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JAMA. 2010;304(18):2057-2058 (doi:10.1001/jama.2010.1641)

http://jama.ama-assn.org/cgi/content/full/304/18/2057

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Despite substantial reductions in cardiovascular disease (CVD) death rates since 1968, CVD remains by far the leading cause of morbidity and mortality in the United States. Cardiovascular disease annually accounts for more than 800 000 deaths and more than 7 million hospital discharges and chronically affects more than 80 million US adults.[1] The projected health care cost of CVD in 2010 is $0.5 trillion.[1] Even though CVD death rates have recently leveled off among younger adults (35-54 years),[2] the overall future CVD burden is predicted to further increase as a result of the US population's aging and the increasing prevalence of obesity and diabetes.

Recent health care reform in the United States will expand treatment coverage. However, more effective additional prevention will be essential to control the exponential increase in health care expenditures. Although diverse prevention strategies exist, the most effective and cost-effective mix remains unclear.

Current Status of CVD Prevention

When CVD events occur, an array of evidence-based medical and procedural therapies is available to decrease case fatality and reduce recurrent CVD events (secondary prevention). Primary prevention, reducing the chances of a first event, is less simple to implement. All manifestations of CVD have common predisposing risk factors, especially smoking, adverse dietary patterns, overweight, and sedentary lifestyles. These in turn lead to adverse blood lipid, blood glucose, and blood pressure levels.

However, the majority of first CVD events occur in individuals with average or only mildly elevated levels of risk factors (who would not typically qualify for intensive prevention efforts).[3] The corollary is clear: extensive CVD prevention can be achieved only through lifestyle and environmental modifications. Because population-wide medication prescription is considered inappropriate, other population-wide strategies are needed to shift the entire distribution of risk.

Beyond Secondary and Primary Prevention: Primordial Prevention

Primordial prevention represents an even more radical concept: ensuring that the ideal levels of cardiovascular risk factors observed in healthy children are preserved into adulthood. Several recent studies demonstrate that individuals who maintain a profile of ideal cardiovascular risk factor levels from young adulthood into middle age essentially escape their remaining lifetime risk for major CVD events. Indeed, both CVD and non-CVD mortality rates are reduced, thereby resulting in an additional 10 years' longevity.[4,5] These individuals have markedly better health-related quality of life at older ages and also have lower annual Medicare costs. Conversely, any adverse level of a risk factor in middle age substantially increases lifetime risks for CVD. The American Heart Association therefore recently endorsed primordial prevention as a powerful new mechanism for improving cardiovascular health in all Americans in the coming decade.[4]

Primordial prevention strategies have the potential to reduce the population burden of CVD substantially by preventing the development of adverse risk factors. Capewell et al[6] recently demonstrated that if the majority of the US population reached middle age with this ideal phenotype, more than 90% of the coronary heart disease deaths otherwise expected in 2010 might be prevented. However, barely 5% of the US population now maintains this ideal profile into middle age.[4,5] Such evidence introduces an important question: Which effective public health policies could promote primordial prevention and maintain ideal cardiovascular health into middle age? This change would require an environment that supports health, rather than, as now, promoting obesity, hypertension, hyperlipidemia, diabetes, and inactivity.

Choosing the Best CVD Prevention Strategies

Prevention efforts fall into 2 complementary categories, as described by Rose.[3] "High-risk" strategies focus on the detection and treatment of individuals identified as being at unacceptably high short-term risk for CVD. High-risk strategies are medically based and effective for persons with high CVD risk.[3]

Complementary "population-based" strategies aim to improve the entire population by favorably shifting the distributions of risk factors.[3] Recent examples have provided clear

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evidence of effectiveness and surprisingly rapid benefits. For instance, indoor smoking bans in a variety of municipalities and countries have been followed within months by substantial and persistent reductions in hospitalizations for acute coronary heart disease events. Likewise, CVD rates in Poland decreased within 3 years after the repeal of subsidies for meat and animal fats in the early 1990s.[7] The North Karelia Project, begun in Finland in the 1970s, is another example of comprehensive, community-based and national policy interventions focused on favorably influencing dietary habits and reducing smoking that was followed by substantial decreases (>80%) in CVD mortality rates during 25 years.[8]

CVD Prevention: Possible Options

Federal, state, and local US governments and health organizations are now addressing CVD prevention with both approaches, first by encouraging clinicians to identify and treat individuals at high cardiovascular risk, and second through policy initiatives (eg, promoting smoke-free legislation and salt reduction). However, these current policies appear limited and conflicted. Past and current US agricultural policy still focuses on subsidies for certain crops (tobacco, corn) that can promote disease rather than health. Elsewhere, agricultural subsidies have been used more positively; for example, in Finland to encourage a shift from dairy to berry production and in the European Union to make fruit less expensive for schoolchildren.[6] Favorable subsidies or policies in the United States could promote polyunsaturated vegetable oils, skim milk, whole grains, or fresh fruits and vegetables.

