 (of 16).[28] Given the substantial attrition in community-based programs (some report drop-out rates of >75%),[12,13] it is probable that the individuals most likely to be engaged in this session do not remain in the program long enough to benefit from it.

In December 2016, the American Diabetes Association published a position statement on psychosocial care for persons with diabetes;[29] while this position statement addresses management, rather than prevention, of diabetes, it provides a lens into the current state of thinking of many health professionals about how psychosocial factors operate to influence the course of this disease. Even in this discussion dedicated of the role of psychosocial factors in diabetes care, there is little attention to the specific ways in which stress and environmental context influence a person's ability to adopt and maintain behavior modifications, or how such factors, in turn, drive social inequalities in diabetes. Indeed, the words, "disparity" or "inequality," do not occur even once in the text of this position statement.[29]

Conclusion

The research reviewed here illustrates the potential for innovation in observational and intervention epidemiologic research on diabetes prevention that reflects the complex ways in which stress, health behaviors, and mental health relate to each other. This requires a fundamental shift in how we think about health behavior change. Without reorientation, we fear that the successful implementation of type 2 diabetes prevention programs may inadvertently result in a widening, rather than narrowing, of disparities as others have warned.[11]

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Conflict of Interest

No conflicts of interest to report.

Author Contributions

Research concept and design: Mezuk, Perrin, Green; Acquisition of data: Mezuk, Perrin; Data analysis and interpretation: Mezuk, Perrin; Manuscript draft: Mezuk, Concha, Perrin, Green; Acquisition of funding: Mezuk, Perrin; Administrative: Concha, Perrin, Green

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