Improving Outcomes After Myocardial Infarction in the US Population

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In the effort to combat the epidemic of cardiovascular disease (CVD) and to improve the overall health of the US population, the American Heart Association (AHA) has launched specific strategies and goals. The first iteration of these initiatives successfully achieved a commendable reduction in CVD by 35.7% and improvements in the control and treatment of hypertension and hypercholesterolemia.[1] The implicit assumption was that this would improve health. However, it is increasingly evident that health is a broader more positive construct than the absence of clinically evident disease. In 2011, the AHA created a new set of strategic Impact Goals not only to reduce CVD deaths, but also to improve cardiovascular health, composed of 7 metrics (Life's Simple 7). These include 4 health behaviors (diet, physical activity, smoking, and body mass index) and 3 health factors (blood cholesterol, blood pressure, and blood glucose). To encompass the broad spectrum of cardiovascular health encountered in the general US population and to measure progress, each metric has 3 clinical categories, defined as ideal, intermediate, and poor, and graded on a score of 2 to 0, respectively (Table).[2] Since the AHA announced its 2020 Impact Goals, several independent studies have confirmed the importance of cardiovascular health. A robust inverse and stepwise association of cardiovascular health with incidence of CVD, all-cause mortality, CVD mortality, and heart failure in US and non-US populations has been reported.[3–6]

Myocardial infarctions (MIs) are among the leading causes of morbidity and mortality in the United States and lead to >$11 billion in annual hospitalization costs.[7] Of individuals >45 years of age who have a first MI, incidence of recurrent MI or fatal coronary heart disease within 5 years ranges from 17% to 20%, and heart failure rates are similar, adding further healthcare costs, which are projected to increase by almost 100% by 2030.[7] Although the overall mortality from MI has improved over the years, the prevalence of modifiable risk factors, especially obesity, diabetes mellitus, and hypertension, is on the rise in this population.[8] Moreover, although effective procedural, medical, and device therapies for secondary prevention improve outcomes after MI, they pose a significant cost burden on the healthcare system. As higher-risk populations are encountered and healthcare costs increase, there is a dire need for population-based cost-effective measures to improve outcomes.

Although it makes intuitive sense that mitigating or at least attenuating these poor health factors can lead to better outcomes, such an association has not been shown. In fact, several investigators have reported a paradoxical association of poor premorbid health (ie, high number of risk factors) with improved outcomes with MI.[9,10] However, these studies are limited by misclassification bias and retrospective design.

In this context, the findings reported by Mok et al[11] in this issue of *Journal of the American Heart Association* (*JAHA*) are both timely and important. Leveraging prospective data from the ARIC (Atherosclerosis Risk in Communities) study, the authors show a robust and highly significant association of better cardiovascular health (as measured by a higher Life's Simple 7 score on the index visit) in middle age (45–64 years), with a decreased incidence of and improved prognosis after MI later in life. Strengths of the investigation include the timing and importance of the question, rigorous assessment of exposure and outcomes in a prospective cohort, use of a clinical (versus an administrative) database, and appropriate application of statistical methods to explore important associations. Specifically, the authors conducted 2 sets of longitudinal analyses. In the secondary analysis, they assessed the association of Life's Simple 7 score and each health factor with incidence of MI in this biracial cohort of 13 079 men and women from 4 US communities. Compared with participants with a low Life's Simple 7 score of 0 to 3, those with a score of ≥10 and 7 to 9 had a statistically significant 84% and 67%, respectively, lower risk of incident MI over a median follow-up of 24 years, after adjusting for all confounders.

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Table. AHA's Life's Simple 7 CVH Score[2]

CVH Metric	Ideal CVH Definition (2 Points)	Intermediate CVH Definition (1 Point)	Poor CVH Definition (0 Point)
Smoking	Never smoker	Former smoker	Current smoker
Body mass index, kg/m^2	<25	25–29.9	>30
Physical activity	≥150 min/wk moderate or ≥75 min/wk vigorous or ≥150 min/wk moderate+ vigorous activity	1–149 min/wk moderate or 1–74 min/wk vigorous or 1–149 min/wk moderate+vigorous activity	None
Diet score, no. of components*	4–5	2–3	0–1
Total cholesterol, mg/dL	<200†	200–239† or treated to goal	≥240
Blood pressure	<120/<80 mm Hg†	SBP 120–139 mm Hg† and/or DBP 80–89 mm Hg† or treated to <120/<80 mm Hg	SBP ≥140 mm Hg and/or DBP ≥90 mm Hg
Fasting glucose, mg/dL†	<100	100–125	≥126

AHA indicates American Heart Association; CVH, cardiovascular health; DBP, diastolic blood pressure; and SBP, systolic blood pressure.
*Fruits and vegetables: ≥4.5 cups/d; fish: ≥2 3.5-oz servings/wk (preferably oily fish); fiber-rich whole grains (≥1.1 g of fiber per 10 g of carbohydrate): ≥3 1-oz equivalent servings/d; sodium: <1500 mg/d; sugar-sweetened beverages: ≤450 kcal (36 oz)/wk.
†Untreated values.

