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Preventing Cardiovascular Disease in Kentucky: Epidemiology, Trends, and Strategies for the Future

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PREVENTING CARDIOVASCULAR DISEASE IN KENTUCKY: EPIDEMIOLOGY, TRENDS, AND STRATEGIES FOR THE FUTURE

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Cardiovascular disease (CVD) is the leading cause of death in the United States despite dramatic improvements in the treatment of heart disease in recent years. Kentucky leads the nation in the prevalence of several individual risk factors for cardiovascular disease, the prevalence of multiple risk factors, and in cardiovascular mortality. While trends in the prevalence of some of these cardiac risk factors have shown improvement, others have remained unchanged or have worsened. The increased prevalence of obesity and diabetes, especially among young persons, is one of the most worrisome trends. The prevalence of smoking in Kentucky remains high, and has not declined substantially in the past fifteen years. As a consequence of poverty, low educational levels, a high unemployment rate, and often limited access to medical care, select populations in the Appalachian region of the state have among the highest rates of cardiovascular disease in the developed world. In the 2004 Behavioral Risk Factor

CME INFORMATION

TARGET AUDIENCE

The April 2008 CME article is intended for general/multidiscipline physicians, primary care physicians, hospitalists, pediatricians, and cardiologists, as well as nurse practitioners, physician assistants, nurses, and other medical personnel practicing in Kentucky. The target audience also includes nonmedical persons with a role in public health improvement and policy.

EDUCATIONAL OBJECTIVES

1) Describe the epidemiology and high prevalence of cardiovascular disease in Kentucky.
2) Identify the modifiable risk factors associated with cardiovascular disease and understand that lifestyle changes can have a significant impact on the burden of cardiovascular disease in Kentucky.
3) Understand that Kentucky has unique social and economic characteristics that must be addressed when planning public health initiatives to combat cardiovascular disease.
4) Encourage the reader to advocate for more accessible and comprehensive strategies for cardiovascular risk reduction throughout Kentucky's communities.

DISCLOSURE

Dr Rugg has nothing to disclose
Dr Bailey has nothing to disclose
Dr Browning has nothing to disclose

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Surveillance System (BRFSS) report of the Centers for Disease Control and Prevention, Kentucky had met none of the stated objectives related to cardiovascular risk for Healthy Kentuckians 2010. *Public health initiatives and interventions directed toward the prevention of CVD in Kentucky must address Kentucky's unique challenges if progress is to be made.*

INTRODUCTION

Cardiovascular disease (CVD), which includes coronary heart disease (CHD), heart failure, hypertension, and stroke, is the leading cause of death for all race and gender groups in the United States.[1] The traditional established risk factors for CVD include age, family history of CVD, high blood pressure, abnormal lipid levels, diabetes, tobacco use, obesity, lack of exercise, low socioeconomic status, and psychosocial stressors.[2] While age and family history are nonmodifiable risk factors, they are estimated to be the primary risk factors in less than 10% of people presenting with an initial acute myocardial infarction (AMI)[3] and in fewer than 20% of those with established CVD.[4,5] This finding suggests that most people with CVD have at least one modifiable risk factor, and thus the vast majority of cardiovascular disease is preventable.[4,5] Hence, control of these risk factors has been the principle approach to primary and secondary prevention of CVD.

Data from the Framingham Heart Study and other epidemiologic investigations have substantiated the increased risk of cardiovascular disease among persons with multiple risk factors.[6-10] The clustering of cardiovascular risk factors results in more than an additive effect. Instead, a synergistic effect exists, with the presence of multiple risk factors conferring a greater likelihood of disease than would be expected from the simple addition of individual risk factors. The associations are complex, but are clearly seen with overweight and obesity, physical inactivity, elevated blood glucose, elevated blood pressure, and abnormal lipid levels.[6-11] Therefore, an integrated approach to risk factor reduction has been advocated in prevention guidelines.

