

## Stroke Disparities Large Global Problem That Must Be Addressed

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Stroke disparities are wide spread and pervasive throughout the world. In this review, we will examine the effect of socioeconomic status (SES), race, and ethnicity on stroke incidence and outcome. There are 2 main reasons that should compel us to fix the damage caused by stroke disparities. The first is based on the justice principle: no person or group should suffer more than others. Although this reason should be a sufficient motivator, another incentive to remedy stroke disparities is the tremendous expense that disparities impose on society. Because minority populations have stroke at younger ages and are often more severe; the cost is far greater per capita than in majority populations.<sup>1</sup> We will look at opportunities to improve stroke prevention and stroke preparedness (recognizing stroke and alerting emergency medical services) in underserved populations toward remedying stroke disparities. The Table provides a summary of the potential intervention targets discussed in this article.

Much of the work in this area is centered in the United States. However, there are important data emerging from international locations. Indeed the epidemiological transition, the change from infection and trauma to chronic diseases as major causes of death and disability in the developing world, speaks directly to the need for prevention and preparedness in the poorest parts of the globe. Paradoxically, increases in stroke risk and mortality in developing countries are associated with increasing SES, but decreases in stroke risk and mortality in developed countries are associated with increasing SES.<sup>2</sup> In rural villages in China, higher incomes brought prosperity but also brought higher stroke risk.<sup>3</sup> It is likely that when new monies enter a previously impoverished area that certain unhealthful behaviors are initially adopted. These may include increased consumption of meat and sugar-rich foods, as well as using motorized transport rather than walking. With increased health literacy, the economic advantage is put to good use with improved diet, exercise, and access to medical prevention and treatment. A key goal will be to help developing countries to control increasing stroke risk and obtain the same health benefits with prosperity seen in the West.

### Non-US Disparities

#### Prevention

Studies in non-US developed countries show greater stroke risk and worse outcome in ethnic minority populations compared with European origin populations.<sup>4-6</sup> Efforts to prevent stroke in developing countries and in disadvantaged areas of developed countries have focused mainly on primary prevention. Because the largest population attributable stroke risk factor is hypertension, it has become the most important target for stroke prevention. Hypertension is a formidable foe. It often does not cause pain or obvious stigmata until stroke, heart, kidney, and eye disease are already advanced. It is, however, readily treatable with behavior modification (smoking cessation, weight control, diet, and aerobic exercise) and low-cost pharmacotherapy.

The Nigerian antihypertensive adherence trial was a randomized population-based study. Hypertensive individuals (n=544) were randomized to receive nurse-led clinic visits and home visits compared with just clinic visits. At baseline, mean blood pressures of enrollees was 168/92. Diet and exercise interventions as well as low-cost medication (thiazide diuretic±a  $\beta$ -blocker) were used. At 6 months, 77% had stayed in the study and 98% of these were compliant with the program. At 6 months, 2 of the 3 subjects in both arms of the study had blood pressure controlled <140/90; a phenomenal success for a low cost, low resource intervention.<sup>7</sup>

A second study conducted in China and Nigeria further illustrates how successful targeted risk factor reduction programs can be. The study enrolled 60 hypertensive patients at 10 pairs of primary care facilities and randomized the pairs to educational intervention (behavioral risk factor reduction and medication as needed) and control. There was significant reductions in blood pressure in the intervention compared with the control group. Interestingly, the control group also showed significant blood pressure declines suggesting that participating in a clinical trial in the developing world may be beneficial by itself.<sup>8</sup>

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**Table. Potential Intervention Targets and Timing to Reduce Stroke Disparities in Developed and Developing Countries Discussed in This Article**

	Developed Countries	Developing Countries
<b>Prevention</b>		
Improved health literacy	Now	Now
Hypertension control		
Tobacco cessation	Now	Now
Weight control and diet	Now	Now
Exercise	Now	Now
Low-cost medication	Now	Now
Lipid control	Now	Now
Antiplatelet/anticoagulant	Now	Now
Community focus	Now	Now
Genetic tailored focus	Future	Future
<b>Preparedness</b>		
Public awareness	Now	Now
Health team readiness	Now	Now
<b>Acute treatment</b>		
Intravenous r-tPA	Now	In many locations
Catheter intervention	Now	Future
Rehabilitation	Now	Now

r-tPA indicates recombinant tissue-type plasminogen activator.

