What is it about neighborhood characteristics that influence survival after a stroke or TIA?

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Using a random sample of stroke and TIA patients from the Registry of the Canadian Stroke Network Nationwide Inpatient Sample, Kapral and colleagues[1] report, in this issue of *Neurology*®, that survival at 1- and 3-year intervals poststroke/TIA was higher in persons who lived in higher income neighborhoods at the time of their stroke/TIA than those who lived in lower income neighborhoods. Adjustment for covariates had a relatively modest attenuating effect on these differences, suggesting that the neighborhood income differences act through some other pathway.

Neighborhood income is only one measure of neighborhood socioeconomic status (SES); however, it is a reasonable proxy for a general index of neighborhood disadvantage. Others have shown that individuals in lower SES neighborhoods are at higher risk for incident stroke.[2–5] This work complements those reports by assessing whether similar associations exist with survival following stroke and TIA, an important addition toward understanding the potential effect of neighborhood characteristics on stroke.

Residents of the wealthy neighborhood were more likely to have a TIA diagnosis than those in poor neighborhoods. The 1-year mortality for TIA cases was lower than for ischemic strokes (adjusted hazard ratio 0.37; 95% confidence interval 0.31, 0.43). One potential explanation is that the clinical distinction between stroke and TIA may not be as crisp as we assume and the strokes in the wealthy neighborhoods may be closer to being TIAs than those in the poor neighborhoods. While the authors did adjust for stroke severity, much of these differences might not be captured by this adjustment.

The study did not find a statistical relationship between neighborhood income and 30-day mortality, but it did with 1-year (and 3-year) mortality. While the authors acknowledge that the lack of association at 30 days could be attributable to lack of statistical power, they nevertheless conclude there was "no income-mortality gradient at 30 days" and that better outcomes are not due to acute stroke care delivery. Some caution should be expressed in moving to this conclusion. First, power to detect differences is related to the number of events (deaths); shorter follow-up will have fewer deaths and less power. However, the relative risks of death between the most wealthy and poorest neighborhoods were remarkably constant over time: 1.20 (12% mortality/10% mortality) at 30 days, 1.22 (22%/18%) at 1 year, and 1.21 (35%/29%) at 3 years. In addition, the design of the study does not allow an assessment of the effect of neighborhood income on the general stroke-free population. It is possible that neighborhood income also affects the survival of those without stroke, and it is not clear whether the influence of neighborhood income on those with stroke is smaller, the same, or greater than the stroke-free population.

Some concern also must be expressed regarding the original stratification of neighborhood income into 5 categories, and the subsequent combining of the bottom 2 and middle 2 income strata to produce low, middle, and high strata used in analysis. There are several reasons why these strata could be combined; for example, a narrower range of incomes in the combined 1 and 2 quintiles and in the combined 3 and 4 quintiles, making combining them logistically attractive. It is unknown if a post hoc review of the relationships between neighborhood income and outcome following stroke was performed to find the categories that could be combined to gain statistical power.

As the authors state, this study is one of the first steps toward the development of interventions to address socioeconomic disparities in stroke outcome. It is noteworthy that the combined effect of all the factors only accounted for 13% of reduction in neighborhood effects. That the covariates explained so little raises both a question and a concern. If this extensive list of factors accounts for such a small portion of the effect, the natural question is: what are other characteristics of the neighborhoods (or the residents or poststroke care) that do account for the substantial dif-

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ferences? Some other likely factors include aspects of the physical and social environment such as transportation, availability and cost of "healthy" foods, safety and violence, social support and cohesion, and access to and availability of health care.[6] Individual factors may be related to health literacy, social support, and compliance with secondary prevention management. However, an alternative explanation for the relative small attenuation observed with the adjustment for covariates is a potential role of measurement error. Regression models assume that predictor variables (i.e., the comorbid conditions and risk factors) are measured with precision, and the potential for these variables to attenuate (or mediate) the association between neighborhood income and outcomes is reduced with increasing imprecision. That the predictor variables were determined from administrative databases not specifically designed for research purposes does make this possibility a concern. This concern is, however, somewhat lessened by the "success" in mediating the effect of neighborhood differences after acute myocardial infarction using very similar methods.[7]

Although this study found no differences in stroke severity by neighborhood income, there could be systematic differences in the likelihood of discharge to nursing home, rehabilitation facility, or home of a family member in different neighborhoods. Future research could examine the characteristics of the pre- and poststroke neighborhood on outcomes following stroke. In addition, it would be interesting to assess if the medical record system in Canada could be used to construct a record of neighborhood exposures over the life course. Long-term exposure to conditions of economic disadvantage is strongly associated with many health outcomes.[8] Perhaps the remarkable health care system of Canada offers a unique opportunity to explore these relationships in cerebrovascular disease.

This work of Kapral et al. compels us to understand why neighborhood income can influence outcomes following stroke as the first step in designing interventions to improve the health of all Canadians and residents of poorer neighborhoods worldwide.

DISCLOSURE

The author reports no disclosures relevant to the manuscript. **Go to Neurology.org for full disclosures.**

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