The burden of cardiovascular disease is particularly high in Kentucky. In 2003, the state ranked 6th highest in total cardiovascular disease age-adjusted death rate, 9th highest in

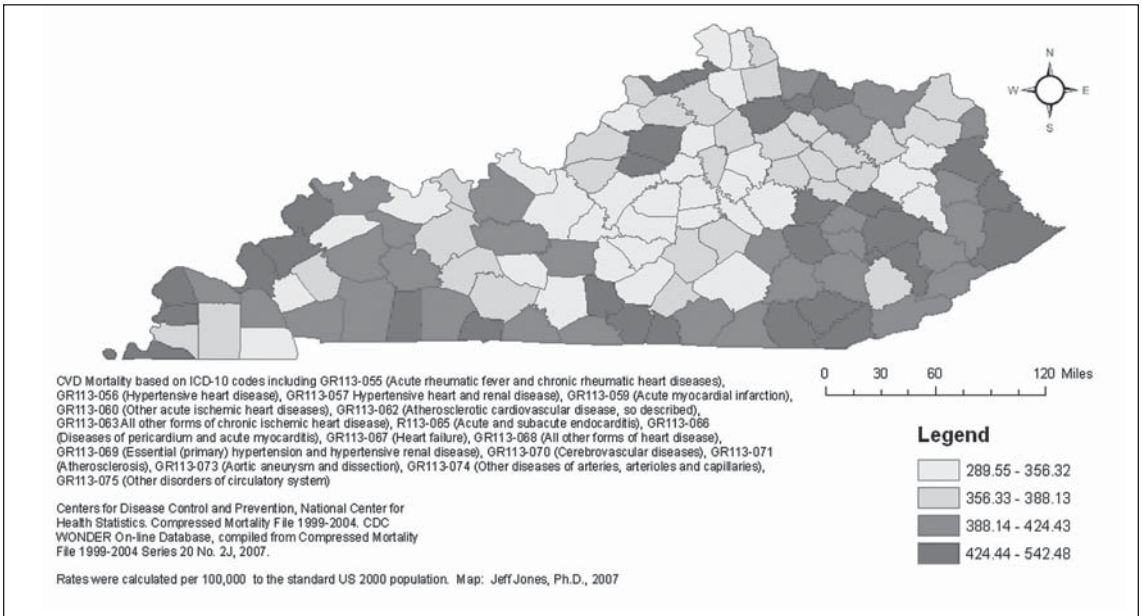


Figure 1. Age-adjusted Cardiovascular Disease Mortality Rates for Kentucky, 1999-2004. Total Population

coronary heart disease age-adjusted death rate, and 10th highest in total stroke age-adjusted death rate.[1] The morbidity and mortality from cardiovascular disease in Kentucky are among the highest in the United States (Figure 1).[12-14]

Kentuckians have the highest prevalence of multiple cardiovascular risk factors in the nation at 46.2% of the adult population.[15] The state ranks 1st for the proportion of the adult population who are current cigarette smokers[16] and 1st for adults who are physically inactive.[21] The prevalence of adult obesity and overweight is 66.4%,[16] ranking the state as 3rd in the United States for these variables combined. These data, however, are averaged across the state and mask some of the regional disparities in the population. In predominantly rural counties, the risk prevalence may be even higher than in more metropolitan areas of the state.

Kentucky has unique characteristics that contribute to its poor rankings in cardiovascular health. The state's social and economic demographics foster communities that are known to have a clustering of cardiovascular risk factors and tend to be concentrated geographically in the southeastern part of the state. The geographic distribution of cardiovascular diseases in the southeastern United States has led to the designation of the regions adjacent to the Ohio and Mississippi Rivers as the "Coronary Valley."[73] Kentucky has 120 counties, of which 104 are considered rural[17] and 51 are considered part of Appalachia.[18] This region has among the highest rates of cardiovascular disease in the United States.[19] Residents of economically depressed Appalachia are more likely to die from heart disease than residents living elsewhere in the United States, with the highest mortality rates occurring in middle Appalachia—central West Virginia, eastern Kentucky, western Virginia, and northern Tennessee.[12]

In this manuscript, we use recent data to describe the distribution and burden of cardiovascular disease in Kentucky and implications for the planning and design of public health interventions appropriate for this population. Cardiovascular risk factor prevalence is summarized in Table 1. Data were obtained from secondary sources including the Centers for Disease Control's Wonder Website for mortality data, as well as the CDC's state-based Behavioral Risk Factor Surveillance System (BRFSS), and the Youth Behavior Risk Surveillance System (YBRSS). Details regarding the collection of the data can be obtained at the CDC Website.[20] The BRFSS is a telephone health survey system tracking at-risk health behaviors in the United States yearly since 1984.[21] The YBRSS is a school-based survey evaluating at-risk health behaviors in students in the 9th through 12th grades.[22]