The South London Stroke registry found a 75% increased chance of poor outcome among the lowest SES group compared with the highest after controlling for clinical variables, including stroke severity.<sup>9</sup> The potent effect of SES on stroke outcomes suggests a tremendous need for improved resources for those recovering from stroke.

### Preparedness

We have been unable to find evidence about stroke preparedness directed specifically at minority populations in the developing world. Indeed a recent systematic review of stroke preparedness for minority populations found 15 studies, all done in the United States.<sup>10</sup> This may, in part, be because of the expense associated with both intravenous thrombolysis and acute stroke intervention. Still, there is ample evidence that early presentation and expert acute stroke care improve stroke outcome even without thrombolysis and intervention.<sup>11</sup> Although a lofty goal may be the spread of thrombolysis and intervention globally, it remains clearly important to advocate worldwide rapid presentation to a hospital equipped with the personnel and necessary equipment to properly manage fluid status, blood pressure, and prevent stroke complications.

## US Disparities

### Prevention

Epidemiological studies in the United States show that race/ethnic minorities have a higher stroke risk and worse outcome than non-Hispanic whites.<sup>12-14</sup> Stroke risk in blacks has varied by age, with highest risk in younger age groups and less disparity at older ages.<sup>15-17</sup> In a similar fashion, Mexican Americans had a higher cumulative incidence of ischemic

stroke at younger ages with similar incidence rates in older age groups.<sup>18</sup> In studies with longitudinal data, the stroke incidence rates for non-Hispanic whites has been decreasing,<sup>19,20</sup> whereas incidence rates for race/ethnic minorities have not.<sup>20,21</sup>

In clinical trials of recurrent stroke performed during the past 50 years, annual stroke recurrence rates have declined from 6.1% in the 1960s to 5.0% in the 2000s. After the linear trend, the stroke rate in the control group of secondary prevention trials during the next 10 years is projected to be as low as 2.3%.<sup>22</sup> This speaks to improvements in the optimal or control regimen for secondary stroke prevention. Although hard to strictly implement such regimens outside of the rigorous environment of a clinical trial, recurrent stroke rates have declined in the broader US population as well. Among elderly Medicare beneficiaries, recurrent stroke rates declined by almost 5% between 1994 and 2002.<sup>23</sup> These results speak to the potential for multifactorial risk factor reduction including antiplatelets, antihypertensives, lipid-lowering agents, and behavior change in reducing the risk for stroke when systematically applied.<sup>24,25</sup>

About primary prevention, significant racial disparities have been noted in major stroke risk factors, such as hypertension, even after controlling for sociodemographic and clinical characteristics, and for medication adherence.<sup>26</sup> Risk factor awareness has been consistently found to be lower in race/ethnic minority groups.<sup>27</sup> However, in 1 study blacks were 30% more likely to be aware of their hypertension than whites, and when aware, were 70% more likely to be treated than whites, but still less likely to have adequate blood pressure control.<sup>28</sup> A recently reported primary prevention trial found significant improvement in behavioral risk factors for hypertension after a Catholic Church-based educational intervention aimed at Mexican Americans and non-Hispanic whites. This study of 801 community residents found significant increases in fruit and vegetable intake and in sodium reduction, meeting its primary, prespecified end point.<sup>29</sup>

In the future, targeted prevention strategies may emanate from specific genetic predispositions for stroke risk. Indeed, genome-wide association studies have already yielded clues for genetic stroke risk in minority populations.<sup>30</sup>

In summary, the potential effectiveness of primary and secondary prevention in the United States is limited by the complex interwoven issues of adherence and compliance, inability to afford medications, unequal access to medical care, mistrust, low medical literacy, and medication side effects. These issues are more pronounced in race/ethnic minority groups.<sup>31</sup> It is of paramount importance to recognize that inefficiencies and inequalities in the healthcare system drive these issues, and that we should not blame the victims but rather look in the mirror for solutions. A possible solution to at least some of these issues is found in the Affordable Care Act, which provides low-cost health insurance to those in the United States and widens access for the poor to Federally Qualified Health Centers who provide guideline concordant vascular disease prevention.<sup>32</sup> Another key component to finding stroke treatments for minority population is the need to recruit minority populations into stroke clinical trials. A recent article suggests specific key steps to improve minority recruitment that

