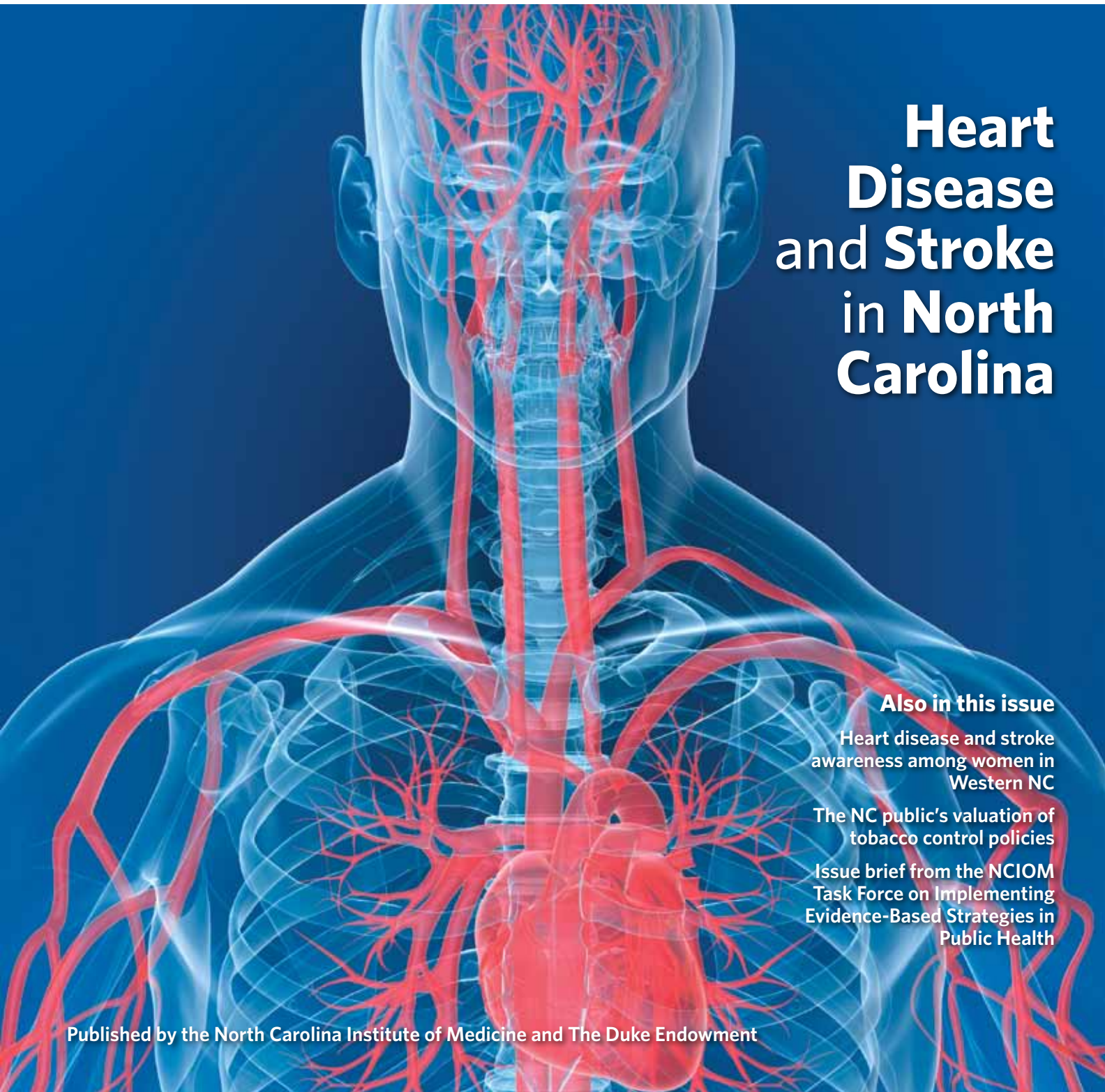


November/December 2012
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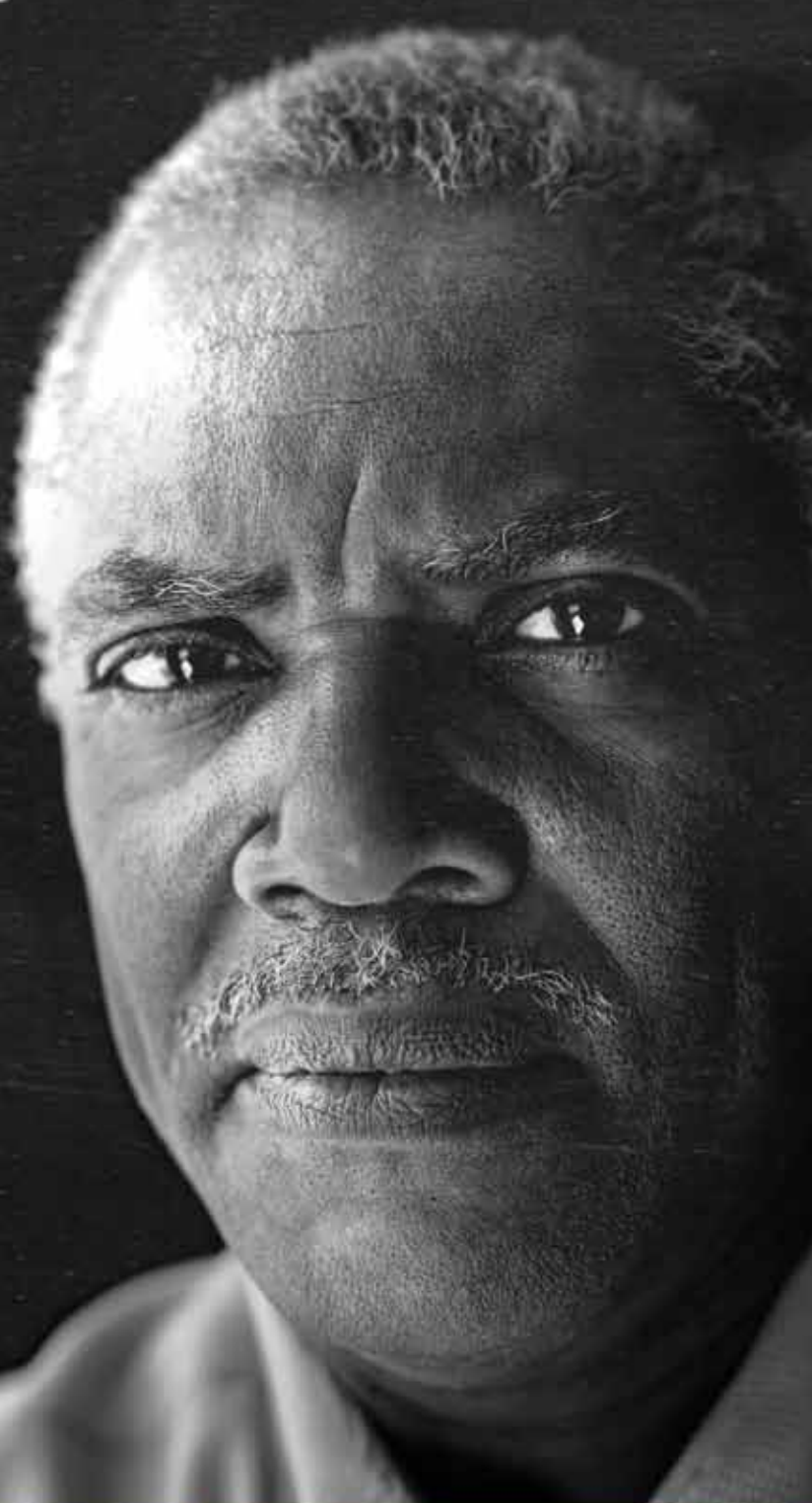
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Tar Heel Footprints in Health Care

*A periodic feature that recognizes individuals whose efforts—
often unsung—enhance the health of North Carolinians*

Gladys Lundy



Gladys Lundy's story is one of impressive perseverance, dedication, and leadership. After suffering 2 strokes and a heart attack caused by previously undetected heart disease, Ms. Lundy was left unable to speak and physically incapacitated. Ms. Lundy spent 4 years recuperating in a nursing home, regaining her mobility and speech, during which time she was determined to educate herself on women's health issues, particularly heart disease and stroke.

As Ms. Lundy recovered, she became involved with WomenHeart, the National Coalition for Women with Heart Disease, and served as a member of the national board of directors. Ms. Lundy is also the president and founder of The Minority Women Health Project, a non-profit organization that addresses health issues affecting women of color, and co-chair of the Triangle Stroke Education Outreach Initiative, which aims to reduce the incidence and impact of stroke by raising awareness through education programs focused on stroke prevention, risk factors, symptoms, treatment, and advocacy. Programs have included offering CPR training, healthy cooking demonstrations, various seminars, and a recent senior fun run sponsored in collaboration with community partners.

Ms. Lundy has dedicated herself to volunteer efforts to build awareness and educate North Carolinians around the issue of women's heart health and the signs of a stroke. She has convened support groups, led educational campaigns on stroke, talked to leaders in government and industry, and been a leader in local initiatives such as the Wake County Power to End Stroke Task Force.

"I want to help others and save lives by telling my story," Ms. Lundy says. "I ignored the symptoms of my first stroke because I didn't know enough. I feel empowered now, because I can share this experience

with others and make a difference." Her courage and dedication inspires those around her and her peers praise her tireless efforts.

Suzanne Banfield, PhD, a member of the WomenHeart board of directors, said of Ms. Lundy after working together on the national level for close to a decade, "In the time I've known her, Gladys has battled health challenges that would leave most of us isolated and fearful of the future. But she has emerged from each challenge with even more energy and a stronger voice to advocate for all those who suffer from health disparities in our country. Her physical and emotional courage in using her own experience as a springboard to help others is one of the things I most admire about Gladys."

Bettye Murchison, a retired senior administrator in the Wake County Public School System, who served with Ms. Lundy for several years on the Power to End Stroke Task Force and in The Minority Women Health Project says Ms. Lundy is a "community activist who has left an indelible imprint on health disparities, cardiovascular disease, and stroke prevention in North Carolina. Her dedication to educating the public is unsurpassable and stands as a shining example for others to emulate."

Ms. Lundy serves as a strong advocate for women's heart health in North Carolina and is excited to be continuing her admirable work as a recently appointed member of the Region-IV Health Equity Council, the members of which serve as leaders and catalysts to strengthen health equity and enhance collaboration between stakeholders, align initiatives, and leverage assets to more effectively reduce health disparities. **NCMJ**

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The Red Dress Survey: Awareness Among Women in Western North Carolina of Heart Disease and Stroke in Women

Shelley L. Galvin, Alison Parker, Carol C. Coulson

BACKGROUND The aim of this cross-sectional survey was to measure knowledge about cardiovascular disease (CVD) among low-income women in Western North Carolina.

METHODS A self-administered survey was distributed to a convenience sample of women presenting for obstetrical or gynecological care at resident and faculty clinics in Asheville, North Carolina, from July 2011 through February 2012.

RESULTS Responses from 340 completed surveys were analyzed. The response rate was 51.7%. The majority of respondents (57.1%) were either overweight or obese, and 23.2% reported that they currently use tobacco products. Overall, accuracy on knowledge questions ranged from 0% to 90%, with a mean score of 57.8% (SD = 16%). Women in their 20s, minorities, and smokers had lower knowledge scores ($P = 0.03$, 0.022 , and 0.009 , respectively). Gender variations in symptoms and consequences of CVD for women were not widely understood by this group. Most knew that it is appropriate to respond rapidly to symptoms of heart attack or stroke. Increasing daily physical activity and managing stress effectively were picked most often as the behavioral strategies patients might initiate or increase to reduce their health risks.

LIMITATIONS This was a convenience sample and the response rate was only 51.7%, so results may be biased.

CONCLUSIONS This group's overall knowledge of CVD in women was poor, with most scores below 70%, and gaps in knowledge existed for minorities. These results are consistent with findings from national awareness surveys. Educational strategies need to include gender-specific risks, symptoms, and consequences, and they need to target tobacco users, minorities, and young adults. Resources are needed for obstetrician-gynecologists to use as they assist patients in becoming more aware of CVD and reducing personal risk through lifestyle modification.

Cardiovascular disease (CVD) remains the leading killer of women in the United States and in North Carolina [1, 2]. Improving the cardiovascular health of all Americans is a national priority; the goal is to reduce the morbidity, mortality, and huge financial burden of CVD, which constitutes 17% of national health expenditures [3]. Reducing the rate of death from CVD is an important objective of the Healthy People 2020 initiative, both nationally and across the state [4, 5]. The Million Hearts initiative is a new, multifaceted, multiagency, national campaign to eliminate 1 million heart attacks and strokes in the United States by 2017 [6, 7].

Increasing people's awareness of CVD is a primary strategy of these initiatives; awareness is correlated with engaging in activities that reduce CVD risks [8]. Results of triennial, nationally representative surveys by the American Heart Association (AHA) over the past 15 years indicate that women's awareness of CVD has doubled during that time; however, gaps still exist, especially among racial and ethnic minorities [9, 10].

Women report that seeing, hearing, or reading information related to heart disease, and being encouraged by their health care providers to modify health risks are effective strategies. Barriers to taking actions that benefit cardiovascular health that have been noted by women include a lack of health insurance, lack of perceived personal risk for CVD, lack of perceived concern and/or education about heart

disease from their health care providers, lack of knowledge about what to do, and fearfulness of being overwhelmed by how complicated risk prevention actions seem to be [9, 10].

Obstetrician-gynecologists (OB/GYNs) are uniquely positioned to play a significant role in the prevention of CVD [11-15]. They are the primary health care providers for many women of childbearing age. For many low-income women, health care is only sought when financial assistance is available. For most, that availability is limited to the provision of family planning, birth control, or obstetric care through government-sponsored programs such as Medicaid [15, 16].

Many of the risk factors for CVD, including obesity, lack of exercise, high blood pressure, diabetes, and smoking, are also risk factors for complications during pregnancy and for poor birth outcomes [17, 18]. Additionally, there are some complications of pregnancy, including preeclampsia and abnormal placental development that are associated with increased risk of subsequent CVD [19, 20]. OB/GYNs already provide their patients with information and encour-

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agement to engage in risk reduction related to their immediate health priorities (that is, preconception, antenatal and postpartum health, and healthy babies). The extension of education and encouragement to the long-term goal of cardiovascular health could be easily integrated into obstetric and gynecologic care.

Our long-range goal is to design an intervention that will demonstrate health care provider concern and provide basic patient education and encouragement for risk reduction of CVD. The objective of this project was to identify gaps in patient knowledge about CVD in women.

Methods

This cross-sectional survey was approved by the Institutional Review Board at Mission Hospital in Asheville, North Carolina. A convenience sample of patients, presenting for routine obstetrical or gynecologic (ob/gyn) care in the resident and faculty clinics, completed anonymous, voluntary surveys in exam rooms. The clinics, located in western North Carolina, provide routine and high-risk obstetrical care as well as routine and specialized gynecological care in more than 56,000 office visits annually. The patient population consists of women from a 16-county rural region that has 2 small urban centers; most (85%) of the women have low incomes. The majority of patients are white; 8% are African American, 8% are multiracial, and 4% are Asian or Native American; 20% are uninsured Hispanic women; and another 8% are from Eastern European countries. The clinics also serve a disproportionate number of women smokers, pregnant women smokers, and overweight or obese women relative to rates in North Carolina for those groups (Mountain Area Health Education Center, unpublished data, 2012).

Materials. The 40-item paper-and-pencil survey administered contained 5 CVD personal risk factor items and 7 true-false items assessing knowledge of the leading cause of death for women. The warning signs for stroke were presented and accompanied by 4 true-false items about stroke symptoms, potential consequences of having a stroke, and appropriate response to symptoms. The warning signs of heart attacks were provided and accompanied by 10 true-false items about sex differences in symptoms, consequences, and appropriate response to symptoms. Twelve major risk factors for heart disease were presented, and patients were asked to indicate whether it is true or false that the risk factor is preventable. Lastly, 8 behaviors that present the top threats to women's health were presented, and women were encouraged to pick 1 behavior they could increase or initiate to decrease their health risks.

Survey items including the warning signs, risks, and preventive behaviors were generated for this project using information on the Web sites of the Centers for Disease Control and Prevention (CDC) and the AHA; in addition, some items were borrowed from surveys conducted by the Behavioral Risk Factor Surveillance System (BRFSS) and the AHA [9, 21-24]. The survey underwent 2 revisions following

pretesting with staff and patients. Using the Flesch-Kincaid readability test, the survey's readability was determined to be grade level 4.7.

Surveys were administered between July 2011 and February 2012. Patients sealed surveys in attached envelopes and returned them to nurses or to clinic staff at checkout.

Data Analysis. Body mass index (BMI) was calculated from self-reported height and weight (current weight for gynecology patients and prepregnancy weight for obstetric patients). Categories were collapsed when infrequent responses precluded meaningful analysis; the "underweight" BMI category was combined with the "appropriate weight" category, and all racial/ethnic minority categories were combined.

Responses were scored for accuracy. Responses of "I don't know" and missing responses were scored as incorrect. Overall knowledge score was the total number of correct responses out of the 33 knowledge questions, and overall

TABLE 1.
Cardiovascular Disease Risk Factors of
Obstetrics and Gynecology Patients in
Asheville, North Carolina

| Respondent characteristic | No. (%) (N = 340) |
|--|----------------------|
| Age (years) | |
| 50+ | 29 (8.5) |
| 40-49 | 33 (9.7) |
| 30-39 | 108 (31.8) |
| 20-29 | 139 (40.9) |
| 13-19 | 21 (6.2) |
| Not reported | 10 (2.9) |
| Race/ethnicity | |
| White | 262 (77.1) |
| Black | 34 (10) |
| Hispanic | 5 (1.5) |
| Other | 17 (5) |
| Not reported | 22 (6.5) |
| Body mass index^a | |
| Obese (≥ 30) | 104 (30.6) |
| Overweight (25.0-29.9) | 90 (26.5) |
| Appropriate weight (18.5-24.9) | 123 (36.2) |
| Underweight (<18.5) | 5 (1.5) |
| Not reported | 18 (5.3) |
| Smoke or use other tobacco products | |
| Currently use | 79 (23.2) |
| Quit in the past 5 years | 33 (9.7) |
| No use ever | 214 (62.9) |
| Not reported | 14 (4.1) |
| Use oral contraceptive pills | |
| Currently use | 22 (6.5) |
| Do not currently use | 316 (92.9) |
| Not reported | 2 (0.6) |

^aWe calculated body mass index from the respondent's self-reported height and weight.

accuracy was the percentage of responses that were correct. Surveys were excluded from analysis if any 1 entire page was left blank.

Knowledge scores were compared between categories of risk factors using t-tests (for race, current smoking, and oral contraceptive use) or analysis of variance with least significant difference after analyses (for BMI and age categories). Stepwise linear regression was used to examine relationships between accuracy scores and risk factors that were found to be significantly different in univariate analyses.

Answers to the 3 questions about appropriate responses to signs and symptoms of heart attacks or strokes were further examined because these responses have the greatest potential to reduce or increase harm from a heart attack or stroke. Responses to these 3 questions were used to categorize women into 3 groups: those who knew all of the appropriate responses; those who were unsure of any response; and those who were wrong about any appropriate response. Chi-square analysis was used to examine differences in knowledge about risk factors across these 3 groups of respondents.

Results

Surveys were returned by 362 women, for a response rate of 51.7%; 22 surveys were excluded due to lack of responses.

The responses regarding the women's personal CVD risk factors are shown in Table 1.

The majority of the women who responded were white (77.1%) and 20-39 years of age (72.7%). Only 36.2% of the women reported a BMI indicating appropriate weight, and 57.1% reported being overweight or obese. And 23.2% of the women smoked cigarettes or used other tobacco products.

Overall accuracy. Knowledge scores ranged from 0 to 29, with a mean of 19.3 (SD = 5.4). Accuracy ranged from 0% to 88%, with a mean of 59% (SD = 16%). The majority of women (264 [77.6%]) scored below 70%, and 151 (44.4%) scored below 60%.

Univariate analyses indicated significant differences in knowledge scores by age, race, and current smoking status, but not by BMI or use of oral contraceptives (see Table 2). Women aged 20-29 years scored lower than women aged 30-39 years or 40-49 years. Minorities scored lower than white women, and current smokers scored lower than non-smokers. Stepwise linear regression indicated that age, race, and smoking status were weak but significant predictors of knowledge scores (adjusted R² = 0.058; P = 0.030, 0.022 and 0.009, respectively).

Leading cause of death in American women. Only 171 respondents (50.3%) correctly identified CVD as the leading cause of death in American women. Another 18 women

TABLE 2.
Knowledge about Cardiovascular Disease in Women Among Obstetrics and Gynecology Patients in Asheville, North Carolina, by Race or Ethnicity, Age, and Tobacco Use

| Respondent characteristic | No. (N = 340) ^a | Knowledge score Mean (SD) | Accuracy score ^b Mean % (SD, %) | P-value |
|------------------------------|----------------------------|------------------------------|---|--------------------|
| Race/ethnicity | | | | 0.009 ^c |
| White | 262 | 19.8 (5.1) | 60 (15) | |
| All minorities | 78 | 18 (6) | 54 (18) | |
| Age (years) | | | | 0.008 ^d |
| 50+ | 29 | 19.7 (5.1) | 60 (16) | |
| 40-49 | 33 | 21.3 (4.2) | 64 (13) | |
| 30-39 | 108 | 20.5 (4.3) | 62 (13) | |
| 20-29 | 139 | 18.2 (6.1) | 55 (19) | |
| 13-19 | 21 | 18.7 (4.9) | 57 (15) | |
| Body mass index ^e | | | | 0.687 ^d |
| Normal/underweight (≤24.9) | 128 | 16.7 (5.3) | 58 (16) | |
| Overweight (25.0-29.9) | 90 | 19.9 (5.6) | 60 (17) | |
| Obese (≥30) | 104 | 19.4 (5.1) | 59 (16) | |
| Current tobacco use | | | | 0.001 ^e |
| Yes | 79 | 17.7 (5.7) | 54 (17) | |
| No | 247 | 19.9 (5) | 60 (15) | |
| Oral contraceptive pill use | | | | 0.871 ^e |
| Yes | 22 | 19.6 (5.4) | 59 (16) | |
| No | 316 | 19.4 (5.3) | 59 (16) | |

^a18 responses were missing for tobacco use, 2 responses were missing for height or weight (used to calculate body mass index), and 2 responses were missing for contraceptive pill use.

^bThe accuracy score is the percentage of answers that are correct.

^cCalculated using t-test analysis.

^dCalculated using analysis of variance.

^eWe calculated body mass index from the respondent's self-reported height and weight.

(5.3%) picked heart diseases among a number of leading causes circled. Incorrect responses included the following: 69 (20.3%) respondents chose cancer, 5 (1.5%) chose other causes (accidents, stroke, diabetes mellitus, or chronic lower respiratory diseases including chronic obstructive pulmonary disease), and 77 (22.6%) answered, "I don't know." More than half of respondents (191 [56.2%]) knew that the leading cause of death varies by age, and 159 (46.8%) knew that it varies by race or ethnicity. Most women (203 [59.7%]) knew that 1 in 3 women will die from CVD, but 160 (47.1%) did not know that CVD kills more women annually than all forms of cancer combined.

Gender differences in CVD. Only 35 women (10.3%) knew that the leading cause of death for women is the same as for men. Only 57 women (16.8%) knew that women are more likely than men to experience a second heart attack within a year of the first one. Approximately one-third of women cor-

rectly identified the symptoms of a heart attack that women are more likely than men to experience (see Table 3). The majority responded they did not know which symptoms women were more likely than men to experience.

Consequences of and appropriate responses to heart attacks and strokes. Fewer than half (149 [43.8%]) of the women knew that stroke is the leading cause of long-term disability and leaves 15%-30% of survivors permanently disabled. Many women (276 [81.2%]) knew that the warning signs of stroke may vary across events, and 246 women (72.4%) knew that it is important to get early treatment to minimize the damage caused by heart attacks and strokes. Although most women also knew to note when signs or symptoms first appeared and not to ignore them, more than a quarter of them did not know that they should call 911 within 5 minutes (see Table 3).

Women were categorized as correctly knowing these

TABLE 3.
Knowledge of Heart Attack and Stroke Among 340 Obstetrics and Gynecology Patients in Asheville, North Carolina

| Knowledge of Gender Differences in Symptoms of Heart Attacks: True-false question about symptom likelihood | Answered correctly No. (%) | Answered incorrectly No. (%) | Answered "I don't know" No. (%) |
|---|-------------------------------|---------------------------------|---------------------------------------|
| Women are more likely than men to experience | | | |
| ... pain or discomfort in the neck and/or jaw. | 113 (33.2) | 44 (12.9) | 183 (53.8) |
| ... shortness of breath. | 102 (30) | 57 (16.8) | 181 (53.2) |
| ... nausea and vomiting. | 122 (35.9) | 39 (11.5) | 179 (52.7) |
| Women are not more likely than men to experience | | | |
| ... chest discomfort lasting more than a few minutes. | 95 (27.9) | 68 (20) | 177 (52.1) |
| ... chest discomfort that comes and goes. | 62 (18.2) | 103 (30.3) | 175 (51.5) |
| ... breaking out in a cold sweat. | 52 (15.3) | 99 (29.1) | 189 (55.6) |
| ... lightheadedness. | 35 (10.3) | 121 (35.6) | 184 (54.1) |
| Knowledge of Gender Differences in Symptoms of Heart Attacks: True-false question | | | |
| It is important to know when signs or symptoms first occurred. | 321 (94.4) | 5 (1.5) | 14 (4.1) |
| It is not okay to ignore symptoms that go away. | 317 (93.2) | 4 (1.2) | 19 (5.6) |
| Not all warning signs will occur in every stroke. | 276 (81.2) | 30 (8.8) | 34 (10) |
| It is important to call 911 within 5 minutes. | 246 (72.4) | 39 (11.5) | 55 (16.2) |
| Knowledge of Preventable Risk Factors for Cardiovascular Disease (CVD): Which of these risk factors are preventable? | | | |
| Smoking | 320 (94.1) | 4 (1.2) | 16 (4.7) |
| Overweight/obesity | 315 (92.6) | 3 (0.9) | 21 (6.5) |
| Inactivity | 297 (87.4) | 9 (2.6) | 34 (10) |
| Excessive alcohol intake | 297 (87.4) | 7 (2.1) | 36 (10.6) |
| Poorly managed stress | 291 (85.6) | 10 (2.9) | 39 (11.5) |
| Previous heart attack, stroke, or mini-stroke | 138 (40.6) | 60 (17.6) | 142 (41.8) |
| Family history of CVD | 259 (76.2) | 37 (10.9) | 44 (13) |
| Increasing age | 279 (82.5) | 14 (4.1) | 47 (13.8) |
| High cholesterol levels | 298 (88.6) | 10 (2.9) | 32 (9.4) |
| High blood pressure | 286 (84.1) | 15 (4.4) | 39 (11.5) |
| High triglyceride levels | 117 (52.1) | 46 (13.5) | 117 (34.4) |
| Diabetes mellitus | 113 (33.2) | 110 (32.4) | 117 (34.4) |

appropriate actions (233 [68.5%]), being unsure of some or all of the appropriate actions (63 [18.5%]) or being incorrect about any 1 of the appropriate actions [44 (12.9%)]. Chi-square analyses indicated no significant differences among these 3 action-knowledge categories of women with regard to any of the 5 personal risk factors (age, $P = 0.776$; race, $P = 0.122$; BMI, $P = 0.855$; smoking status, $P = 0.762$; oral contraceptive use, $P = 0.122$).

Risk prevention. The statement that many of the leading threats to women’s health can be prevented was marked as “true” by 302 (88%) of the women. When asked to specify which threats were preventable, the majority correctly identified the preventable and nonpreventable risks (see Table 3). When asked to pick 1 behavior that they could increase or initiate to decrease their personal risk, 1 in 7 women did not limit themselves to just 1 of the 8 specific behavioral targets listed. Another 1 in 5 women did not pick any listed behaviors, nor did they write in another option. The top behaviors identified were daily exercise, stress management, and smoking cessation (see Table 4).

Discussion

Among many of these female patients, overall knowledge of CVD in women was poor, with most women scoring less than 70% accuracy; small but significant knowledge gaps existed among women in their 20s, minorities, and those who currently use tobacco products. Our results mirror the results of the most recent national AHA survey of women’s awareness in regard to knowledge gaps, limited awareness of CVD as the leading cause of death for American women, and generally good awareness that preventable risk factors for CVD are primarily lifestyle behaviors [8, 9].

Recognition of the symptoms of heart attacks that women were more likely to experience than men was very poor. In 2006, Mosca and colleagues reported that knowledge of the symptoms of heart attacks in general had not improved since 1997 [8].

Daily physical activity and effective stress management were the behavioral strategies most frequently identified by women as ones that they might begin or increase to reduce their health risks. We specifically asked for just 1 change because many women report being fearful or overwhelmed by how complex risk reduction appears to be [9]. The lack of response to this question by almost 20% of the women, and the fact that an additional 20% chose multiple or generalized behavioral strategies (eg, “eat better”), may reflect respondents’ sense of how daunting lifestyle modification can be.

There are several limitations to this study. The response rate among women in our convenience sample was low, which may bias our results and limits generalizability. The basic demographic information, however, does suggest accurate representation of the patient population seeking care in our routine obstetric and gynecologic clinics.

We included women considerably younger than those included in the national survey, which excludes women

TABLE 4.
Possible Risk Reduction Behaviors Identified for Action by Obstetrics and Gynecology Patients in Asheville, North Carolina

| Name 1 behavior that you could increase or begin doing to decrease your risk. | No. (%) |
|---|-----------|
| Engage in daily physical activity | 64 (32.4) |
| Manage stress effectively | 62 (31.8) |
| Refrain from smoking | 50 (18) |
| Maintain healthy weight | 42 (15.9) |
| Eat 5-9 servings of fruits and vegetables daily | 35 (12.1) |
| Avoid saturated fat/salt | 14 (5) |
| Drink alcohol in moderation | 0 (0) |
| Other behaviors written in | 27 (9.7) |
| “Eat better” | 24 (8.6) |
| “Drink more water” | 1 (0.3) |
| “Get cholesterol checked” | 1 (0.3) |
| Nothing—“I do all of the above always.” | 4 (1.2) |
| No response | 67 (19.7) |
| More than 1 response | 49 (14.4) |

younger than 25 years of age. This limits comparability between our survey and the national one. Furthermore, we did not assess education level, precluding analysis of this important knowledge correlate. The reading level of the survey, however, may have helped to mitigate the confounding that might have occurred as a result of the inclusion of young women and those with limited literacy. We also did not inquire about pregnancy status. Although this potential correlate would affect development of appropriate behavioral interventions, it may have less effect on potential knowledge or awareness interventions. We also chose to use the survey as an educational tool for basic warning signs, symptoms, and prevention behaviors even though we recognized this might inflate the knowledge scores. We did not, however, assess the validity of the survey as an educational tool. It was somewhat surprising that the percentage of women who chose CVD as the leading cause of death in women was not higher because our survey was called the Red Dress Survey and was clearly about heart disease, heart attacks, and stroke. Also, patients could easily go back and change their answer to that question after reading the remainder of the survey.

We did not assess what our patients were already doing to prevent or treat CVD, nor did we inquire whether they wanted help with risk reduction. And we did not ask what they perceived their own risks to be, or whether they understood that their risks for reproductive health complications overlapped with the risks of CVD.

Many OB/GYNs report that they have few resources with which to assist patients with lifestyle risk modifications and indicate that they feel it is outside of their scope of care except within the context of reproductive health. Although the American College of Obstetricians and Gynecologists (ACOG) has provided tools for lifestyle counseling during

pregnancy, OB/GYNs reported having received little guidance with regard to CVD prevention during routine gynecologic care [14].