The most intriguing findings from this study were from the main analysis, in which the authors noted a significant and stepwise decrement in cardiovascular and overall mortality at a median follow-up of 3.3 years in post-MI participants associated with a higher Life's Simple 7 score at baseline. After adjusting for demographic, socioeconomic, and clinical variables, participants with a Life's Simple 7 score of ≥7 had a 40% to 60% reduction in mortality after MI compared with participants with a Life's Simple 7 score of ≤3. Interestingly, among individual components of Life's Simple 7, better status for smoking, body mass index, blood pressure, and fasting glucose at baseline was significantly associated with lower risk of adverse outcomes after incident MI, but diet and physical activity were not.

Several important limitations of the investigation deserve mention. As Mok et al[11] acknowledge, measurement of metrics at a single time point, without exploring the effect on outcomes of changes in these metrics over time, might lead to potential bias. For diet and exercise, the authors point out that the quality of questionnaire data, which were self-reported, may have been an issue, along with the definition of the ideal AHA diet, which was prevalent in only 5% of ARIC study participants. Moreover, it is not clear whether different groups varied in treatments received, which may have significant impact on outcomes, although the authors tried to mitigate this by performing sensitivity analyses for severity of MI and long-term mortality, which are less likely to be influenced by treatment offered during the hospitalization and after discharge. In addition, the population studied was largely composed of whites and blacks and, as such, may not be generalizable to all ethnic subgroups.

The study makes excellent use of a well-characterized cohort to underscore 2 important points that are at the core of the AHA better health goals: (1) most MIs can be prevented or at least delayed by achieving better cardiovascular health in middle life, and (2) optimal control of modifiable risk factors, like blood glucose, hypertension, body mass index, and smoking, is associated with improved longer-term outcomes after MI. Whether a higher Life's Simple 7 score in middle age can be used as a marker of prognosis after MI remains to be seen, and more data are needed. However, if such an association is consistently noted in future studies, it will be of potential interest because most of the current prognostic scores (like TIMI [Thrombolysis in Myocardial Infarction] and GRACE [Global Registry of Acute Coronary Events] study scores) focus on short-term outcomes in the setting of acute coronary syndromes. In the most recent iteration of performance and quality measures for patients with ST-segment–elevation myocardial infarction and non–ST-segment–elevation myocardial infarction by the American College of Cardiology/AHA, Jneid et al emphasize improved mortality and better health status as a true reflection of success of performance and quality measures and underscore the need to identify predictors of disparate care in these patients so quality improvement efforts can be focused on these populations.[12] An important finding in the study is the strong association of low scores with less education, lower income, and black race, evidence supporting more intensive efforts for education and health screening and improved access to health care for these subgroups.

Several investigations have reported the decline in lifetime risk of overall and cardiovascular mortality in association with higher number of cardiovascular health metrics.[13–15] On the basis of the National Health and Nutrition Examination Survey data from 1988 to 2006, the hazard ratios for people with 6 or 7 ideal health metrics compared with 0 ideal health metrics were 0.49 (95% confidence interval, 0.33–0.74) for all-cause mortality and 0.30 (95% confidence interval, 0.13–0.68) for ischemic heart disease mortality. Similarly, Wilkins et al[16] conducted a pooled analysis using patient-level data from cohorts included in the Cardiovascular Lifetime Risk Pooling Project and showed that adults with all optimal risk factor levels (such as ideal levels of cholesterol, blood glucose, and blood pressure, and nonsmoking) have significantly longer overall and CVD-free survival than those who have poor levels of $\geq$1 of these cardiovascular health factor metrics. In that study, at 45 years of age, individuals with optimal risk factor profiles lived, on average, 14 years longer free of all CVD events, and 12 years longer overall, compared with people with at least 2 risk factors.[16]

The study by Mok et al[11] adds to the growing body of evidence in support of AHA's Life's Simple 7 goals, which are based on strategies that prevent risk factor development (or primordial prevention), and use of "population strategies" to shift the entire population distribution of risk factors toward more favorable levels. When population strategies and primordial prevention are successful, small changes in population mean levels can result in large reductions in disease rates and improved outcomes.

Disclosures

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