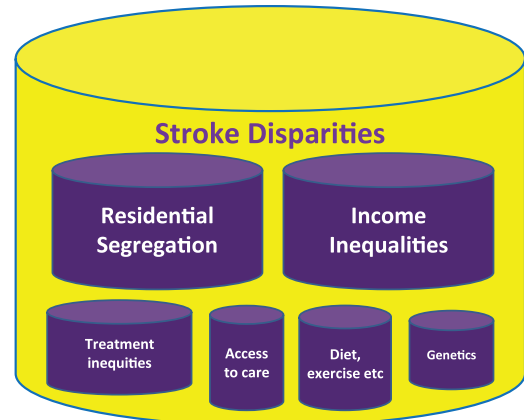
includes having the budget to perform outreach, using standard, practiced and culturally competent recruitment strategies, and the crucial role of partnering with the community.<sup>33</sup>

### Preparedness

Studies of knowledge among US citizens vary widely in results obtained. In the best case results from the National Health Interview Survey in 2009, 51% of subjects were aware of 5 stroke warning symptoms and also knew to call 911 to seek treatment. In this study, female sex and higher level of education were associated with greater knowledge, and whites had higher awareness than race/ethnic minorities (the percent who were aware of all 5 stroke warning symptoms and would call 911 was 56% for whites, 47% for blacks, and 37% for Hispanics).<sup>34</sup> In another study, only 3.6% of those surveyed could identify that acute stroke therapy existed.<sup>35</sup> The latter case demonstrates that preparedness is still lacking, and further educational efforts are needed. There have been some large studies aimed at improving stroke preparedness in minority populations. Although a systematic review found that the effectiveness of interventions designed to promote stroke awareness in race/ethnic minority groups was considered inconclusive because of mixed results and design limitations, there have been some successes including 4 randomized clinical trials.<sup>10</sup> In 1 study, predominantly Mexican American middle school children received an intensive educational intervention aimed at stroke recognition and motivation to call 911. Students randomized to intervention compared with control were more knowledgeable about stroke and had more intent to call 911 for witnessed stroke.<sup>36</sup> Another impressive, on-going effort combines culturally appropriate music to teach black elementary school students about stroke. Early reports on Hip-Hop Stroke suggest both engagement of the students and potential effectiveness of the intervention.<sup>37</sup>

### Toward an Approach to Reducing Disparities

Approaches to remedying health disparities may fundamentally consider 1 of 2 approaches. The first is health equity; the implication being that if we really treat everyone equally that health outcomes will be equal across race/ethnic and SES groups. This concept is fundamentally grounded in civil rights approaches to housing, health, and other social factors. It has been more than a decade since the Institute of Medicine chronicled the poor quality of care given to minority populations in the United States.<sup>38</sup> It is absolutely crucial that we strive for health equity, and recent reports in other disciplines suggest that improved health equity reduces disparities and improves outcomes.<sup>39</sup> However, the problem is that disparities exist for a variety of reasons, only one of which is unequal treatment. As the Figure shows, health equity is likely just one of the many components that influence health and, therefore, stroke disparities. The second approach therefore is one that strives for health equity and also targets underserved populations for specific prevention and preparedness activities to actively reduce disparities. Evidence from other disciplines supports this approach and suggests the need for a multicomponent and multilevel approach to reducing health disparities.<sup>40</sup>



**Figure.** Potential contributors to stroke disparities.

### Summary and Recommendation

Stroke disparities are a ubiquitous problem facing populations around the world. Most research in documenting and remedying stroke disparities is from the United States but the epidemiological transition argues for a far greater effort in developing countries. Regardless of the location, everyone in health care can make a difference on the individual patient, health system, and community level. Working with individual patients to identify personal barriers to stroke prevention, improving health equity in health systems, and organizing communities to provide preventive resources and motivation to activate emergency medical systems in acute stroke are likely to have high yield in reducing stroke disparities.

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### Disclosures

None.

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