Nonetheless, our results indicate that the majority of these OB/GYN patients were young, with modifiable lifestyle risks and knowledge gaps with regard to the prevention of the morbidity and mortality associated with CVD in women. Because of the considerable overlap between risk factors for CVD and those for poor reproductive outcomes, we believe that OB/GYNs can play a role in the prevention of CVD. Tools much like the ACOG 5A Smoking Cessation Program for Pregnant Women—a brief, highly structured, potentially reimbursable intervention that can be easily integrated into care—are needed [24]. We join the call for the development of patient education materials and tools, continuing medical education and ACOG guidance, community-based referral resources, evidence-based interventions, and reimbursement strategies to integrate CVD prevention into reproductive health care [12-15]. NCMJ

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Valuation of Tobacco Control Policies by the Public in North Carolina: Comparing Perceived Benefit With Projected Cost of Implementation

Anne E. Sanders, Gary D. Slade, Leah M. Ranney, Laura K. Jones, Adam O. Goldstein

BACKGROUND After 40 years of continuous decline, smoking rates in the United States have stabilized signaling a challenge for tobacco control. Renewed decline may be guided by public opinion where support for tobacco control is strong. This study sought the public's preferences about tobacco control strategies.

METHODS This contingent valuation study investigated whether the public's valuations of 2 tobacco control policies outweighed their implementation costs. In a hypothetical referendum, a representative sample of North Carolinians aged 45-64 years ($n = 644$) was asked to indicate whether they would prefer a policy that would halve the youth smoking rate or one that would reduce smoking-related deaths by 10%, and to indicate how much additional tax they would be willing to pay to implement their preferred policy. This willingness-to-pay value formed the perceived "benefit" component in a cost-benefit analysis. Costs to halve youth smoking were calculated from evidence about the resources required to increase the state tobacco excise tax. Costs to reduce tobacco-related deaths were based on evidence about the resources required for a counseling quitline offering free nicotine replacement therapy.

RESULTS The majority (85%) of respondents voted to halve the youth smoking rate. The mean maximum amount per person that voters were willing to pay in 1 year to do that was \$14.90 (95% CI, \$10.10-\$19.60), and the maximum amount per person they were willing to pay in 1 year to reduce smoking-related deaths was \$13.70 (95% CI, \$2.10-\$25.40). When aggregated to the North Carolina population aged 45-64 years ($N = 2,400,144$), the perceived benefit of halving youth smoking was \$35.8 million. Implementation of a program to achieve this outcome would cost \$109.8 million. Aggregating to the same population, the perceived benefit of a 10% reduction in tobacco-related deaths was \$32.9 million, an amount that exceeds the \$12.8 million estimated cost of achieving the outcome.

CONCLUSION A counseling quitline with free nicotine replacement therapy would achieve a positive net benefit.

Public support for tobacco control is strong. A proposal to deny provision of tobacco to citizens born in 2000 or later was supported by 60% of smokers and 73% of non-smokers in Singapore [1]. In England, 45% of respondents believed that the government should ban the sale of tobacco completely within 10 years [2]. Even in China, where 35% of male physicians smoke [3], and 76% of all smokers have no plan to quit [4], a 2007 study found that more than 80% of respondents supported bans on tobacco advertising and on smoking in public places [5]. Support in the United States is weaker than in countries with stronger regulations [6]. In North Carolina in 2006-2007, 70% of adults reported that they supported smoking bans at work sites, but only 52% supported smoke-free restaurants, and only 36% supported smoke-free bars [7].

It is unknown whether the public is willing to pay for tobacco control in exchange for its benefits. Public support for tobacco control in the face of stable smoking rates [8] has prompted the criticism that tobacco-control policies are out-of-step with public opinion [9].

This study quantified the direction and strength of public preferences for tobacco control using contingent valuation methodology. This methodology, based in welfare economics theory, is a form of cost-benefit analysis used for non-

traded goods, such as the effects of government policy [10]. Contingent valuation presents a hypothetical scenario in which respondents choose between 2 programs and indicate how much they are willing to pay for their preferred program. The benefit to society is the sum of how much the public is willing to pay. Costs for the policies are compared with this perceived benefit. When the perceived benefit exceeds the costs, the program is deemed to have a positive net benefit.

Our first aim was to elicit preference for policies for North Carolina that, if enacted, would: (a) halve the rate of youth smoking in the state, or (b) reduce the rate of premature smoking-related deaths in the state by 10%. Our second aim was to estimate costs of feasible and realistic policies to achieve those outcomes and to determine whether either program yielded a positive net benefit.

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Materials and Methods

The biomedical Institutional Review Board of the University of North Carolina at Chapel Hill (UNC-CH) approved the study.

Study and sampling designs. The North Carolina County Study was a cross-sectional sample survey of North Carolina residents aged 45–64 years, which was conducted to investigate whether attributes of the counties were associated with outcomes. A target sample size of 1,000 interviews was determined based on the study's aim to detect county-level factors with odds ratios of at least 2.0 that were hypothesized to be associated with oral disorders.

Sampling was restricted to this age group because it represents the numerically large post-World War II baby boom cohort, which predated widespread introduction of the major public health interventions of the 20th century, including tobacco control and fluoridation of public water supplies.

A stratified 2-stage sampling design drew a random sample of counties and households. Where more than 1 eligible adult was present in a sampled household, the telephone interviewer sampled 1 occupant by random selection. Interviews were conducted by the Survey Research Unit at UNC-CH in 2009.

Data collection. Questions were pretested for comprehensibility and acceptability. The first contact by telephone allowed interviewers to explain the purpose of the study and to collect details about cigarette-smoking status, health insurance coverage, and sociodemographic characteristics. Out of 1,405 eligible households, 420 did not participate in the telephone interview, so the participation rate was 70.1%.

Contingent Valuation Methodology

Hypothetical scenario. The contingent valuation was conducted by means of a questionnaire that was mailed to interviewees after the telephone interview. The questionnaire limited social desirability bias arising from contact with an interviewer and allowed participants to view the policy descriptions and payment amounts. One addressed primary prevention (preventing youth from smoking). The other addressed tertiary prevention (reducing smoking-attributable mortality in adults). The 2 policies were described in a hypothetical scenario posed as a referendum and described as follows:

Suppose a referendum is held in North Carolina this week. This referendum will enact policies that will halve the rate of smoking in youths (grades 9–12) from 22% to 11%. This means that 55,158 fewer youths aged 14–17 in North Carolina will smoke cigarettes. This will result in a substantial reduction in illness and premature deaths and a decrease in the social and medical costs of smoking-related disease.

Now suppose the same referendum offered more medical treatment for tobacco-related diseases to reduce tobacco-related deaths by 10%. Based on current figures in North Carolina for one year, this will save 1,174 lives among people aged 35 years or older.

Set aside how these policies would operate; just accept with certainty that they are effective. In this hypothetical referendum you can only vote for one of these two options.

The size of the reductions in youth smoking and smoking-related premature death were guided by evidence. The North Carolina Department of Health and Human Services reported that from 2003–2010, smoking prevalence among high school students decreased by 43% (from 27.3% to 15.5%), and among middle school students smoking prevalence decreased by 55% (from 9.3% to 4.2%) [11]. The effect of a policy on smoking-related premature death takes longer to accrue, is more modest, and is most beneficial for adults 45–60 years of age [12]. Consequently we nominated a smaller effect size of 10%. The model assumption of a linear effect of price on tobacco sales comes from economic modeling of price elasticities of demand [13]. Our own analysis showed that for each additional \$0.10 in cigarette excise tax, predicted per capita sales fell 0.74 packs per month [14]. Further, consistent data exist about the additive effects of comprehensive (multiple) policy interventions, and this research applies both to adults and to youth. The effects appear to be additive rather than multiplicative [15, 16].

Elicitation of public preferences and willingness to pay. Participants were asked to either vote or indicate that they would not vote. Those abstaining were asked no further questions. Voters were asked whether they were willing to pay anything in extra taxation for their preferred policy. Those who were willing were asked to state the maximum in extra taxation they would be willing to pay per month over a 10-year period. A payment card presented 12 amounts that ranged from 10 cents to 10 dollars. Maximum-willingness-to-pay amounts (hereafter “benefit”) were multiplied by 12 to scale values in dollars per year.

Explanatory variables. Characteristics of individuals were age, sex, race, socioeconomic status, cigarette-smoking status, and health insurance status. County-level variables (for the county in which the participant resided) were the proportion of the county classified as rural, the number of acres in the county that were devoted to tobacco production, and the percentage of the population of the county that was registered to vote.

Costing. Cost estimates for feasible and realistic interventions were based on published evidence.

Program to halve the rate of youth smoking. We concluded that in order to achieve the goal of halving the rate of youth smoking, 2 things would be necessary: The North Carolina state tobacco excise tax would need to be increased substantially, and the state's annual funding for tobacco control programs would need to increase to \$106.8 million, the level recommended by the Centers for Disease Control and Prevention (CDC) (only \$18.3 million was spent on such programs in 2011) [17, 18].

The Campaign for Tobacco-Free Kids reports that a 6.5% decline in youth smoking follows every 10% increase in price of tobacco products [18]. The price of a pack of cigarettes in North Carolina in 2010 was \$4.36 [19]. Increasing the state cigarette excise tax from the current rate of \$0.45 per pack [18] to \$2.50 per pack would have increased the

price of a pack to \$6.86, an increase of 57.3%. This would be expected to decrease youth smoking by 37.2% ($5.73 \times 6.5\%$). In 2008 there were 417,168 high school students in North Carolina (aged 14-17 years old) [20], 79,262 (19%) of whom smoked [21]. A 37.2% decrease in that number would mean that 29,541 fewer high school students smoked. We used this number for costing estimates as this was the actual number at the time of the cost calculation. Using the real number in the cost calculation ensures that we do not over-estimate cost-savings by overstating the number that had quit. We also conservatively used only students rather than all youth this age. Based on data from the Robert Wood Johnson Foundation's SmokeLess States National Tobacco Policy Initiative [22], we estimated that a campaign to raise the excise tax by \$2.50 would require lobbying, media campaigns, community surveys, direct mail, and paid staff at a minimum cost of \$3 million.

Research on the relation between state spending on tobacco control and the prevalence of youth smoking [23] suggests that spending the CDC-recommended amount (\$106.8 million) on a targeted comprehensive program would produce a 14.4% decrease in the number of youths who smoke, resulting in 11,414 fewer high school smokers ($79,262 \times 14.4\%$). This targeted program and the increase in the excise tax of \$2.50 together would decrease North Carolina youth smoking by 51.7% (resulting in 40,955 fewer youth smokers), at a total cost of \$109.8 million. Data indicate that these 2 measures would act in concert to achieve the desired outcome [15, 16].

Policy to increase medical care to reduce the rate of tobacco-related deaths by 10%. We projected that establishment of expanded quitline services with greater promotion and free nicotine replacement therapy for 1 year would save the lives of 1,174 adults 35 years of age or older. Three assumptions underpinned this estimate. First, we assumed that increasing promotional expenditure for QuitlineNC, an existing program that provides free cessation services to any North Carolinian trying to quit tobacco, would increase call volume to levels comparable with those achieved by additional spending on quitline services in New York, as reported by Farrelly and colleagues [24]. Second, we assumed that adding free nicotine replacement therapy to quitline services would double call volume, as happened in Oregon when free nicotine patches were offered there, according to Fellows and colleagues [25]. Finally, we assumed that the lives of 72% of those who quit would be saved, and that 28% of those who quit would nevertheless die prematurely from smoking related-illness [26, 27].

In 2008, there were 4,860,711 North Carolinians age 35 years or older [28], and 20.9% of the adult population of the state smoked [29], so there were 1,015,888 smokers in that age group. QuitlineNC data for the year 2008-2009 show that with a media campaign, the QuitlineNC call volume during that period for adults 35 years of age or older was 3,661 (approximately 0.36% of smokers in that age group) [29].

A 2007 study of the New York smokers' quitline [24] demonstrated that increases in expenditure for television and radio advertising of 0.87% and 153%, respectively, increased call volume by 0.1% and 5.7%, respectively—figures that were arrived at by multiplying the percentage increase by an elasticity figure (.151 for television advertising, and .037 for radio advertising) accounting for the effectiveness of the particular medium in increasing call volume [24]. Using those elasticity figures, we projected that increasing television spending by 425% would increase call volume by 64% ($.151 \times 425\%$) and that increasing radio spending by 500% would increase call volume by 18.5% ($.037 \times 500\%$), for an average increase in call volume of 41%, resulting in a new call volume of 0.51% ($0.36\% \times 1.41$). We projected that adding free nicotine replacement therapy would then double that new 0.51% rate to 1.02%. The new call volume would then be 10,362 callers ($1,015,888 \times 1.02\%$). Combining the behavioral counseling already offered by the quitline with the provision of free nicotine replacement therapy would increase the average long-term quit rate from to 16% (which is the mean quit rate from 6 treatments) [25]. So 1,658 (16%) of those 10,362 callers could be expected to quit. Although 28% of those who quit would nevertheless die prematurely of tobacco-related illness, the premature deaths of the remaining 1,194 ($1,658 \times 72\%$) would be prevented [26, 27]. During 2005-2009, an estimated 13,000 North Carolinians died each year from tobacco-related illness [30], so the 1,194 lives saved would represent a reduction of approximately 9.2% in that number—close to the size of the 10% reduction called for in the scenario.

Cost calculations are based on the cost of 2008-2009 QuitlineNC media buys and on cost-per-caller estimates. In 2008-2009, 66% of a media buy of \$1.61 million was spent on television advertising and 34% on radio advertising. Increasing television and radio spending by 425% and 500%, respectively, would result in a 4.5-fold increase in spending, from \$1.61 million to \$7.25 million. Additional expenditures would be needed for increased provision of services concomitant with increased use of QuitlineNC. Based on an analysis of QuitlineNC expenditures for 2008-2009 by McCullough and Ramney [31, 32], we estimate that, when these additional expenditures are combined with media campaign costs, they would amount to \$296.56 per caller; multiplied by 10,362 callers, the expenditures would total \$12,103,023.24 million. In addition, it would cost \$125 per caller to provide an 8-week supply of free nicotine replacement therapy to those interested in using it. Based on research on interest among smokers in free nicotine replacement therapy by Cunningham and Selby [33], we project that 55.2% of callers (5,725) would choose it, at a cost of \$719,602. So the total cost of the program would be \$12,818,625—approximately \$12.8 million.

Analytic methods. Sample weights took account of the sampling probability with adjustment for nonresponse. The complex survey design was taken into account in STATA

SE 12.0 software to produce correct variance estimates with Taylor series linearization methods. Poststratification adjustments were made to improve the representativeness of age, race, and education characteristics using 2007 American Community Survey data from the US Census Bureau [34] as the calibration population.

Bivariate associations of categorical variables were tested for statistical significance with the Pearson chi-square test. A multivariable analysis using binary logistic regression produced odds ratios for adjustment for potential confounders. To

ascertain the robustness of the benefit estimates, a sensitivity analysis assumed that the true benefit could be as low or as high as the lower or upper limits of the 95% confidence interval for the mean maximum benefit. Linear multiple regression identified characteristics associated with maximum benefit; this was done separately for each of the 2 programs.

Results

Of the 985 interviewees, 644 returned a completed questionnaire (response rate=78.6%). Among these, smoking

TABLE 1.
Associations of Selected Variables With Decision to Vote and With Tobacco-Control Policy Preference of Questionnaire Respondents (North Carolina Adults Aged 45-64 Years), 2009

| Characteristic of participant | No. of survey respondents (% in population) | % who voted | P-value ^a | % who favored policy to reduce youth smoking rate weighted/unweighted | % who favored policy to reduce deaths from smoking weighted/unweighted | P-value ^a |
|---|---|-------------|----------------------|---|--|----------------------|
| All participants | 644 (100.0) | 76.7 | | 84.9 | 15.1 | |
| Sex | | | | | | |
| Male | 221 (34.5) | 90.4 | 0.107 | 76.4 | 23.6 | 0.241 |
| Female | 423 (65.5) | 72.4 | | 90.5 | 9.5 | |
| Age in years | | | | | | |
| 45-54 | 310 (52.2) | 80.7 | 0.778 | 90.6 | 9.4 | 0.257 |
| 55-64 | 334 (48.8) | 76.3 | | 78.4 | 21.6 | |
| Race | | | | | | |
| White | 553 (72.5) | 82.6 | 0.384 | 92.2 | 7.8 | 0.017 |
| African American or Black | 69 (19.7) | 63.3 | | 62.3 | 37.7 | |
| Other | 22 (7.8) | 79.7 | | 59.8 | 40.2 | |
| Highest level of educational attainment | | | | | | |
| ≤ High school diploma | 160 (32.5) | 58.1 | | 73.1 | 26.9 | 0.267 |
| College, 1-3 years | 202 (32.0) | 84.9 | | 87.2 | 12.9 | |
| College, ≥4 years | 282 (35.5) | 91.8 | 0.017 | 89.9 | 10.1 | |
| Household income | | | | | | |
| <\$35,000 | 139 (25.3) | 64.7 | | 91.2 | 8.8 | 0.490 |
| \$35,000-\$74,999 | 211 (33.7) | 80.4 | | 79.4 | 20.6 | |
| ≥\$75,000 | 241 (41.0) | 96.7 | 0.008 | 85.0 | 15.1 | |
| Missing | 53 | | | | | |
| Cigarette-smoking status | | | | | | |
| Current | 89 (20.1) | 85.0 | 0.164 | 69.9 | 30.1 | 0.082 |
| Former | 183 (16.7) | 92.1 | | 92.7 | 7.3 | |
| Never | 372 (63.3) | 73.1 | | 87.8 | 12.2 | |
| Health insurance status | | | | | | |
| Uninsured | 79 (13.4) | 80.9 | 0.853 | 94.3 | 5.7 | 0.135 |
| Insured | 565 (86.6) | 78.3 | | 83.4 | 16.6 | |
| Proportion of county of residence that is rural | | | | | | |
| <50% rural | 350 (46.5) | 92.3 | 0.002 | 93.6 | 6.4 | 0.029 |
| ≥50% rural | 294 (53.5) | 66.8 | | 74.5 | 25.5 | |
| No. of acres devoted to tobacco production in county of residence | | | | | | |
| < 2000 acres | 373 (49.7) | 85.9 | 0.224 | 94.6 | 5.4 | 0.011 |
| ≥ 2000 acres | 271 (50.3) | 71.4 | | 73.5 | 26.5 | |
| Proportion of population registered to vote in county of residence | | | | | | |
| <80% | 149 (21.7) | 82.7 | 0.673 | 84.1 | 15.9 | 0.939 |
| ≥80% | 495 (78.3) | 77.5 | | 85.1 | 14.9 | |

All of the percentages in this table have been weighted to take account of sampling probability with adjustment for nonresponse. ^aP-values were determined using Pearson's chi-square test.

prevalence for whites (20.3%) and African Americans and blacks (24.4%) closely approximated 2008 US estimates of 22.0% and 21.3% for non-Hispanic whites and non-Hispanic blacks respectively [35].

Characteristics of voters. The 76.7% of respondents who voted (Table 1) were more likely than were nonvoters to have a college education, to have an annual household income of \$75,000 or more, and to live in predominantly urban counties ($P < 0.05$). The decision to vote was not associated with sex, age, race, smoking status, health insurance status, number of acres devoted to tobacco production in the participant's county of residence, or the proportion of the population of the participant's county of residence that was registered to vote. A clear majority (84.9%) of those who voted preferred the program that would halve youth smoking (Table 1).

Willingness to pay: the benefit. Of those who voted, 60.1% were willing to pay at least \$0.10 per month of additional tax to fund their preferred program (Table 2). More than half (55.1%) of those favoring a policy to reduce youth smoking were willing to pay that much, and 88.1% of those who favored a policy to reduce smoking-related deaths were willing to pay that much (Table 3).

After adjustment for age, sex, household income, smoking status, and rural density of county of residence, nonwhites were more likely than whites to state that they were willing to pay (Table 4). In addition, for each 20% increase in the proportion of the county that was rural (based on population density), the odds of being willing to pay increased 60%.

The mean perceived benefit (the sum of each person's maximum-willingness-to-pay amount) was similar for the 2 programs after a value of \$0.00 was imputed to the 44.9% who were unwilling to pay for the policy to reduce youth smoking and the 11.9% who were unwilling to pay for the program to reduce tobacco-related deaths. Specifically, the mean perceived benefit of the policy to reduce youth smoking was \$14.90 per year (95% CI, \$10.10-\$19.60), and the mean perceived benefit of the policy to reduce smoking-related deaths was \$13.70 per year (95% CI, \$2.10-\$25.40) (Table 3). No sociodemographic factor was associated with the level of perceived benefit of the policy for reducing youth smoking. Greater rural density and lower household income were associated with higher perceived benefit for the policy reducing smoking-related deaths (results not tabulated).

Costs. Aggregated to the 2009 North Carolina population aged 45-64 years ($n = 2,400,144$), the estimated perceived benefit for the policy to halve youth smoking was \$36 million, which is approximately one-third of the projected implementation cost of \$109.8 million for a policy to reduce youth smoking by 51.7%, representing a perceived benefit-to-cost ratio of 0.3:1. Based on our assumptions of a linear effect of expenditures on health outcomes, we expect that a \$36 million investment in youth smoking programs would therefore reduce youth smoking by approximately one-third

of 51.7%—that is, by 17%. Given the lower and upper limits of the 95% confidence interval for the mean amount participants were willing to pay, the perceived benefit could be as little as \$24 million or as much as \$41 million. Aggregating to the same population (those aged 45-64 years), the mean perceived benefit of \$33 million for a reduction in tobacco-related deaths of 1,174 deaths would exceed the \$12.8 million cost of reducing the risk of tobacco-related death with a program of increased quitline promotion and free nicotine replacement therapy. This represents a perceived benefit-to-cost ratio of 2.6:1. Given the lower and upper limits of the 95% confidence interval for the mean amount participants

TABLE 2.
Percentage of All Voting Participants (n=304) Who Were Willing to Pay at Least \$0.10 per Month in Taxes for Their Preferred Tobacco-Control Policy

| Characteristic of participant | % willing to pay \$0.10 or more per month for preferred tobacco-control policy weighted | P-value ^a |
|---|---|----------------------|
| All | 60.1 | |
| Sex | | |
| Male | 50.0 | 0.239 |
| Female | 67.0 | |
| Age in years | | |
| 45-64 | 65.3 | 0.376 |
| 55-64 | 54.2 | |
| Race | | |
| White | 52.7 | 0.007 |
| African American or black | 88.0 | |
| Other | 75.4 | |
| Highest level of educational attainment | | |
| ≤ High school diploma | 75.5 | 0.159 |
| College, 1-3 years | 54.5 | |
| College, ≥4 years | 55.8 | |
| Household income | | |
| <\$35,000 | 74.3 | 0.268 |
| \$35,000-\$74,999 | 60.5 | |
| ≥\$75,000 | 52.2 | |
| Cigarette-smoking status | | |
| Current | 65.1 | 0.786 |
| Former | 55.0 | |
| Never | 60.0 | |
| Health insurance status | | |
| Uninsured | 69.1 | 0.528 |
| Insured | 58.7 | |
| Proportion of county of residence that is rural | | |
| <50% rural | 47.1 | 0.011 |
| ≥50% rural | 75.4 | |
| No. of acres devoted to tobacco production in county of residence | | |
| < 2000 acres | 49.7 | 0.026 |
| ≥ 2000 acres | 72.9 | |
| Proportion of population registered to vote in county of residence | | |
| <80% | 60.3 | 0.992 |
| ≥80% | 60.1 | |

^aP-values were determined using Pearson's chi-square test.

TABLE 3.
Maximum Willingness to Pay (WTP) Overall and for Each Type of Tobacco-Control Policy

| | WTP Overall | WTP of those favoring a policy to halve youth smoking | WTP of those favoring a policy to reduce deaths from smoking |
|--|---------------------------|---|--|
| % of voters (n=304) who were willing to pay | 60.1% | 55.1% | 88.1% |
| Mean amount per year that those willing to pay more than \$0.00 were willing to pay | | | |
| Mean amount (95% CI) ^a | \$23.7 (\$16.0-\$31.5) | \$26.2 (\$18.8-\$33.6) | \$15.2 (\$0.5-\$29.9) |
| 25 percentile | \$6.0 | \$12.0 | \$3.0 |
| 50 percentile | \$12.0 | \$12.0 | \$3.0 |
| 75 percentile | \$30.0 | \$24.0 | \$30.0 |
| Mean amount per year that all voters were willing to pay, imputing \$0.00 for those unwilling to pay anything | | | |
| Mean amount (95% CI) ^a | \$14.70 (\$10.10-\$19.30) | \$14.9 (\$10.1-\$19.6) | \$13.7 (\$2.1-\$25.4) |
| 25 percentile | \$0.0 | \$0.0 | \$1.2 |
| 50 percentile | \$3.0 | \$3.0 | \$3.0 |
| 75 percentile | \$18.0 | \$18.0 | \$30.0 |

^aCI, confidence interval.

were willing to pay, the perceived benefit could be as little as \$5 million or as much as \$61 million.

Discussion

Key findings. This is the first contingent valuation survey to investigate the public's preferences for tobacco control policies and the first to estimate the perceived net benefits of such programs. Although the policy to halve youth smoking was the clear preference of the majority, only half of voters were willing to pay more in personal taxes to achieve it. In contrast, 88% of voters were willing to pay for policies to reduce smoking-related deaths by 10%. We calculated the cost of policies to achieve these outcomes and found that the amount spent to decrease smoking-related premature loss of life by 1,174 deaths among smokers was less expensive than the amount that would need to be spent to halve the rate of youth smoking. The establishment and promotion of a quitline service offering free nicotine replacement therapy along with counseling would cost \$12.8 million. The mean maximum perceived benefit (the amount the public was willing to pay in 1 year) exceeded those costs of implementation by a ratio of 2.6:1, revealing a positive perceived net benefit.

The amount the public was prepared to pay in 1 year to halve the rate of youth smoking was approximately one-third of the cost of policy implementation. We calculated that to halve the youth smoking rate, the North Carolina state tobacco excise tax would need to increase substantially, and state funding for tobacco-control programs would need to increase to the level recommended by the CDC.

It is cheaper to induce quitting for a small number of adults than it is to reduce smoking by a large number of adolescents. However, the actual return on investment

from substantial declines in youth smoking are far greater than the much smaller return on investment from smaller declines in smoking by adults. Thus the public's willingness to pay likely does not reflect a full understanding of the actual economic benefits of the programs. Still, this information is helpful in understanding why certain public health policies may receive more support from the public or from those who make health policy decisions with insufficient knowledge.

One factor possibly explaining the weaker support of racial minorities for a reduction in youth smoking is that African Americans initiate smoking at an older age than do whites [36-39]. African Americans adolescents smoke fewer cigarettes than their white peers and are less likely to be regular smokers [37, 40]. Consequently, youth smoking may be of less concern to this group.

Other studies. The contingent valuation method has been applied in several public health settings to value such diverse benefits as a reduction heart in attack risk [41], a reduction in childhood obesity [42], a reduction in dental caries [43], a reduction in the number of babies born with neural tube defects [44], and a reduction in severity of injuries from road traffic accidents involving motorcycle users [45]. As was the case in our study, in each of these studies, not all respondents were at risk of the condition and therefore not all stood to benefit personally.

Interpretation. Despite the fact that in our study the number of respondents preferring primary prevention was greater than the number preferring tertiary prevention, fewer supporters of the primary prevention program were willing to pay for it. One interpretation is that although it is easy to describe youth smoking as a problem, once respondents were confronted with a hypothetical tax burden, few

TABLE 4.
Multivariable Binary Logistic Regression Results Modeling Odds of Being Willing to Pay at Least \$0.10 per Month for Either Tobacco-Control Policy

| Participant characteristic | Odds ratio (95% CI) ^a |
|---|----------------------------------|
| Male sex | Reference case |
| Female sex | 2.1 (0.6-7.4) |
| Age in years | 0.9 (0.8-1.0) |
| White race | Reference case |
| Nonwhite | 6.3 (2.6-15.3) |
| Household income <\$35,000 | Reference case |
| Household income \$35,000-<\$75,000 | 0.6 (0.2-2.0) |
| Household income U\$75,000 | 0.7 (0.2-2.2) |
| Current smoker | Reference case |
| Former smoker | 1.3 (0.4-3.7) |
| Never smoked | 1.1 (0.5-2.5) |
| Rural density of county of residence (quintiles) ^b | 1.6 (1.2-2.1) |

Note. Unweighted n = 505 people who voted.

^aCI, confidence interval.

^bFor each 20% increase in the proportion of the county that was rural, the odds of being willing to pay increased 60%.

of them felt strongly enough to pay for their convictions. If this interpretation is correct, the apparent support for the youth program may have been inflated by social desirability bias. The implication for tobacco control is that if the goal is to maximize net perceived benefit, the greatest gain will come from the program designed to reduce smoking-related loss of life through counseling and free pharmacotherapy, based on the valuations of these people aged 45-64 years, a numerically large age group.

Strengths and Limitations

Our study complied with the recommendations for use of contingent valuation methodology. We used a referendum approach, asked about willingness to pay for a policy with higher taxes, and ascertained maximum willingness to pay. We used a payment card for eliciting valuations. Unlike the iterative bidding approach [46], which starts at an initial monetary value and adjusts it until the respondent's maximum willingness to pay is reached, the payment card is not prone to starting-point bias [47].

We did not discount costs, because both programs were calculated to be fully funded in 1 year. Neither did we discount perceived benefit, because few data exist on which to base a valid assessment. Although on face value, the public preferred a policy to reduce youth smoking, we cannot be certain how sensitive this preference was to the magnitude of nominated health benefits. For instance, what might be the effect on preferences if a referendum specified a 10% reduction in youth smoking and a 20% reduction in rate of tobacco-related deaths? What would occur if we told the participants about the number of lives that would be saved by the large reduction in youth smoking? These questions can and should be the focus of additional work that can seek to better understand

how the public perceives health benefits and what influences their willingness to pay for those benefits.

Nonetheless, this study revealed that although respondents preferred to reduce youth smoking, they placed an approximately equal value on treatment to reduce tobacco-related deaths. Future research could investigate whether the choice of intervention influences public preferences. Finally, we assumed that the overall sustained quit rates from quitline promotions and services combined with free nicotine replacement therapy would result in sustained quit rates of 16%. Despite some relapse among those who quit during the course of a year, this projected overall quit rate is consistent with published data and is probably conservative.

These valuations are informative for policymakers who are considering how best to allocate scarce resources. In addition, the probability sample allows valuations to be generalized to all North Carolinians aged 45-64 years, not just to smokers or to users of a health care program.

The age-restricted sample limits the generalizability of our findings. We weighed this limitation against the potential of confounding by age inherent in sampling adults of all ages and decided that reduced generalizability was the lesser limitation. Values about smoking are shaped by social context and historical experience. This cohort began smoking at a time before the health hazards were widely recognized, and well before cigarette advertising was banned on television and radio and current social norms about the undesirability of smoking were established. Our conclusion that there would be a positive net perceived benefit for the program to reduce smoking-related deaths is dependent upon the interventions used in costing the program. For example, costs for surgical revascularization treatments to reduce an equivalent number of deaths from coronary heart disease in smokers would far exceed the costs of smoking cessation used here, creating a negative net benefit.

Conclusion

This study is the first of its kind, and so its conclusions must be interpreted with caution until future studies provide more evidence to substantiate or refute these findings. Policy preference may be sensitive to the magnitude of the change proposed, and this effect may overshadow the focus of the policy. In addition, different age groups may express quite different valuations.

In this study, the ratio of perceived benefit-to-cost ratio for the program to halve youth smoking was 0.3:1, and the perceived benefit-to-cost ratio for the program to reduce the rate of tobacco-related deaths was 2.6:1. When costed using a counseling quitline with free nicotine replacement therapy, it achieved a positive perceived net benefit. NCMJ

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KNOW THE FACTS ABOUT

High Cholesterol



What is high cholesterol?

Cholesterol is a waxy, fat-like substance that your body needs. But, when you have too much in your blood, it can build up on the walls of your arteries. This can lead to heart disease and stroke—leading causes of death in the United States.¹

Are you at risk?

About one in every six adult Americans has high cholesterol.² Anyone, including children, can develop it.

Several factors that are beyond your control can increase your risk. These include your age, sex, and heredity. But, there are some risk factors that you can change. Examples include eating an unhealthy diet, being overweight, and not getting enough exercise.



¹ CDC: Deaths: Final Data for 2008. www.cdc.gov/nchs/data/nvsr/nvsr59/nvsr59_10.pdf

² CDC: High serum total cholesterol—an indicator for monitoring cholesterol lowering efforts; U.S. adults, 2005–2006. www.cdc.gov/nchs/data/databriefs/db02.pdf

What are the signs and symptoms?