Cigarette Smoking

Kentucky, a national leader in tobacco production,[23] has consistently ranked as one of the top two states in the past decade for the highest proportion of smokers in the population.[21] In the most recent BRFSS data from 2006, 28.5% of Kentuckians were current smokers, compared to 20.1% nationally.[16] During the period from 1985 to 1992, the annual decrease in prevalence of smokers in Kentucky was about 0.6%, a decrease inadequate to meet goals.[24] Since that time, however, smoking rates have leveled out, with smoking prevalence ranging from 27% to 32% since 1990.[16]

In contrast with adults, there have been dramatic declines in youth smoking rates in Kentucky. In 1997, 47% of Kentucky students had smoked within the last month. By 2005, only 26.2% of Kentucky students smoked. While this number is still higher than the national average of 23%, it does represent a significant improvement for Kentucky.[22]

A more worrisome observation is that of higher smoking levels in lower income and education groups. About 38% of Kentuckians below the poverty level smoke, compared with 19% of those earning more than $50,000 a year.[21] Education level has a particularly strong association with smoking, with 41.5% of adults with less than a high school education smoking, compared to 14.4% of college graduates.[21]

Smoking has numerous detrimental cardiac effects. It induces a hypercoagulable

Table 1. Prevalence of Cardiovascular Disease Risk Factors for Adults by Gender for Kentucky and the United States. (Behavioral Risk Factor Surveillance System Data from 2005 and 2006).

	Males		Females	
Risk Factor (data year)	Kentucky % (95% CI)	United States %	Kentucky % (95% CI)	United States %
Current smokers (Adults) (2006)	29.1 (26.1-32.1)	22.2	28.0 (26.0-30.0)	18.4
Weight classification by body mass index (BMI) (2006)				
Overweight (BMI 25.0-29.9)	44.2 (40.9-47.5)	43.7	32.6 (30.4-34.8)	29.5
Obese (BMI 30.0-99.8)	28.2 (25.3-31.1)	25.9	27.9 (25.8-30.0)	24.4
Physician diagnosed diabetes (2006)	11.1 (9.4-12.8)	7.9	8.8 (7.7-9.9)	7.1
High blood pressure (2005)	27.8 (25.4-30.2)	25.4	28.6 (26.9-30.3)	24.9
High cholesterol level (2005)	37.6 (34.5-40.7)	37.3	38.5 (36.4-40.6)	34.2
No physical activity in past month (2006)	27.0 (24.2-29.8)	20.6	33.6 (31.6-35.6)	25.0
Consume < 5 fruits or vegetables per day (2005)	86.5 (84.3-88.7)	81.4	80.0 (78.3-81.7)	71.9

Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Data. Atlanta, Georgia; US Department of Health and Human Services, Centers for Disease Control and Prevention (2005-2006).

state, causes coronary vasoconstriction, reduces oxygen delivery due to carbon monoxide, accelerates atherosclerosis through damage to the endothelium, and increases fibrinogen levels.[25] In addition, nicotine-related hemodynamic effects occur, with increased blood pressure and heart rate, increased oxygen demand, and arterial constriction. These factors create a particularly lethal combination, with tobacco use being linked definitively to sudden death, myocardial infarction, and stroke.[26] Tobacco use causes a twofold to threefold increase in the risk of death from coronary heart disease.[27] The use of all forms of tobacco increases the risk of cardiovascular diseases, with the magnitude of risk closely related to the number of cigarettes smoked, even at low levels of smoking.[28]

Environmental tobacco smoke, also called passive or secondhand smoke, has also been shown to have deleterious effects. A 2006 report of the US Surgeon General, *The Health Consequences of Involuntary Exposure to Tobacco Smoke*, described a 25% to 30% increase in the risk of coronary heart disease from secondhand smoke exposure.[29] The INTERHEART study found that non-smoking spouses exposed to secondhand smoke had a significantly increased risk of myocardial infarction (OR 1.28, 95% CI 1.12-1.47).[28]

Smoking cessation has appreciable cardiac benefits. The INTERHEART study found that while former smokers had a higher risk of AMI than non-smokers, the risk decreased over time, with much of the excess risk diminished within 5 years.[28] Light smokers had

no excess risk after 3 to 5 years, though moderate and heavy smokers still had some residual risk, even after 20 years of smoking cessation.[28] Inflammatory markers return to normal 5 years after smoking cessation, suggesting that the inflammatory component of cardiovascular disease associated with smoking is reversible.[30]

