

Quality of Residential Neighborhood

A Modifiable Risk Factor for Type 2 Diabetes?

THERE HAS BEEN A DRAMATIC INCREASE IN THE incidence of type 2 diabetes mellitus in developed countries during the last 50 years. In the United States, the prevalence of diabetes has increased from 0.9% in 1958 to 4.4% in 2000¹ and is projected to reach 7.2% by 2050.² Diabetes causes substantial morbidity, disability, and mortality¹ and is a major contributor to increased health care costs. In 2007, medical expenses related to diabetes totaled an astronomical \$116 billion in the United States.³ We are therefore in great need of interventions to reduce the incidence of this disease.

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The cause of type 2 diabetes is multifactorial, including both genetic and behavioral risk factors. As clinicians and public health practitioners, our job is to focus on those risk factors that are modifiable. We cannot do anything about genetics (at least not yet!), and so most interventions have focused on lifestyle changes. Indeed, multiple randomized controlled trials have found that providing counseling on diet and exercise are effective at lowering the incidence of diabetes among high-risk persons.⁴⁻⁶

However, translating the benefits of these trials into community practice is challenging. It requires identifying persons at high risk for diabetes, scaling the intervention to reach a large affected population, adopting the intervention to meet the different cultural needs of affected communities,⁷ motivating at-risk individuals to participate, and funding the program. The last 2 steps may be the hardest. We know that persons who participate in randomized controlled trials are more motivated and less heterogeneous than those seen in clinical practice. The societal cost of these programs, depending on the model used, is either cost-effective (\$8800 per quality-adjusted life-year)⁸ or in the range of other commonly used interventions (\$62 600),⁹ but in neither case is it cost saving, which is a problem, given the pressure to decrease health care costs.

BETTER NEIGHBORHOODS, BETTER HEALTH?

Given the challenges of mounting an intervention at the individual level, it is heartening to read a study suggesting that it may be possible to decrease the incidence of diabetes by modifying the environment. In this issue of the *Archives*, Auchincloss and colleagues¹⁰ report the results of a 5-year study of 2285 participants among whom 233 incident cases of diabetes were identified. Partici-

pants were prospectively classified by the degree to which their neighborhood supported physical activity and healthful foods. The difference between living in a neighborhood rated in the 90th percentile in resources for physical activity and healthful foods and living in one in the 10th percentile of neighborhood resources was an impressive 38% lower incidence of type 2 diabetes.

A major strength of the study was that neighborhood resources were assessed by a separate population-based sample, not by the cohort participants themselves. Therefore, the results cannot be biased by active, well-eating participants perceiving their neighborhood differently than their more sedentary, high-fructose corn syrup-guzzling neighbors.

To better elucidate the mediating pathway between neighborhood resources and diabetes incidence, the authors adjusted for individual exercise and dietary profiles. What they found—that adjustment for exercise and dietary habits did not weaken the association between environment and type 2 diabetes—either strengthens their findings or weakens them, depending on your interpretation.

One interpretation is that the benefits of living in a neighborhood where it is “pleasant to walk” and where there is a “high-quality selection of fruits, vegetables, and low-fat foods” are greater than what could be captured in the individual measures of physical activity and diet used by the investigators. In this regard, the authors note that individual health behaviors are hard to measure, and there may have been error in their measurements especially since diet was measured only at baseline. Moreover, healthful resources may increase community cohesion and an individual’s sense of well-being, and these factors might influence behaviors or neuroendocrine levels in ways that might affect incidence of type 2 diabetes.

A different interpretation is that adjusting for individual behavior does not diminish the association between environment and incidence of type 2 diabetes because the association is spurious; specifically, that the association is confounded by self-selection: people motivated to exercise and eat well choose to live in neighborhoods that support this lifestyle. In support of this hypothesis are the authors’ findings that persons who lived in neighborhoods with the best physical activity and food resources (1) had higher income, (2) had higher education, (3) were more likely to be white and Hispanic and less likely to be African American, (4) were less likely to be current smokers, (5) had higher activity rates, (6) had better diets, and (7) had lower body mass index than persons in the worst neighborhoods at baseline. Although the authors adjusted for these factors in their multivari-

able analysis, it is impossible to adjust for the motivation to live in a healthier place.

On the other hand, it is possible that the groups were different at baseline due to the prior influences of neighborhood conditions. Also, even if there is self-selection into neighborhoods with particular characteristics, the fact is that it is hard to be active if there are no safe places in the neighborhood to walk, and hard to eat better if the nearby stores sell only highly processed foods.

STUDYING NEIGHBORHOOD INTERVENTIONS

To say the least, it is challenging to unravel environmental and individual behavioral determinants. We cannot randomize people to neighborhoods. Instead, the direction of future studies should be to assess the impact of interventions to improve neighborhood characteristics. Ideally, communities would be identified and randomized to receive an intervention or not. However, nonrandomized studies can also be useful if comparable communities can be identified.

For example, Farley and colleagues¹¹ developed a common-sense, low-cost environmental intervention: they opened a schoolyard for play during nonschool hours in a low-income neighborhood in New Orleans and provided attendants to ensure children's safety. They compared the activity of children in this community to children from a neighboring community. Prior to the opening of the schoolyard, the number of children observed to be active in the intervention community was lower than that in the comparison community. After the intervention, the number of children observed to be active was significantly greater in the intervention community, not counting the children in the schoolyard.

An intervention such as opening a schoolyard to encourage activity is a structural intervention in that it changes the environment in a way that makes it easier for people to be healthy without individuals enrolling or even knowing they are participating in an intervention.¹² Other structural interventions to increase activity or improve diet include widening sidewalks; building residential property in close proximity to schools, stores, and public amenities; creating walking paths in parks; closing streets; increasing the number and/or extent of bicycle paths; planting community gardens; and establishing farmers' markets.¹²

CONCLUSION

Although we have little data demonstrating the impact of specific environmental interventions on decreasing the incidence of type 2 diabetes, we have observational data on the association between changes in the structural environment and increases in diabetes rates from a very large multinational population-based cohort that has been observed for the past 50 years: the developed world. Specifically, 50 years ago, few people had cars. People had little choice but to walk or take public transportation, which required walking to the transit stops. Clothes were washed by hand and hung to dry, lawn mowers were pushed, groceries were carried up steps, tools in the

kitchen and in the garage were unpowered, and supermarkets were less common and less extensive, necessitating walking to multiple different stores. If you had a television set, you at least had to get up to change the channels, and there were many fewer channels to choose from. Fast food meant grabbing something from the refrigerator while walking to school or work, not a super-sized meal with a full day's calories and saturated fat under a bun with a side of fries.

Unfortunately, in most developed countries today, the environment offers few opportunities for exercise, and highly processed foods are more plentiful than fresh vegetables and raw grains. While causality cannot be proven, the increase in obesity and type 2 diabetes in developed countries¹³ tracks with these environmental changes. If we are to decrease the rates of type 2 diabetes, we need to change the environment in ways that make it easy for people to exercise and eat right as part of their daily routine.

Mitchell H. Katz, MD

Correspondence: Dr Katz, San Francisco Department of Public Health, 101 Grove St, Room 308, San Francisco, CA 94102 (mhkatz59@yahoo.com).

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