High cholesterol itself does not have symptoms. Many people do not know that their cholesterol level is high. That's why it's important to schedule regular visits with your doctor. Be sure to ask about having your cholesterol tested.

How is high cholesterol diagnosed?

Doctors can do a simple blood test to check your cholesterol. Most adults should get their cholesterol levels checked every five years. If your total cholesterol is 200 mg/dL* or more, or if your HDL (good cholesterol) is less than 40 mg/dL, you will need to have a lipoprotein profile blood test done. Ask your doctor about what may be right for you.

What levels of cholesterol are healthy?

| | Desirable Levels |
|--------------------------|----------------------|
| Total cholesterol | Less than 200 mg/dL* |
| LDL ("bad" cholesterol) | Less than 100 mg/dL |
| HDL ("good" cholesterol) | 40 mg/dL or higher |
| Triglycerides | Less than 150 mg/dL |

* Cholesterol levels are measured in milligrams (mg) of cholesterol per deciliter (dL) of blood.

National Center for Chronic Disease Prevention and Health Promotion
Division for Heart Disease and Stroke Prevention



POLICY FORUM

Heart Disease and Stroke in North Carolina

Introduction

Of the many models describing the development and implementation of public policy perhaps the simplest describes a dynamic interaction between data, strategy, and will.

Proposed by the late pediatrician and Surgeon General Julius Richmond and maternal and child health luminary Milt Kottelchuck, this “data use triangle” suggests that public policy is best shaped when data, or knowledge, informs strategies and interventions. But without political will, even the best information and plans go nowhere. In 1979 Dr. Richmond published *Healthy People: The Surgeon General’s Report on Health Promotion and Disease Prevention*, which contained the first national quantitative goals to measure our success in improving population health. *Healthy People* has been updated every 10 years since. But we need not look so far ahead.

This issue of the NCMJ is a call to action, pulling together the data, the strategies, and the will that seek to save a million lives from heart disease and stroke—30,000 in North Carolina—in the next 5 years.

We know the data: heart disease and stroke stubbornly remain a leading cause of death in our state and country. We know the strategies, and we practice our ABCS—*aspirin use when appropriate, blood pressure management, cholesterol control, and smoking cessation or abstinence*. We learn more each year and apply better and best practices in our medical offices and hospitals, homes and workplaces, and communities and state.

This issue of the NCMJ reminds us that North Carolina has long been a leader in data and strategy. We don’t *lack* plans. From the forward thinking Justus-Warren Heart Disease and Stroke Prevention Task Force Plan to the North Carolina Stroke Care Collaborative and the many community based initiatives to improve education, practice, and access, North Carolina is determined to bring data and strategy to implementation.

Does this mean North Carolina has the commitment and will to save 30,000 lives? Have we become inured to the data and complacent with the strategies? Have we simply been polishing the brass and loosening a notch on the buckle of the nation’s stroke belt? This issue says no.

The Million Hearts initiative is more than a slogan or a dream. It is a reality daring to happen. NCMJ

*Peter J. Morris, MD, MPH, MDiv
Editor in Chief*

30,000 Fewer Heart Attacks and Strokes in North Carolina: A Challenge to Prioritize Prevention

Alain G. Bertoni, Don Ensley, David C. Goff

Heart disease and stroke are leading causes of death in North Carolina and are also important contributors to poor health and excess health care expenditures. The risk factors for heart disease, stroke, and other forms of cardiovascular disease are well known, and include smoking, high blood pressure, elevated serum cholesterol levels, diabetes mellitus, and obesity. These risk factors persist as a result of sub-optimal assessment, treatment, and control; adverse trends in health behaviors; and environmental and societal conditions negatively affecting the pursuit of optimal cardiovascular health. If North Carolina is to do its share in making it possible for the national Million Hearts initiative to meet its goals, then 30,000 heart attacks and strokes need to be prevented in the state over the next 5 years. Both the Million Hearts initiative and North Carolina's Justus-Warren Heart Disease and Stroke Prevention Task Force Plan include specific recommendations aimed at the primary and secondary prevention of heart disease and stroke. Million Hearts focuses on the ABCS: aspirin use when appropriate, blood pressure control, cholesterol control, and smoking cessation or abstinence. The task force plan also addresses physical inactivity, poor nutrition, and the control of obesity and diabetes. The commentaries published in this issue of the NCMJ address the challenge of cardiovascular disease prevention among children and adults across the state and highlight efforts to enhance prevention via public policies and legislation, community coalitions, and quality improvement in the clinical arena.

This issue of the NCMJ highlights heart disease and stroke and challenges us to improve the prevention of these disorders in North Carolina. In 2011, a coalition of federal, state, and local government agencies launched a national campaign to prevent 1 million heart attacks and strokes over the next 5 years, which would represent a 10% reduction each year from the 2 million cases per year now occurring in the United States [1]. If North Carolina is to do its fair share in accomplishing the goal of the Million Hearts initiative, there will have to be 30,000 fewer heart attacks and strokes among the state's residents over the next 5 years. Census figures for 2010 show that nearly 3.1%

of the US population lives in North Carolina [2]; thus the state must prevent approximately 6,000 of the 200,000 heart attacks and strokes that must be prevented annually in order for the nation to meet the ambitious Million Hearts goal. Because the state has a population of approximately 10 million, 30,000 may not seem like a very large number of heart attacks and strokes to prevent. However, this is 1 fewer persons among every 333 residents having a heart attack or stroke. North Carolina's role in the Million Hearts initiative is discussed in this issue by Simpson and Massing [3].

If successful, the Million Hearts initiative will also likely reduce the incidence of other forms of heart disease including heart failure and peripheral vascular disease, as well as the number of persons requiring vascular interventions. This is, in part, because survivors of acute coronary heart disease and stroke events are at increased risk for other forms of cardiovascular disease (CVD). Finally, Million Hearts may have a substantial impact on the economic cost of CVD; the direct medical cost of CVD nationally in 2010 was estimated to be \$270 billion [4]. Reducing heart attacks and strokes is likely to have a positive impact on health costs in North Carolina, as well.

Million Hearts will likely reduce CVD deaths. In North Carolina, heart disease and stroke are the second and fourth leading causes of death, respectively, and all CVD is a major cause of premature death and years of potential life lost [5]. North Carolina is an average state with regard to heart disease mortality. For 2007-2009, the state death rate from heart disease was 184.8 per 100,000 population, and the national rate was 185.2 per 100,000 population [6]. However, North Carolina is part of the stroke belt, a large area of the country with excess stroke. The state death rate from stroke for 2007-2009 was 49.1/100,000, which substantially exceeded the national rate of 40.5/100,000 during that time period [7]. There are striking racial/ethnic

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and geographic differences in the burden of CVD in North Carolina. In general, African Americans have a higher burden of both heart disease and stroke than do whites. This contributes to some of the differences observed geographically across the state (Figure 1).

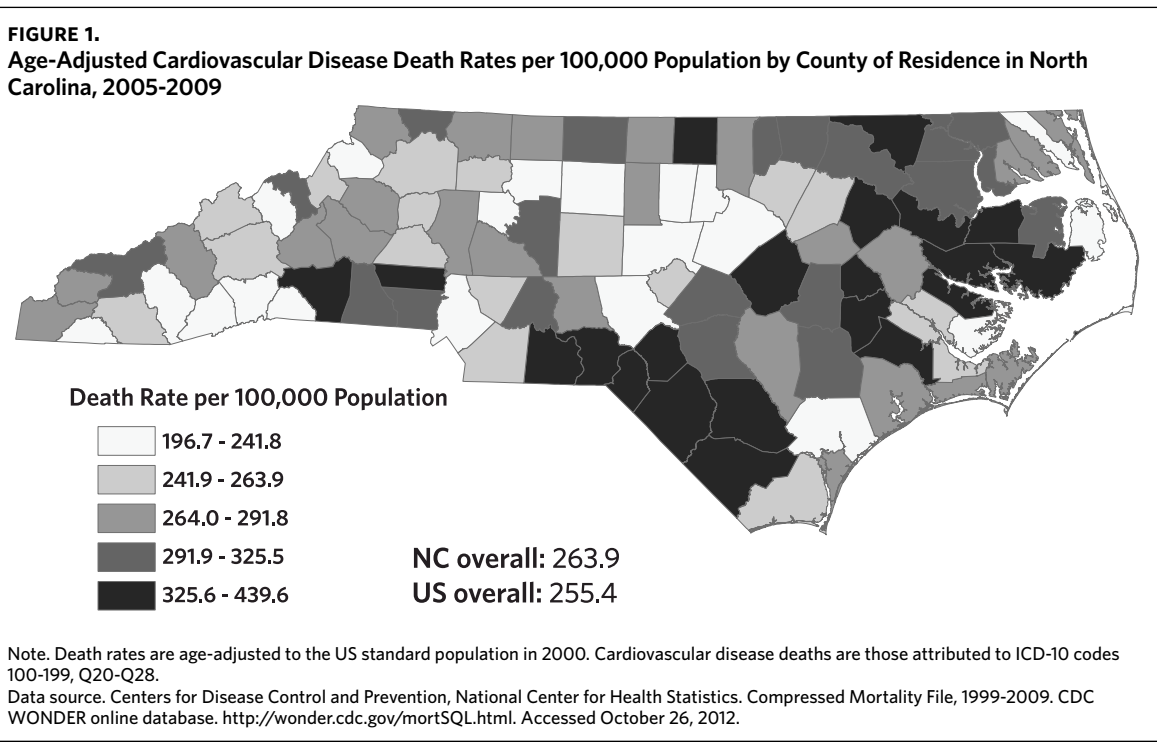
For all cardiovascular diseases (including stroke) and stroke specifically, hospitalizations and mortality are greater in Eastern North Carolina than in the rest of the state and are greater in rural counties than in the more populous and urban counties including Mecklenburg, Wake, Guilford, and Forsyth. Some of the counties with higher mortality rates—particularly in the eastern part of the state—have a higher proportion of the population that is nonwhite. However, the excess CVD death rates seen are not simply attributable to higher CVD rates among minorities. Whites residing in Eastern North Carolina have a greater burden of CVD than do whites in the central part of the state, and there is also a higher burden of CVD in the western mountain counties. Finally, there are striking differences in death rates by county: They range from 277.3 per 100,000 in the county with the lowest heart disease mortality rate (Forsyth) to 712.6 per 100,000 in the county with the highest mortality rate (Washington) [8].

Sharp increases in heart attack and stroke rates in the mid-20th century led to research that contributed to an understanding of the underlying risk factors for heart disease. By the mid-1960s, it was established that elevated blood pressure and cholesterol levels were important contributors, along with older age [9]. Additional major risk factors include tobacco smoking, family history of CVD, and diabetes [10]. These factors contribute to the development

of atherosclerosis, the underlying biological substrate for most heart disease [11]. These conditions are largely the same factors predisposing towards cerebrovascular disease. An important additional risk factor for stroke is atrial fibrillation [12]. Obesity, physical inactivity, and poor dietary patterns are also associated with risk of heart disease and stroke. The extent to which lifestyle factors and obesity contribute independently to CVD risk is subject to ongoing debate, because these factors also influence blood pressure, diabetes, and dyslipidemia. Disability also greatly affects risk for CVD and CVD risk factors as Herrick and Luken discuss in their commentary. In fact, the prevalence of CVD among adults with disabilities is 3 times that of non-disabled adults, and disabled adults are twice as likely to have 3 or more CVD risk factors [13].

There have been major advances in the treatment of heart disease and stroke, and in the ability to control the underlying risk factors. It is very likely that advances in treatment and prevention led to the significant reduction in heart disease mortality seen since the 1960s [14]. Indeed, it has been estimated that roughly half of the recent reduction may be attributed to changes in risk factors (eg, reductions in tobacco use, reductions in cholesterol consumption, and increases in physical activity levels) and half to evidence-based medical therapies for events (eg, coronary care units, revascularization) and for management of risk factors (eg, effective drugs for controlling blood pressure and cholesterol levels) [15].

It is sobering, however, that despite progress, there remain many adults (and an increasing number of children) with inadequate control of risk factors. For example, recent



national statistics (2009-2010) showed that the prevalence of hypertension was 30.5% among men and 28.5% among women [16]. A 2012 study of US adults using 1999-2010 data found that awareness of one's own hypertension overall was 74.0%, and 71.6% of people with hypertension were being treated. Among those being treated, blood pressures were controlled (< 140/90 mm Hg) in 64.4% [16]. However, when those who were untreated or were unaware that they had hypertension were included, blood pressures were controlled in only 46.5% [16]. State-specific estimates are more difficult to ascertain. However, evidence of suboptimal control of blood pressure was found in patients seen between June 1, 2001 and May 31, 2003 at a sample of 60 primary care practices in North Carolina [17]. Similar patterns of inadequate awareness, treatment, and control are seen for hypercholesterolemia [18, 19].

In 2008, using data from NHANES from 1998-2004 and mathematical modeling using the results from clinical trial-supported interventions, Kahn and colleagues [20] estimated that 78% of adults aged 20-80 years in the United States were candidates for at least 1 prevention activity. If everyone received the activities for which they are eligible, heart attacks and strokes would be reduced by 63% and 31%, respectively [20]. When diet, physical activity, and excess weight are included in addition to the traditional risk factors, only 2% of adults in the United States display all of the following characteristics of optimal cardiovascular health: They do not smoke, are physically active, have normal blood pressure, have normal levels of blood glucose and total cholesterol, are of normal weight, and eat a healthy diet [21].

With respect to how best to prevent CVD in North Carolina, in 2005 the Justus-Warren Heart Disease and Stroke Prevention Task Force published a plan for 2005-2010 with a broad array of goals and recommendations to address CVD prevention in the state [22]. Additional information regarding the task force is available in the article by Holmes and Puckett [23], and an updated task force plan is in press. Importantly, the plan notes that a lot of CVD (as well as non-CVD) morbidity and mortality can be prevented by addressing 3 problematic health behaviors—physical inactivity, poor nutrition, and tobacco use. These behaviors contribute directly to several risk factors for heart disease and stroke. Improvements in the management of high blood pressure and elevated serum cholesterol levels will likely prevent CVD, while managing overweight or obesity will help to control blood pressure and lipid levels and to prevent diabetes. As will be discussed further below, there is uncertainty as to how best to manage glucose levels in order to maximally prevent CVD among those with diabetes; however, blood pressure and lipid control are beneficial.

Finally, the 2005-2010 task force plan and the update highlight the need to improve awareness of the symptoms of heart attack and stroke, the need for immediate treatment of heart attack and stroke, and the improvement of secondary prevention efforts by promoting high-quality care that

is consistent with established guidelines for acute coronary and cerebrovascular disease. Articles in this issue highlight quality improvement and access to care initiatives in regard to stroke and heart attack. Rosamund and colleagues discuss the North Carolina Stroke Care Collaborative, and its successes and challenges in improving quality of care for stroke in the state [24]. In their commentary, Cykert and colleagues discuss how the North Carolina Division of Public Health and the Area Health Education Centers Program are assisting practices to improve clinical preventive strategies such as these to reduce the burden of heart attack and stroke in North Carolina [25]. Halladay and Hinderliter discuss another quality improvement initiative—a course to train clinical office staff on how to accurately measure blood pressure [26].

Many of the factors cited in the task force plan are consistent with the more recent Million Hearts initiative, which is based on the premise that enhanced CVD prevention needs to be undertaken both in the clinical and community settings. Emphasis is placed on appropriate aspirin use, blood pressure control, cholesterol management, and smoking cessation as targets for enhanced clinical prevention. In addition to clinical strategies, the plan and the initiative call for complementary community-based prevention efforts focused on reducing smoking rates and exposure to second-hand smoke, and improving nutrition (reducing the intake of salt and trans fats). Excess dietary sodium contributes substantially to hypertension, and trans fats contribute to hyperlipidemia [27, 28].

A major difference between the Million Hearts initiative and the task force plan is the task force's inclusion of diabetes, which in 2009 affected approximately 9.5% of adults in North Carolina [29]. The close relationship between diabetes (especially type 2) and CVD has long been recognized [30]. The biochemical hallmarks of diabetes (hyperglycemia, increased levels of free fatty acids, and insulin resistance) contribute to the formation of atherosclerosis [31]. CVD complications may be reduced or delayed by intensive management of glycated hemoglobin A1c levels, blood pressure, and lipid levels [30]. Unfortunately, risk factor control among all US adults with diabetes is suboptimal [33, 34]. In the Action to Control Cardiovascular Risk in Diabetes (ACCORD) trial, the glycemic control portion of the study was halted after 3.5 years of follow-up, because the intensive-therapy group—which had achieved a stable median HbA1c level of 6.4% after 1 year, versus 7.5% for the standard-therapy group—had a higher rate of death from any cause than did the standard-therapy group (5.0% vs. 4.0%, hazard ratio 1.22; 95% CI, 1.01-1.46; $P = 0.04$) [35]. Intensive therapy was not associated with a decreased risk of the primary outcome, which was a combination of nonfatal myocardial infarction, nonfatal stroke, or death from cardiovascular causes (hazard ratio 0.90; 95% CI, 0.78-1.04; $P = 0.16$). Taken together, the results of the ACCORD trial, the Veterans Affairs Diabetes Trial, and the Action in Diabetes

and Vascular Disease—Preterax and Diamicron Modified Release Controlled Evaluation (ADVANCE) trial do not provide strong support for normalization of HbA1c levels by means of currently available pharmacologic therapies [36].

Perhaps the best way to prevent CVD among persons with diabetes is to prevent diabetes. In the Diabetes Prevention Program, in adults at high risk for diabetes, lifestyle modifications (losing at least 7% of body weight and engaging in physical activity for at least 150 minutes per week) were shown to reduce the incidence of diabetes by 58% compared with placebo, and metformin use was associated with a 31% reduction in the incidence of diabetes compared with placebo [37]. Recent research has demonstrated that approaches that translate the Diabetes Prevention Program intervention into community-based programs are effective and can be delivered at lower cost [38].

The article by O'Connell and Vetter in this issue discussing the role of nutrition, exercise, and tobacco cessation in prevention [39] leaves little doubt that behaviors that influence risk factors and heart disease and stroke incidence can be changed. There is strong evidence from randomized trials that interventions with 1 or more of the following components reduce blood pressure levels: reduction of dietary sodium, potassium supplementation, weight loss, moderation of alcohol consumption, participation in regular physical activity, and adoption of the Dietary Approaches to Stop Hypertension (DASH) and similar dietary patterns [27, 40]. Briefly, DASH entails increased consumption of fruits and vegetables (4-5 servings of each per day), low-fat dairy products, legumes, and other lean sources of protein, along with a reduction in consumption of saturated fats and of sweetened foods and beverages [41].

Cigarette smoking has long been recognized as a risk factor for cardiovascular diseases including heart disease and stroke, and smoking cessation leads to rapid reductions in risk. The excess risk of a heart attack goes down by about 50% in former smokers within a year of cessation; however, residual risk persists for many years [42]. Approximately 22% of all adults in North Carolina still smoke tobacco [43]. Increases in tobacco excise taxes have been particularly effective in reducing initiation of smoking among minors and in promoting cessation among all smokers [44]. Further increases in the tobacco excise tax in North Carolina would likely lead to substantial reductions in CVD.

In recent years, the benefits of eliminating exposure to secondhand smoke have been assessed [45]. A meta-analysis supports the conclusion that heart attack rates in the community may decrease by 17% within a year of implementing a work site smoking ban [46], resulting in tremendous public health benefits and health care cost savings. This evidence supported the implementation of a partial ban in North Carolina in 2010, affecting all restaurants and bars. A report to the state health director in late 2011 confirmed that the population of North Carolina experienced a benefit at least as great as that predicted by the meta-analysis [47].

Extending this benefit to all workers in all work sites in North Carolina may lead to further reductions in heart attack rates.

Resources available in communities have also been shown to affect CVD risk factors. Geographic areas with a relative paucity of stores with healthier foods for purchase have been labeled *food deserts* [48]. It has been shown nationally, and in at least 1 community in North Carolina, that minority residents are more likely to live in food deserts [48, 49]. A study that included residents of Forsyth County demonstrated that residence in neighborhoods with fewer resources for physical activity and fewer stores with healthy foods was associated with a greater incidence of diabetes [50]. A recent study confirmed that residents of areas with a shortage of primary care health professionals had a higher prevalence of CVD risk factors [51], although the analyses did not suggest that control of CVD risk factors was better among participants who lived in areas without a shortage of primary care providers; the greater prevalence of risk factors appeared to be attributable to the demographic and socioeconomic characteristics of the residents.

Combating heart disease and stroke in North Carolina has been viewed as a public health and medical challenge for the past century. In order to realize enhanced prevention of CVD, there is still a role to be played by improvements in the quality of medical care delivered in the hospital setting following acute events. Piper and Malfitano review the journey of Onslow Memorial Hospital, a rural hospital in Southeastern North Carolina, from its decision to focus on improving stroke care in 2006 to its certification by the Joint Commission as an Advanced Primary Stroke Center in 2012 [52]. And Tegeler describes the use of enhanced communication technologies to increase access to acute stroke services through the telestroke initiative, which is playing an important role in reducing the burden of cerebrovascular disease throughout North Carolina [53].

However, a model based on the efficacy of strategies for prevention and treatment as well as the prevalence of risk factors and disease among US adults found that ideal primary prevention (prevention before any event has taken place) would prevent or postpone 33% of all CVD deaths; secondary prevention (prevention between acute events) would prevent or postpone 22% of all such deaths; and ideal care during an acute event would prevent or postpone 8% of all such deaths [54]. This suggests that improvement of prevention in the ambulatory medical setting should be strongly emphasized. The American College of Cardiology Foundation and the American Heart Association (AHA) have collaborated to promulgate recommendations and performance metrics to be applied to enhance primary [55] and secondary prevention [56].

Recently, the American Heart Association has collaborated with the American Cancer Society and the American Diabetes Association to implement the Guideline Advantage program, which focuses on clinical prevention of heart disease, cancer, stroke, and diabetes in outpatient primary care

settings [54]. The program uses data collected through electronic health records or other platforms to support the use of evidence-based guidelines for prevention and disease management. In her sidebar, Schwartz discusses how early quality-improvement efforts, coupled with electronic medical record use, have helped Roanoke Chowan Community Health Center deliver high-quality care that also meets Meaningful Use standards [58].

Increasingly, it is recognized at the national and state levels that any successful public health intervention must involve individuals taking a more active role in managing their own health and in taking responsibility for promoting healthier communities and neighborhoods. This approach is made possible when community leaders, policymakers, businesses, work sites, and community groups including faith-based, fraternal, and social organizations, take a more active role in promoting health at the individual and community levels. Several community-based approaches are discussed in this issue, including the West and colleagues article on the Cabarrus Health Alliance's faith-based Healthy Lives, Healthy Futures program, which trains volunteers to lead exercise classes at their respective churches [59], and the article by Ransdell and colleagues discussing the Eastern North Carolina Stroke Network, which has 400 members in 30 North Carolina counties collaborating to promote the implementation of stroke best practices in the eastern part of the state [60]. Page et al discuss Project DIRECT Legacy for Men—Hyde County, which addresses hypertension and diabetes among African American men in that county [61].

Specific evidence-based strategies applicable to the entire community are reviewed in the Guide to Community Preventive Services [62]. The guide includes recommendations to increase community physical activity opportunities, enhance community tobacco control, and support tobacco cessation (Table 1). The guide provides less evidence regarding approaches for improving diet at the community level; however, a recent American Heart Association Scientific Statement [63] reinforces the recommendations found in the guide and provides several promising approaches for improving diet (Table 1).

A reemerging approach in health promotion programs and health care delivery is the utilization of community health workers and other health care extenders. Utilization of these individuals, who are grounded in the community, expands health care resources and better assures that programs and services are tailored to the individuals and communities they serve. One program in North Carolina that demonstrates such an approach, the Healthy Living Partnerships to Prevent Diabetes project, uses community health workers and group-based instruction to promote weight loss and to decrease glucose levels among adults at risk for type 2 diabetes [64].

The Justus-Warren Heart Disease and Stroke Prevention Task Force's update of its comprehensive plan gives increased attention to the roles of individuals, families, and

TABLE 1.
Strategies to Increase Physical Activity, Improve Nutrition, and Control and Reduce Tobacco Use

Community-level strategies to increase physical activity^a

- Community-wide informational campaigns
- Community-scale urban design and land-use policies
- Creation of enhanced access to places for physical activity combined with informational outreach activities
- Street-scale urban design and land-use policies
- Point-of-decision prompts to encourage use of stairs

Community-level strategies for improving nutrition^b

- Sustained, focused media and educational campaigns, using multiple modes, for increasing consumption of specific healthful foods or reducing consumption of specific less healthful foods or beverages, either alone or as part of multicomponent strategies;
- On-site supermarket and grocery store educational programs that support the purchase of healthier foods
- Mandated nutrition-facts panels or front-of-pack labels/icons as a means of influencing industry behavior and product formulations
- Agricultural subsidy strategies that lower prices of more healthful foods and beverages
- Tax strategies that increase prices of less healthful foods and beverages
- Changes in agricultural subsidies and other related policies in order to create an infrastructure that facilitates production, transportation, and marketing of healthier foods
- Regulatory policies aimed at reducing the presence of in food of nutrients such as salt, trans fats, and certain other fats
 - Point-of-decision prompts to encourage use of stairs

Community-level strategies for tobacco control and tobacco cessation^a

- Increasing the unit price for tobacco products (via taxes or user fees)
- Smoking bans and restrictions at work sites
- Community mobilization combined with additional interventions (such as stronger local laws directed at retailers, active enforcement of retailer sales laws, and retailer education with reinforcement to reduce minors' access to tobacco)
- Cessation interventions
 - o Telephone support
 - o Reductions in out-of-pocket costs for evidence-based tobacco-cessation treatments.
 - o Mass media campaigns can be effective when combined with other interventions, but are less effective as stand-alone efforts

^aStrategies excerpted from The Guide to Community Preventive Services [57]
^bStrategies excerpted from Mozaffarian D, Afshin A, Benowitz NL, et al [58].

communities in the prevention and management of risk factors for heart disease and stroke. These stakeholders can play a vital role in addressing social, behavioral, policy, and environmental changes that will improve population health. Families and communities are likely to be particularly influential in promoting prevention among North Carolina's youth. It is quite evident that cardiovascular health begins in childhood [4]. The recent national trend of an increasing proportion of children being obese [65] is alarming; obesity is associated with other CVD risk factors in children, just as it is in adults. Armstrong's paper in this issue on heart dis-

ease in childhood discusses the significance of the increasing prevalence of these risk factors in children [66].

In addressing the burden of heart disease and stroke in the state, the Justus-Warren Heart Disease and Stroke Prevention Task Force develops formal and informal relationships with different sectors of the community. This is an important strategy that has been successful and should be adopted at the regional and local levels. The Eastern North Carolina Stroke Network is a partnership of representatives from the state's Division of Public Health, local health departments, faith-based organizations, the American Heart Association and the American Stroke Association, community health centers, and other community groups, who have assembled to address stroke care and related risk factors. The results have enabled the residents of the eastern region of the state to actively participate in improving and coordinating the delivery of health services there.

In North Carolina, policymakers and other stakeholders and others have received a return on their investment: The state has experienced significant reductions in the mortality rates for heart disease and stroke. In this issue, Murry and colleagues note that legislators have an "opportunity to accelerate the adoption of Million Hearts objectives," and they suggest that "doing so will impact population health and perhaps generate cost-savings in the care of North Carolina's Medicaid population" [67]. It is imperative that the state avail itself of all its resources in addressing the challenges of heart disease, stroke, and other chronic diseases. The results will yield a better and more productive quality of life for all residents. NCMJ

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The Justus-Warren Heart Disease and Stroke Prevention Task Force and the North Carolina Plan to Prevent Heart Disease and Stroke

M. Anita P. Holmes, Elizabeth M. Puckett

One in 4 deaths in North Carolina is attributed to heart disease and stroke. The legislatively mandated Justus-Warren Heart Disease and Stroke Prevention Task Force provides statewide leadership for the prevention of cardiovascular disease. This commentary reviews the work and accomplishments of the task force and its comprehensive plan to reduce the state's cardiovascular burden.

Hearth disease and stroke are the cause of approximately 29% of all deaths in the United States and 27% of all deaths in North Carolina. The need for a multi-pronged approach involving changes in policy, the health care system, and the environment has become increasingly evident as the state and nation continue to battle these significant health problems [1,2]. For more than 17 years, the Justus-Warren Heart Disease and Stroke Prevention Task Force has served as an umbrella organization for stakeholders along the continuum of cardiovascular disease (CVD) prevention and care who have united to fight against these leading causes of death and disability.

When the task force was established, heart disease and stroke were respectively the first and third leading causes of death in North Carolina, and the state had the nation's third highest mortality rate from stroke [3, 4]. Prior to the establishment of the task force in 1994, Dale Simmons, the director of the state's Division of Community Health (which no longer exists, but was part of the state's health department in the mid 1990s) recognized that "there was no attention to, no fear of, and no funding for the prevention of cardiovascular diseases, the leading cause of hospitalization and death, and a leading cause of severe long-term disability in adults" [5]. Simmons called for the establishment of an internal state health department work group to develop a preliminary plan for the prevention of heart disease and stroke. The plan, completed in the spring of 1995, was reviewed and endorsed by 25 partner organizations [5]. The first of 10 recommended activities was to establish and fund a legislative heart disease and stroke prevention task force in order to increase visibility and ownership by key policymakers and stakeholders, enhance the state's ability to address policy changes, and secure funding [5].

Later in 1995, the North Carolina General Assembly passed legislation establishing the North Carolina Heart Disease and Stroke Prevention Task Force (subsequently named the Justus-Warren Heart Disease and Stroke Prevention Task Force) [6]. The legislation specifies that North Carolina's governor and the General Assembly, upon the recommendations of the speaker of the house and the president pro tempore of the senate, shall appoint 24 of the task force's 27 members [5], with 6 of those seats designated for legislators (3 recommended by the president pro tempore of the senate and 3 recommended by the speaker of the house). The remainder is filled by health professionals, survivors, members of volunteer and governmental organizations, business leaders, and a representative of the media. In addition, there are 3 designated positions for certain key leaders within the North Carolina Department of Health and Human Services (NC DHHS), thereby ensuring a close working relationship between the task force and the department. The membership is configured to also reflect North Carolina's demographic characteristics. In addition, a large number of partners and resource persons attend task force meetings and participate in committees, giving essential support to the work of the task force. Relationships with the American Heart Association/American Stroke Association (AHA/ASA) and with groups such as the North Carolina Hospital Association, which have government relations staff, have been particularly helpful in addressing the policy work and maintaining the viability of the task force.

The legislation enabling the task force outlines 3 key charges: to develop a profile of the CVD burden in North Carolina; to publicize that burden and its preventability; and to develop a comprehensive statewide prevention plan [5]. The initial task force appropriation in 1995 of \$100,000 per year for 2 years established 2 positions: an executive director and administrative assistant [5].

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North Carolina has a stroke mortality rate that is among the highest in the nation [7]. In April 2005, a bill was introduced in the North Carolina General Assembly, requiring that every hospital in North Carolina have a plan for acute stroke care [8]. Although this legislation did not pass, other legislation was passed in 2006 directing the task force to establish and appoint a Stroke Advisory Council (SAC) [9]. The council was charged with advising the task force regarding the development of a statewide system of stroke care that would include the identification and dissemination of information about the location of primary stroke centers. Seventeen SAC members, including stroke experts and stakeholders, were appointed by the task force. The task force and the SAC are supported by staff of the Division of Public Health, NC DHHS, and specifically staff of the Heart Disease and Stroke Prevention Branch, with assistance from other members of the Chronic Disease and Injury Section.

Task Force Accomplishments

There have been numerous accomplishments since the task force was formed. One that best reflects the collective achievement is the reduction between 2000 and 2009 in North Carolina's heart disease and stroke death rates by 32.7% and 37.9%, respectively. These reductions exceed Healthy Carolinians 2010 objectives [10]. In addition, the proportion of all North Carolina deaths due to CVD dropped from 38.1% in 1996 to slightly less than 28% in 2010. Between 1996 and 2010, there was also a narrowing of the gaps in stroke mortality between North Carolina and the United States and also between African American North Carolinians and white North Carolinians [10]. Although numerous factors contributed to these successes, many experts on this subject believe that the work of the task force and its many partners is the major contributing factor.