Overweight & Obesity

It is well established that elevated body weight is associated with excess morbidity and mortality rates.[31] The most commonly used tool to assess weight and body fat is the body mass index (BMI). Both overweight (BMI of 25.0-29.9) and obesity (BMI>30) are independent risk factors for cardiovascular disease and adversely affect other CVD risk factors, such as LDL and HDL cholesterol levels, triglyceride levels, blood glucose, and blood pressure.[32-34] While there has been a decline in the prevalence of most cardiovascular risk factors over the last 25 years, the prevalence of overweight and obesity has been increasing in all race and gender groups and across all geographic regions and socioeconomic status levels.[35]

Kentucky is no exception. In 2006, the prevalence of obesity in the state was 28%, an increase of more than 130% since 1990, and the prevalence of overweight was 38.4%, an increase of around 40% in 1990. While both categories are increasing in number, the sharper rise is seen in the obese subgroup. Although the prevalence of overweight is similar to the national average, Kentucky is above the average for obesity and ranks 3rd in the nation for largest overweight and obese population.[16]

There are differences in the prevalence of overweight and obesity in certain population subgroups that warrant attention. A higher proportion of males are overweight than females, but obesity is similar between the sexes. No racial differences can be elucidated among white, black, or Hispanic males. However, black and Hispanic women are overrepresented in both the overweight and the obese categories.[21] Socioeconomic status seems to have a paradoxical effect on overweight versus obese status. As income and education increase, overweight status parallels the rise but obesity rates decline.[21]

The trend of increasing body mass in adults is paralleled in youths. In 2005, 13.1% of the nation's students were considered overweight, with a body mass index at or greater than the 95th percentile, compared to 10.7% in 1999. In Kentucky 15.6% of students were overweight, with an additional 17% considered at risk for overweight, with a body mass index between the 85th and 95th percentiles. Nationally, 15.7% of students were considered at risk.[22] These rates of youth body mass increase show no signs of slowing, indicating that childhood obesity is likely to continue and contribute to the epidemic of cardiovascular disease.

Physical Inactivity

Physical inactivity contributes to increased all-cause mortality as well as to increased CVD risk and is one of the leading causes of preventable death.[36, 37] The American Heart Association, the US Surgeon General, the Centers for Disease Control and Prevention, and the American College of Sports Medicine recommend at least 30 minutes per day of at least moderate-intensity physical activity on most, and preferably all, days of the week.[38] In 2005, only 34% of Kentuckians reported regular physical activity and only 68% of Kentuckians reported *any* physical activity in the last month. This gives Kentucky the distinction of being the least active state in the nation.[21]

Worrisome trends can be seen in certain population subgroups. Regular physical activity is correlated with income level and education, with those at the lowest income and education levels reporting the least amount of regular physical activity. In addition, low levels of regular physical activity are also seen with increasing age, black or Hispanic race, and distance from a metropolitan area.[31]

Trends in Kentucky students elicit even more concern. In 2005, only 58.7% of students had participated in regular physical activity in the past week, compared to 68.7% nationally.

Females were less physically active than males both in Kentucky and nationwide. The lack of physical activity during the school day contributes to this problem. Only 25.2% of Kentucky students attended even one physical education class per week. The average nationwide was 54.2%, indicating an astonishing disparity between Kentucky and the rest of the country in promoting exercise among youth. Kentucky students, however, watch a heavy amount of television, with 35.5% watching at least 3 hours on an average school day.[22] Lifelong patterns of physical inactivity are initiated in Kentucky's young people, persisting into adulthood with potentially lethal consequences.

Diabetes

Diabetes is considered a CVD risk equivalent, indicating that the risk for a person with diabetes is equivalent to that of persons with an established history of CVD. Diabetics are a high-risk population, requiring aggressive control of other CVD risk factors as well as tight control of blood glucose. Cardiovascular risk and all-cause mortality increase as the level of glucose control decreases.[39]

In 2005, the prevalence of diabetes in Kentucky's population was 9%, compared to 7% nationally. Kentucky ranks 8th in the number of diabetics in the population.[21] Since 1990, the prevalence of diagnosed diabetes in the United States has increased 61% and shows no signs of slowing.[1] Like several other cardiovascular risk factors, the prevalence of diabetes increases with advancing age, lower income, lower educational status, and is positively correlated with black and Hispanic races.[21]

