Poster
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Protecting the gains: what changes are needed to prevent a reversal of the downward CVD mortality trend?

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Background

- The decline in cardiovascular disease (CVD) mortality over the past 50 years has been labeled a public health success story.
- This trend may be reversing, given changes in population risk factors and insufficient development and uptake of technological advances.

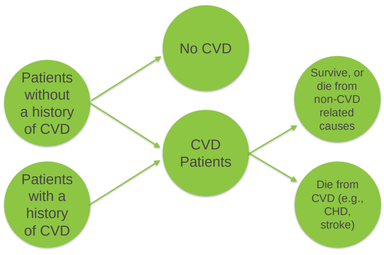
Objective

- Project CVD mortality rates and assess impact of pharmacological innovations and risk factor changes.

Methods

- A Microsoft® Excel based model was developed to project CVD mortality trends.
- The model considered both patients with and without a history of CVD.
- Patients with CVD faced risks of CVD mortality, non-CVD mortality, or could survive (Figure 1).

FIGURE 1: MODEL SCHEMATIC



- NHANES data from 2003-2014 analyzed to estimate current levels of risk factors.[1]
- Future risk factor values projected based on linear regression, and incorporated separately by sex, smoking status, diabetes status, and treatment for hypertension.
- Model also incorporated growing and aging US population.
- Based on projections, hypothetical cohorts of 1 million individuals were created and assigned an age and risk factor profile.
- Framingham Risk Scores were calculated for each CVD-naïve individual to estimate 10-year risk of CVD and predict incidence.[2]
- We separately included prevalent cases using data from the 2017 AHA Statistical Update.[3]
- Those with CVD, either an incident case or a history of CVD prior to entering the model, were at risk of dying from CVD each year based on real-world case fatality rates.[3,4]
- Those who survived a given year continued to the following year, where they were again at risk of dying.
- Those who died of CVD, or of non-CVD causes, were removed from the pool of susceptible people.
- Scenarios, differing by assumptions regarding changes in risk factors and introduction of new therapies, were assessed to compare CVD mortality under various conditions.

Results

Figures 2A-F show trends in risk factors from 2003 to 2040. Smoking, HDL and total cholesterol, and systolic blood pressure are predicted to decrease, while diabetes and hypertension treatment are predicted to increase.

FIGURES 2A-F. HISTORIC AND PROJECTED LEVELS OF CVD RISK FACTORS FROM 2000-2040

FIGURE 3. 2040 MORTALITY BASED ON PREDICTED CHANGES IN INDIVIDUAL RISK FACTORS

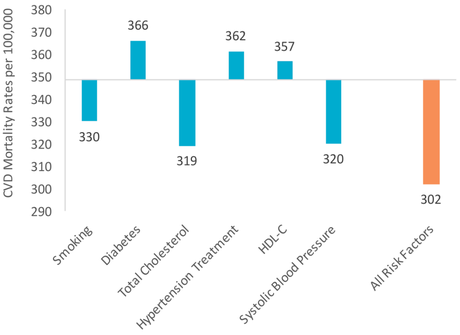


Figure 3 depicts CVD mortality per 100,000 in 2040 given shift in risk factors. Horizontal line shows projected mortality if risk factor levels remain constant (~350 per 100K). The first 6 vertical bars display deaths when risk factors vary as projected. Changes in smoking, cholesterol, and blood pressure will decrease CVD mortality, while changes in diabetes, hypertension treatment, and HDL cholesterol increase mortality. Cumulative effects shown in orange.

FIGURE 4. MORTALITY PROJECTIONS FOR THREE SCENARIOS

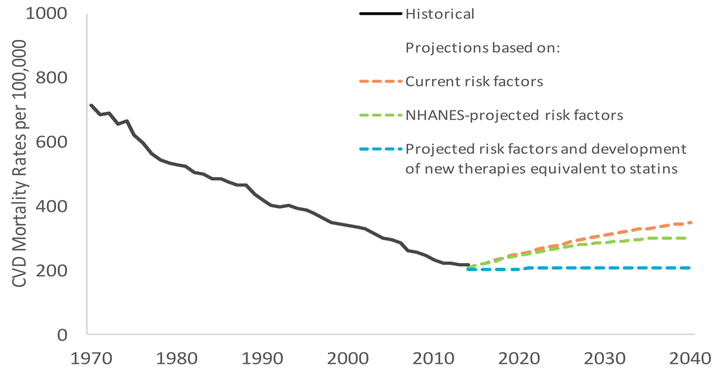


Figure 4 depicts results for three scenarios. The orange line, assuming no change in current levels of risk factors, and the green line, reflecting changes in risk factors as predicted from NHANES, both indicate an increase in CVD mortality from 2015 to 2040. The blue line, which incorporates aging, risk factor changes, and introduction of innovations that provide the same incremental benefits as the introduction of statins, suggests rates may remain unchanged.

FIGURE 5. MORTALITY PROJECTIONS GIVEN INNOVATIONS

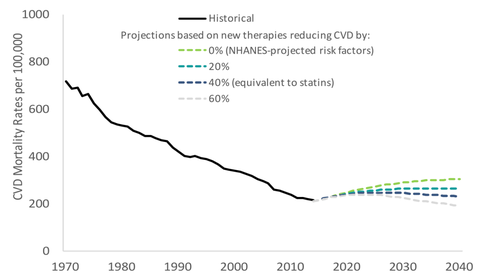


Figure 5 shows impact of projected risk factors changes and introduction of innovations that decrease CVD incidence. With such innovations, incidence in 2015 is unchanged, decreases linearly until reaching a maximum decrease in year 2030, and remains constant from 2030-2040.

Conclusions

- While increasing access and adherence to currently available treatment options could slow the expected increase in mortality, changes in risk factors and development of new therapies are necessary to improve the outlook for CVD associated morbidity and mortality.
- CVD is the leading area of healthcare spending, with current direct medical costs of $230 billion and indirect costs of >$400 billion. However, given the significant disease burden and expected shifts in risk factors, further CVD-related innovations are necessary.

References:
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3. Benjamin EJ, Blaha MJ, Chiuve SE, et al. Heart Disease and Stroke Statistics—2017 Update: A Report From the American Heart Association. Circulation. 2017;135(10):e146-e603.
4. Centers for Disease Control and Prevention, National Center for Health Statistics. Compressed Mortality File 1999-2015 on CDC WONDER Online Database, released December 2015. Data are from the Compressed Mortality File 1999-2015 Series 20 No. 2U, 2016, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Accessed at http://wonder.cdc.gov/cmf-icd10.html on Dec 30, 2016.

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