Because of the widespread prevalence of CVD and the multiple risk factors with which it is associated, there is an unparalleled opportunity to make a measurable difference by bringing together all those involved along the continuum of care from primary prevention to rehabilitation and recovery. The task force has served as a vehicle to garner diverse support from multiple partners and has enabled the state to leverage significant human and financial resources. The important accomplishments of the task force and its many partners would have been unlikely had North Carolina not been one of the first 2 states in the nation to be awarded CDC funding at the comprehensive level. In 1998—when CDC announced this funding opportunity—the Justus-Warren Heart Disease and Stroke Prevention Task Force was in place and had already received some state funding. The comprehensive funding from CDC (\$1.25 million per year for 5 years) positioned North Carolina to become a leading state in heart disease and stroke prevention. Since 1998, the state's initial investment of \$100,000 per year for 2 years has provided a return of over \$20 million in CDC funds.

There have been other milestones as well. In 1998, the task force first published a comprehensive report on the burden of CVD in North Carolina, which is continuously updated. Three comprehensive plans to prevent and improve cardiovascular health (CVH) along the continuum of care have been developed, including an evidence-based comprehensive stroke system of care (SSoC) plan for North Carolina. Several noteworthy accomplishments have been made based on task force reports and plans. These accomplishments have had statewide implications, and have allowed for customized approaches at the regional and local level. For instance, stroke networks, which provide regionally coordinated and locally driven approaches to cerebrovascular issues, have been developed in the western and then the eastern areas of the state.

Legislative members of the task force have been instrumental in the development and passage of legislation to support task force recommendations. Members have successfully sponsored legislation that prohibited smoking in multiple venues statewide. The task force recommended legislation in 2007 that made all state government buildings smoke-free [11], and sponsored the bill that prohibited smoking in the state government motor fleet in 2008 [12]. They also recommended legislation in 2008 that gave clear local authority for community colleges to prohibit smoking and all tobacco use on their campuses [13]. In addition, task force members sponsored legislation in 2009 making all restaurants and bars smoke-free [14]. In a presentation to the task force in November 2011, then State Health Director Jeffrey Engel, MD, reported on a study showing a 21% decline in the average number of emergency department visits per week for heart attacks in the 12 months following implementation of the smoke-free restaurants and bars law [15].

The task force has provided supplemental support to the CDC-funded North Carolina Stroke Care Collaborative quality improvement program, as recommended by the task force's Stroke Advisory Council in January 2007, to assure evidence-based stroke care in all North Carolina hospitals. And the task force partnered with the North Carolina Office of Emergency Medical Services (EMS) to develop an acute stroke care toolkit for all of the state's EMS systems to assure evidence-based protocols for prehospital recognition and treatment of stroke. The task force also supported a signs and symptoms awareness campaign to address the time-sensitive nature of heart attacks and strokes and to enhance early recognition and activation of the chain of survival by calling 911.

The complexity and demands of today's health care environment require continued leadership by the task force. In May 2012, in correspondence to a legislator regarding recent North Carolina legislation (the Boards and Commissions Efficiency Act of 2012) seeking to eliminate the task force along with a long list of other boards and commissions, Jim Stackhouse, a member of the task force for 17 years, made the following statement:

The task force actually evolved to coordinate the activities of multiple private and state-funded activities in heart disease and stroke prevention. It did this by bringing to the table entities that had had little to do with each other before, and in some cases did not know of each other's existence. But the synergy was impressive. And duplication of state services was reduced.

North Carolina's Plan to Prevent Heart Disease and Stroke

As noted above, the development of a comprehensive statewide plan to prevent heart disease and stroke is 1 of 3 main charges to the task force. To date, 3 plans have been developed. The first was published in 1999 (for years 1999-2003), the second in 2005 (for years 2005-2010), and a third will be released in late 2012 (for years 2012-2017). Each comprehensive plan describes the vision of diverse stakeholders who collectively have prioritized goals, objectives, and strategies to best address CVH in North Carolina. The current plan guides the work of the task force and of the state Heart Disease and Stroke Prevention Branch, and its work with partners as well. The plan also includes a platform for funding and policy priorities and incorporates the work done by the SAC in developing the SSoC Plan, which is incorporated in the 2012 plan.

The overarching goals of North Carolina's comprehensive plan are to increase quality and years of healthy life through heart-healthy and stroke-smart environments; to improve cardiovascular disease prevention, treatment, and rehabilitation; and to eliminate health-related disparities. These objectives are all designed to increase the proportion of North Carolinians who live healthy lifestyles supportive of cardiovascular health, whose risk factors have been identified and are appropriately managed and controlled, who have access to and receive appropriate integrated emergency and acute care for cardiovascular events, and who receive appropriate coordinated management of postacute transitional care following cardiovascular events.

Each updated version of the plan reflects new and expanded priorities and partnerships. To work most effectively and use the expertise of members and partners in the development of the 2012-2017 plan, working groups have been formed along the continuum of care to focus on each of these areas: prevention and public awareness, emergency response, prehospital care, acute care, recovery and transitions of care, and telestroke. Each group has been tasked with identifying goals, objectives, strategies, and organizations responsible for implementation and baseline and target measures—all while addressing disparities. Strategies must be implementable within 5 years, have the greatest opportunity for impact and reach, be evidence-based, and leverage resources.

The new plan also includes some promising practices such as advocating for system changes that integrate and sustain the use of community health workers and other health care extenders into primary care settings. This would provide

increased support for CVD prevention and management. And several strategies in the plan have implications beyond CVH. One of these, telehealth, holds particular promise for treatment and services in areas where there is limited access to specialists and rehabilitation. In addition, access to primary care is another facet of health care that has received strong recognition in the plan for its pervasive influence on CVH.

The initial plan (1999) centered on primary prevention [16]. The second plan (2005) continued to address primary prevention, but also incorporated an increased focus on secondary prevention, which was required by CDC funding and was reflected in the 2003 edition of the CDC publication *A Public Health Action Plan to Prevent Heart Disease and Stroke* [17, 18]. This national action plan includes a comprehensive framework on which the North Carolina plan has been based and which will continue to guide the work of plan implementation, which lies ahead. Also during the planning period for the 2005 plan, modified directives were received from the CDC to focus on the ABCS (aspirin, blood pressure, cholesterol, smoking cessation) reflected in the national Million Hearts Campaign. The 2005 plan also incorporated new data findings, national guidelines, evidence-based strategies, and promising practices identified by expert panels and groups.

As evidence-based information and recommendations on behavioral approaches become available, along with clinical guidelines, social determinants of health, community and clinical linkages, transitions of care, policy changes, environmental changes, and system-level changes, they will be incorporated into the objectives and strategies of the new plan, which is currently under review. Work on the plan and the partnerships required to develop and implement it have highlighted the need to continue to break down disease-specific silos and integrate public health into new domains. Implementation will require support at fiscal, clinical, programmatic, and policy levels. Each year of delay in moving forward imposes a substantial burden on the state and the many individuals and families representing the faces of CVD. With new research findings, evidence-based strategies, and an economy that demands efficiency, we are perhaps better armed than ever to meet the challenge of creating a heart-healthy and stroke-free North Carolina. NCMJ

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Unbuckling the Stroke Belt: Answering the Call Through the Eastern North Carolina Stroke Network

Christine Ransdell, Marie Welch, Jo Morgan, Elynor Wilson, Jill Jordan

The Eastern North Carolina Stroke Network was formed in 2006 by local partners in 30 counties in what is known as the buckle of the stroke belt, where stroke mortality is alarmingly high. The organization's goal is to improve the continuum of stroke care from community prevention through recovery.

In 2009, the 4,391 stroke deaths accounted for an estimated 23,695 years of life lost in North Carolina [1]. (Years of life lost refers to the number of years a person lost by dying prior to the average life expectancy of 77.9 years in 2009.) In 2010, stroke was the fourth leading cause of death in the state [2], but it was the third leading cause of death for residents living in Eastern North Carolina [3]. North Carolina is one of the 8-12 states included in a region that is known as the stroke belt because stroke death rates have been higher there than in the rest of the nation. The coastal plains of North Carolina, South Carolina, and Georgia are known as the buckle of the stroke belt, because stroke mortality rates there are even higher than elsewhere in the belt [4]. Death rates from stroke in Eastern North Carolina are among the highest in the United States [4].

In response to the impact of cardiovascular disease and the prevalence of stroke in Eastern North Carolina's rural communities, the Eastern North Carolina Stroke Network (ENCSN) was established in 2006 following groundwork laid during meetings between Vidant Medical Center (formerly Pitt County Memorial Hospital) and the East Carolina University (ECU) Brody School of Medicine in Greenville, North Carolina. The purpose was to identify ways of improving stroke care in Eastern North Carolina. In 2005, the American Stroke Association (ASA) published an article titled "Recommendations for the Establishment of Stroke Systems of Care" [5]. These recommendations, which ultimately became the framework for the ENCSN, stated that a stroke system of care should do the following things:

First, a stroke system should ensure effective interaction and collaboration among agencies, services, and people involved in providing prevention and the timely identification, transport, treatment, and rehabilitation of individual stroke patients in a locality or region. Second, a stroke sys-

tem should promote the use of an organized, standardized approach in each facility and component of the system. Third, a stroke system should identify performance measures (both process and outcomes measures) and include a mechanism for evaluating effectiveness through which the system and its individual components continue to evolve and improve. [5]

In an effort to enhance cross-collaboration within the entire eastern region of the state, it became obvious that public health leaders could offer expert advice with regard to community engagement through existing and developing relationships. Additionally, the North Carolina Division of Public Health, through funding from the Centers for Disease Control and Prevention, had awarded funding to public health agencies to implement the North Carolina Heart Disease and Stroke Prevention (HDSP) Program in Eastern North Carolina. In 2006, local leaders from the American Heart Association (AHA), ECU Brody School of Medicine, Eastern Area Health Education Center (EAHEC), North Carolina HDSP Program, Vidant Medical Center, and Pitt County Public Health Department assembled in hopes of enhancing and improving stroke care in Eastern North Carolina through connecting health care providers in the region. This effort to engage all providers involved in the care of the stroke patient throughout the continuum from community prevention through recovery was accomplished through quarterly educational programs under the name of the Eastern North Carolina Stroke Network.

The quarterly educational programs offered to the region's health care providers resulted in other initiatives to improve stroke care. ENCSN focused on raising awareness of the complexities of stroke care and increasing educational opportunities related to stroke treatment in hospital settings. This provided impetus for Eastern North Carolina hospitals to plan systems of care using best practices for treatment of stroke and that would improve population health outcomes.

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Journey Toward Improving Stroke Care: Onslow Memorial Hospital

Ed Piper, Josephine Malfitano

In 2006, the leadership at Onslow Memorial Hospital (OMH) decided to address stroke care—a major population health issue in Onslow County. OMH is located in the southeastern region of North Carolina, which has been labeled the buckle of the stroke belt [1]. The southeastern region of North Carolina was so labeled due to high rates of hypertension, cardiovascular disease, obesity, and diabetes. Notably, Onslow County had an increase in stroke deaths in 2006 compared to the declining rates in North Carolina overall [2, 3].

The magnitude of the need for stroke care improvement was realized through benchmarking data in the North Carolina Stroke Care Collaborative (NCSCC). This data provided the framework to measure the quality of stroke care using evidence-based standards and recognized performance measures supported by the American Heart Association/American Stroke Association, Brain Attack Coalition, National Quality Forum, and the Joint Commission. Quality improvement (QI) initiatives began with development of an interdisciplinary stroke team to measure progress toward improved stroke care. The NCSCC shared data comparisons with registry hospitals across the state and provided monthly stroke care QI webinars and annual workshops for educational and networking purposes as well as to share best practices and guidelines for current stroke care standards. Additionally, grant funding was available and provided to further support hospitals with development or enhancement of innovative stroke care QI programs and projects.

Initial data collected in 2006 showed that OMH's com-

pliance with the stroke education performance measure score was only 28%, which was the lowest measured score for all the stroke performance indicators. There was a clear need to improve stroke care at OMH as well as in the community. OMH created an interdisciplinary stroke team to work on low stroke measure performance scores. The team helped implement process improvements such as stroke education with staff, improved documentation needed to show compliance with stroke performance measures, and enhanced educational resources for patients and families about stroke disease risks and poststroke care. These interventions improved OMH's stroke education performance score to 40% by 2007. In 2007, OMH began participation in the NCSCC's Quality Improvement Working Group which meets monthly to review registry data and makes recommendations for stroke care QI initiatives that are reasonable and feasible for hospitals to implement. OMH participation ensures that the perspective of a rural community hospital is taken into consideration when making decisions about which initiatives to implement. From this work came relevant stroke care QI monthly presentation topics for participating registry hospitals. Pivotal to the successes at OMH is the unwavering and unique support from the OMH Board and executive leadership in conjunction with the passion of frontline stroke care champions. These champions include nurses, physicians, physical therapists, pharmacists, radiologists, dietitians, and other health professionals who help ensure compliance with stroke standards, mentor new staff, and identify opportunities to improve stroke care.

From July through September of 2008 the regional coordinators of the Eastern and Northeastern North Carolina HDSP programs, who had been designated by partners to staff the ENCSN, initiated a strategic planning effort in response to the ENCSN's growth. As had been the case in 2003 and 2006, key strategic partners—including the AHA and Vidant Medical Center—recognized the value and importance of engaging members from 30 targeted counties in Eastern North Carolina in the strategic planning process. Counties were identified as targets based on several definitions of Eastern North Carolina: counties located east of Interstate 95; counties with the highest stroke mortality; counties previously grouped by trauma systems; and counties falling within the service areas of the ECU Brody School of Medicine, EAHEC, the North Carolina HDSP Program, Vidant Medical Center, and other networked hospitals.

Ultimately, stakeholders from 25 organizations met 3 times to develop plans for strengthening the ENCSN's structure and membership and to identify priority actions for addressing stroke care needs in Eastern North Carolina. During the planning process, the ASA recommendations

for the establishment of stroke systems of care [5] were adopted and each facet of the stroke continuum of care—primary prevention, pre-hospital, acute, subacute, secondary prevention, and rehabilitation/recovery—was discussed.

As a result of the strategic planning process, the vision, mission, structure, and membership targets were defined. The vision of the ENCSN is "to be recognized as a leading resource for voluntary collaboration on stroke best practices in Eastern NC communities." The mission of the network is "to improve the prevention, treatment, and quality of stroke care in Eastern NC through a coordinated regional system" [6]. The ENCSN is staffed by regional coordinators of the North Carolina HDSP Program, who receive support from a steering committee. Target membership counties of the ENCSN are Beaufort, Bertie, Camden, Chowan, Carteret, Craven, Currituck, Dare, Duplin, Edgecombe, Gates, Greene, Halifax, Hertford, Hyde, Jones, Lenoir, Martin, Nash, Northampton, Onslow, Pamlico, Pasquotank, Perquimans, Pitt, Tyrrell, Warren, Washington, Wayne, and Wilson. Membership is open to any person or organization from these counties who will champion the improvement of

OMH's focus is on increasing the community's awareness of the state's stroke reduction program using a three-pronged approach: prevention and education in pre-hospital screening; individualized acute care education; and post-hospital follow-up. Grant funding in 2008 from the NCSCC, the NC Stroke Association (NCSA), and the Kate B. Reynolds Charitable Trust (KBR) further optimized opportunities to enhance the OMH Stroke Program and realize its vision. Through this funding, a dedicated Stroke Nurse Coordinator (SNC) was hired to coordinate the increasing need to facilitate the stroke care across the continuum. The dedicated educator/SNC serves as the liaison to and resource for community stroke needs and patient and family education while also providing education and support to hospital staff. The SNC also facilitates interdisciplinary care coordination and monitors stroke outcomes.

The SNC provides community outreach and education on inpatient and outpatient poststroke care utilizing a Stroke Risk Identification Screening Program which provides standardized protocols for identifying stroke risk factors, counseling participants, directing them to resources, and providing outcome management through partnerships for those found to be at high risk for stroke. In this way, potential problems with access and interventions, as needed, are identified. Staff education is ongoing from the time of orientation to the hospital. The education includes annual mandatory computerized module learning, updates at regular staff meetings and real time feedback with chart reviews and care management discussions.

In 2010, OMH became designated as Stroke Capable with the Onslow County Emergency Medical Services (EMS). Performance measure scores for stroke education improved to 96.9%. In 2011, OMH's stroke education per-

formance score for stroke education (95.2%) was statistically higher than the aggregate 80.4% stroke education score for all NCSCC registry hospitals. In June 2012, Onslow Memorial Hospital received accreditation from the Joint Commission as Advanced Primary Stroke Certified. NCMJ

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stroke care in their community.

Following the formal strategic planning process, the ENCSN moved forward to work on 4 priorities: community prevention education, hospital plans of care, quality improvement programs, and continuing education requirements for health professionals. Representatives of the AHA, EAHEC, North Carolina Stroke Care Collaborative, Onslow Memorial Hospital, Vidant Medical Center, and Pitt County Health Department were identified as co-chairs for work groups for each of the Network's priorities.

From January 2009 through May 2012, 9 ENCSN meetings were held and the regional coordinators of the North Carolina HDSP Programs helped sponsor 4 Eastern Regional Stroke Conferences in partnership with other major stroke stakeholder organizations, including the ECU Brody School of Medicine, EAHEC, and Vidant Medical Center.

Quarterly meetings are rotated throughout the region to engage the full partnership base and are usually held at a facility belonging to a member of the ENCSN. Since 2009, meetings have been held in Greenville, Jacksonville, Kinston, Morehead City, New Bern, Rocky Mount, and Williamston.

The ENCSN has been able to successfully attract local, state, and national speakers to these meetings. Topics addressed have included innovative practices and emerging issues facing each of the ENCSN's work groups, including, but not limited to topics such as assistive technology for stroke patients, emergency medical services and hospital collaboration in Duplin County, faith-based cardiovascular disease management in Eastern North Carolina, and telehealth and chronic care management to reduce hypertension.

Specialized trainings sometimes occur immediately following quarterly meetings. For example, in January 2012, a blood pressure measurement mini-course was offered by the regional coordinators of the North Carolina HDSP Program. Because the ENCSN meetings draw attendees from across the region, partners from a variety of locations were able to attend the class. Attendees included people who work in acute stroke care, emergency medical services, federally qualified health centers, hospital community outreach, long-term care, and public health.

As part of the quarterly meeting format, health care professionals from community-based organizations, pub-

lic health organizations, hospitals, physician practices, rural and community health centers, rehabilitation centers, emergency medical services, educational institutions, Area Health Education Centers, the AHA, and the North Carolina Stroke Collaborative join together with stroke survivors to plan, coordinate and accomplish goals which improve patient care through education and best-practice management throughout the continuum of care. As part of the network's response to the region's needs, a rehabilitation/transitions of care work group was added to the ENCSN's organizational structure in 2010. The network's membership continues to grow. As of August 2012, the ENCSN had 400 members representing all of the 30 target membership counties in Eastern North Carolina. For comparison, in April 2009 the ENCSN had only 165 participants, and only 80% of the target counties were represented. When the membership was last surveyed, the top 4 types of organizations participating in the ENCSN were hospital-based staff (41%), emergency medical services (26%), public health (15%), and rehabilitation (7%).

Integral components of the ENCSN include a wealth of resources and the means to share and replicate these resources—processes for educating health professionals and patients, for managing cases, for rehabilitating patients, for supporting applied health care providers, and for supporting individuals dealing with stroke. In addition to its regular programs, the ENCSN has led the region toward increased use of the Advanced Stroke Life Support (ASLS) curriculum by encouraging prehospital and hospital collaboration in the provision of stroke care; by providing technical assistance to providers seeking information about ASLS; by subsidizing ASLS training costs in critical areas; and by promoting ASLS classes offered by members throughout the region. Members have had the opportunity to apply for and receive scholarships from the ENCSN that enable them to attend other stroke continuing education courses, such as the Stroke Knowledge Program at the University of North Carolina at Chapel Hill. Also, the ENCSN has promoted and helped hospitals apply for funding to support improvement of stroke care through organizations such as the North Carolina Stroke Care Collaborative and the North Carolina Stroke Association. A Web site (www.encsn.org) has been developed to help those trying to manage cardiovascular disease and stroke; it contains data, references, resources, and partner news and events.

The ENCSN has demonstrated success in carrying out the ASA's 3 recommendations to implement a stroke system of care [5]. First, quarterly meetings, work groups, and individual partner connections have fostered effective interaction and collaboration among ENCSN members. Second, hospitals in Eastern North Carolina have worked together through the ENCSN to establish and share stroke care plans that reflect best-practice recommendations, and hospital-based stroke teams have formed that represent the stroke continuum of care at the community level.

Third, progress toward improving the quality of stroke care provided in Eastern North Carolina is measured, evaluated, and shared with the ENCSN members by stakeholder partners, including the AHA (which offers a program called "Get with the Guidelines—Stroke"), the North Carolina Office of Emergency Medical Services, the North Carolina Stroke Care Collaborative (which is a Paul Coverdell Stroke Registry), and the Primary Stroke Center at Vidant Medical Center. Through a combination of structure, initiatives, and key relationships, the ENCSN has developed into a locally determined and relevant vehicle for implementing 6 historical priorities of the NC HDSP Program including increasing awareness of the signs and symptoms of heart attack and stroke; controlling high blood pressure; controlling high cholesterol; improving quality of care; improving emergency response; and eliminating health disparities.

The ENCSN continues to grow and to provide resources to those serving on the front lines of stroke care in Eastern North Carolina. The network hopes to remain a strategic partner in bridging the gaps in the continuum of care to help unbuckle the stroke belt in Eastern North Carolina. **NCMJ**

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The Role of Legislators in the Prevention of Heart Disease and Stroke

Tom Murry, Becky Carney, Alexander White

Legislators play a critical role in reducing death and disability due to heart disease and stroke. North Carolina's Justus-Warren Heart Disease and Stroke Prevention Task Force presents a forum for legislators to receive and exchange information that will help them make well-informed decisions that affect the cardiovascular health of North Carolinians.

North Carolina has a rich tradition of support for medicine and public health. As the nation looks for ways to reverse increases in the cost of health care, to improve the quality of care, and to decrease the incidence of chronic diseases, North Carolina is often seen as a model for what is possible. What has made North Carolina unique in many instances is the political will that supports innovation and the fulfillment of public health needs.

North Carolina is highly regarded for its public health successes and for legislation addressing heart disease and stroke. In 1995, in response to alarming data about heart disease and stroke burden in the state, the North Carolina General Assembly created and funded what is now known as the Justus-Warren Heart Disease and Stroke Prevention Task Force. At the time, no other state had an equivalent task force that brought together survivors of heart attacks and strokes, nationally recognized talent in the fields of public health and medicine, business and community leaders, members of the media, and members of a bicameral legislature from both parties. Moreover, in 2006 the General Assembly added a Stroke Advisory Council, which convened various leaders in stroke care and prevention, the North Carolina Hospital Association, the North Carolina Office of Emergency Medical Services, and other stakeholders and tasked them with developing a stroke system of care for the state.

There have been other recent public health-related legislative actions that address major risk factors for heart disease and stroke. In 2011, the North Carolina House of Representatives passed a resolution to create awareness of the benefits of eliminating excessive dietary sodium intake as one way to address high blood pressure. The resolution also brought attention to the support needed to help people identify their personal risk for high blood pressure, as well as the ways to help people build healthier lifestyles to prevent and better manage high blood pressure and related

supporting measures to decrease heart disease and stroke [1]. In 2009, the General Assembly banned smoking in bars and restaurants [2]. It was reported in 2011 that the law may have contributed to a 21% reduction in the rate of emergency room visits for heart attacks since the law went into effect in January 2010 [3]. In previous years, the General Assembly had also protected state employees from secondhand smoke exposure by banning smoking in government buildings, on government grounds, and in state government vehicles; state law also allows community colleges to protect teachers and students by banning the use of tobacco products on their campuses [4]. And in 2008, the General Assembly funded a successful public campaign to increase the awareness of signs and symptoms of stroke and the need to call 911 immediately when such signs or symptoms are observed [5].

Public health interventions to address chronic diseases face complexity and formidable obstacles. Chronic diseases entail a complex interaction of risk factors, take years to develop, are characterized by a long period of living with the illness, and can have multiple causes [6]. Outside the health care community, many people do not view the prevalence of chronic diseases as a crisis, despite the fact that heart disease, stroke, and cancer account for two-thirds of all deaths in the United States [6]. In North Carolina in 2010, the most recent year for which data are available, cardiovascular diseases (heart disease, hypertension, cerebrovascular disease, congenital malformation, and atherosclerosis combined) were the leading cause of death in the state, accounting for 29.6% of all deaths [7]. The lack of urgency is due in part to perception. With regard to chronic diseases, the public is generally more concerned about involuntary risks (potential exposure to toxic chemical waste, for instance) than they are about voluntary risks (eg, eating fatty foods or failing to exercise) [6]. Public investment (or underinvestment, depending on your view) to prevent and manage chronic diseases is hampered by the fact that the benefits of investing today's prevention dollars are not seen until years in the future [6].

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Moreover, the economic crisis and other pressing state fiscal matters do not make it any easier to make support for public health a priority. But these are the very reasons and justification for an elevated sense of urgency.

Given the crunch of an economic crisis and ballooning health care costs, precision in deciding what policies are selected and supported is crucial. Policies using evidence-based approaches within a legal framework are likely to achieve their goal of establishing new, healthier social norms. Policy and environmental changes can provide support to people seeking to adopt and sustain healthy behaviors or to live in healthier environments (those that are smoke-free, for instance) [6]. Thus such policy and environmental changes have greater reach and impact than does a singular focus on getting individuals to change [6] and may, over time, save money.

A shift in health care emphasis from a disease treatment model of clinical care to a primary prevention model has long been advocated by public health professionals. A renewed paradigm has emerged that fuses the 2 approaches into a population health model that works at both the individual level and the community level [8]. Domains that are the focus of the prevention model include access to care, quality of care, the community environment, and governmental policies [8]. Many evidence-based policy changes can be implemented at low cost. Examples include clean indoor air policies and nutrition standards gradually implemented through procurement policies.

Legislators can also play a role in authorizing or directing the state to study or participate in promising initiatives. This is a way for North Carolina to leverage group efforts and produce outcomes that can achieve public health goals and state government goals. The Million Hearts initiative, for example, is a major national campaign under way that seeks to prevent 1 million heart attacks and strokes over the next 5 years [9]. The goal is audacious because the need is urgent. If present trends continue, inflation-adjusted direct medical costs related to heart disease and strokes are projected to be 3 times as high in 2030 as they were in 2010 [10]. Million Hearts, which is being undertaken by the US Department of Health and Human Services working in partnership with other federal, state, and local government agencies and various private sector entities, will implement effective evidence-based strategies both in the community and in clinical settings [9].

In the clinical setting, Million Hearts seeks to improve clinical management of aspirin use, blood pressure control, cholesterol control, and smoking cessation. From a community perspective, the initiative seeks to reduce the sodium content and artificial fat content of foods and to reduce tobacco use and public exposure to secondhand smoke [9]. Legislators have an alluring opportunity to accelerate the adoption of Million Hearts objectives; doing so will impact population health and perhaps generate cost-savings in the care of North Carolina's Medicaid population, which is

a major driver of the state's health care safety-net expenditure. Legislators can be very helpful in continuing to support community and systems transformation in order to reduce tobacco use, improve population-wide nutrition, and improve access to and coordination of health care; better access and better coordination avoid costly disease progression and substantially eliminate the administration of routine care in hospital emergency departments. Legislators can also support the capture of accurate population-wide data, which can be used to make more precise adjustments to systems and policies.

Legislators can play a major role in assessing the critical need for preventive health care and measures to improve population health, and in helping fellow legislators to understand and work through the issues so that they will support good public health policy decisions. Legislators come from various professions and backgrounds. A regular legislative session has several thousand bills introduced. These bills cover a huge variety of subjects—far too many for any 1 legislator to be an expert, or even adequately proficient, in all of them. Legislators have an assortment of mechanisms at their disposal to help them understand and tackle complex issues. There are legislative committees that focus on particular topic areas, which seat legislators with subject matter expertise. These legislative committees are a good way for legislators to hear differing views on a bill, get expert testimony and special reports, and be better prepared to answer questions asked by their colleagues.

Task forces (also councils and other health-related boards and commissions) are another way for legislators to get crucial information. Legislators are free to sit in on task force meetings and are often among the appointed members of these task forces, as is the case for the Justus-Warren Heart Disease and Stroke Prevention Task Force. One of the most critical roles a legislator can play in the prevention of heart disease and stroke, or any other public health-related issue for that matter, is to attend and participate in the meetings of these task forces. These task forces enable legislators to get a more in-depth and detailed view of the issue, so that they can more effectively participate in the deliberations that lead to productive legislative action.

Convening stakeholders with various perspectives, reconciling complex issues, and achieving consensus are particularly important contributions that legislators can make. Deliberative democracy in its purest form is an approach to public-policy making that can be used when parties are dealing with complex issues or when they have conflicting interests or divergent moral and political viewpoints [11]. It seeks to resolve controversial public-policy questions by emphasizing open, deliberative debate among the affected parties as an alternative to voting [11]. Deliberative democracy is marked by the following characteristics: political legitimacy (parties abide by the decision reached), mutual respect, inclusiveness, public reason (commitment to publicly acceptable arguments), and equality—all parties have equal standing to

defend and criticize arguments [11]. Task force meetings can serve as public forums in which to have such debates. The goal should be to foster open debate, information sharing, constructive criticism, and mutual understanding [11].

Proponents of deliberative democracy argue that this approach is fair and effective in resolving controversial political issues. Critics argue that deliberative democracy is an idealized theory of political decision making and that its standards are difficult to meet in the real world [11]. Whatever side you may agree with, this approach—which was originally devised to level the playing field and to be inclusive of all stakeholders—gives legislators the important role of attending the meetings, contributing ideas, and examining the scientific evidence base, providing them with a major opportunity to enrich the policy-making process.

The issues related to heart disease and stroke prevention are complex and deserve the rigor of careful deliberation by the many stakeholders, including legislators. North Carolina has a history of finding what works for our state and producing successes that others have admired. **NCMJ**

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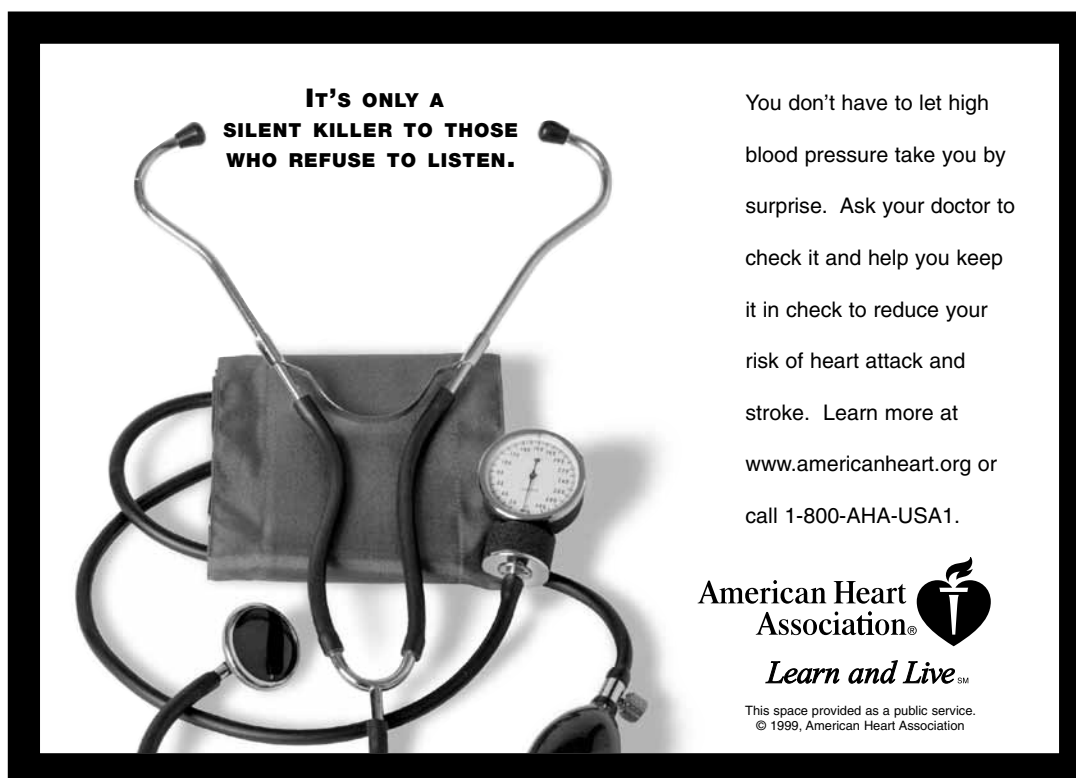
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It Takes a Community: The North Carolina Division of Public Health and the North Carolina Area Health Education Center Program Partner to Reduce Strokes and Heart Attacks

Samuel Cykert, Ruth Petersen, Ann Lefebvre

The North Carolina Division of Public Health is leading a statewide project using a combination of approaches to address cardiovascular risk factors including obesity, hypertension, diabetes, and cigarette smoking. The objectives are to decrease tobacco use, increase physical activity, improve nutrition, and increase access to evidence-based clinical preventive services targeting hypertension, hypercholesterolemia, tobacco use, and weight management.