Hypertension

A strong relationship exists between elevated blood pressure and risk of vascular mortality. A meta-analysis of 61 studies evaluating one million people with no prior history of vascular disease showed a strong, direct relationship between blood pressure and vascular mortality, as well as overall mortality.[40] This effect persisted down to a blood pressure of at least 115/75, with no apparent threshold effect. In adults aged 40-69 years, each increase in systolic blood pressure of 20 mmHg was associated with a doubling increase in the risk of death from stroke, as well as a doubling in the risk of death from ischemic heart disease and other vascular causes.[40]

In 2005, 28.2% of Kentuckians reported awareness of high blood pressure, compared to 25.5% nationwide.[21] These numbers have remained unchanged since 1999, both in Kentucky and nationwide. They may, however, underestimate the number of people with hypertension. Hypertension has few manifestations early in its clinical course, and many people may be unaware of the diagnosis.

Abnormal Lipid Levels

Lipids can be divided into total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and triglycerides (TG). Elevated LDL cholesterol is a major cause of coronary heart disease (CHD). Likewise, elevated triglycerides and low HDL are independent risk factors for CHD. Conversely, high HDL confers a decreased risk for CHD.

There is strong evidence that LDL-lowering therapy reduces the risk for developing CHD as well as the number of CHD events in those individuals with established disease. Therefore, LDL is the primary target for therapy. The optimal LDL goal for the population is less than 100 mg/dL and should be achieved with therapeutic lifestyle changes (TLC) plus pharmacologic agents, if needed, depending on an individual's risk. Elevated serum triglycerides (>200 mg/dL) and low levels of HDL (<40 mg/dL) should be treated with TLC and the addition of pharmacologic agents, if needed, as secondary goals.[41]

In 2005, the prevalence of high cholesterol in Kentucky was 38%, placing it 9th highest in the nation. The likelihood of an individual having abnormal lipid levels increases with low income, low education, and increasing age. Whites have higher rates of abnormal lipid lev-

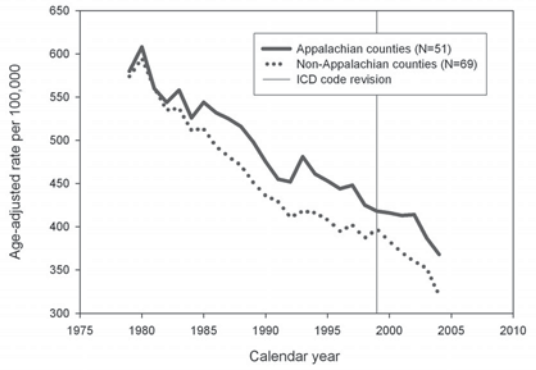
els than either black or Hispanic races, but no gender differences are apparent.[21]

Ecologic Risk Factors

There are great disparities in coronary heart disease risk among certain population subgroups. Persons with lower educational status, lower household income, or self-described inability to work or unemployed status have a much greater prevalence of multiple CHD risk factors.[1, 42] They also tend to have worse clinical status at baseline, higher levels of risk factors, and more comorbidities.[43] In addition, the incidence of ischemic heart disease is inversely related to education, income, and poverty status.[44] Patients with lower socioeconomic status who have cardiac events also have worse outcomes, with a greater mortality rate after an AMI and higher rehospitalization rates.[43]

Kentucky's economic, educational, and social environment is such that a large portion of the population is contained in low socioeconomic subgroups. According to 2005 Census data, 17% of Kentuckians live in poverty. The average per capita income is 80% of the national average. Only 79% of Kentucky's adult population has a high school diploma or equivalent, and only 19% has a bachelor's degree or higher.[45] A full 20% of adult non-institutionalized Kentuckians aged 21-64 consider themselves disabled,[46] and an additional 5.7% are unemployed.[47] Of those older than 65, nearly 50% consider themselves disabled.[46]

While Appalachia as a region has an excessive CHD mortality, the more rural and less affluent areas, such as the counties that comprise Appalachian Kentucky, are at particularly high risk.[12] Figure 2 shows the trends in cardiovascular disease mortality rates for Kentucky from 1979 to 2004, comparing the Appalachian to non-Appalachian counties. While trends in CVD mortality rates in Appalachian counties have paralleled the declines in non-Appalachian counties, the overall rates have been consistently higher. In the most recent decade, the rate of decline in CVD seen in the Appalachian region of Kentucky may be slower than in other parts of the state.



