Coronary Mortality in China
Fence, Ambulance, or Hospital Treatments?

George A. Mensah, MD, FACC; Uchechukwu K.A. Sampson, MBBS, MPH, MBA, MSc, FACC

In a poem titled “Fence or Ambulance” written more than one hundred years ago, Joseph Malins described the policy dilemma a city faced in tackling the rising morbidity and mortality from accidental falls from a dangerous cliff. The 2 policy options considered included building a strong fence around the edge of the cliff or raising funds to support an ambulance down in the valley. The city initially chose to fund the ambulance to efficiently transport victims to the hospital for treatment. However, the city eventually realized that even the best and most efficient ambulance system was not enough and that it also had to build the fence.

The rising mortality from coronary heart disease (CHD) in China presents a similar policy dilemma. In 2010, CHD caused nearly 1 million deaths in China. Rapid demographic and epidemiological changes, plus adverse trends in dietary risk factors, high blood pressure, and tobacco exposure, have contributed significantly to premature CHD mortality and disability in China. For example, between 1984 and 1999, CHD mortality rates in Beijing increased by 50% in men and 27% in women aged 35 to 74 years. More recently, Cheng et al showed that CHD death rates have further increased in Beijing in 1999 to 2010. In fact, China is projected to experience a 69% and 64% increase in CHD events and deaths by 2030, respectively. To what extent can interventions attenuate and reverse these trends, and at what costs? How should these interventions be prioritized, especially given limited healthcare resources and competing national priorities? Cost-effectiveness analysis presents a strategy for informing these policy decisions.

In this issue of Circulation Cardiovascular Quality and Outcomes, Wang et al have built on their prior efforts by providing insights on the cost-effectiveness of optimal use of hospital-based acute myocardial infarction (AMI) treatment strategies in China using the CHD Policy Model-China. This policy model is a Markov (state-transition) computer simulation model of cardiovascular disease (CVD) in the adult Chinese population. The parent CHD Policy Model has been used for >2 decades to predict CHD incidence, prevalence, mortality, and costs in US adults aged 35 to 84 years. The Chinese adaptation of this model comprises 3 submodels that have been used to forecast CHD events and disability-adjusted life years, project CVD risk factor trends, and estimate the impact of urbanization on CVD in Chinese adults.

In the current study, the authors analyzed incremental cost-effectiveness ratios (ICERs) to determine the cost-effectiveness of the hospital-based treatment strategies recommended by both the Chinese and the international guidelines for ST-segment–elevation myocardial infarction (STEMI) and non-STEMI (NSTEMI). The strategies analyzed included the use of aspirin, β-blockers, statins, and angiotensin-converting enzyme inhibitors during the first 30 days after the index event; use of clopidogrel during the first 30 days; use of unfractionated heparin in patients with NSTEMI; use of primary percutaneous coronary intervention (PCI) in tertiary hospitals and thrombolysis in secondary hospitals in patients with STEMI; use of primary PCI in all patients with STEMI; and use of primary PCI in high-risk patients with NSTEMI in tertiary hospitals. For each treatment strategy, they assumed an optimal use criterion defined as the use of treatment in 100% of eligible patients. The outcomes analyzed were 30-day mortality in hospitalized patients with AMI, total CHD mortality, quality-adjusted life years, and total healthcare costs.

Based on their simulations, Wang et al report that the collective use of all the selected hospital-based AMI treatment strategies was cost-effective and reduced the total CHD mortality rate in China by ≈9.6%. Specifically, the optimal use of either 4 oral drugs (aspirin, β-blockers, statins, and angiotensin-converting enzyme inhibitors) in all eligible patients with AMI or unfractionated heparin in patients with NSTEMI was highly cost-effective (ICERs approximately US$≤$3100), the optimal use of reperfusion therapies in eligible patients with STEMI was moderately cost-effective (ICERs≤$10700), and the use of clopidogrel for all eligible patients with AMI or primary PCI among high-risk patients with NSTEMI in tertiary hospitals was less cost-effective.

