Thomas Friedman’s revolutionary book *The World Is Flat* describes how recent changes in technology are transforming the world.¹ The ubiquitous nature of the Internet now facilitates rapid information exchange, thus empowering the consumer. As a result, the world is becoming more “flat”; i.e., traditional regional boundaries are breaking down, and opportunities are more evenly spread. In stark contrast to this new world of commerce, Ko and colleagues² demonstrate just how “nonflat” the cardiovascular world has been. Rather than homogenized delivery of evidence-based care, the authors observe remarkable intercountry and intracountry variability in both treatments and outcomes.

**Article p 196**

The study by Ko et al, published in this week’s *Circulation*, was well performed. The authors had access to detailed clinical information on a large random sample of US Medicare acute myocardial infarction (AMI) patients and a similar cohort of elderly AMI patients from Ontario, Canada, all hospitalized between 1998 and 2001. The authors paid special attention to creating similar entry criteria and examining comparable process indicators. Short and intermediate outcomes also were compared only after risk adjustment. Overall, the study found that AMI patients hospitalized in the United States were slightly less likely to receive aspirin, β-blockers, or angiotensin-converting enzyme inhibitors but much more likely to receive invasive cardiac procedures than their Canadian peers. Yet, the study also demonstrates that the term, US AMI care, is a misnomer in that regional access to invasive procedures tended to be a mismatch in that regional differences within the United States were as large as or larger than those seen across international boundaries.

An important first question is whether these findings are of historical interest or applicable to current day practice. Since the 1990s, many publications have highlighted the problems of underuse of evidence-based AMI therapies. Thankfully, recent data demonstrate that the gap between evidence and practice is narrowing.³⁻⁶ Using data available from the US Health and Human Services Web site (http://www.hospitalcompare.hhs.gov) we display 2004 to 2005 post–AMI discharge β-blocker use from 3462 US hospitals divided into the 4 major census regions. The data provide several messages. First, overall community use of β-blockers appears to have risen since the study by Ko et al. Second, despite higher overall use of these medicines, these contemporary data show regional variability that mirror results found by Ko et al. AMI patients hospitalized in the northeastern and midwestern US regions remain more likely to receive β-blockers than their western or southern peers, with mean hospital rates of 90% and 86% versus 83% and 81%, respectively. Third, and perhaps most important, the data demonstrate that interhospital variability in care dwarfs regional variability. For example, within a western US region, the standard deviation in hospital-to-hospital β-blocker use was 22%, whereas the 25th to 75th hospital distribution ranged from 79% to 98%, twice as large as seen among the regional averages. Thus, although Ko et al emphasize that national summary statistics may be misleading because of regional differences, these data point out that even regional classifications mask remarkable local site-to-site variability.

Beyond using evidence-based medicines, the Ko et al study also examined variability in access to invasive cardiac procedures, including cardiac catheterization, percutaneous coronary intervention, and coronary artery bypass surgery (CABG). All would agree that eligible AMI patients have access to and should get an aspirin, a β-blocker, an angiotensin-converting enzyme inhibitor, and a statin. Access to invasive facilities is limited, however, and there exists divergent clinical opinion on who should receive such procedures after an AMI. As the findings of Ko et al clearly demonstrate, regional access to invasive procedures tended to be a remarkably strong predictor of subsequent use.

Such analyses always leave a reader wondering which rate is right and whether any of these differences matter. Are the tighter controls on technology seen in Ontario resulting in more efficient cardiac care? Or are they depriving AMI patients of needed, lifesaving procedures? Although observational studies cannot fully determine these answers, regional analyses can provide provocative yet conflicting suggestions. First, it is interesting to compare regional patterns of patient selection for catheterization. While randomized trials have consistently demonstrated that an invasive treatment strategy is most beneficial among older and higher risk AMI patients, the current study finds paradoxically that younger and healthier patients receive more interventions in all US regions as well as in Ontario (Table 4). Thus, physicians in all regions may have opportunities to improve their procedure selection criteria to maximize use among those most in need.⁸ Regional data also allow one to examine how differences in use of a diagnostic procedure affect subsequent treatment. A goal of cardiac catheterization is to identify those with severe coronary disease, a setting in which revascularization can improve survival relative to conservative care.⁹ If regions with higher catheterization rates have lower efficiency for detecting severe disease, then the word “flat” may more accurately describe “flat of the curve” medical care.¹⁰ Al-

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The opinions expressed in this article are not necessarily those of the editors or of the American Heart Association.

From Duke Medical Center, Durham, NC.