- Appalachian counties for Kentucky (N=51) were defined as per the designation used by the Appalachian Regional Commission. Rates were calculated per 100,000 to the standard US 2000 population. CVD mortality rates for the period 1979-1998 were based on the ICD-9 classification codes 390-459 (diseases of the circulatory system). CVD mortality rates for the period 1999-2004 were based on the ICD-10 classification and included codes I00-I99. Data were from the compressed mortality files for 1979-2004 from the Center for Disease Control and Prevention, National Center for Health Statistics. CDC WONDER On-line Database, compiled from CMF 1968-1988, Series 20, No. 2A, 2000 and CMF 1989-1998, Series 20, No. 2E, 2003 for the 1979-1998 data and CMF Series 20 No. 2J, 2007 for the 1999-2004 data.

Figure 2. Cardiovascular Disease Mortality Rates in Kentucky for All Age, Race, and Gender Groups. Appalachian versus Non-Appalachian Counties, 1979-2004

In general, life expectancy for both men and women is lower in Appalachian counties than the United States. National data on CVD mortality trends suggest that a substantial gap exists between the poor and undereducated and the wealthy and educated.[48] This finding places the Appalachian region at high risk, as it is characterized by low levels of urbanization, lower standards of living, higher poverty levels, and less education than the nation as a whole. In addition to fewer economic resources, many Appalachian counties lack the medical care facilities and personnel to treat CHD adequately. This deficiency results in the increasing inequalities seen in CHD mortality between Appalachia and the nation.[49]

DISCUSSION

Tremendous advances have been made in treating cardiovascular disease. Between 1980 and 2000 in the United States, the mortality rates associated with CHD fell by more than 40%.[50] The

decrease is related to multiple factors including improved interventional techniques, more aggressive medical therapy, and widespread public health campaigns to improve primary and secondary prevention of CVD. In a recent paper, Ford et al quantified how much each variable contributed to the decreases in mortality. Utilizing a mortality model, the authors performed an analysis that yielded several interesting conclusions. The majority of reduction in mortality (72%) can be attributed to preventive strategies; these include secondary preventive therapies after an AMI or revascularization (11%) as well as reductions in total cholesterol (24%), systolic blood pressure (20%), smoking prevalence (12%), and physical inactivity (5%).[50] These decreases were partially offset, however, by diabetes and obesity, which accounted for an 18% increase in deaths.[50]

Over a similar time period, 1979-2004, the total number of inpatient cardiovascular operations and procedures increased 432%.[1] These interventions are costly: for example, in 2003, a coronary artery bypass grafting surgery (CABG) cost, on average, $83,919. Diagnostic cardiac catheterization cost $24,893, with a percutaneous intervention costing $38,203.[1] Revascularization by either CABG or angioplasty, however, accounted for only about 7% of the overall decline in deaths.[50] With ever-mounting data that primary and secondary preventive measures save lives in greater numbers than procedural interventions, health care funding should be targeted toward prevention to gain the greatest mortality benefit.

Despite evidence that prevention has a significant mortality benefit, preventive therapies continue to fall short of goals. The prevalence of cardiovascular risk factors among those who have had cardiac events, as well as those who have not, continues to increase.[4] To date, the United States and Kentucky, in particular, have been unsuccessful in achieving the recommended goals for treatment of lipids, blood pressure and glucose, smoking cessation, weight loss, and increased physical activity on a widespread basis.[51, 52] Only 10% of adults with established CVD have achieved control of their risk factors, despite public awareness campaigns and the introduction of formal guidelines.[53, 54]

We propose changes in several key areas to address Kentucky's cardiac prevention needs. The state should target smoking cessation, increased physical activity, improvement in diet and nutrition, and cardiac rehabilitation for those with established CHD. A special focus should be placed on Kentucky's youth to establish healthy lifestyle patterns early.

Smoking Cessation

Smoking cessation is an important component in any campaign to reduce cardiac mortality, particularly in Kentucky where tobacco abuse is widespread. With the strength of the tobacco industry in the state, pressure exists to keep taxes on tobacco low. The Federation of Tax Administrators reported data for state excise tax rates on cigarettes from January 1, 2007, showing that Kentucky has a comparatively low 30 cents per pack tax rate on cigarettes, ranking the state 46th for cigarette taxes.[55] A study of cigarette purchase patterns in four countries, including the United States, showed that those who purchased low tax or untaxed cigarettes were less likely to make quit attempts or to quit successfully.[56] An analysis of tobacco company documents revealed that price has a significant impact on cigarette smoking, with higher taxes resulting in a reduction in smoking.[57] Tax increases seem to affect minorities and lower-income populations more than other groups.[58] In addition, young adults also tend to be more sensitive to cigarette price, with higher cigarette prices reducing the probability of youth smoking.[59] It has been estimated that a 50% price increase could result in a 12.5% decrease in US cigarette consumption.[58] Kentucky should consider increasing the tax on cigarettes and other forms of tobacco to reduce smoking in the state, particularly among youth.