The burden of cardiovascular disease in North Carolina remains large. In 2011, the cardiovascular death rate was 275 per 100,000 population [1]. Cardiovascular diseases accounted for almost one third of deaths in the state [2]. In 2011, North Carolina was ranked 31st in the nation for cardiovascular deaths (meaning that the rate was lower in 30 other states) [1]. The annual cost of hospitalization attributable to cardiovascular causes in North Carolina is more than \$4.6 billion, a figure that does not include the cost of outpatient care, loss of work, rehabilitation, and home health services [2].

Why is cardiovascular morbidity so great a problem in North Carolina? Disease progression is largely determined by risk factors including diabetes, hypertension, serum cholesterol levels, and tobacco use. All of the risk factors except tobacco use are intertwined with dietary habits, exercise, and obesity. Yang and colleagues [3] recently assessed cardiovascular risk factors in individuals 20 years of age or older who had participated in the National Health and Nutrition Examination Survey (NHANES) and found that the effects of the risk factors were cumulative. Meeting a greater number of American Heart Association cardiovascular health metrics—being a non-smoker, being physically active, eating a healthy diet, having a healthy weight, having normal blood pressure, as well as normal levels of blood glucose and total cholesterol—was associated with a lower risk of mortality [3]. People who met at least 6 of the 7 metrics were half as likely to die of any cause and one fourth as likely to die of cardiovascular disease as were those who met only 1 or none of the metrics [3]. People who do poorly on these measures

are not uncommon in North Carolina: 65% of adults in the state are overweight or obese (30% are obese), 32% have hypertension, nearly 10% have diabetes, 20% smoke, and 54% fail to meet physical activity targets [4]. In addition, 27% of people with diabetes are unaware of their diagnosis because they have no regular source of medical care, and 13% of those who have been diagnosed with diabetes have poor control of their glucose levels (ie, their glycosylated hemoglobin level is greater than 9%) [5, 6]. Only half of patients treated for hypertension currently have their blood pressure under control [7], and only half of patients aged 40 to 64 with elevated serum cholesterol levels have been treated sufficiently to lower their cholesterol to recommended levels [8]. Best practice care can help mitigate the burden of cardiovascular disease and premature death that is prevalent today in North Carolina. Yang's age threshold highlights the urgency of risk-factor modification, not just in the middle-aged individuals that we usually think of as needing help, but in adolescents and young adults as well. Healthier lifestyles and more comprehensive primary care will be the key to improving outcomes.

Several factors contribute to disappointing population results. On the clinical side, most medical practices lack data systems that would allow them to readily identify patients whose chronic illnesses are out of control outside the confines of a particular office visit [9]. As a result, care intensification is often delayed, because the health care system depends on the patient to initiate sporadic appointments. What is needed is a persistent, systematic monitoring and intervention plan triggered by an electronic, real-time, chronic disease registry that identifies high-risk patients whether they are present in the office or not. On the community side, because of limited health literacy or lack

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One Rural Federally Qualified Health Center's Journey With North Carolina's Improving Performance in Practice (IPIP) Program

Kim A. Schwartz

Roanoke Chowan Community Health Center (RCCHC) has been a Federally Qualified Health Center since May 2005, but the group of physicians, family nurse practitioners, and physicians assistants involved has been serving the ambulatory health care needs of Hertford, Bertie, Gates, and Northampton counties in Northeastern North Carolina for nearly 50 years. In the mid 1990s, the group received funding from a national grant to establish an electronic medical record (EMR).

Back in 2006, when Dr. Hilary Canipe, quality improvement (QI) director at RCCHC, made a cold call to Ann Lefebvre, executive program director of the North Carolina Area Health Education Center Program, and inquired about how to start an effective QI program, the only way to mine data was to pay a report writer a huge sum of money and pray that one had asked for the correct information. At the time, it just so happened that Lefebvre was looking for 2 more medical practices to participate in the QI pilot program Improving Performance In Practice (IPIP), funded by the Robert Wood Johnson Foundation. Within a week, Lefebvre made a visit to Ahoskie, North Carolina, to meet the RCCHC team.

Two RCCHC locations—Murfreesboro Primary Care and RCCHC-Ahoskie—became pilot practice sites for IPIP (there were 16 sites in all). The center was assigned a QI coach, Bobbie Bonnet, a registered nurse, who initially spent about 1 day a week at each location. Bonnet quickly determined that RCCHC had a wonderful EMR system,

MedicaLogic Logician (which has since been purchased by GE Healthcare and has become part of their Centricity technology); however, every provider was using Logician in his or her own way, with little or no standardization.

RCCHC's team was familiar with National Diabetes Collaborative standards due to the high incidence of diabetes in Eastern North Carolina and the impact of diabetes on heart disease and stroke. However, almost every provider had his or her own personalized template for the EMRs of patients with diabetes. So Canipe, Bonnet, and Dr. Colin Jones, RCCHC's chief medical officer, decided to use the Plan-Do-Study-Act (PDSA) method to test how quickly and efficiently a nurse manager could locate documentation of a diabetic foot exam in the EMR. Ten random charts were pulled for each medical provider, and a nurse manager not located at the same clinic was charged with recording how much time it took to find foot exam documentation in each record. The mean time for the 10 records was reported to each provider and ranged from only 8 seconds to a full 12 minutes and 40 seconds. Canipe and Bonnet used this information to demonstrate to the RCCHC clinical team the need for standardization in order to make the EMR work for them and for their patients.

A work group was formed and tasked with developing a standardized EMR template for patients with diabetes. A diabetic care workflow was established containing standing orders for the steps to be performed when placing a patient into an examination room. All clinical team

of education in self-management, many individuals have a poor understanding of their chronic illnesses, the consequences of poor control, and the significant impact that lifestyle and medication adherence can exert in attenuating what are often asymptomatic conditions with insidious long-term sequelae [10-12].

Although preclinical, community-based, primary prevention is the ultimate goal, the incremental impact of achievable small improvements in clinically important care measures for people with diabetes and cardiovascular disease cannot be overlooked in the short term. For instance, in a trial in which patients newly diagnosed with diabetes were randomized to receive either conventional or intensive treatment with either sulfonyleurea insulin or metformin, mean glycosylated hemoglobin level in intensive treatment groups was 0.5 to 0.6 percentage points lower than in the conventional treatment groups [13]. And a decade later, risk of death in the intensively treated groups was significantly lower than in the conventionally treated groups (absolute risk of death from any cause in the metformin-treated patients was 25.9% in the intensively treated group, compared with 33.1% in the conventionally treated group), as was the risk of potentially

debilitating complications of diabetes [13]. Treatment for hypertension also reduces risk. A systematic review of the effectiveness of lowering blood pressure in patients with a history of stroke or transient ischemic attack showed that in comparison with those who did not receive antihypertensive therapy, those who were treated were 24% less likely to have a stroke, 21% less likely to have a myocardial infarction, and 21% less likely to have any kind of vascular event [14]. Finally, antiplatelet therapy with daily aspirin for individuals who have experienced a vascular event leads to the prevention of 36 serious vascular events for every 1,000 patients treated for 2 years [15].

The North Carolina Community Transformation Grant (CTG) program, funded through the Centers for Disease Control and Prevention (CDC), is a unique opportunity to combine improved clinical care with community interventions to promote healthier lifestyles. With its CTG award, the North Carolina Division of Public Health will work with state and local partners, including local health directors, AHEC, and Community Care of North Carolina, over a period of 5 years to help communities make it easier to live healthily in North Carolina. The objectives of the North

members were educated and monitored, and each clinic received a quarterly report card on the indicators through the IPIP extranet resource. Bonnet helped to establish a robust peer review process as well.

Strong glycemic control improved from a baseline of achievement by 24% of patients with diabetes in 2007 to achievement by 47% of such patients in 2011. In 2009, Bonnet worked with the team to initiate hypertension guidelines, repeating the process, with even better results: Blood pressure control in patients with diabetes improved markedly, from satisfactory control in only 20% of patients in 2009 to satisfactory control in 58% of patients in 2011. RCCHC became a recognized American Diabetes Association (ADA) site and continues to meet rigorous ADA standards.

In May of 2011, RCCHC converted to a new electronic health record (EHR) system, primarily because it needed to maximize its regional connection with Vidant Health Systems and to comply with Meaningful Use (MU) standards for EHRs. The EpicCare system, through the Oregon Community Health Information Network (OCHIN), which is a Health Resources and Services Administration Health Center Controlled Network, was selected. All of RCCHC's eligible providers have attested that they meet the thresholds and requirements for MU incentive payments, and to date 90% of them are achieving MU targets. In fact, within 6 months after the center went live with OCHIN, more than 80% of eligible providers were achieving MU in the 90th percentile.

RCCHC's EMR journey has had a poignant impact on individual patients. Recently, at a Vidant Roanoke-Chowan Hospital Community Benefit awards presentation, Debbie Klingler, RCCHC's ADA coordinator, shared several suc-

cess stories. She told of a gentleman who, after years of denial, finally became motivated to effectively self-manage his diabetes. Along with visits to his primary care provider, he received an individualized goal setting plan, individual and group diabetes education sessions, and positive reinforcement and coaching from the entire treatment team. As young adult, he had been unable fit into his bathtub because of his morbid obesity, and in his 30s he got too winded to do much of anything. He was taking a large quantity of insulin daily without achieving control of his diabetes. Now, he no longer needs insulin, walks regularly, and has lost 18 pounds. In the past year, he has used smart phone applications to help manage his food intake, weight, and glycemic levels, and his glycosylated hemoglobin level, which was 8.6% a year ago, has dropped to 6.9%.

RCCHC is fortunate in having a long history of EMR use and in having had the technical assistance of an IPIP QI coach to cultivate "meaningful use" of the electronic record for RCCHC's clinical team long before MU standards were put in place. NCMJ

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Carolina project are to decrease tobacco use, increase physical activity levels, improve nutrition, and increase access to evidence-based clinical preventive services targeting hypertension, hypercholesterolemia, tobacco use, and weight management. The North Carolina CTG has 10 multicounty collaboratives, each with 1 local health department that has assumed responsibility for coordinating efforts. AHEC quality improvement coordinators will be working with the multicounty areas to address health care practices that implement quality improvement systems regarding prevention, screening, treatment, and referral for hypertension, hypercholesterolemia, tobacco use, and overweight or obesity. CTG staff in each of the multicounty areas will work in a strategic manner, taking into account health needs and disparities, to create environmental changes such as smoke-free local government buildings, smoke-free housing, and increased access to healthy foods and places for physical activity. Together, this partnership promotes clinical interventions that will lead to immediate cardiovascular health benefits and emphasizes community awareness, practices, and environmental constructs that will achieve the dream of neighborhood-based primary prevention. This article provides a summary of the approaches embraced by this

important initiative dedicated to protecting the hearts of North Carolinians.

Enhanced Practice-Based Support

In 2007, the North Carolina Improving Performance in Practice (IPIP) program was developed to help make quality improvement tools and techniques available to primary care practices across the state. IPIP was developed in collaboration with Community Care of North Carolina, the North Carolina Division of Public Health, the North Carolina Academy of Family Physicians, the North Carolina Pediatric Society, the Carolinas Center for Medical Excellence, Area Health Education Centers (AHEC) program, and other partner organizations. The AHEC Program in 2 distinct areas of the state hired 2 quality improvement consultants to deliver an educational model of specific changes structured to improve the delivery of care for diabetes and asthma patients in practices that volunteered for this service. AHEC was involved in this initiative because of its mission to meet the state's health and health workforce needs by providing educational programs in partnership with academic institutions, health care agencies, and other organizations committed to improving the health of the people of North Carolina.

The NC BP Mini:

A Brief Course for Clinicians and Medical Office Staff Addressing Accurate Blood Pressure Measurement

Jacqueline R. Halladay, Alan L. Hinderliter

The Heart Disease and Stroke Prevention (HDSP) Branch of the North Carolina Division of Public Health has developed a blood pressure measurement mini-course that it provides onsite to health care teams that are involved in cardiovascular quality improvement (QI) programs. The course, which is called “the NC BP mini” because of its brevity, is designed as a hands-on activity for office staff members who measure blood pressure or who counsel patients regarding blood pressure management.

One of the most important priorities of the HDSP Branch is the development and implementation of strategies to increase the proportion of hypertensive patients with adequately controlled blood pressure. The HDSP Branch has therefore aimed to address hypertension by devising and supporting an office-based hypertension QI project similar in structure to North Carolina QI programs that target other chronic diseases.

After reviewing the hypertension QI literature, those of us devising the QI program realized that 1 of the most important measures we would use to assess improvement in blood pressure control is fraught with error. Blood pressure is often measured without using the proper technique, which is described in national guidelines such as those found in the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure [1]. In fact, in clinical settings, blood pressure is measured inaccurately 60% to 100% of the time [2, 3]. Burgess and colleagues [4] have noted that, on average, blood pressures obtained through “usual care” have systolic readings that are 12.4 mm Hg higher than those obtained using the recommended technique, and they have diastolic readings that are 6.0 mm Hg higher than those obtained using the recommended technique. And importantly, in the era of patient goal setting, these authors noted that inaccurate measurements resulted in only 26% of patients reaching their treatment

goals, whereas 54% would have achieved their goals if accurate technique had been used. Thus, after some discussion with HDSP Branch stakeholders, we agreed to direct our efforts toward improving the accuracy of blood pressure measurement in clinical settings in North Carolina.

As a first step in creation of the mini-course, we invited a member of the Virginia HDSP Branch to come to North Carolina and provide us with their 2-day Blood Pressure Measurement Specialist Certification Course (see <https://va.train.org/DesktopShell.aspx>). Twenty healthcare professionals were certified to teach this course by successfully completing a 2-day workshop.

We then worked to create a course that could be readily disseminated in clinical settings and at health care conferences. We devised a “lunch and learn” format and developed it iteratively, piloting it at 8 clinical sites and in 4 conference settings before finalizing the content.

The program includes both didactic and hands-on experiences, such as choosing the right cuff size, performing the maximum inflation level technique, listening to and demonstrating proficiency at identifying Korotkoff sounds, and reviewing appropriate patient preparation and positioning for blood pressure measurement. Instructors perform a “walk through” of each clinical setting to address barriers in office processes or the physical environment that may impede measurement accuracy, and they discuss the need to have equipment checked regularly.

Feedback on the course has been outstandingly positive, and the program has been incorporated into the Community Transformation Grant as a possible benefit to participating practices.

Four of the clinical sites that piloted the NC BP mini are practices that are involved in the Heart Healthy Lenoir project [5], a 5-year National Heart, Lung, and Blood Institute trial that aims to improve the care of hypertensive patients and reduce disparities in hypertension control in Eastern North Carolina. As part of this multilevel project,

Eighteen practices participated in the pilot program, and after 1 year of intervention, improvement was found in almost every clinical indicator for the 2 disease states included in the program [16]. In 2010, under the auspices of a federal grant that created the North Carolina Regional Extension Center for Health Information Technology, AHEC’s consulting services expanded to include on-site guidance regarding the adoption, implementation, and meaningful use of electronic health records (EHRs) in an effort to provide practices with the tools necessary to improve care. Nearly 1,100 practices across North Carolina are currently receiving practice-based consulting services to help them to select and use EHR systems, to implement necessary changes in

their delivery of care, and to improve vital clinical indicators for patients with chronic diseases.

The recent development of the North Carolina CTG program creates an additional opportunity for the North Carolina Division of Public Health to again partner with AHEC to focus on clinical prevention strategies. These strategies include blood glucose control, blood pressure control, tobacco cessation, cholesterol reduction, and aspirin use after ischemic vascular events—all of which have all been shown to reduce the incidence of coronary disease, strokes, and other disabling cardiovascular events. Building on the experience of improving care in other chronic disease states, the AHEC Program will apply these tried and true methods

patients with hypertension are taught to correctly measure their blood pressure with home devices. Providers, office staff, and a health coach are encouraged to review the home blood pressure data with patients and to use this information to help patients with strategies to achieve better blood pressure control.

Our enthusiasm for the use of home monitoring data in developing treatment plans for hypertensive patients is based on evidence suggesting that home blood pressure levels are more predictive of the adverse consequences of high blood pressure than are traditional office measurements [6-9]. In addition, home blood pressure data can aid in the diagnosis of masked hypertension and the white-coat effect, and such data may contribute to better adherence to therapy [10].

To increase awareness of the value of home blood pressure monitoring, the Heart Healthy Lenoir study team has created a continuing medical education (CME) curriculum that addresses the benefits of out-of-office blood pressure measurement. CME sessions are provided in association with regional dinner meetings, along with in-office interventions to reinforce this information.

We hope that by aligning our efforts with other statewide programs, such as the Community Transformation Grant initiative and the Roanoke Chowan Community Health Center's telemonitoring initiative (which promotes the effective use of home blood pressure measurement and monitoring), we can enhance the accuracy and reliability of blood pressure measurement. This can then impart confidence that hypertension control efforts and interventions are having their desired impact of improving the health of North Carolinians. **NCMJ**

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to assist practices with improvements to their care delivery systems that initially will improve control of these risk factors and ultimately will reduce the burden of heart attack and stroke in the state.

The proven method of high-level, systems-based changes used throughout the AHEC practice-support program was developed by the AHEC Program together with the national Improving Performance in Practice Program through the American Board of Medical Specialties. It is based on the Chronic Care Model developed by Edward H. Wagner and others at the MacColl Center for Health Care Innovation [17]. Wagner and his colleagues have shown that care is often compromised by inattention to robust care coordina-

tion, failure to follow evidence-based practice guidelines, and insufficient patient teaching of self-management techniques, because of lack of data, lack of team organization, and lack of electronic tools in traditional medical practices. There is evidence that adherence to these concepts results in better clinical outcomes [18].

The AHEC Program provides participating practices with on-site, skilled consultants to help providers address these key areas. The work begins with using EHR systems to produce clinical data that can be used as the basis for measuring improvements in care. In conjunction with data reporting, the EHR system can be programmed to complement real-time clinical care by triggering alerts and remind-

ers that address issues such as screening, drug allergies, and application of evidence-based interventions. The EHR can also provide educational materials for patients related to diagnoses, prescribed medications, and local resources. As sophisticated as EHR technologies are, they are of limited value unless they are integrated into normal practice patterns and daily workflows by the physician provider and the entire medical practice team. It is the melding of technology, teams, teaching, and patient access that establishes true patient-centered medical homes. So far, this approach has been extremely effective in the realms of diabetes and asthma. The CTG will extend this methodology to measures of cardiovascular care, so that primary care practices can specifically mitigate the risk factors that perpetuate devastating cardiovascular events in our state.

Addressing Environmental Influences on Cardiovascular Risk

North Carolina needs high-quality, accessible clinical systems to effectively address cardiovascular disease. However, even the best and most accessible clinical network cannot eliminate cardiovascular disease in isolation [19]. North Carolinians are at risk for heart disease and stroke due to a multitude of factors in their communities and environments. Choices that individuals make, such as whether they use tobacco, maintain appropriate weight, and are physically active, do influence their risk for heart disease and stroke. However, these individual choices are influenced by complex social and physical surroundings. If a physician advises a patient with heart disease to quit smoking, yet that patient is continuously exposed to tobacco or to encouragement to continue smoking, he or she is not likely to be successful at implementing the physician's advice. Likewise, if patients with hypertension and heart disease are asked to increase their level of physical activity to address weight management, they will fail to make these individual behavior changes if their environment does not provide safe, attractive, accessible places to be physically active. Unfortunately, populations with the greatest health disparities regarding cardiovascular disease are the ones most likely to reside in areas characterized by a high concentration of establishments that sell tobacco, and a low concentration of places that sell healthy foods or have safe venues for physical activity [20-23].

Understanding the effect that one's environment has on one's risk of cardiovascular disease, the CDC is using CTGs to support states in making environmental changes to reduce the incidence of chronic diseases, promote healthier lifestyles, reduce health disparities, and control health care spending.

Environmental approaches to disease prevention have been found to be more cost-effective than clinical interventions or nonclinical, person-directed interventions [19, 24]. A recent example showing that environmental change can reduce cardiovascular risk in North Carolina is that the number of emergency department visits for acute myocardial infarction was found to have dropped 21% after

the implementation on January 1, 2010, of legislation that banned smoking in bars and restaurants in the state [25]. Continued environmental interventions on the part of the North Carolina CTG will be critical if similar successes are to be obtained.

In conclusion, although systematic clinical intervention remains important for those with current cardiovascular compromise or risk, a combined course that also includes environmental tactics that address cardiovascular disability and death represents the only approach that positions North Carolina to effectively reduce health disparities, improve health status, and lower health care costs. **NCMJ**

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The Million Hearts Initiative: Applying the ABCS of Healthy Hearts in North Carolina

Christina Simpson, Mark Massing, Ross J. Simpson

Cardiovascular disease (CVD) is the leading cause of death in the United States. The goal of the national Million Hearts initiative is to prevent 1 million heart attacks and strokes by 2017 by promoting evidence-based preventive care and treatments for CVD. North Carolina has ongoing services and investments that will contribute to the success of this initiative.

Cardiovascular disease (CVD), which is the leading cause of death in the United States, imposes a great economic burden. Treatment of CVD accounts for 17% of all national health expenditures; total costs, including lost productivity, approach \$450 billion annually [1, 2]. The prevalence of CVD is expected to increase over time as the population ages and the incidence of obesity and diabetes increases [1]. The American Heart Association estimates that by the year 2030, 40.5% of the US population will have some form of CVD, and that these individuals will require an estimated \$1 trillion in care annually [2, 3]. North Carolina has a high burden of CVD, ranking 19th in CVD mortality nationally and sixth in deaths from stroke [3]. CVD also affects North Carolinians at younger ages when compared to other states and the national average. According to a 2010 report from the Justus-Warren Heart Disease and Stroke Prevention Task Force [3], North Carolina's rates of death from stroke and from coronary heart disease for individuals under the age of 65 are greater than the national rates (Figure 1).

CVD is primarily the result of atherosclerosis and as such is largely preventable. As much as 90% of the population-wide risk for CVD may be reduced through attention to identified risk factors such as smoking, physical inactivity, and consumption of sodium, saturated fats, and trans fats. Consistent use of evidence-based interventions leading to smoking cessation, better blood pressure control, and better cholesterol management could prevent more than half of all heart attacks and strokes [2]. Similarly, daily use of a low dose of aspirin is an effective, low-risk secondary preventive measure, which alone can reduce all-cause mortality by 18% [4].

The US Department of Health and Human Services (DHHS) launched the Million Hearts campaign in September 2011, with the Centers for Medicare and Medicaid Services and the Centers for Disease Control and Prevention (CDC)

sharing leadership of the program. The objective is ambitious: preventing 1 million heart attacks and strokes over the next 5 years, nationwide. To accomplish this, the campaign has developed a 2-pronged approach focusing on (1) optimization of clinical interventions for individuals already receiving treatment and (2) community outreach and education aimed at reducing the number of those needing treatment. Million Hearts places prevention at the heart of DHHS's scope of work in addressing CVD, relying for the most part on existing investments and inexpensive, effective interventions, and aligning public contracts to reflect the investment in quantified deliverables.

North Carolina has experience corraling resources with which to address CVD. The Justus-Warren Heart Disease and Stroke Prevention Task Force and its subsidiary, the Stroke Advisory Council, were established by the North Carolina General Assembly in 1995 [5]. The task force and the council, which have members and partners from across the state and across disciplines, provide the infrastructure and initiative to meet the Million Hearts goal of a 10% reduction in the number of heart attacks and strokes. North Carolina's recognition of the high prevalence and economic burden of CVD in the state and its commitment to addressing this public health issue were demonstrated most recently by the passage in 2009 of legislation banning smoking in restaurants and bars [6]. Such programs and initiatives have likely contributed to the reduction in both CVD mortality and hospitalization rates in North Carolina [3].

Improving Delivery of Clinical Care

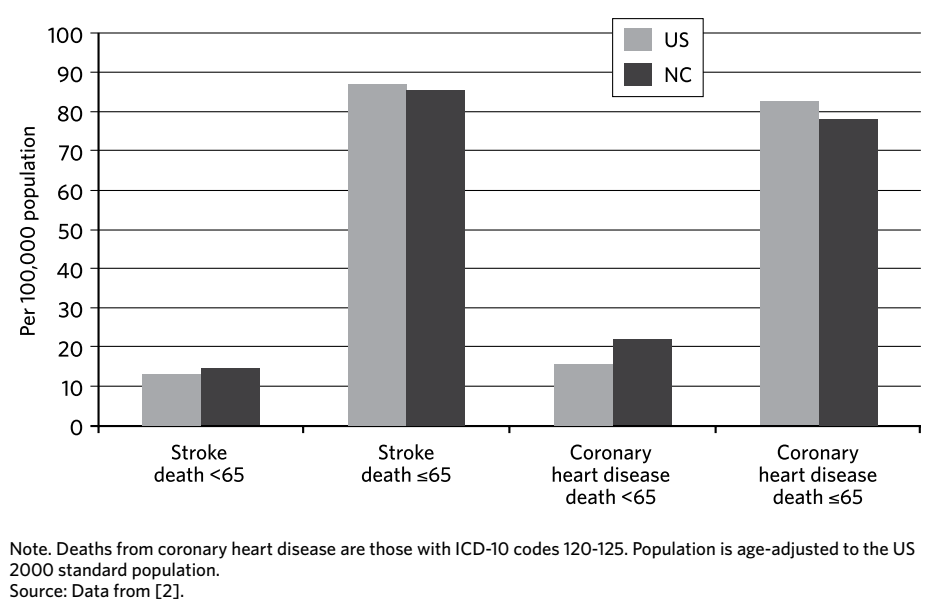
The clinical front of the Million Hearts campaign centers on what the campaign refers to as "the ABCS" of systematic treatment of coronary disease: appropriate administration of aspirin to people at risk; blood pressure control; cholesterol management; and smoking cessation. Access and adherence to these preventive interventions would, by some estimates, reduce the incidence of myocardial infarctions and strokes by

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FIGURE 1.
Rates of Death From Stroke and Coronary Heart Disease in North Carolina and the United States, by Age, 2002 - 2006



63% and 31%, respectively, by 2040 [2, 7]. Although these measures seem simple, they are not always implemented in clinical preventive practice. Currently, fewer than half (47%) of all patients who are at increased risk for CVD are prescribed aspirin; 46% of patients diagnosed with hypertension have adequately controlled blood pressure; and only 33% of patients with high serum cholesterol levels have adequately controlled low-density lipoprotein (LDL) cholesterol (Table 1). Million Hearts aims to raise these rates to 65% [7].

The ABCS measures are evidence-based best practices for the treatment and management of CVD. They also provide an opportunity to demonstrate the capacity for electronic health records to improve quality of care. The incorporation of clinical cues and the documentation of integral patient information through use of electronic health records make it possible to document improvement and to provide benchmarks within and across systems. The records also serve as a tool that physicians can use to improve care.

The Carolinas Center for Medical Excellence (CCME), the federal quality-improvement organization serving the Carolinas, has taken a leading role in measuring, tracking, and improving adherence to the ABCS in North Carolina. CCME is working with the Centers for Medicare and Medicaid Services in the statewide implementation of national projects to promote the adoption and meaningful use of electronic health records, including individual physician reporting of the ABCS to Medicare's Physician Quality Reporting System. The Physician Quality Reporting System further supports physicians in their efforts to evaluate progress in cardiovascular event prevention for their patients. CCME provides technology assistance in data collection, analysis, and benchmarking. On the premise that "you can't

improve what you don't measure," CCME has recruited 67 offices and health centers across the state to participate in its Learning and Action Network focusing on cardiovascular population health.

Although it is too early to report data, the success of CCME in recruiting practices to participate in this national project and the enthusiasm with which practices are participating bode well for the project's success. Initial project implementation shows that there is much room for improvement in the documentation and use of ABCS measures in outpatient clinical practice. Although there are many barriers to treatment in real world settings, integrating these measures into the electronic health record is an important component of population prevention strategies.

Community-Based Approach to Prevention and Management of CVD

Improving the care of those at risk of CVD is important. But it is just as important to reduce the number of individuals who have CVD risk factors in the future. Between 1980 and 2000, the US death rate from coronary heart disease fell by roughly 50%, and nearly half (44%) of this reduction was attributable to reductions in risk factors resulting from community-based prevention strategies and personal management of identified risk factors [8]. Community-based prevention is aimed at promoting healthy lifestyles and behaviors. The US DHHS and key nongovernmental organizations including the American Heart Association, the Association of Black Cardiologists, and the YMCA, are focusing their efforts on 2 broad goals: increased smoking cessation and improved nutrition, with particular reference to target populations that have a higher incidence of chronic

The Cabarrus Health Alliance's Healthy Lives, Healthy Futures Program

Jennifer L. West

Created in 1997 as a successor to the Cabarrus County Health Department, the Cabarrus Health Alliance (CHA) is a model public health department that provides preventive health care services and programming for individuals in Cabarrus County and surrounding areas. CHA clinical services include the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), women's health care, family planning, immunizations, pediatric care, and dental care. In addition to offering clinical services, CHA also focuses much of its effort in the community on prevention programs that address areas such as teenage pregnancy, heart disease and stroke, obesity, tobacco use, diabetes, and dental health. CHA believes that population health needs are best addressed by local partnerships; thus its stated mission is to achieve "the highest level of individual and community health through collaborative action" [1].

CHA received a 7-year grant from the Kate B. Reynolds Charitable Trust in 2008 to implement the Healthy Lives, Healthy Futures (HLHF) program in partnership with the Cabarrus County Department of Aging, the Faith Community Health Ministry in the greater Charlotte area (which is affiliated with Carolinas HealthCare System), and CHA's regional Heart Disease and Stroke Prevention Program. HLHF is a faith-based program that trains volunteers from various congregations to lead safe and effective exercise classes at their respective churches at no charge. The goal is to reduce the risk of chronic diseases such as diabetes, heart disease, and stroke among underserved residents of Cabarrus, Mecklenburg, and Rowan counties who are living at or below 200% of the federal poverty guidelines. Recently, in recognition of its successful, community-based work, HLHF was 1 of only 47 organizations in the na-

tion to receive a 2012 Community Leadership Award from the President's Council on Fitness, Sports, and Nutrition.

North Carolina's second and fourth leading causes of death are heart disease and stroke, respectively [2], both of which are largely preventable. Self-reported data from the Behavioral Risk Factor Surveillance System indicate that in 2010, 27.3% of North Carolina residents were not getting the recommended amount of physical activity [3], 79.3% were not eating the recommended number of fruits and vegetables per day [4], and 66.5% were overweight or obese [5], all of which are modifiable risk factors for heart disease and stroke. In addition, in North Carolina the incidence of and/or mortality rate from many chronic diseases, including high blood pressure, diabetes, heart disease, stroke, and some types of cancer, is higher among African Americans than among whites [6]. These data support the need for programs like HLHF, because most North Carolinians are not practicing healthy habits to reduce their risk of chronic diseases such as heart disease and stroke.

The HLHF program's uniquely effective approach has 3 key elements. Its community- and faith-based train-the-trainer program for lay community health advocates, which teaches them to lead weekly exercise classes at their churches, has already been mentioned. In addition, HLHF staff members lead behavioral modification and general nutrition education classes at HLHF churches, and HLHF establishes peer-to-peer support systems to encourage and facilitate long-term behavior change.