This study has many strengths. As in any well-conducted economic analysis, it provides a comparison of healthcare strategies and clearly delineates the methods and data input used in the assessment and valuation of costs and outcomes. The
authors rightly explored the external validity of their model by comparing predicted and real CHD mortality rates using data from the World Health Organization and the National Health and Family Planning Commission of China. They demonstrated additional scientific rigor using Monte Carlo methods to assess uncertainties in the estimates of treatment costs and mortality related to treatment versus no treatment scenarios. Despite the methodological rigor of this study, the authors correctly acknowledge a major limitation in their effort—the lack of an accounting for the implementation costs that would attend the achievement of optimal use of hospital-based AMI treatments, especially when optimal use criterion is defined as treatment in 100% of eligible patients. Excluding the implementation costs for the accomplishment of utopian rates of treatment utilization represents an important underestimation of costs, which is further compounded by the fact that we do not know the costs associated with community level services consumed by patients after their hospital stay. Furthermore, although economic analysis is usually directed at informing policy at the societal level, costs and outcomes can also be evaluated from other perspectives. The patient’s perspective is potentially paramount given the rural–urban and socioeconomic gradients in China. In this context, the transferability of cost estimation costs for the accomplishment of utopian rates of treatment in 100% of eligible patients. Excluding the implementation costs for the accomplishment of utopian rates of treatment utilization represents an important underestimation of costs, which is further compounded by the fact that we do not know the costs associated with community level services consumed by patients after their hospital stay. Furthermore, although economic analysis is usually directed at informing policy at the societal level, costs and outcomes can also be evaluated from other perspectives. The patient’s perspective is potentially paramount given the rural–urban and socioeconomic gradients in China. In this context, the transferability of costs across Chinese regions is questionable because of variations in access, logistics, practice pattern, and local prices.

Wang et al. correctly integrate data on costs and outcomes by calculating the ICER associated with each treatment strategy. Although it is important to note that ICER of a given strategy is highly dependent on the comparison made, other conceptual issues loom large. Whether a policy decision can be made based on the reported ICERs is a value judgment that the use of study data cannot resolve. This brings into focus another shortcoming in the arena of health economic studies. In the utopian setting, an opportunity cost analysis is needed to determine the correct interpretative-strategy of ICERs. That is, vis-a-vis the report by Wang et al., we need to know the health outcomes that society will forgo from other interventions that will not be funded as a result of implementing the AMI hospital-based treatment strategies. Opportunity cost analysis presents a major challenge in health economic studies because of limited data, which leaves us with second-class alternatives one of which is to make present value judgments based on insight from historical decisions.

Another approach is to make decisions about resource allocations based on rank orderings of treatment strategies by ICERs. However, it has been suggested that 2 conditions must be met for this approach to be valid. First, the treatment strategies under investigation must have a constant return to scale, which means a linear relationship between costs and outcomes at various levels of implementation. Second, the treatment strategies must be divisible, that is, reallocation of any dollar amount to another treatment strategy should yield benefits at the rate implied by the ICERs. It is hard to fulfill the condition of constant returns to scale because most biological processes are not linear. Similarly, the divisibility conditionality is challenged by the fact that reallocation of any additional dollar amount to any AMI hospital-treatment strategy, for example, PCI, would still require a base block of resources equal to the cost of PCI. The challenges we have highlighted in relation to the use of ICERs are not peculiar to the study by Wang et al.; in general, these issues represent opportunities to improve contemporary health economic studies in an effort to maximize their potential impact on health policy decisions.

Previous reports based on the CHD Policy Model-China that project unfavorable trends in major risk factors and CHD events and mortality are certainly cause for concern and make a strong case for risk factor prevention and control. In fact, the remarkable declines in CHD mortality rates for Poland, Italy, The Netherlands, Finland, England and Wales, Scotland, and the United States were largely attributable to reductions in major risk factors (especially high blood pressure and cholesterol) and in general, less so to evidence-based CHD treatments. These findings, in conjunction with the projected modest cost-effectiveness of AMI hospital-treatment strategies, teleport us to a decision fork where China, and presumably other nations, find themselves in the health policy debate. Thus, like the resurrection of a phoenix, the cardinal philosophical question rises from the ashes: fence, ambulance, or hospital treatments? Joseph Malins’ advice is clear: “To rescue the fallen is good, but ’tis best to prevent other people from falling…Better put a strong fence ‘round the top of the cliff, than an ambulance down in the valley”. On this point, the authors must be congratulated for their other reports inspired by the policy model wherein fence-building or prevention has been heralded as a strategic imperative for mitigating the projected CVD burden.

Disclosures

None.

References


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