Correspondence to Eric Peterson, MD, Duke Medical Center, Durham, NC 27715. E-mail peter016@mc.duke.edu

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though the Ko et al study does not give a breakdown by region of coronary anatomy findings, others have studied this question and have found the diagnostic efficiency of US and Canadian catheterization strategies to be identical.8

As a surrogate, the Ko et al study provides data on the percentage of patients receiving subsequent CABG or percutaneous coronary intervention per diagnostic procedure performed. On the basis of data from the Ko et al Table 3, the rate of CABG per catheterization performed in Ontario is higher than that seen in the overall US population (23.8% versus 16.5%). The US regional analysis gives a much less consistent message, however. The Northeast (with the most frugal catheterization rate) paradoxically also has the lowest CABG yield per catheterization performed (13.7%). And if the metric is changed to any revascularization procedure, then the Midwest (with one of the most liberal catheterization strategies) also has the highest rate of percutaneous coronary intervention or CABG per diagnostic study performed (71%), compared with 62.5% in Ontario. Thus, it appears that the set point for revascularization and catheterization appears to vary markedly among regions.8

Beyond such surrogates, the authors appropriately emphasize that patient outcomes should be the ultimate metric for comparing differing care strategies. Despite the varied use of medicines and invasive procedures, Ko and colleagues found that 30-day risk–adjusted mortality rates in the United States and Canada were not different. In contrast, within the United States itself, 30-day mortality rates actually did differ among regions, from a low of 15.3% (14.9% to 16.5%) in the Northeast to a high of 19.0% (18.4% to 19.6%) in the South. By 1 year, the international comparisons had changed. Standardized mortality rates became significantly higher in the United States compared with Canada (31.9% versus 27.7%) and remained so at 3 years (45.9% in the United States, 40.3% in Canada).

These differences between the United States and Canada in intermediate mortality rates are interesting for several reasons. First, they appear to be contradictory to earlier works done by this group. In a similar analysis of patients hospitalized for AMI in 1991 to 1992, Tu et al11 found slightly lower 30-day mortality rates in US patients compared with Canadian patients and no difference in 1-year mortality rates. Interestingly, during the interval between the 2 study populations, differences in cardiac catheterization rates in the 2 countries actually attenuated, more as a result of the increase in rates in Canada (from 6.7% to 16.8%) than in the United States (34.9% in 1991–1992 to 38.7% in 1998–2001).

Second, these findings are in contrast to those observed from the Global Utilization of Streptokinase and t-PA for Occluded Coronary Arteries (GUSTO-I) trial. In GUSTO, 1-year mortality rates were equivalent between the United States and Canada, and 5-year mortality actually favored the United States (19.6% versus 21.4%, P<0.0001; risk-adjusted Canadian hazard ratio, 1.17; 95% CI, 1.07 to 1.28).12 There are many possible explanations for the differences in outcomes observed among these cohort studies. The GUSTO population represents those selected for a clinical trial, yet it also is representative of findings in an all-ages patient population and those treated in all regions of Canada. In contrast, the Ko et al cohort represents an unselective, elderly-only population from Ontario. Interestingly, in the GUSTO population, the revascularization differential between United States and Canada was also more marked than seen in the present study (the GUSTO US-Canadian CABG rates of 13.1% versus 4% compared with US-Ontario rates of 6.4% versus 4%). Additionally, there were differences in the modeling approaches used. Ko et al were unable to combine the data across countries and therefore calculated an estimated standardized mortality rate for both countries using a published short-term mortality model.13 In contrast, the GUSTO analysis identified factors associated with 5-year mortality in a combined database and directly assessed intercountry risks. Unfortunately, the Ko et al study does not provide observed crude mortality rates, so it remains unclear
whether differential adjustment methodologies contributed to these divergent conclusions.

Although survival is certainly an important end point, it may not be a sensitive or specific metric for assessing the downstream impact of differential treatment strategies. In particular, beyond cardiovascular care, subtle differences in baseline comorbidity or social and environmental factors can significantly influence one’s lifespan after an AMI. As an alternative outcome assessment, patient symptom status and functional outcomes may be considered when the impact of differential treatment patterns is measured. Although the Ko et al study did not provide such data, the GUSTO trial has previously reported that lower revascularization rates in Canada were associated with greater functional impairment at 1 year.14 Similarly, another study found that a more conservative use of revascularization in blacks relative to whites also was associated with a higher burden of angina symptoms and cardiac impairment among the black patients.15 Although none of these works are definitive, they stress the need for a broad assessment of the downstream consequences of differential care.

In summary, the work by Ko et al provides important insights. Their study clearly demonstrates that the 3 key determinants of one’s AMI care may not be the evidence but rather, as in real estate, “location, location, location.” But will the next generation’s cardiovascular care be different? Medicine is just beginning to enter Friedman’s brave new world of technology-assisted open access to information. As evidenced by the Figure, the public can, with a click of a mouse, freely view their local hospital’s AMI care quality. In an even more revolutionary development, payers are rapidly attaching strong financial incentives to such quality indicator information. However, as in real estate, “location, location, location.” But will the next generation’s cardiovascular care be different? Medicine is just beginning to enter Friedman’s brave new world of technology-assisted open access to information. As evidenced by the Figure, the public can, with a click of a mouse, freely view their local hospital’s AMI care quality. In an even more revolutionary development, payers are rapidly attaching strong financial incentives to such quality indicator information.

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P. Kaul and E.D. Peterson

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