Smoking in the workplace is also a problem in Kentucky businesses. Hahn et al found that most manufacturing facilities in Kentucky

allowed indoor smoking and few helped smokers quit.[60] This finding is disturbing, especially with data suggesting that smoke-free workplaces reduce both the prevalence of smoking and the number of cigarettes smoked, thereby reducing total cigarette consumption by 29%.[61] Kentucky's legislature should consider prohibiting smoking in the workplace.

Recently, smoking bans have been initiated in several cities nationwide, as well as in several Kentucky counties. Early reports suggest that smoke-free ordinances may be successful in improving cardiovascular outcomes. Sargent et al examined Helena, Montana, prior to and following the institution of a smoke-free ordinance. They found a statistically significant decrease in the number of admissions for AMI during the time period studied.[62] In another study, Bartecchi et al examined admission rates for AMI within the city limits of Pueblo, Colorado, for 1½ years prior to and 1½ years following the initiation of a smoke-free ordinance. They also compared the city to El Paso County, Colorado, a community without a smoking ban, as an external control. They found a significant decrease in the number of admissions for AMI within Pueblo following the smoking ban, with no corresponding decrease outside the city limits or in the control community.[63] While results from these recent studies should be interpreted with some caution as they involve small numbers and do not closely evaluate changes in smoking behavior among individuals, smoke-free ordinances do seem to hold promise in improving cardiovascular outcomes.

One concern about smoke-free ordinances is that they may harm the economy of businesses in the area. Lexington was the first Kentucky community to become smoke-free, instituting a smoking ban in April 2004. Pyles et al evaluated the effect of the ban on employment and restaurant closures, by comparing the time periods before and after the ban went into effect. They found an increase in employment in restaurants, but no change in employment in bars. There was no significant difference in the rate of restaurant closures before and after the institution of the ordinance.[64] Data for Lexington were consistent with data from other communities around the nation with smoking bans, such as New York City, and El Paso, Texas, showing no detrimental economic effect in the measured outcomes.[65, 66] With early data showing promise that smoking bans may decrease cardiovascular morbidity without causing economic harm, smoke-free ordinances may represent a critical policy approach for reducing the risk of CHD.

Comprehensive anti-smoking programs have been effective in other states. Fichtenberg and Glantz describe the California Tobacco Control Program, a large, aggressive campaign involving an increased cigarette tax with allocation of a portion of the tax revenue to an anti-tobacco educational program. After the initiation of the program, the rates of decline in cigarette consumption and cardiac mortality were significantly greater than the pre-1989 rates of decline. The program was associated with 33,300 fewer deaths from heart disease between 1989 and 1997 than would otherwise have been expected during that time period based on earlier mortality trends.[67] In New York City, a comprehensive program including taxation, smoking cessation services, provider education, and a media campaign resulted in a decrease in adult smoking prevalence from 21.5% to 18.4% from 2002 to 2004.[68]

For Kentucky to be successful in reducing smoking prevalence, a comprehensive approach must be undertaken. Excise taxes on cigarettes must be raised, with a portion of the revenue dedicated to funding education for smokers and healthcare providers, smoking cessation programs, and an anti-smoking media campaign directed at both children and adults. Workplaces should be smoke-free, and smoke-free ordinances in communities as a whole should be considered.

Physical Inactivity and Nutrition

While smoking is a major problem in Kentucky, the state confronts other challenges as well. Kentucky needs a comprehensive program to address the risk factors of poor nutrition and physical inactivity to halt the growing obesity

epidemic. Educational materials such as posters and pamphlets have had only limited success because they do not address the problem many Kentuckians have in accessing healthy lifestyle choices.

Rurality, particularly in Appalachia, affects many aspects of a healthy lifestyle, including food choices. Fresh produce is costly and often unavailable. Government subsidies for grocery stores or food vouchers should be considered as a way to encourage healthier food choices. The food stamp system could be modified to allow greater purchasing power for healthier items among those receiving government assistance. Nutrition classes should be offered at the community level to teach people to make healthy food choices and to instruct them in preparation of those foods. Co-ops are another option for communities to have improved access to fresh produce.