Currently, the HLHF program has 19 church sites in Cabarrus, Mecklenburg, and Rowan Counties. These provide 25 weekly exercise classes, such as yoga, kickboxing, strength training, and aerobics classes. In addition, as part

TABLE 1.
National Goals for Improving Adherence to Best Practices for the Treatment of Cardiovascular Disease

| Clinical indicator | Percentage of patients in adherence in 2011 | Goal for percentage of patients that will be in adherence in 2017 |
|--|---|---|
| Appropriate use of daily aspirin by patients at high risk of a cardiac event | 47% | 65% |
| Adequate control of blood pressure | 46% | 65% |
| Effective management of high LDL serum cholesterol level | 33% | 65% |
| Refraining from smoking | 81% | 83% |

Source: Information from [7].

diseases. The national smoking rate is 19%, and only 23% of individuals seeking to quit receive support and services, so there is a need for community interventions to address tobacco dependence [9].

The CDC campaign is implemented, in part, through the awarding of Community Transformation Grants made available by the Affordable Care Act. These grants have 3 objectives: to improve health, to reduce disparities across populations, and to control spending through a sound investment in continued health. To date, more than \$103 million in federal monies has been awarded to 61 recipient organizations nationwide [10]. North Carolina, through its Division of Public Health, is one of 10 states to receive an implementation grant to address chronic disease statewide. The first phase of this 3-year award (amounting to nearly \$7.5 million) focuses on the defense of the 2009 law banning smoking in restaurants and bars and on the implementation of local ordinances promoting tobacco-free public places and worksites [11].

of the grant evaluation process, every 6 months individuals enrolled in exercise classes receive a comprehensive physical assessment completed by a trained exercise professional. Physical assessments include blood pressure measurement, calculation of body mass index, body fat measurement, and circumference measurements, as well as tests of muscular strength, endurance, and flexibility. Participants also complete a self-report health behavior survey to measure fruit and vegetable consumption and total weekly minutes of physical activity.

In addition to the free exercise classes led by volunteers and the nutrition classes facilitated by HLHF staff, HLHF offers program participants the opportunity to engage in motivational programs, such as "The Biggest Loser" contest. In January 2012, 8 churches enrolled 140 church members to participate in a church-to-church challenge. Participants collectively lost a total of 650 pounds. The top 3 churches were awarded funds to be used for their Health and Wellness Ministry activities, and the top 5 individual winners earned gift cards. Participant testimonials illustrate the true success of the Biggest Loser Challenge and the HLHF program. One member said, "Our church lost well over 293 pounds, and so many people were able to lower their medication intake and just feel better. I have people who are ready to do it again. This is an amazing program!"

To date, almost half (41%) of program participants have reported eating more fruits and vegetables, and 66% have increased the amount of exercise they perform each week. In addition, more than half of participants have reduced their waist circumference and/or have lost weight. By reaching participants in a setting they trust and providing them with support and tangible resources, the HLHF program has institutionalized healthy behaviors and practices throughout the community that would otherwise have been difficult to achieve. This is a truly collaborative effort that has demonstrated tremendous success over the past 5 years. **NCMJ**

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Other important grant recipients whose national networks will target and enrich the North Carolina ABCS campaign include the American Public Health Association and the Community Anti-Drug Coalitions of America, both of which are charged with developing and distributing training materials and strategies for promoting tobacco-free living, and the American Lung Association and the YMCA, which will accelerate the dissemination of outreach materials and messages to underserved, rural, and other target populations.

Conclusion

The Million Hearts initiative constitutes a concerted and comprehensive approach to addressing a national health epidemic. It is unique in both its comprehensive approach and its intentional alignment of payment for preventive interventions. Its aggressive and targeted use of proven clinical and

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community-based interventions demonstrates the shared role of clinical medicine and public health in addressing this challenge. Moreover, it provides the funding and mandate necessary to finance that integration of clinical medicine and public health, promoting the improvement of both individualized clinical care and population-based management of chronic disease. After decades of research, we have learned much about the causes and prevention of cardiovascular disease. Million Hearts will apply these lessons to save lives. **NCMJ**

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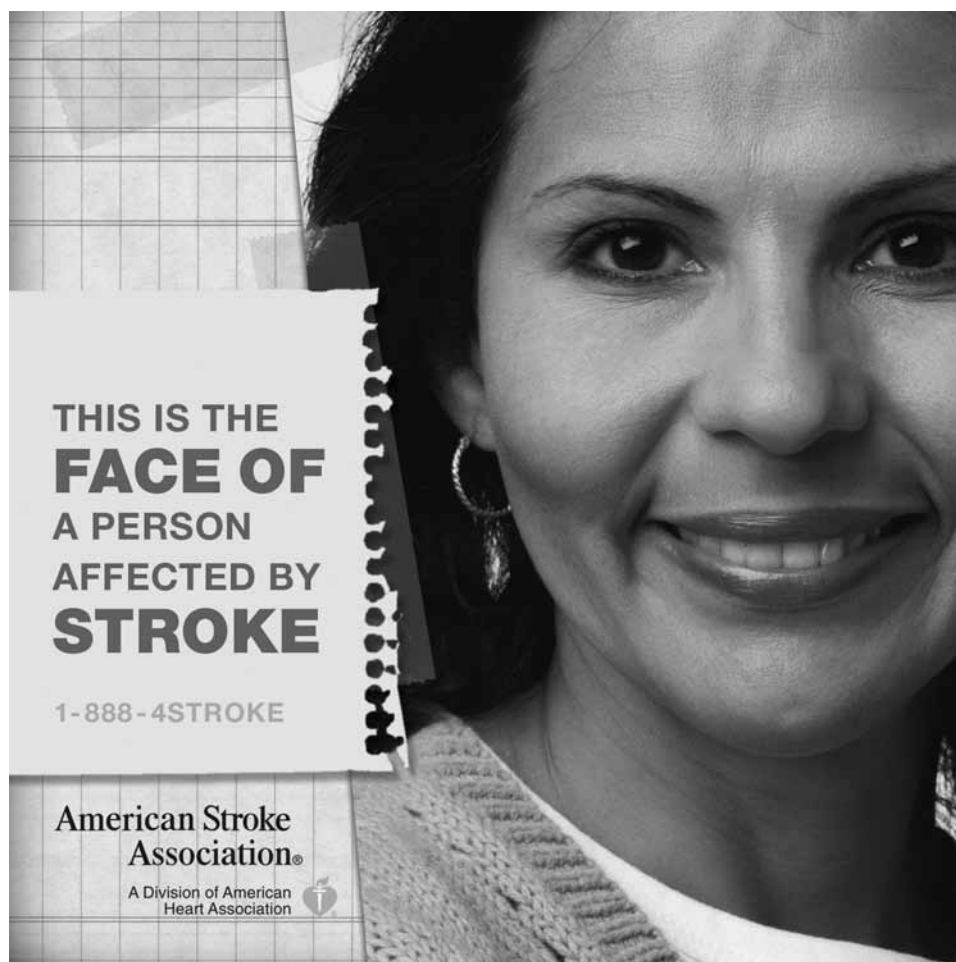
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Telestroke to Improve Acute Stroke Care in North Carolina

Charles H. Tegeler, Sureerat Suwatcharangkoon, Edward Bradbury

Effective, albeit time-limited, treatment is available for acute ischemic stroke but is underutilized in North Carolina. There is a mismatch between stroke resources and expertise and the services available at many hospitals where patients seek initial care. Video telecommunications can improve access to stroke expertise and to potentially life-saving therapies.

Stroke remains a worldwide health burden, causing high morbidity, mortality, and medical costs. The American Heart Association reports that in the United States there is a death due to stroke every 4 minutes, and stroke accounts for approximately 1 out of every 18 deaths [1]. In 2010, the estimated direct and indirect costs of stroke in the United States was \$73.7 billion [2]. The use of stroke units and thrombolysis has been strongly recommended for treatment of acute ischemic stroke in order to improve patient outcomes [3]. Intravenous recombinant tissue plasminogen activator (tPA) was first approved by the US Food and Drug Administration in 1996, with recent widespread acceptance in clinical practice of a slightly expanded window of 4.5 hours for possible use. Yet the overall rate of thrombolytic usage has remained very low in the United States. This is especially true for small hospitals, as well as for those in rural or underserved areas, and those located in the South or the Midwest [4].

North Carolina has been identified as 1 of 11 states included in the stroke belt, and the eastern part of the state is actually in the region known as the buckle of the stroke belt, where overall average stroke mortality is more than 40% higher than in the rest of the nation [1]. In 2010, stroke was the fourth leading cause of death in the state. That year, the overall stroke death rate was 44.9 per 100,000, and there were 3,588 stroke deaths from among the 56,039 deaths from all causes among those aged 65 and over [5].

Asimos and colleagues reported that in 2008, 56% of patients in North Carolina who died of stroke (3,482 of 6,204) lived within a 40-minute drive of a Primary Stroke Center certified by the Joint Commission [6]. According to a study of the availability of stroke prevention and treatment services in North Carolina from 1998-2008 [7], in 2008 41% of North Carolina residents lived in a county with at least 1 primary stroke center, and an additional 40% lived in a county that used telemedicine or had a transfer plan in place for patients with acute stroke. Nearly 20% of North

Carolinians resided in a county without a primary stroke center and without any facility that used telephone or telemedicine support or had a transfer plan or policy [7]. Data from the North Carolina Stroke Care Collaborative and the North Carolina Division of Public Health (Figure 1) show that the 29 hospitals that have achieved designation as primary stroke centers from the Joint Commission are primarily located in the center portion of the state and along major highways [8]. As a result, many counties, and thus people, are quite a distance from a primary stroke center.

This is important, because effective therapies for acute ischemic stroke, such as thrombolysis with tPA, are time-limited. Physicians in rural hospitals are often reluctant to even consider the use of such treatments due to lack of experience managing acute stroke, the risks associated with thrombolysis, and lack of neurological backup. Thus there is a mismatch, or gap, between populations with significant clinical stroke needs, especially in rural regions of the state, and the expertise and resources needed to provide high-quality care for acute stroke.

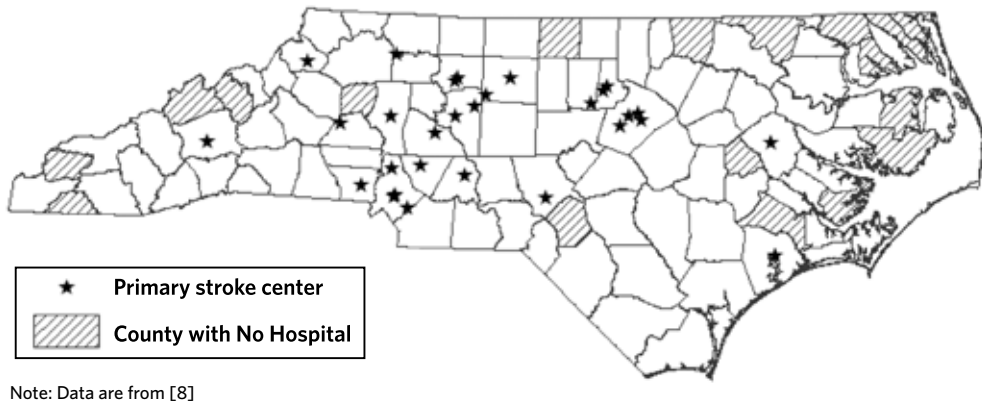
Technology has long been used in medicine to try to overcome geographic barriers and mismatches between patient need and the necessary expertise and resources. For stroke, it has been common to use telephone communications to connect rural facilities with stroke centers in order to facilitate acute care. Advances in technology have created opportunities for more robust interactions. Telemedicine for stroke, for which the term *telestroke* has been coined, was first proposed in the 1990s, by Levine and Gorman [9], as a method for overcoming barriers to effective stroke care. Telestroke can be beneficial during both acute and subacute stroke care. It is useful for providing expert opinions not only when decisions are being made regarding the initiation of intravenous thrombolysis with tPA, but also when patients are being selected for other treatments or for further investigations. It can also be used to recruit patients for studies [10]. In 2009, the American Heart Association / American

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FIGURE 1.
Map Showing the Location of Each of the 29 Joint Commission Primary Stroke Centers in North Carolina



Stroke Association recommended implementation of telestroke consultation, using high-quality video teleconferencing, in conjunction with stroke education and training for health care providers, as being helpful for increasing the use of intravenous tPA at community hospitals without access to adequate on-site stroke expertise. The recommendation regarding the use of telestroke consultation to assist with decisions about the use of intravenous tPA was categorized as class I, level of evidence B, meaning the recommendation is based on evidence from a single randomized trial or evidence from nonrandomized studies [11].

The use of telestroke has grown significantly over the past decade. In a recent survey in which 97 potential programs across 43 states in the United States were contacted, 56 programs confirmed telestroke activity, and 38 of them participated in the survey [12]. Telestroke has been shown to increase the thrombolysis rate, with mortality rates and functional outcomes comparable to those of stroke referral centers providing the telemedicine consultations [13, 14]. Additionally, using a lifetime horizon, telestroke appears to be cost-effective compared with usual care [15].

There are now many options and models for telestroke, with solutions available to meet varying hospital needs and clinical situations. There are multiple choices for technology, provider, relationship between hospitals, credentialing, costs, and billing. The most common approach has been for a primary stroke center to establish a hub-and-spoke relationship with smaller, usually rural, hospitals, or those in which on-site neurological coverage is difficult to obtain or is lacking. Technology is deployed at the "spoke" hospitals, allowing the remote presence—for purposes of consultation—of those with greater stroke or neurological expertise. Equipment used for telestroke consultation includes a variety of devices ranging from cart-based (eg, computer/camera on wheels) to self-propelled robotic systems. The common thread has been the capability for high-quality video teleconferencing. Hospitals may also contract directly with third-party vendors for telestroke services without being tied to a hub hospital.

Consultations may be provided by stroke physicians at the hub hospital, or they may be outsourced to commercially available services that provide access to neurological consultation for such patients. The spoke hospital may be a subsidiary or satellite facility of the hub hospital, or it may be part of a different health system. Consultants must be licensed in the state in which the service is provided and must also be credentialed at the spoke hospital. This can be a rather costly and time-consuming process, but recent changes in Medicare rules now allow spoke hospitals to use the credentialing process at the hub hospital as the basis for conferring telemedicine-consulting privileges at the spoke hospital.

There are also many variations in the type of financial relationship the hub hospital has with the spoke hospital. In general, if the hub and spoke are in the same region, so that it is possible for the hub hospital to receive hospital transfers of patients requiring higher levels of care from the spoke hospital, then the costs for technology and consultation services are borne by the hub hospital and are provided without charge to the spoke hospital. In that scenario, the technology is considered to enhance the ability of the hub hospital to manage patients in a preexisting consultation relationship. Legal stipulations require that patients needing transfer to higher levels of care retain the right to go to any hospital they choose after consultation. Spoke hospitals that are so distant from the hub as to practically preclude transfers usually pay the hub hospital a monthly or annual fee for the equipment and professional services. Such spoke hospitals typically transfer patients to a different stroke center that is geographically closer to them. Under Medicare rules, billing for telemedicine services, including telestroke, is possible only when the spoke hospital is in a county designated as rural. There is a national effort under way to try to modify Medicare rules to allow reimbursement for telemedicine services irrespective of a hospital's rural or metropolitan status. Even if that effort is successful, billing by hub hospitals for consultations may cause conflict when a local neurologist assumes care of a stroke patient remaining at the

spoke hospital and tries to bill for consultation. Thus, most telestroke hubs are not currently billing patients for acute stroke consultations.

The focus of telestroke has been consultations in the emergency department for acute stroke, but there is growing interest in using the technology in outpatient settings for hospital follow-up, rehabilitation, and preventive services.

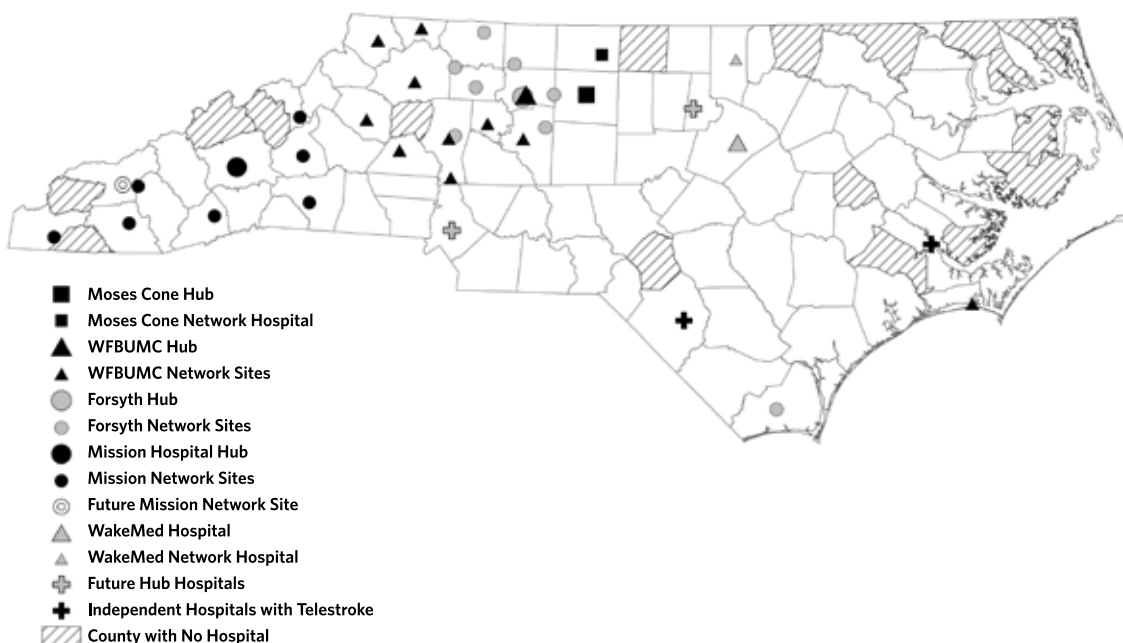
Telestroke provides an opportunity to improve stroke care across North Carolina, especially access to acute therapy with thrombolysis for rural hospitals lacking the resources to be able to offer such services without telestroke consultation. Since 2009, the use of telestroke has grown rapidly in North Carolina. There are now 27 sites that have been identified as spoke hospitals, with 2 additional sites independently contracting for telestroke services (Figure 2). One of the duties of the telestroke subcommittee of the North Carolina Stroke Advisory Council is to help facilitate dissemination of telestroke across the state, with a vision that every hospital will someday have access to telestroke services as a means of improving stroke care in the state.

The Wake Forest Baptist Hospital Telestroke Network (WFBHTN), which was established in November 2009, illustrates the impact a telestroke program can have. The *a priori* objectives of the WFBHTN were to improve stroke care across North Carolina, improve access to local stroke expertise, increase access to acute stroke treatments such as tPA, avoid unnecessary transfers, and encourage local care while facilitating appropriate transfer of those who require

higher levels of care. In addition to offering remote consultation in the emergency department, the WFBHTN strives to improve the quality of stroke care offered at network hospitals by sharing protocols and order sets (evidence-based lists of standardized orders for patients with stroke) and by providing assistance with raising community awareness, education of hospital staff and providers of emergency medical services, and regular review of outcomes for quality improvement purposes. WFBHTN also provides encouragement and consultative assistance when a network hospital decides to move toward applying for designation as a primary stroke center.

There are now 10 spoke hospitals across North Carolina in the WFBHTN, extending from Jefferson in the mountains to Morehead City on the coast. Physicians from the WFBHTN also provide acute stroke consultative services for a hospital that is part of another telestroke network. The WFBHTN provides 24/7 access to stroke consultation with a vascular neurologist. As of October, 2012, there had been 505 network activations, with 311 remote-presence consultations. When remote-presence consultation was provided, 34% of the patients received treatment with acute thrombolysis (C.T. unpublished data, 2012). Because the use of intravenous tPA is known to improve outcomes after acute ischemic stroke, and tPA was not even available in some of these network hospitals prior to the implementation of telestroke, we believe this service is directly improving stroke care in North Carolina.

FIGURE 2.
Map Showing the Locations of Facilities in North Carolina That Are Using High-Quality Video Teleconferencing for Stroke Care or Have Announced Plans to Do So



Note. Figure is based on North Carolina Heart Disease and Stroke Prevention Branch data current as of November 8, 2012.

When no local neurological follow-up care is available, those who have received thrombolysis are transferred to a facility offering a higher level of care. Of the patients who have been seen using a WFBHTM remote-presence consultation, 59% have been able to remain at the network hospital. When this can be done safely, it not only is preferable for the patient and his or her family but also may be financially beneficial for the network hospital. Both patients and families have uniformly embraced the telestroke process; they appreciate direct, visual access to stroke expertise. Another important benefit is that in 2011, 5 patients at a WFBHTN network hospital, who would have otherwise received tPA, were identified by the vascular neurology consultant as having a condition mimicking stroke, and were thus able to avoid the cost and potential risk of tPA treatment. Telestroke can have a positive effect on patient safety.

Telestroke has changed the landscape for acute stroke care in North Carolina, providing a viable solution to a glaring problem. Residents in areas served by telestroke now have access both to stroke expertise and to acute therapies not previously offered in many of those locations, helping to decrease the burden of stroke in North Carolina. Many areas of the state remain without such services, but growing awareness of the capabilities, further advances in technology, and changes in reimbursement policies are expected to support continued growth in the use of telestroke. Research efforts are under way to confirm the beneficial impact of telestroke based on objective clinical and financial outcomes. NCMJ

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A Shared Vision to Prevent Heart Disease and Stroke Through United Action

Peg O'Connell, Betsy Vetter

Cardiovascular diseases are the second and fourth leading causes of death in North Carolina, and when combined become the leading killers of North Carolinians. A key strategy for reducing this disease burden and saving lives is to focus on prevention through a combined approach of policy change and program implementation.

As advocates for better health in North Carolina, the 2 of us work every day with policymakers to adopt and implement proven evidenced-based strategies for the prevention and reduction of tobacco use and obesity, with the end goal of decreasing the incidence and lessening the burden of chronic disease in the state. The biggest and most devastating of these chronic diseases, both economically and socially, are heart disease and stroke. North Carolina is in the stroke belt, and the eastern counties of the state are said to form the buckle of the stroke belt. In 2010, cardiovascular diseases were the second and fourth leading causes of death in North Carolina; taken together, they were the leading killer of North Carolinians, accounting for 27.2% of all deaths in the state [1]. According to the North Carolina State Center for Health Statistics, in 2011 cardiovascular disease cost Medicaid \$621,991,406 (North Carolina State Center for Health Statistics, unpublished data, 2012). That same year, the United Health Foundation ranked North Carolina 31st in cardiovascular deaths [2].

The current numbers are staggering, but they used to be worse. Consider where we were as a state in the mid 1990s when the strategic decision was made to form the Justus-Warren Heart Disease and Stroke Prevention Task Force. At that time, heart disease and stroke were the first and third leading causes of death in the state; in 1995, together they accounted for 37.9% of all deaths in the state [3]. And in 1996, North Carolina was ranked 36th in cardiovascular disease deaths by the United Health Foundation [4]. Over the course of the past 16 years, we have been moving in the right direction, toward fewer deaths from cardiovascular disease.

A key strategy for reducing this disease burden and saving lives has been to focus on the prevention of cardiovascular disease through a combined approach of policy change and program implementation. A shared vision of cardiovascular disease prevention has forged a strong relationship between the North Carolina Division of Public Health and

health organizations. Partners have concentrated on the top 3 behaviors that drive the preventable risk factors: smoking, physical inactivity, and poor nutrition. If we can move our citizens to adopt healthier lifestyles and create healthier environments, we can change the statistics and prevent cardiovascular diseases.

We began where the evidence was strongest and where we knew we could get the greatest benefit: by reducing the number of North Carolinians who smoke and the number who are exposed to secondhand smoke. Partners came together to undertake what was once inconceivable in the land of the golden leaf: tobacco-control policy change. In 2002, the North Carolina Alliance for Health was formed to work on state-level tobacco-control policy change. The first hurdle was to increase the state's cigarette excise tax. For every 10% increase in the price of a pack of cigarettes, 7% fewer children start to smoke [5]. Cigarette tax increases also have a beneficial effect on the number of adult smokers who try to quit. In 2005 North Carolina raised the state's cigarette tax by 25 cents per pack with an additional 5-cent increase the following year. In 2009, legislators raised the tax again by 10 cents per pack, which established the state's current cigarette tax of 45 cents per pack. However as a public health intervention, cigarette excise taxes must be significantly increased for a health benefit to be realized. Nationally, the average tax is \$1.49 per pack, and North Carolina ranks 45 out of 51 states including Washington, DC [5, 6]. North Carolina, while having made some marginal progress, still has a long way to go in using this evidence-based intervention to keep kids from starting to smoke and to help current smokers quit.

At the same time this work was being done, advocates began trying to protect workers from secondhand smoke. In 2004, Representative Alma Adams from Greensboro led an effort to make the floor of the North Carolina House of Representatives smoke-free. This marked a historic milestone in North Carolina. The following year, while advocates were focused on increasing the state's cigarette tax, move-

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Community Leaders and Health Agencies Partner to Stop the Devastation of Diabetes and Hypertension Among African American Men in Hyde County

Joyce Page, Wesley P. Smith, Archie Green

As David Satcher, Surgeon General of the United States from 1998 to 2002, has noted, "Among the most overlooked populations who experience the poorest health outcomes and face the biggest barriers to care are men of color" [1]. African American men have the lowest life expectancy and the highest death rate of any racial or ethnic group in the United States [2]. Research indicates that activities to raise health consciousness are seldom participated in by men in this group [3]. The Centers for Disease Control and Prevention (CDC) recommends taking a peer-to-peer approach in health interventions to encourage African American men to participate [4].

In 2010, the North Carolina Public Health Foundation received funding from REACH US: SEA-CEED, the South Eastern African American Center of Excellence in the Elimination of Disparities in Diabetes, at Medical University of South Carolina, to pilot a project targeting African American men. The program is based on Project DIRECT (Diabetes Interventions Reaching and Educating Communities Together), a CDC-funded diabetes community demonstration project conducted in Raleigh from 1995 to 2003. Project DIRECT demonstrated that the diabetes rate could be slowed with strong community involvement.

The new project, called Project DIRECT Legacy for Men—Hyde County, is led by 5 African American men who also serve as peer leaders. It addresses diabetes and cardiovascular disease in Hyde County in Eastern North Carolina. Staff from the North Carolina Division of Public Health partnered with the North Carolina Public Health Foundation to implement the initiative.

Hyde County, one of the state's most economically challenged counties, faces a growing problem with diabetes and cardiovascular disease. The Behavioral Risk Factor Surveillance System survey for 2010 found that the prevalence of cardiovascular disease was greater in Eastern North Carolina (10.7%) than it was statewide (9%), and among African Americans in Eastern North Carolina the prevalence was even greater (12.7%, versus 10.7% for

whites) [5]. The 2010 survey also found that the prevalence of diabetes was greater in Eastern North Carolina (11.3%) than it was statewide (9.8%), and again, among African Americans in Eastern North Carolina the prevalence was even greater (16.7%, versus 10.2% for whites) [6]. Despite this devastating evidence of disparity, Hyde County lacks the necessary medical resources to address the health challenges of its residents. In 2012, the county had only 1 physician and no dentists.

Project DIRECT Legacy for Men is unusual in several respects. First, it focuses on African American men, although women are also involved. Second, when it was implemented, local African Americans were trained as lay leaders to conduct Stanford School of Medicine's Chronic Disease Self-Management Program [7] and Diabetes Self-Management Program. Third, workshops and presentations are conducted with at least 1 male as cofacilitator. Finally, the project represents a partnership of diverse organizations, including, for example, Hyde County's Toy Truckers Club, an organization of truck-loving men who support youth interested in higher education, as well as faith-based organizations and local, regional, and state agencies.

With financial support from 2 small grants, technical assistance from the North Carolina Division of Public Health and the Hyde County Health Department, and the work of community volunteers, the project has achieved a great deal. It has established an advisory committee, which is led by 5 African American males, with participation from the following entities: the Area Agency on Aging for Region R (which consists of 10 counties in Northeastern North Carolina), the Hyde County Health Department, the North Carolina Cooperative Extension Service, the Northeastern North Carolina Partnership for Public Health, the North Carolina Diabetes Prevention and Control Program, the North Carolina Heart Disease and Stroke Prevention Program, Care Share Health Alliance, and the Division of Services for the Blind in the North Carolina Department of Health and Human Services. Healthy living

ment toward making public places smoke-free began to take place. Representative Hugh Holliman introduced House Bill 76, legislation which would have made restaurants smoke-free. The bill did not pass, but the good news was that a legislative champion had emerged: Holliman was a lung cancer survivor who was passionate about the smoke-free issue.

Between the 2005 and 2006 legislative sessions, a statewide strategy to move North Carolina toward smoke-free work sites and public places was born. The 2006 legislative session accomplished additional incremental steps toward the long-range goal of making all work sites and public

places smoke-free. Advocates focused on making the North Carolina General Assembly smoke-free as their first step. In June of that same year, the US Surgeon General's Report provided incontrovertible evidence that there is no safe level of exposure to secondhand smoke [7]. From there, advocates were ready to pursue legislation that would further restrict smoking in public places. Representative Holliman introduced House Bill 259, which would have banned smoking in work sites and public places. The legislation made history by making it through committee and was voted on the floor of the House, where it was defeated narrowly, by 6 votes

and disease self-management workshops have been held; these were attended by 286 people, 41% of whom were male. Participants and recipients have been recruited for programs and services offered by local and regional agencies. Three of the male leaders of Project DIRECT Legacy have participated in the local health department's health assessment planning sessions. Twelve church secretaries and clerks have been recruited to be health communicators. Twenty people have been trained as lay leaders for the Stanford self-management program workshops. And 27 men were persuaded to attend a conference on "Healing the Body: Diet, Exercise and Spirit for MEN ONLY," led by a Duke University Medical Center endocrinologist.

Participants in healthy living workshops reported the following lifestyle improvements: Twelve of the 14 members of the advisory committee lost weight, and as a result most of whom were able to reduce their use of medications. In the Eat Smart, Move More, Weigh Less Program, 19 of the 20 participants lost weight, and 3 of the 5 participants with elevated blood pressure readings experienced reductions in blood pressure.

Poor health for African American men leads to consequences for individuals, families, and the community. Project DIRECT Legacy has several characteristics that are predictors of sustainability, including leadership, membership diversity, a history of collaboration, structure, resource diversity, and community buy-in [9]. However, many challenges remain. This group may have difficulty sustaining its activities in a large geographical area without travel reimbursements and material funding. Yet this collaboration of men and women has already made a difference in the health of the Hyde County community. *NCMJ*

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which "swung" during final moments. Significant progress had been made, which included the passage of incremental legislation that accomplished the following: Smoking was prohibited in state-owned buildings, and local governments were empowered to make their buildings smoke-free; the University of North Carolina system was allowed to implement smoke-free policies; both the buildings and grounds of all public schools in North Carolina were made 100% tobacco-free; and smoking was banned inside long-term care facilities [8]. The 2008 session brought more incremental successes, including legislation that made vehicles

owned or leased by the state smoke-free and gave local governments the authority to do the same [9]. This set the stage for the historic work of the 2009 legislative session, in which House Bill 2, sponsored again by the House Majority Leader, Hugh Holliman, passed the General Assembly and was signed into law by Governor Beverly Perdue [10].

There can be no doubt that enacting legislation that reduces exposure to secondhand smoke has had a positive impact on the cardiovascular health of North Carolinians. In 2011 it was reported that emergency department visits by North Carolinians experiencing heart attacks declined by

21% between 2008 and 2010, probably in part as a result of passage of the 2009 legislation, referred to as the smoke-free restaurants and bars law [11]. This represents an estimated \$3.3 to \$4.8 million in health care cost savings [12].

In the spring of 2012, the North Carolina Department of Health and Human Services (DHHS) reported that North Carolina was experiencing the lowest smoking rates among middle school and high school students in the state's history [13]. DHHS attributes these historic low rates in large part to the evidence-based programs developed by the North Carolina Health and Wellness Trust Fund, including the Tobacco Reality Unfiltered program, aimed at keeping children from starting to smoke and helping adults quit [13].