Regulation, legislation, and partnering with the food industry also have great potential. Modeling studies have suggested substantial benefits of reducing salt in the food supply.[9] Likewise, potentially large benefits might occur from implementation of broader dietary strategies for reducing intake of *trans* fats and saturated fats.[10]

Economic Issues

The increasing CVD economic burden is driven especially by 3 factors: revascularization procedures, hospital care, and prescriptions for statins and antihypertensive, diabetes, and obesity drugs. Obtaining reliable cost-effectiveness estimates for preventive interventions is therefore crucially important. Thus far, medication-based primary prevention appears relatively costly. Conversely, primordial prevention interventions might generate savings when targeting specific behaviors such as smoking cessation, dietary cholesterol reduction, or increasing physical activity. Studies from the United States, Australia, and United Kingdom consistently suggest that population-wide prevention programs may substantially reduce health care expenditures.[10]

An economic model commissioned by the UK National Institute for Health and Clinical Excellence was recently developed for the entire UK population of 60 million.[10] Even using conservative assumptions, any policy intervention achieving a 1% population-wide reduction in CVD risk factor levels would be cost saving. Reducing mean population cholesterol levels or blood pressure levels by 5% or enacting legislation to eliminate *trans* fats or reduce dietary salt intake by 3 g per day was each estimated to achieve discounted savings exceeding $1 billion per year.[10]

Modeling Prevention Strategies for the Population: A Research and Policy Agenda

Health officials, professionals, and patients need a better understanding of the consequences of recent conflicting trends in CVD risk factors and the different options for reducing the future burden of CVD in the United States. Ideally, large population-based randomized trials could compare mixes of intervention strategies. However, such studies are clearly not feasible. Pressing questions regarding large-scale prevention strategies might therefore be rapidly answered with validated policy models. The best models synthesize extensive data on population risk-factor profiles and disease prevalence and then simulate the effects of different interventions. A better understanding of the potential benefits and optimal mix of current and future preventive strategies is urgently needed. Given the massive current and future projected costs of health care and the long-term strategies needed for CVD prevention, delays in identifying more effective strategies for CVD prevention will be very costly. The status quo is not acceptable politically, ethically, or economically.

Financial Disclosures: None reported.

REFERENCES

1. Lloyd-Jones D, Adams RJ, Brown TM, et al; American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2010 update: a report from the American Heart Association. *Circulation*. 2010;121(7):e46-e215.
2. Ford ES, Capewell S. Coronary heart disease mortality among young adults in the US from 1980 through 2002: concealed leveling of mortality rates. *J Am Coll Cardiol*. 2007;50(22):2128-2132.
3. Rose G. *The Strategy of Preventive Medicine.* Oxford, England: Oxford University Press; 1992.
4. Lloyd-Jones DM, Hong Y, Labarthe D, et al; American Heart Association Strategic Planning Task Force and Statistics Committee. Defining and setting national goals for cardiovascular health promotion and disease reduction: the American Heart Association's Strategic Impact Goal through 2020 and beyond. *Circulation*. 2010; 121(4):586-613.
5. Lloyd-Jones DM, Leip EP, Larson MG, et al. Prediction of lifetime risk for cardiovascular disease by risk factor burden at 50 years of age. *Circulation*. 2006; 113(6):791-798.
6. Capewell S, Ford ES, Croft JB, Critchley JA, Greenlund KJ, Labarthe DR. Cardiovascular risk factor trends and potential for reducing coronary heart disease mortality in the United States of America. *Bull World Health Organ*. 2010;88(2): 120-130.
7. Zatonski W, Campos H, Willett W. Rapid declines in coronary heart disease mortality in Eastern Europe are associated with increased consumption of oils rich in alpha-linolenic acid. *Eur J Epidemiol*. 2008;23(1):3-10.
8. Puska P, Vartiainen E, Tuohmilehto J, Salomaa V, Nissinen A. Changes in premature deaths in Finland: successful long-term prevention of cardiovascular diseases. *Bull World Health Organ*. 1998;76(4):419-425.
9. Bibbins-Domingo K, Chertow GM, Coxson PG, et al. Projected effect of dietary salt reductions on future cardiovascular disease. *N Engl J Med*. 2010; 362(7):590-599.
10. National Institute of Health and Clinical Excellence. *NICE Public Health Guidance 25: Prevention of Cardiovascular Disease at Population Level.* London, England: National Institute of Health and Clinical Excellence; 2010.