Exercising can also be difficult in rural areas. Walking for exercise is an excellent choice for cardiovascular health, but many rural Kentuckians do not have access to safe places to walk because they live near rural highways without sidewalks. Community centers should be available with exercise facilities and walking tracks in areas that are easily accessible to Kentuckians.

A wry observer once noted, "Knowledge is power, but it is not willpower." Comprehensive and successful approaches to behavior change, like the Cooper Clayton method of smoking cessation developed by researches at the University of Kentucky, employ not only education but also social support and skills training. Another example of an interactive program that goes beyond mere education is the University of Kentucky's Healthtrac Rewards program, by which employees gain monetary compensation by participating in wellness activities. These types of novel incentive programs could be adapted for many populations throughout Kentucky.

These efforts must start at the elementary school level. Kentucky has already begun to make positive changes in this area. Senate Bill 172 was passed by the Kentucky General Assembly in 2005, establishing nutrition requirements regulating the types of food sold in schools, when food can be sold, and developing guidelines for vending machines and soft drinks. Physical activity guidelines have also been initiated in an attempt to ensure that children in public schools attain at least 30 minutes of physical activity per day. School districts are now required to have written wellness plans. Based on these changes, the Center for Science in the Public Interest rated Kentucky highest in the nation in 2006 for its school nutrition policy.[69] These measures are a step in the right direction in teaching children to make healthy lifestyle choices, but we must go even further and allocate resources that will allow Kentuckians to continue to make good decisions in the school years and beyond.

Cardiac Rehabilitation

Cardiac rehabilitation programs afford an impressive 15% to 28% reduction in all-cause mortality and a 26% to 31% reduction in cardiac mortality.[70] These programs offer a comprehensive approach to diet and exercise education for patients with cardiovascular disease, as well as facilities for monitored, medically directed exercise. Unfortunately, these programs are vastly underutilized in Kentucky, with only about 13% of Kentuckians who are likely to benefit from cardiac rehabilitation attending any sessions. Not surprisingly, utilization rates of cardiac rehabilitation parallel income and education levels, with the lowest utilization rates in the lower socioeconomic groups.[70] While there are more than 100 cardiac catheterization laboratories in Kentucky, there are only 60 cardiac rehabilitation programs, and only 16 of those are in Appalachian counties.[71] Distance to the nearest cardiac rehabilitation program is highly reflective of utilization, with those living more than 30 miles away having the lowest rates of use.[70] Resources must be redirected to fund preventive strategies such as cardiac rehabilitation and improve its availability in the state to see continued improvement in cardiac mortality.

SUMMARY

Kentucky faces tremendous challenges in decreasing CVD prevalence. In the 2004 BRFSS report, Kentucky had met none of the stated objectives related to cardiovascular risk for Healthy Kentuckians 2010.[72] In addition, Kentucky's children show disturbing increases in cardiovascular risk factors, especially obesity and diabetes. The cultural legacy of the state with respect to tobacco production, poverty, disability, unemployment, and low levels of education has resulted in a disproportionate burden of cardiovascular disease. This burden particularly affects the poor and undereducated. Previous approaches to targeting risk factor prevention may have neglected these at-risk populations. Future measures must take into account Kentucky's distinctive social and economic milieu.

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CME Test Questions

(Please record your answers on the CME Registration and Answer Form.)

Question 1:
True or False: Kentuckians have the highest prevalence of multiple cardiovascular risk factors in the nation.

***Answer*:**
True/False True False

Question 2:
Traditional risk factors for cardiovascular disease include all of the following except:

***Answer*:** (A) Tobacco Abuse
Multiple Choice (B) Obesity
(C) Atrial fibrillation
(D) High blood pressure

Question 3:
True or False: Over the last 25 years, the prevalence of overweight and obesity in Kentucky has declined.

***Answer*:**
True/False True False

Question 4:
Factors placing the Appalachian region at increased risk for cardiovascular mortality include all of the following except:

***Answer*:** (A) High poverty levels
Multiple Choice (B) Well water
(C) Lower education levels
(D) Decreased access to medical facilities

Question 5:
True or False: It is estimated that only 10% of adults with cardiovascular disease have achieved control of their risk factors.

***Answer*:**
True/False True False

Question 6:
True or False: Cardiac rehabilitation programs have been found to have a 26 to 31% reduction in cardiac mortality.

Answer:
True/False True False

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