Clearly the combination of evidence-based policy change and program implementation has worked to improve health by modifying behaviors and preventing disease. Unfortunately, this good work in tobacco control may be undermined by recent dramatic reductions in funding for the state's tobacco use prevention and cessation programs [14]. Helping smokers quit and keeping new generations from starting smoking is not a one-shot deal. If we want to keep our state moving in the right direction on cardiovascular disease, we must continue to invest in these programs that keep smoke out of our lungs and cigarettes out of our children's hands.

But even as we make progress in reducing the tobacco risk factor for cardiovascular disease, we are being hit hard by the other 2 leading risk factors: poor nutrition and physical inactivity. Together, these 2 factors are creating a tidal wave of obesity, which could swamp our health care system and put us back on a path to increased death and disability from heart disease and stroke.

According to the North Carolina Prevention Partners' 2012 Report Card, 66% of adults in the state are overweight or obese, 22% of adolescents are obese, and, most shockingly, 30% of children ages 6-11 are obese [15]. The Bogalusa Heart Study [16] found that nearly 60% of overweight children ages 5 to 17 had 1 or more risk factors for cardiovascular disease, and as many as 20% of overweight children had 2 or more risk factors. This landmark study indicates that the consequences of childhood overweight and obesity have significant health implications that will continue to affect individuals well into adulthood. North Carolina's chronic disease rates will continue to spiral upward until we create an environment that offers accessible, affordable healthy food and convenient ways to be physically active.

The evidence for policies and programs that work to prevent obesity is newer, but no less sound, than that for tobacco prevention. Increasingly, leaders and organizations are focusing on what works in this area and are dedicating resources to the problem, collaborating and coordinating to best focus their efforts. The Eat Smart, Move More movement in North Carolina uses national and state sources of evidence-based strategies and has created a state plan containing approaches for creating healthy eating and active liv-

ing environments [17]. The plan includes recommendations for improved nutrition guidelines and physical activity for child care and school settings, strategies to make communities more walkable and conducive to safe physical activity, and recommendations for health care providers to incorporate obesity prevention into their clinical care.

If we have any doubt that policy change and political will can have an impact on the weight and behaviors of children, we need look no further than our southern neighbor, Mississippi. The prevalence of overweight and obesity among elementary-age students in Mississippi dropped from 43.0% in 2005 to 37.3% in 2011 [18]. This was accomplished through media campaigns; work in faith-based, community, and workplace settings; legislative activity; boot-camp and weight-management programs; and, of course, obesity prevention advocacy [18].

Tobacco use, poor diet, and lack of physical activity are unhealthy behaviors that are preventable risk factors for cardiovascular disease. They are putting North Carolina behind the curve with regard to life expectancy, economic vitality, and quality of life. Many of us have seen the impact of heart disease and stroke on parents and spouses. We know what these conditions look like in adults. Children who are overweight and obese increasingly are developing metabolic syndrome, diabetes, high cholesterol, and high blood pressure, putting them at greater risk of heart disease and stroke. We must stop talking about addressing unhealthy behaviors and actually start doing what we know must be done, or else we will see an increase in heart disease and stroke prevalence as these children become adults. Study after study has shown that more and more children are being diagnosed with diabetes, high blood pressure, and high cholesterol levels. Meanwhile, other studies continue to show that cardiovascular fitness helps children succeed in school. The evidence is clear that young people who are active and fit perform better in school, and yet we continue to allow the downward spiral of unhealthy behaviors to continue.

We must now ask ourselves what type of future we want for our children and what we are willing to do to make it happen. Are we going to saddle our children with lifetimes of battling diabetes, high blood pressure, high cholesterol levels, heart disease, and stroke? In North Carolina we must change this trend with strong leadership and a vision for a healthier tomorrow, free of cardiovascular diseases and stroke. We have a strong history of changing the odds through the adoption and implementation of evidence-based policies and programs.

Now we must collectively adopt healthy behaviors and work to create healthy environments. We call on all North Carolinians to join us. Together we will build healthier communities that have easy access to fresh, nutritious foods and daily physical activity; provide our children with a healthy and active school environment with investments in nutrition programs and physical education so that our youth learn how to live a heart-healthy lifestyle; fully fund a compre-

hensive tobacco control program that helps prevent young people from starting to smoke and helps current smokers to quit; and make sure all North Carolinians have access to health care, so that they can receive the health guidance they need to prevent disease. Then we will bring to pass a North Carolina in which citizens enjoy healthy lifestyles and have the freedom to live, work, and play in vibrant communities. NCMJ

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Heart Disease in Childhood: From Malformed Hearts to the Silent Impact of Unhealthy Lifestyles

Brenda E. Armstrong

Early recognition of congenital heart disease, coupled with the growth and sophistication of diagnostic, medical, and surgical interventions at early ages, has resulted in significantly improved outcomes. However, the cardiovascular impact of the epidemic of childhood obesity and its related disorders now looms as an even greater threat to the health of children.

Heart disease begins in childhood [1, 2]. Over the past several decades, pediatricians have primarily focused on congenital or structural heart disease, and during that time, advances in surgery, intensive care, cardiac catheterization, cardiac imaging, and medical therapies have significantly lowered mortality rates for infants and children with complex congenital heart disease [3]. An estimated 85% of patients now survive into adulthood; in the United States there are now more adults than children living with congenital heart disease. The number of adults with congenital heart disease is expected to keep growing by about 5% each year [4]. In recent years, however, these remarkable successes have been counterbalanced by an increase in the prevalence of risk factors for early-onset cardiovascular disease, attributable to the epidemic of childhood obesity. A growing number of children who were born with structurally normal hearts are now being diagnosed with hypertension, diabetes, and hyperlipidemia [5].

Congenital Heart Disease

For centuries, heart disease in childhood has been synonymous with “blue babies.” However, many infants born with major malformations of the heart and cardiovascular system heart disease, consisting of a significant malformation of the heart and its vascular system, occurs in 8 to 10 out of 1,000 live births. The impact on affected children is profound; in 2 out of 1,000 live births, a child has heart defects severe enough to cause death in the first week of life [7, 8] (Table 1).

In many cases, the potential for a normal life expectancy, the ability to achieve an optimal quality of life, and the availability of sufficient family financial and social resources to support a child with significant congenital heart disease are at best limited. Most families lack the financial resources to

cover all of the expenses of having a child with significant congenital heart disease, which may include but are not limited to the costs of multiple surgeries requiring prolonged hospital stays, multiple other inpatient and outpatient hospital visits, expensive medications, physical and occupational therapy, and additional home support once patients are discharged. In addition, the illness results in time away from work for parents, jeopardizing their economic stability, and the family’s social stability may also be disrupted. There is a limited body of research available which addresses the impact of the stresses imposed on families with children who have serious congenital heart defects [11, 12]. Our preliminary experience among the CHD population at Duke suggests that marital disruption occurs at a higher rate than in the general population. Until recently, the possibility of children with congenital heart disease being denied health insurance served as an additional stressor for families. The provision of health care for those children who survive to

TABLE 1.
US Prevalence of Selected Congenital Heart Defects

| Type of Defect | Prevalence per 10,000 Live Births |
|------------------------------------|-----------------------------------|
| Ventricular septal defect | 15.57 |
| Valvar pulmonary stenosis | 3.78 |
| Atrioventricular septal defect | 3.27 |
| Atrial septal defect | 2.35 |
| Tetralogy of Fallot | 2.60 |
| Congenital aortic stenosis | 0.81 |
| Transposition of the great vessels | 2.64 |
| Coarctation of the aorta | 1.39 |
| Hypoplastic left heart syndrome | 1.78 |
| Patent ductus arteriosus | 0.88 |

Source: Data are from [9, 10].

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adulthood is still problematic, not only because many have been denied health care coverage on the grounds that their congenital heart disease is a preexisting condition, but also because of the cumulative effects of congenital heart defects on a person's educational and vocational preparation to live independently as an adult.

The abnormalities in the development of the heart that constitute congenital heart disease occur between 25 and 60 days after conception. This means that in most cases congenital heart defects are already present by the time pregnancy is confirmed. Despite extensive research, most of the actual causes of congenital heart disease are unknown. The point in heart development at which specific defects occur is known, but the actual triggers causing an arrest in the normal development of the heart have yet to be described. A multifactorial cause for congenital heart disease is hypothesized but has not been confirmed, and the illness does not conform to most generally held genetic theories [8, 13, 14]. Until a cause is identified, prevention is not possible. As a result, the incidence of congenital heart disease has remained stable for centuries.

Sophisticated 2-dimensional cardiac ultrasound imaging capable of resolving to very small structures became available only recently; before that, the diagnosis of congenital heart defects awaited the end of pregnancy. Because fetal circulatory physiology confers protection to fetuses with many of even the most complex congenital heart defects, affected babies survived during pregnancy, only to experience near-fatal or fatal outcomes once fetal circulation was replaced by a more normal circulatory physiology at birth. Most babies with heart defects, because their defects had not been diagnosed before birth, were born in local hospitals that lacked high-tech interventions, and the morbidity and mortality of congenital heart disease was greater than 50% in the first week of life [15, 16]. Heart defects such as transposition of the great vessels, hypoplastic left heart syndrome, congenital aortic stenosis, and coarctation of the aorta were responsible for 95% of deaths in the first week of life.

Certain heart defects cluster among genetic syndromes, some of which are listed in Table 2 [17, 18]. The most common such syndrome is Down syndrome, in which more than 50% of affected babies are born with atrioventricular septal defects (formerly known as endocardial cushion defects).

Congenital heart disease in childhood presents in 1 of 3 ways: central cyanosis (the presence of 3-5 grams of desaturated hemoglobin), congestive heart failure, or a constellation of the following physical exam findings—murmur, lack of pulses, poor peripheral perfusion, hepatomegaly, sustained tachypnea and tachycardia, and diaphoresis with feedings.

The overwhelming majority of patients with congenital heart disease present well before the age of 18 months; most present during the first 6 months of life, and those with critical defects present within the first 3 months of life (Table 3). Early recognition is essential to ensure reasonable outcomes in congenital heart disease. Multiple studies

TABLE 2.
Heart Problems Associated with Selected Genetic Syndromes

| Genetic Problem | Associated Heart Problem |
|---|---|
| Down syndrome | Atrioventricular septal defect, tetralogy of Fallot |
| Turner syndrome | Coarctation of the aorta, congenital aortic stenosis |
| Fetal hydantoin (Dilantin) syndrome | Valvar pulmonary stenosis |
| Trisomy 13 and 18 | Ventricular septal defect, double outlet right ventricle |
| Marfan syndrome | Mitral valve prolapse, mitral regurgitation, aortic insufficiency, aortic root dilation |
| VACTERL association ^a | Ventricular septal defect, atrial septal defect, tetralogy of Fallot |
| DiGeorge syndrome | Tetralogy of Fallot, double aortic arch, vascular rings |
| Noonan syndrome and LEOPARD syndrome ^b | Valvar pulmonary stenosis, hypertrophic obstructive cardiomyopathy |
| Holt-Oram syndrome | Atrial septal defect (secundum) |

^aVACTERL association is defined by the presence of 3 or more of the following congenital malformations, the initial letters of which spell VACTERL: vertebral anomalies, anal atresia, cardiac anomalies, tracheoesophageal fistula, renal or radial anomalies, and limb abnormalities.

^bLEOPARD syndrome, which is associated with Noonan syndrome, is characterized by the following conditions, the initial letters of which spell LEOPARD: lentigines, electrocardiographic conduction abnormalities, ocular hypotelorism, pulmonary stenosis, abnormal genitalia, retarded growth, and deafness (sensorineural).

have documented significantly improved survival in those patients born in, or transferred early to, pediatric cardiovascular centers with high-tech facilities for pediatric cardiovascular interventions, including sophisticated imaging facilities; extracorporeal membrane oxygenation; critical cardiac intensive care units; specialized nursing; physical, occupational, and nutritional therapy; and pediatric cardiovascular surgical and anesthesia programs.

With the discovery of the life-preserving effects of prostaglandin E₁ (alprostadil), the development of sophisticated 2-dimensional echocardiography with Doppler (which is able to identify cardiac defects as early as 16-weeks gestation), the rapid development and miniaturization of specialized cardiac surgical procedures, the sophistication of pediatric cardiac anesthesia support, and the development of extracorporeal membrane oxygenation for pediatrics at major medical centers throughout the country, the outlook for babies with congenital heart disease has significantly improved [18]. Survival for even the most complex and severe congenital heart defects, such as hypoplastic left and right heart syndromes requiring complex surgery, has improved significantly, as has survival for babies born with structurally normal but severely dysfunctional hearts—for example, those with congenital cardiomyopathy requiring neonatal heart transplantation. More than 75% of such children now survive the first month of life. However, early diagnosis and intervention is critical for babies with congenital heart disease. The availability of high-tech resources of this

type is limited primarily to major university medical centers. The specialized technology necessary to diagnose and intervene in critical congenital heart disease is therefore not readily available to many families living in rural towns and remote cities.

Obesity and Hypertension in Childhood: Risk Factors for Early-Onset Cardiovascular Disease

Congenital heart disease is a major challenge to normal cardiovascular function over the long term. However, a new and potentially even more dangerous threat has emerged in the pediatric population: acquired heart disease, like that seen in adults [19-21]. In the past 15 years, with the emergence of childhood obesity as a national health epidemic among children, the incidence of associated hypertension, type 2 diabetes, and hyperlipidemia is soaring, and the clinical pediatric cardiology population is rapidly expanding to include children with structurally normal hearts that have been subjected to the ravages of unhealthy lifestyles. The numbers of children referred to pediatric cardiologists with obesity and hypertension have increased exponentially, fueled by unhealthy lifestyles—physical inactivity combined with excessive dietary intake of sugar, salt, and fat in meals eaten at home, at school, or in fast food restaurants. Misinformation or lack of information about nutrition among parents and caretakers; the proliferation of sedentary alternatives to exercise, such as video and computer games; the lack of easily accessible low-cost after-school physical activities for children; and the absence of regularly required physical education classes in schools have all conspired to make healthy lifestyle choices more difficult to achieve [22]. In turn, we are now facing a generation of children whose life expectancies may be considerably shortened, and the resulting impact on the health care system

from the necessity of managing early cardiac disease will be unprecedented. Many children are the second or third generation in the family to have hypertension, hyperlipidemia, or type 2 diabetes—diseases that will predispose them to early coronary artery disease [20]. The rapid proliferation of conditions predisposing young people to adult heart disease in childhood is a national emergency and threatens an entire generation of our children.

Nationwide, about 1 in 3 children age 2-19 years are estimated to be overweight or obese [23]. Obesity in childhood and adolescence is one of the main predictors of hypertension in adulthood, but it is also associated with other cardiovascular risk factors, such as dyslipidemia, abnormal glucose metabolism, insulin resistance, inflammation, and impaired vascular function (dysmetabolic syndrome). Therapy is largely nonpharmacologic. Major changes in behaviors are needed, including an increase in physical activity and healthier lifestyle choices. Nutrition education also is recommended. The goal is to reduce systolic blood pressures below the 95th percentile for age, gender, and height.

A significant body of work is emerging that describes the demographics of, health care costs, and contributing factors that have led to the growth in childhood obesity [24, 25].

Socioeconomic status is a strong determinant of a young person's potential for obesity. Among children 2-18 years of age, Latino children are most at risk for obesity. Children covered by Medicaid are nearly 6 times more likely to be treated for a diagnosis of obesity than are children covered by private insurance [26].

Children treated for obesity are roughly 3 times more expensive for the health system than is the average insured child. The national cost of childhood obesity is estimated to be approximately \$11 billion for children with private insurance and \$3 billion for those with Medicaid. Annual health care costs are about \$6,700 for children treated for obesity who are covered by Medicaid (compared to \$2,400 for children without obesity) and about \$3,700 for obese children with private insurance (compared to \$1,100 for those without obesity) [26].

Children diagnosed with obesity are 2-3 times more likely to be hospitalized. Children treated for obesity are far more likely to be diagnosed with mental health disorders or bone and joint disorders than are nonobese children [26].

In the 2009 Youth Risk Behavior Surveillance System survey, 13% of high school youth in North Carolina described themselves as obese. Asked whether they had eaten fruits and vegetables 5 or more times per day during the 7 days before the survey, 83% said no. In addition, 32% said they had drunk a can, bottle, or glass of soda or pop (not including diet soda or diet pop) at least 1 time per day during those 7 days. Recommended levels of physical activity were met by only 46% of these adolescents, 35% watched television 3 or more hours per day on an average school day, and 21% played video or computer games or used a computer for something that was not schoolwork for 3 or more hours per

TABLE 3.
Timing of Presentation of Specific Cardiac Lesions in the First Year of Life

| Age of Child at Presentation | Type of Cardiac Lesion |
|------------------------------|---|
| 1 day | Arteriovenous malformations, tricuspid valve insufficiency, transposition of the great vessels, Ebstein's anomaly of the tricuspid valve |
| 1 week | Obstructions Critical pulmonary/aortic stenosis, coarctation of the aorta, hypoplastic left heart syndrome Ductal dependent lesions Transposition of the great vessels, tricuspid atresia, total anomalous pulmonary venous return with obstruction, tetralogy of Fallot, pulmonary atresia with intact ventricular septum |
| 2-4 weeks | Ventricular septal defect |
| 4-8 weeks | Ventricular septal defect, arteriosclerotic vascular disease, truncus arteriosus |
| 8 weeks to 1 year | Anomalous origin of the left coronary artery from the pulmonary artery, congenital myocarditis, congenital cardiomyopathy |

Source: Data are from [17].

day on an average school day [27].

Factors contributing to the emergence of obesity and its related disorders include increased availability and consumption of high-fat, high-calorie foods and soft drinks; a sedentary lifestyle in which a great deal of time is spent watching television and playing computer or video games; a lack of focused physical education programming; a lack of safe places for children to exercise; inability to purchase healthy foods because they are higher in cost or are less readily available; a lack of basic understanding of nutrition; and the proliferation of advertising for fast foods in the media.

In summary, although advances in technology have led to improved survival of children with congenital heart disease, we are now faced with a generation of children burdened early in life by obesity, dysmetabolic syndrome, and hypertension. This is predicted to result in an imminent increase in the incidence of cardiovascular disease and stroke. Reversing this trend will require sweeping policy changes at all levels to make sure that children have access to healthy foods, physical activity, and safe spaces in which to exercise. **NCMJ**

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Monitoring and Improving Acute Stroke Care: The North Carolina Stroke Care Collaborative

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The North Carolina Stroke Care Collaborative is a stroke care quality-improvement (QI) program that provides performance data to hospitals continuously, allowing for rapid feedback and for development of QI initiatives. Between 2005 and 2012, 89,413 stroke cases were enrolled, and the proportion of patients receiving defect-free care improved from 52% to 79%. However, important areas for improvement remain.

Approximately 795,000 new or recurrent strokes occur annually in the United States, making stroke the fourth leading cause of death and a leading cause of long-term disability [1]. Until the 1980s, declines in stroke mortality were thought to be more consistent with improved risk factor profiles than with improvements in the quality of stroke care. More recently, decreases in the number of hospital case fatalities suggest that improved survival after acute stroke contributes significantly to the continued decline in stroke mortality [1].

The Joint Commission (JC), the American Heart Association (AHA), the American Stroke Association (ASA), the American Academy of Neurology (AAN), and the Centers for Disease Control and Prevention (CDC) promote stroke care quality-improvement (QI) efforts through the development and dissemination of evidence-based stroke care guidelines [2, 3]. Despite evidence supporting the benefit of implementing evidence- and consensus-based guidelines [4], gaps remain between such recommendations and the care that is being delivered in hospitals [5, 6].

To reduce these gaps, a number of initiatives have been developed, including the JC's Primary Stroke Center Certification Program and the AAN's Stroke Practice Improvement Network initiative [7]. In addition, QI programs such as the AHA's "Get with the Guidelines-Stroke" and the CDC's Paul Coverdell National Acute Stroke Registry (PCNASR) program have been launched with the goal of improving acute stroke care in the United States.

In 2004, after a 2-year pilot program and a development phase, North Carolina was one of several states selected by the CDC to implement a PCNASR program, which was named the North Carolina Stroke Care Collaborative (NCSCC).

With the exception of Veterans Affairs (VA) hospitals, all hospitals with a dedicated emergency department (ED)

in North Carolina are eligible to participate in the NCSCC. Between January 2005 and June 2012, 68 of the 110 eligible hospitals in the state enrolled nearly 90,000 patients into the NCSCC (Figure 1). Patients who are 18 years of age or older who present with signs or symptoms consistent with a clinical diagnosis of acute ischemic stroke (IS), intracerebral hemorrhage (ICH), subarachnoid hemorrhage (SAH), transient ischemic attack (TIA), or an *International Classification of Diseases, Ninth Edition, Clinical Modification (ICD-9-CM)* discharge diagnosis code indicating a stroke or TIA (codes 430-436) are eligible for enrollment.

Participating hospitals are encouraged to consecutively enroll all eligible stroke cases based on presenting signs and symptoms at the time of ED presentation or hospital admission and to collect specific data elements measuring quality of care and performance concurrent with care throughout the hospitalization. However, some hospitals have retrospectively identified cases based on *ICD-9-CM* discharge diagnosis codes and abstracted the required data elements from medical records or used a combination of methods. In 28% of cases enrolled through June 2012, performance measures were documented concurrent with care.

Hospital staff enter data elements—including patient demographics, medical history, diagnostic procedures, medical treatments, and discharge plans—into an interactive, online data management tool created specifically for the NCSCC. Additional details of the study design have been published elsewhere [8]. To minimize selection bias and for feasibility [9], informed consent is not required, and no patient identifiers are collected. This study was approved by the University of North Carolina at Chapel Hill Institutional Review Board (IRB) and individual hospitals' IRBs where required.

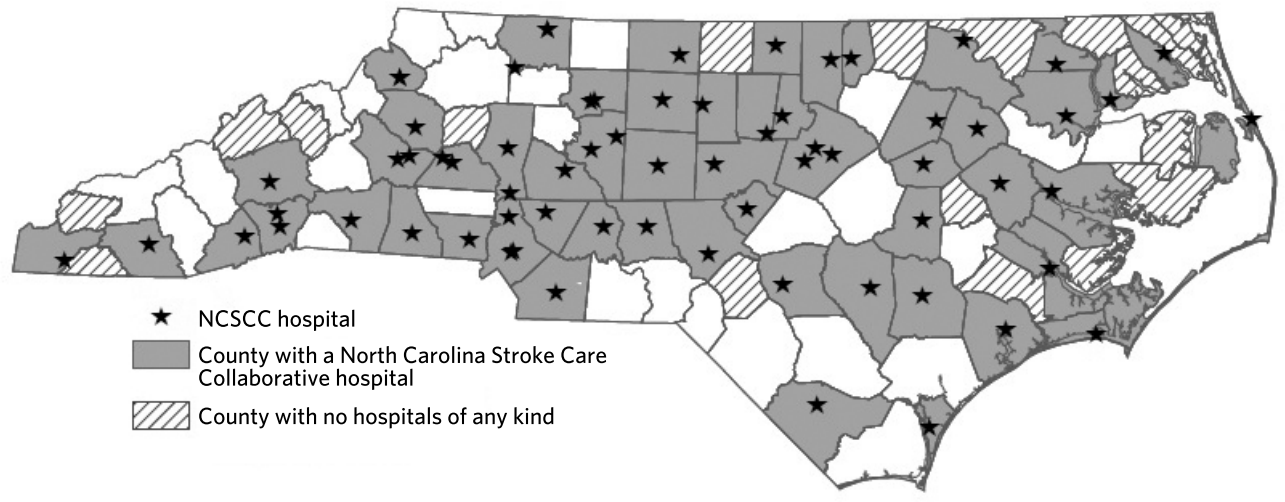
The NCSCC facilitates quality improvement (QI) by promoting and supporting timely collection and analysis of key quality-of-care indicators. Consistent with other PCNASR registries, data elements include the 11 acute stroke per-

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FIGURE 1.
Counties with North Carolina Stroke Care Collaborative Hospitals, 2005 - 2012.



Note: Data are from North Carolina Stroke Care Collaborative.
 *Data from June 30, 2012

formance measures developed by the JC in collaboration with the CDC and the AHA/ASA. A summary index, *defect-free care*, was created to indicate whether or not a patient received all performance measures for which he or she was eligible. Reports featuring performance measures are accessible to hospital staff at any time via an interactive web-based interface and allow comparison with aggregate NCSCC hospital performance data. These up-to-date reports facilitate immediate feedback and serve as a basis for planning QI initiatives. To enhance QI activities, more-detailed analyses of data elements are provided regularly. Monthly QI webinars, updated practice guidelines, regional hospital workshops, interhospital conference calls, and a grant award program funding innovative QI projects designed by hospital staff to address their specific needs have also been provided. Hospitals are encouraged to share QI intervention information with hospital administrators and boards to facilitate policy and system changes.

The following definitions are used for NCSCC analyses: hospital size (small, fewer than 100 beds; midsize, 100-349 beds; large, 350 or more beds); teaching hospital (50 full-time equivalent interns and residents, or at least \$3 million allocated to graduate medical education); stroke unit (designated area within a hospital where staff with training in stroke management provide care); acute stroke team (experienced personnel who respond to a code pager and deliver stroke care, as well as a multidisciplinary task force that works daily to facilitate patient access to treatment); ED acute stroke protocol (standardized process designed to quickly identify and triage patients and initiate treatment orders); thrombolytic therapy protocol (written chain of actions followed by ED staff when a patient presents with signs and symptoms of stroke); primary stroke center

(JC-accredited primary stroke centers).

Of the 68 hospitals participating in the NCSCC between January 1, 2005 and June 30, 2012, the majority were classified as midsize facilities (Table 1). Six were teaching hospitals, 15 were in a rural or small-town area, 8 were critical access hospitals, and 26 were certified stroke centers. Fewer than half reported having an acute stroke team in place; however, more than half reported having a stroke team-like resource, and nearly all reported having an ED protocol for administering thrombolytic therapy to IS patients.

A total of 89,413 cases were registered during this period. The majority of patients were female (53.2%), and Caucasian (73.0%), with a mean age of 68.6 years (range, 18-109 years). More than half (59.7%) of registered cases were discharged with an ICD-9-CM diagnosis code of IS, 13.8% with a diagnosis of hemorrhagic stroke, 17.0% with a diagnosis of TIA, and fewer than 1% with a diagnosis of ill-defined stroke.

Fewer than half (46.5%) of cases arrived at the hospital via emergency medical services (EMS). Of those transported by EMS and having documented times, the median time from symptom onset to calling EMS was 1.1 hours (interquartile range [IQR], 0.3-4.1 hours). Time from symptom onset to hospital arrival was not recorded or was unknown for 49.5% of IS cases. For those with available data, the median delay from symptom onset to hospital arrival was 2.8 hours (IQR, 1.2-6.8), with 40.9% arriving within 2 hours of symptom onset and 51.8% arriving within 3 hours. Thrombolytic therapy was administered to 46.6% of eligible IS cases. Prolonged delay in arrival was the primary documented reason for half of IS cases being deemed ineligible for thrombolytic therapy.

The median length of stay (LOS) in the hospital for

TABLE 1.
Selected Characteristics of the Hospitals That Participated in the North Carolina Stroke Care Collaborative from January 2005 - June 2012

| Characteristic | No. (%) |
|---|-----------------------|
| | (N = 68) |
| Hospital size | |
| Small (<100 beds) | 13 (19.1) |
| Midsize (100-349 beds) | 36 (52.9) |
| Large (≥ 350 beds) | 19 (27.9) |
| Teaching hospital | 6 (8.8) |
| Small town or rural hospital ^a | 15 (22.1) |
| Critical Access Hospital | 8 (11.8) |
| Certified Primary Stroke Center | 26 (38.2) |
| | (N = 45) ^b |
| Has acute stroke team | 20 (44.4) |
| Has thrombolytic therapy stroke protocol | 44 (97.8) |
| Has emergency department ischemic stroke protocol | 38 (84.4) |
| Has stroke unit | 3 (6.7) |
| Has neurosurgeon on staff | 15 (33.3) |

^aThe designation "small town or rural" is based on US Department of Agriculture rural-urban commuting area (RUCA) codes and applies to areas having an urban core population area with a population of less than 10,000.

^bFor 5 characteristics, N = 45 because information about those characteristics was unavailable for 23 hospitals.

patients was 3 days (IQR, 2-6 days). Median LOS varied by stroke type, from 6 days for hemorrhagic cases, to 4 days for IS cases, and 2 days for TIA cases. Overall, 56.9% of cases were discharged home. More than half (66.5%) of all cases were able to ambulate independently both before and after the stroke or TIA.

The JC goal of 85% or more of patients receiving the treatment described in all of the performance measures was met for 7 of the 11 indicators, including receipt of prophylaxis for deep vein thrombosis, antithrombotic medication upon discharge, use of anticoagulant therapy for patients with atrial fibrillation, use of antithrombotics within 48 hours of hospitalization, discharge on statin therapy, smoking cessation counseling, and consideration of a rehabilitation plan (Table 2). This goal was not met for use of thrombolytic therapy, discharge on cholesterol-reducing medication, dysphasia screening, and stroke education. Overall, adherence was highest for discharge on antithrombotic medication (97.7%) and lowest for thrombolytic therapy administration to eligible IS patients (46.6%). The proportion of cases that received defect-free care increased from 52% in 2005 to 79% in 2012, for an average of 3.9% annual improvement (Table 2).

Data collected by the NCSCC on JC acute stroke performance measures and other indicators of care has allowed for timely, comparative feedback to participating hospitals, enabling the development, implementation, and tracking of targeted hospital-specific QI initiatives. Delivery of defect-free care has improved by an average of nearly 4% per year among NCSCC hospitals. These results are similar to those

of a national stroke care QI program [10].

However, gaps in access to optimal care still exist. Notably, fewer than half of eligible IS cases (those arriving within 2 hours of symptom onset) received thrombolytic therapy. Administration of thrombolytic therapy to eligible patients routinely has the lowest compliance reported in registry studies of JC performance measures [10]. In NCSCC data, the primary documented reason for IS cases being deemed ineligible for thrombolytic therapy has been delay in patient arrival. Previous NCSCC findings suggest that using EMS is associated with more timely diagnostic testing and interpretation of results [11]. Together, these data highlight the continued importance of public education campaigns to heighten the awareness of stroke signs and symptoms and the importance of calling 911 when a stroke is suspected. Improvement in this area will require community outreach interventions that evaluate progress with the same level of rigor as in-hospital QI.

The majority of NCSCC hospitals have stroke units and IS protocols in the ED, and more than a third are certified stroke centers; however, fewer than half have an acute stroke team, and only a third have neurosurgeons on staff. Hospital-level improvements in the organization and delivery of stroke care have been demonstrated to be important factors in the quality of care delivered [12, 13]. Delivery of care in a specialized stroke unit has been shown to reduce the likelihood of death and disability by up to 30%, and implementation of ED and thrombolytic therapy protocols has been shown to significantly reduce door-to-imaging time delays and improve the likelihood of IS patients receiving thrombolytic therapy [14]. Although certain hospital characteristics (eg, larger size, teaching status, and urban setting) may predispose hospitals to provide higher quality care, meaningful hospital-level changes can still be made in smaller centers to ensure that state-of-the-art acute stroke care is delivered to all segments of the population. Strategies such as telemedicine and improved coordination with EMS, including ambulance rerouting and transfer agreements, can lead to meaningful improvements in the quality of stroke care delivered [15].

All hospital-based QI programs face important challenges, including sustainment of funding and the provision of infrastructure to support electronic data collection and complete case ascertainment. Compromises between the desire to collect high-quality data and practical feasibility can lead to biased, nonrepresentative case sampling. However, NCSCC hospitals have captured 83.7% of all acute stroke cases that enter the hospital. This high case ascertainment rate may be attributed to the use of both prospective and retrospective case capture methods and to freedom from any requirement to obtain written consent. While allowing for two methods of case capture may increase case ascertainment and improve data completeness, it may also introduce a source of variability in comparative analysis.

The NCSCC is a voluntary program, and hospitals that participate may have greater capacity to deliver stroke QI

TABLE 2.
Adherence to Stroke Performance Measures of Care in North Carolina
Stroke Care Collaborative Hospitals, January 2005 - June 2012

| Performance Measure | Adherence Among Eligible Cases, % |
|--|-----------------------------------|
| Patient received deep vein thrombosis prophylaxis ^a | 90.8 |
| Patient was discharged on antithrombotic medication ^b | 97.7 |
| Patient with atrial fibrillation received anticoagulant therapy ^b | 85.7 |
| Ischemic stroke patient received thrombolytic therapy ^c | 46.6 |
| Patient received antithrombotics within 48 hours of hospitalization ^b | 95.9 |
| Patient was discharged on cholesterol-reducing medication ^d | 75.5 |
| Patient was discharged on statin therapy ^e | 86.3 |
| Patient was screened for dysphasia ^a | 68.7 |
| Patient was given stroke education ^f | 69.8 |
| Patient was given smoking cessation counseling ^g | 94.5 |
| Patient was considered for a rehabilitation plan ^h | 94.1 |
| Defect-Free Care | |
| 2005 | 52 |
| 2006 | 54 |
| 2007 | 52 |
| 2008 | 59 |
| 2009 | 68 |
| 2010 | 71 |
| 2011 | 75 |
| 2012 | 79 |

^aAll stroke patients, excluding TIA and stroke patients who were NPO throughout hospitalization.

^bAll stroke and TIA patients without contraindications.

^cIschemic stroke patients presenting to hospital within 2 hours of symptom onset.

^dIschemic stroke and TIA patients, excluding those with hemorrhagic stroke and those with stays of less than 24 hours.

^eIschemic stroke patients.

^fAll stroke and TIA patients.

^gAll stroke and TIA patients with history of current smoking.

^hAll stroke patients (TIA patients excluded).

than do nonparticipating hospitals, which may limit the generalizability of NCSSC findings. Although NCSSC hospitals may differ somewhat from other hospitals in the state, participating hospitals come from all geographic regions of North Carolina and represent a mix of academic and non-academic, rural and urban, and small and large hospitals. Because the NCSSC requires no fee for participation, barriers to participation were low.

A particular strength of the NCSSC is its collaboration with the North Carolina Division of Public Health and other key stakeholders, enabling a natural link for hospital-level and regional and statewide primary and secondary stroke prevention activities.

The NCSSC provides a wide variety of hospitals in North Carolina with a valuable and sustainable mechanism for creating data-driven support for targeted QI programs. Overall, participating hospitals are providing recommended care in many performance areas for the treatment of acute stroke, and substantial improvements have been made over

time in the provision of recommended treatments for which patients are eligible. These data highlight the importance of hospitals' dedication to providing a coordinated system of care. **NCMJ**

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The Burden of Heart Disease Among North Carolina Adults with Disabilities

Harry W. B. Herrick, Karen J. Luken

Data from the North Carolina Behavioral Risk Factor Surveillance System survey show that, from 2005-2010, cardiovascular disease (CVD) was approximately 3 times more prevalent among adults with disabilities than among those without disabilities. Likelihood of having multiple CVD risk factors was also increased. Early intervention to prevent CVD in people with disabilities is warranted.

One in 5 North Carolinians will have a disability at some point during their lives [1]. A disability can be physical, mental, emotional, intellectual, or communication-related. Disability may result in substantial limitations in 1 or more major life activities or a need for assistive equipment or technology. The severity of disability varies considerably from person to person. Results from the 2009 North Carolina Behavioral Risk Factor Surveillance System (BRFSS) survey found that 27% of respondents who considered themselves to have a disability reported their disability to be mild, 37% reported their disability to be moderate, and 36% reported their disability to be severe (H.H., unpublished data). Disability may be present from birth, or it may occur later in life as a result of injury, chronic disease, or aging.

The number of adults in North Carolina entering retirement age is growing substantially. Analysis of data from the North Carolina Office of State Budget and Management shows that the state's population of adults aged 65 and older will increase by an estimated 41% between 2010 and 2020 [2]. We can likewise anticipate that the number of adults with disability will also increase with the aging of the state's population.

Cardiovascular disease (CVD), primarily heart disease and stroke, causes more deaths in Americans of both genders and all racial and ethnic groups than any other disease and is one of the leading causes of disability [3]. A 1997 population-based study of 1,288 randomly selected participants, aged 65-74 years, in Finland found that cerebrovascular diseases in men and myocardial infarction, heart failure, and cerebrovascular diseases in women were significantly associated with subsequent disability, after adjustment for age and other comorbidities [4]. There is also evidence to suggest that a preexisting disability may pose an independent risk for CVD. A prospective population-based cohort study of 9,294 subjects aged 65 years or older found that

after adjustment for cardiovascular risk factors, subjects with moderate or severe disability had a risk of coronary heart disease that was 1.7 times greater (95% CI, 1.0-2.7) than that of nondisabled subjects [5].

The primary behavioral and physical risk factors for CVD have been well studied. Some risk factors cannot be changed, such as advancing age or heredity. Modifiable risk factors can be treated or controlled by medicine and/or lifestyle changes, and include smoking tobacco, high blood pressure, high cholesterol, physical inactivity, obesity, and diabetes [6]. In addition, more recently poor sleep has been recognized as an important risk factor [7]. Contributing risk factors such as stress, alcohol use, and high levels of homocysteine are associated with CVD, but their significance and exact role have yet to be precisely determined [8].

CVD and CVD Risk Factors in Adults with and without Disabilities

We examined the demographic profiles of North Carolina adults with and without disabilities, looked for differences between these 2 populations in the prevalence of CVD over the past decade, and compared the prevalence of modifiable risk factors for CVD in the 2 populations, testing for statistically significant differences.

We began by obtaining data about these populations from the North Carolina BRFSS survey, a random-digit-dialed telephone survey of the civilian, noninstitutionalized US population 18 years of age or older that is conducted annually by state health departments in collaboration with the Centers for Disease Control and Prevention (CDC). The BRFSS collects information on health behaviors, chronic disease, and use of preventive care. Operational in all 50 states and 5 US territories, it is the largest and longest-running telephone survey in the world. Questions in the core section of the survey are sponsored by various programs and centers within the CDC and are required to be asked by all states and territories.

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We categorized as disabled all respondents who answered yes to either or both of the following questions (from the BRFSS core section): (1) "Are you limited in any way in any activities because of physical, mental, or emotional problems?" and (2) "Do you now have any health problem that requires you to use special equipment, such as a cane, a wheelchair, a special bed, or a special telephone?" Those who answered no to both questions were categorized as nondisabled.

Respondents were considered to have a history of CVD if they answered yes to any of a series of questions asking whether they had ever been told by a doctor, nurse, or other health professional that they had had a heart attack, angina or coronary heart disease, or a stroke. Those who said no to all 3 questions made up the non-CVD group.

From the 2009 North Carolina BRFSS survey, we examined 7 different risk factors for CVD. These included self-reports of doctor-diagnosed diabetes, high blood pressure, and high cholesterol levels. In addition, we included current smoking (daily or occasional), no leisure time activity in the past month, obesity (body mass index of 30.0 or greater), and frequent poor sleep, defined as not getting enough rest or sleep on at least 14 of the preceding 30 days. We used data from the 2009 survey because questions on hypertension and cholesterol were not asked in 2010. A summary "risk index" variable was constructed for those having 3 or more of the 7 risk factors examined.

Table 1 shows the 2009 numbers and weighted percentages for adults with and without disabilities by gender, age, race, ethnicity, income, and employment status. Figure 1

TABLE 1.
Demographic Characteristics, Weighted and Unweighted Prevalence, of North Carolina Adults Responding to the 2009 Behavioral Risk Factor Surveillance System Survey, by Disability Status

| Demographic characteristic | Adults with disabilities | | Adults without disabilities | |
|------------------------------|--------------------------|---|-----------------------------|---|
| | No. | % Weighted ^a / Unweighted | No. | % Weighted ^a / Unweighted |
| Sex | | | | |
| Males | 1,278 | 43.6 / 34.8 | 3,649 | 49.8 / 38.6 |
| Females | 2,390 | 56.4 / 65.2 | 5,806 | 50.2 / 61.4 |
| Age | | | | |
| 18-44 | 489 | 29.6 / 13.4 | 3,100 | 54.9 / 33.1 |
| 45-54 | 633 | 20.4 / 17.4 | 1,902 | 18.3 / 20.3 |
| 55-64 | 897 | 21.5 / 24.6 | 1,861 | 13.3 / 19.9 |
| 65-74 | 814 | 14.1 / 22.3 | 1,517 | 8.1 / 16.2 |
| 75+ | 812 | 14.4 / 22.3 | 982 | 5.3 / 10.5 |
| Race | | | | |
| Non-Hispanic white | 2,866 | 72.1 / 80.1 | 7,378 | 75.8 / 81.9 |
| Non-Hispanic black | 552 | 23.5 / 15.4 | 1,260 | 19.3 / 14.0 |
| Non-Hispanic American Indian | 123 | 2.8 / 3.4 | 182 | 1.5 / 2.0 |
| Non-Hispanic other | 36 | 1.6 / 1.1 | 194 | 3.4 / 2.1 |
| Ethnicity | | | | |
| Hispanic | 58 | 3.0 / 1.6 | 381 | 8.5 / 4.0 |
| Non-Hispanic | 3,597 | 97.0 / 98.4 | 9,052 | 91.5 / 96.0 |
| Income | | | | |
| Less than \$15,000 | 774 | 21.2 / 25.4 | 661 | 8.9 / 8.2 |
| \$15,000-24,999 | 735 | 23.1 / 24.1 | 1,342 | 15.7 / 16.6 |
| \$25,000-34,999 | 390 | 12.6 / 12.8 | 959 | 10.8 / 11.9 |
| \$35,000-49,999 | 391 | 12.4 / 12.8 | 1,300 | 14.4 / 16.1 |
| \$50,000-74,999 | 365 | 14.1 / 12.0 | 1,435 | 17.6 / 17.8 |
| \$75,000+ | 392 | 16.6 / 12.9 | 2,387 | 32.7 / 29.5 |
| Employment | | | | |
| Employed | 893 | 31.7 / 24.4 | 5,420 | 62.8 / 57.4 |
| Unemployed | 260 | 9.9 / 7.1 | 674 | 9.6 / 7.1 |
| Unable to work | 929 | 26.1 / 25.4 | 136 | 1.2 / 1.4 |
| All other | 1,579 | 32.3 / 43.1 | 3,212 | 26.5 / 34.1 |
| Total Sample | 3,668 | 22.1 / 27.9 | 9,445 | 77.9 / 72.1 |

^aPercentages in this column have been weighted to the population characteristics of the North Carolina population.

shows the prevalence of CVD by disability status for years 2005-2010. To account for significant differences in age (see Table 1), the CVD prevalence estimates for those with and without disabilities were weighted to the US 2000 standard population [9]. The age categories used in calculating the age weights are the same as those found in Table 1.

For all of the risk factors shown in Table 2, we also age-adjusted the prevalence using the method previously described. The prevalence ratios were age-adjusted using the Mantel-Haenszel method [10]. The prevalence ratios were calculated to assess the degree of "excess" CVD risk prevalence among persons with disabilities compared with those without disabilities. Percentages have been weighted to the population characteristics of the state of North Carolina. We used SAS-Callable SUDAAN software (SUDAAN release 10.0.1), which is designed for analyzing complex survey data, in all our calculations.

A total of 3,688 respondents had a disability, and 9,445 did not. Weighting of those responses suggests that an estimated 22.1%, or about 1 out of 5 adults in the state had a disability in 2009 (Table 1). More than 28% of persons with disabilities were 65 years of age or older, compared with a little more than 13% of the nondisabled population. Approximately 44% of those with disabilities reported household incomes below \$25,000, compared with about 25% of the nondisabled group. And roughly 1 in 5 persons with a disability reported not being able to work, versus about 1 in 100 persons without any disability (Table 1).

Figure 1 shows the elevated prevalence of CVD found among people with disabilities. From 2005-2010, the rate of CVD for people with disabilities ranged from a high of 16.2% in 2007 to a low of 12.3% in 2009. After adjusting for differences in age, the 6-year annual rates of CVD prevalence were at least 3 times higher for people with disabilities

than for people without them. The prevalence of CVD varied more widely from year to year among those with disabilities than among the nondisabled.

Table 2 shows that, when age was controlled for, both the prevalence and associated prevalence ratios for each of the study risk factors, including the risk index variable, were significantly higher for adults with disabilities than for those without disabilities. The risk factor for which the largest difference between the 2 groups in age-adjusted prevalence was found was poor sleep: the prevalence of poor sleep was 24.9 percentage points higher among those with disabilities than among the nondisabled. For obesity, high blood pressure, and high cholesterol levels, prevalence rates were at least 10 percentage points higher for adults with disabilities. Indeed, more than 40% of the disability population had high blood pressure or high cholesterol levels. Furthermore, almost half of persons with disabilities (49%), compared with only about 20% of those with no disabilities, reported having at least 3 of the 7 CVD risk factors shown in Table 2.

When calculating the age-adjusted prevalence ratios, we found that persons with disabilities had a significantly ($P < 0.05$) higher prevalence of each risk factor we examined (Table 2). The prevalences of doctor-diagnosed diabetes and poor sleep were at least 2 times higher among those with disabilities than among their nondisabled counterparts. Those with disabilities were 80% more likely to be smokers than were those without disabilities. And, most alarmingly, persons with disabilities were 2.2 times more likely to report having at least 3 of the risk factors shown in Table 2.

Comments

One of the reasons for the persistently high prevalence of CVD among North Carolina adults with disabilities may be the multiplicity of risk factors for CVD found among adults

TABLE 2.
Age-adjusted, Weighted and Unweighted Prevalence of Selected Risk Factors for Cardiovascular Disease (CVD) Among North Carolina Adults in 2009, by Disability Status

| Risk factor for CVD | Percentage of population with risk factor ^a | | |
|---|--|---|--|
| | Adults with disabilities Wtd/Unwtd ^b | Adults without disabilities Wtd/Unwtd ^b | Age-adjusted prevalence ratio ^c (95% CI) |
| Diabetes | 15.0 / 24.1 | 6.9 / 8.6 | 2.1 (1.9-2.5) |
| Obesity | 39.2 / 38.2 | 27.0 / 25.5 | 1.5 (1.4-1.7) |
| High blood pressure | 42.6 / 58.3 | 27.0 / 33.9 | 1.5 (1.4-1.6) |
| High cholesterol | 48.1 / 56.6 | 33.7 / 40.1 | 1.3 (1.2-1.4) |
| Current smoker | 31.5 / 22.6 | 18.0 / 16.4 | 1.8 (1.6-2.0) |
| Physical inactivity | 39.6 / 45.0 | 22.5 / 22.2 | 1.8 (1.6-1.9) |
| Poor sleep | 48.8 / 37.2 | 23.9 / 21.4 | 2.1 (1.9-2.3) |
| Risk index variable (3 or more risk factors present) | 49.0 / 54.1 | 20.6 / 23.2 | 2.2 (2.1-2.4) |

Note: CI, confidence interval.

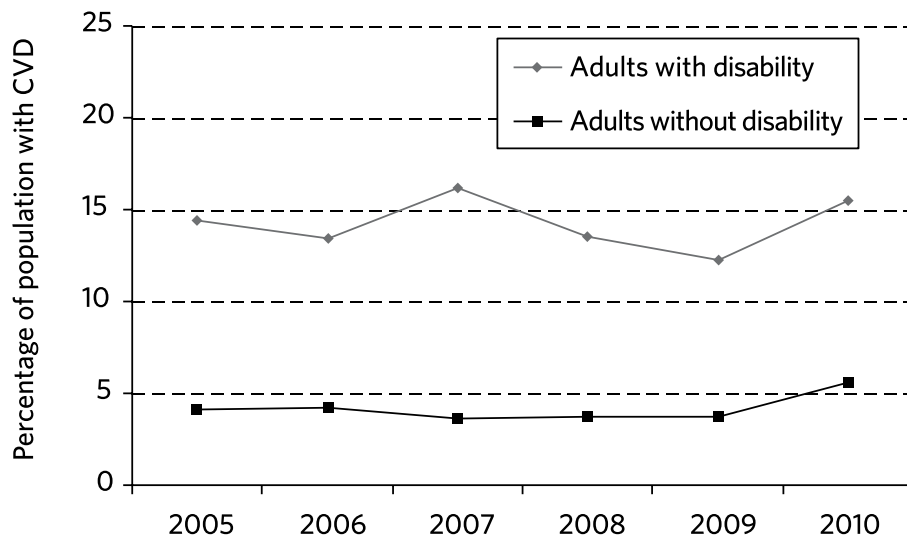
^aPercentages indicating prevalence have been age-adjusted to the US 2000 standard population.

^bWtd, weighted (to the population characteristics of the state of North Carolina); Unwtd, unweighted

^cAll prevalence ratios shown are statistically significant ($P < 0.05$) and have been age-adjusted using the Mantel-Haenszel method.

Source of data: North Carolina Behavioral Risk Factor Surveillance System survey for 2009.

FIGURE 1.
Age-adjusted Prevalence^a of Cardiovascular Disease (CVD) among North Carolina Adults, 2005-2010, by Disability Status



^aPrevalence percentages have been weighted to the US standard population in the year 2000. The age categories used in calculating the age weights were 18-44 years, 45-54 years, 55-64 years, 65-74 years, and 75 years or older. Source of data: North Carolina Behavioral Risk Factor Surveillance System.

with disabilities, even among younger age groups. We found that among adults ages 18-44 years the likelihood of having 3 or more risk factors for CVD was 2.8 times greater for the disability group (results not shown). The National Heart, Lung, and Blood Institute reports that having 3 or more risk factors can increase one's risk of CVD more than 10-fold [11].

North Carolina's Public Health Response to CVD and People With Disabilities

The charge to public health professionals and health care providers is to intervene early in the lives of people with disabilities when the opportunity for prevention of CVD due to high-risk behaviors and treatment of incipient chronic disease are most likely to be effective. The North Carolina Plan to Prevent Heart Disease and Stroke, 2005-2010 [12], offers population-based recommendations that can easily be aligned to support the health of people with disabilities. We should do the following things: ensure that people with disabilities are an identified population that is addressed in risk factor prevention and disease management; deliver health education in diverse and accessible settings that meet the needs of people with disabilities; raise awareness within the disability community about the burden and preventability of heart disease and stroke through statewide campaigns; and ensure that media and education campaigns are inclusive, use diverse images of persons with disabilities, use first-person language, and are available in various literacy levels and alternate formats such as large print, Braille, audiocassette, and accessible Word and PDF files [13].

These recommendations also align with North Carolina's Plan to Promote the Health of People with Disabilities:

Everywhere, Everyday, Everybody, 2010-2020 [14], which emphasizes the need for health promotion programs to recognize that a significant portion of the population has some level of disability.

Given the growing number of elderly people with CVD in our state, disability associated with CVD could become a growing health burden to the North Carolina medical community. For the state to have maximum impact on the risk of CVD, it is important to ensure that people with disabilities, particularly early in their adult lives, have access to a medical home that provides and coordinates high-quality, patient-centered health care, acute illness care, and chronic disease management across the lifespan. NCMJ

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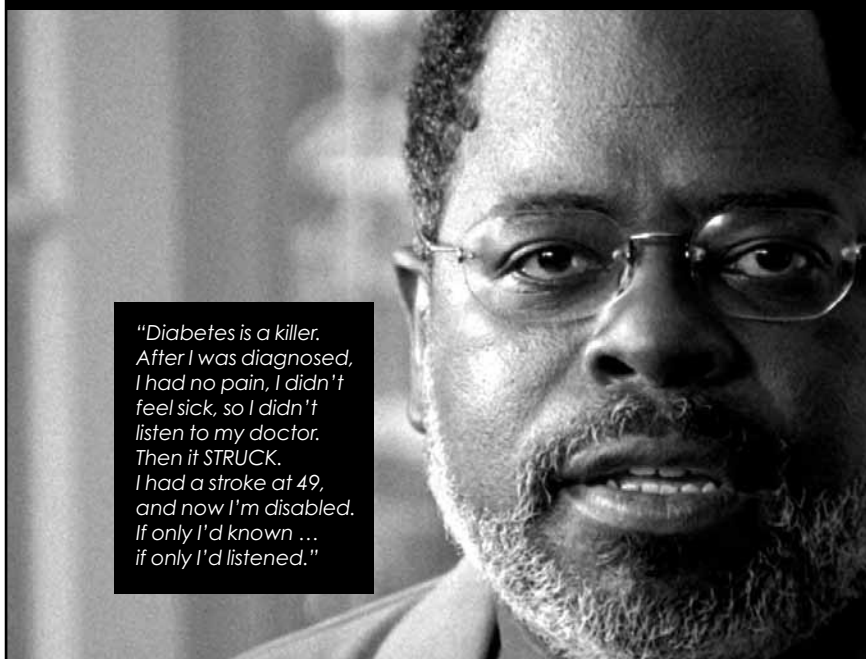
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Running the Numbers

*A Periodic Feature to Inform North Carolina Health Care Professionals
About Current Topics in Health Statistics*

Critical Congenital Heart Defects in North Carolina

Congenital heart defects are the most common type of serious birth defect, occurring in nearly 40,000 infants (approximately 1% of all live births) each year in the United States [1]. Such defects are a leading cause of infant death, accounting for at least 25% of infant deaths related to birth defects in the United States [2-4]. In North Carolina during the 5-year period 2005-2009, 7,690 infants were diagnosed with congenital heart defects, or about 1 in every 83 infants; approximately 10% of these infants died within the first year of life [North Carolina Birth Defects Monitoring Program, unpublished data, 2012].

In recent years there has been a decline in infant and childhood mortality from congenital heart defects in the United States, due in large part to improvements in diagnosis, surgical management, and catheter-based interventions [5]. In many cases, the key to improved survival and reduced risk of serious disability depends on early detection, often before the newborn is discharged from the hospital. Recognizing the importance of early detection, the US secretary of Health and Human Services, Kathleen Sebelius, in September, 2011, adopted recommendations of the secretary's Advisory Committee on Heritable Disorders in Newborns and Children that a subgroup of 7 specific types of defects known as critical congenital heart defects (CCHD) be added to the recommended universal screening panel for newborns, using pulse oximetry screening. The conditions targeted for pulse oximetry screening are hypoplastic left heart syndrome, pulmonary atresia with intact ventricular septum, tetralogy of Fallot, total anomalous pulmonary venous return, transposition of the great arteries, tricuspid atresia, and truncus arteriosus (common truncus) [6]. In each case, the two atria and two ventricles (or in lay terms, the receiving and pumping chambers) of the normal heart are atretic, mislocated, unconnected, or blocked so blood does not flow normally

from the right side of the heart through the lungs to the left, and blood is poorly oxygenated. These 7 conditions may also be classified as cyanotic congenital heart defects, because the affected infant often presents with hypoxemia within the first few days or weeks of life.

Infants with CCHD who are not diagnosed promptly are at high risk for cardiovascular shock and subsequent death when the ductus arteriosus closes and prevents blood from flowing through this connection that had allowed oxygenated blood to mix into the circulation. Although CCHD may be diagnosed through prenatal ultrasound or by physical examination, those methods are unreliable and can result in missed diagnoses. Screening with pulse oximetry, which is a simple noninvasive test of blood-oxygen saturation, can significantly improve detection of CCHD and reduce the risk of death and serious disability. Pulse oximetry screening can identify asymptomatic infants with CCHD within 24-48 hours of birth, providing an opportunity for prompt referral to a specialist to provide critical medical care needed to prevent death or serious disability. The screening can also detect other life-threatening medical conditions that can lead to low blood-oxygen levels, including sepsis, pneumonia, or pneumothorax. The secretary's Advisory Committee on Heritable Disorders in Newborns and Children, in collaboration with the American Academy of Pediatrics, the American College of Cardiology, and the American Heart Association, has developed a screening algorithm to help facilitate implementation of universal screening for CCHD by states [7]. The screening

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TABLE 1.
Prevalence of Critical Congenital Heart Defects (CCHD) in North Carolina, 2005-2009

| Phenotype | Number of Cases ^a | Prevalence (per 10,000 live births) | 95% CI ^b |
|--|------------------------------|--|---------------------|
| Truncus arteriosus | 56 | 0.88 | (0.66, 1.14) |
| Transposition of great arteries | 160 | 2.50 | (2.13, 2.92) |
| Tetralogy of Fallot | 256 | 4.01 | (3.53, 4.53) |
| Pulmonary valve atresia with intact septum | 100 | 1.56 | (1.27, 1.90) |
| Tricuspid valve atresia | 109 | 1.71 | (1.40, 2.06) |
| Hypoplastic left heart syndrome | 169 | 2.64 | (2.26, 3.07) |
| Total anomalous pulmonary venous return | 81 | 1.27 | (1.00, 1.57) |
| Total Number of Infants with CCHD | 828 | 12.96 | (12.09, 13.87) |

^aSome infants had more than one type of CCHD; therefore the numbers for each phenotype when added together do not equal the total number of infants with CCHD.

^bCI, confidence interval

algorithm was developed to improve case detection with a very low rate of false positives (ie, specificity >99.5%). They recommend a broad-based implementation strategy, involving birth facilities, pediatric cardiac surgery centers, primary care providers, and state public health programs such as Title V maternal and child health programs and state-based birth defect surveillance systems. The role of public health in this model is to provide monitoring, quality assurance, and evaluation of universal screening for CCHD.

The purpose of this Running the Numbers article is to provide baseline data on the prevalence and characteristics of infants with CCHD in North Carolina. This information can be used to assist with the initial planning and implementation of universal screening for CCHD, and to help assess the public health impact of such screening, including mortality and economic outcomes.

Methods

Data for this report are from the North Carolina Birth Defects Monitoring Program and cover infants who were born during the 5-year period of 2005-2009. The Birth Defects Monitoring Program is a statewide, population-based, active surveillance system that has been in operation since 1995. The program is housed within the State Center for Health Statistics in the Division of Public Health, North Carolina Department of Health and Human Services. Under state law, the program has the authority to obtain from hospitals and licensed physicians in the state all information on infants suspected of having a congenital malformation,

and to review and abstract that information. All patient-identifying information collected and maintained by the program is considered confidential by state law. The case definition includes all infants born to a mother residing in North Carolina who were diagnosed with a major structural malformation in the first year of life, as well as all fetuses in which malformations were diagnosed after fetal death or pregnancy termination. Birth Defects Monitoring Program field staff review approximately 12,000 medical charts annually using a multistage process involving initial case finding followed by medical record review and abstraction to confirm suspected diagnoses. Information in the medical record that is reviewed includes discharge summaries; prenatal test results; labor and delivery information; newborn and pediatric examinations; diagnostic findings from magnetic resonance imaging, echocardiography, or other imaging studies; cytogenetic and laboratory findings; surgical reports; pathology records; and autopsy results. All data from live-born infants and fetal deaths are linked back to the infant's or fetus' vital record in order to obtain additional demographic data and to facilitate calculation of rates.

Results

During the 5-year period 2005-2009, there were 828 cases of CCHD, of which 795 (96%) were live-born infants and 33 (4%) were fetal deaths or pregnancy terminations. The overall prevalence of CCHD was 12.96 per 10,000 live births; 56% of those affected had 1 or more additional, extra-cardiac malformations, and 44% of the infants

TABLE 2.
Characteristics of Infants with Critical Congenital Heart Defects (CCHD) and Infants Without Birth Defects, and of Their Mothers, in North Carolina, 2005-2009

| Characteristic | Infants with CCHD (N = 828) No. ^a (%) | Infants without Major Birth Defects (N = 620,140) No. ^a (%) |
|---|--|--|
| Gender of infant | | |
| Male | 463 (56.0) | 315,822 (50.9) |
| Female | 364 (44.0) | 304,314 (49.1) |
| Birth weight | | |
| <1,500 grams | 53 (6.5) | 9,579 (1.5) |
| 1,500-2,499 grams | 166 (20.4) | 43,831 (7.1) |
| ≥2,500 grams | 596 (73.1) | 566,516 (91.4) |
| Gestational age (weeks) | | |
| <32 | 50 (6.1) | 10,957 (1.8) |
| 33-36 | 148 (18.0) | 54,114 (8.7) |
| ≥37 | 626 (76.0) | 554,793 (89.5) |
| Maternal age (years) | | |
| < 20 | 100 (12.1) | 71,696 (11.6) |
| 20-24 | 209 (25.2) | 165,316 (26.7) |
| 25-29 | 230 (27.8) | 169,315 (27.3) |
| 30-34 | 171 (20.6) | 135,785 (21.9) |
| ≥35 | 118 (14.3) | 77,996 (12.6) |
| Maternal Race/ethnicity | | |
| White/non-Hispanic | 456 (55.1) | 345,295 (55.7) |
| Black/non-Hispanic | 200 (24.2) | 145,203 (23.4) |
| Hispanic | 127 (15.3) | 101,805 (16.4) |
| Asian/Pacific Islander | 27 (3.3) | 18,615 (3.0) |
| Native American | 15 (1.8) | 8,352 (1.4) |
| Other/unknown | 3 (0.4) | 870 (0.1) |
| Mother's no. of previous live births | | |
| None | 321 (39.2) | 251,760 (40.6) |
| 1-2 | 382 (46.7) | 305,241 (49.3) |
| ≥3 | 115 (14.1) | 62,602 (10.1) |
| Delivery paid by Medicaid | | |
| Yes | 434 (54.6) | 301,069 (48.6) |
| No | 361 (45.4) | 319,071 (51.4) |
| Level of care at delivery hospital | | |
| Level III (tertiary) | 508 (61.4) | 252,413 (40.7) |
| Other (nontertiary) | 320 (38.6) | 367,727 (59.3) |
| Infant death | | |
| Yes | 215 (26.0) | 3,845 (0.6) |
| No | 613 (74.0) | 616,295 (99.4) |

^aNumbers shown for each characteristic may not add up to total number of infants in category because information is missing for some individuals.

had isolated CCHD. Table 1 shows the prevalence of each CCHD phenotype (ie, type of CCHD). Tetralogy of Fallot was the most commonly occurring CCHD, with a prevalence of 4.01 per 10,000 live births, affecting 256 (30.9%) of all children

diagnosed with CCHD. Hypoplastic left heart syndrome was the second-most-common type, with a prevalence of 2.50 per 10,000 live births. Truncus arteriosus was the least common defect, affecting only 56 infants during the 5-year period.

TABLE 3.
Medicaid Claims During the First Year of Life for Infants Diagnosed with Critical Congenital Heart Defects (CCHD) in North Carolina, 2005-2009

| Group | No. of Infants | Total Value of Claims | Median Value of Each Child's Claim |
|--|----------------|-----------------------|------------------------------------|
| All infants with CCHD who were covered by Medicaid | 462 | \$53.4 million | \$72,466 |
| Infants with isolated CCHD | 189 | \$15.0 million | \$57,610 |
| Infants with nonisolated CCHD | 273 | \$38.4 million | \$86,560 |
| Infants who died | 128 | \$17.3 million | \$92,316 |
| Infants who survived | 334 | \$36.2 million | \$71,151 |

Table 2 presents maternal and infant characteristics in cases of CCHD, compared with the characteristics of infants without major birth defects and their mothers. The infants with CCHD were more likely to be male, to be born preterm (<37 weeks), and to weigh less than 2,500 grams. Compared with mothers of infants without birth defects, mothers of infants with critical congenital heart defects were more likely to have had 3 or more previous live births, to have had their delivery paid for by Medicaid, and to have delivered in a tertiary (level III) hospital. The risk of death within the first year of life among infants with CCHD was substantially higher than that among infants without birth defects (26.0% versus 0.6%). Deaths among infants with CCHD were evenly distributed between the neonatal (49%) and postneonatal (51%) period. Low birth weight and low gestational age were important risk factors for infant death among the infants with CCHD, as was high parity of the mother.

Approximately 56% (462) of the 828 infants with CCHD had Medicaid coverage during their first year of life (Table 3). Medicaid claims for these 462 infants during that year totaled \$53.4 million, and the median claim value per child was \$72,466. The median claim value for an infant with nonisolated CCHD was 1.5 times that for an infant with CCHD only. The median claim value for an infant who died was \$92,316—about 30% higher than that for an infant who survived.

Conclusion

Despite medical advances in the treatment of infants with congenital heart disease, mortality among infants with CCHD in North Carolina remains high, particularly among those infants

who are born prematurely. The prevalence of most CCHD phenotypes in North Carolina is similar to that of pooled national prevalence estimates and published data from individual state-based birth-defect surveillance programs [8, 9]. Given the relatively high prevalence of CCHD in the state (about 1 in 772 newborns), the availability of life-saving interventions, and the importance of early detection to reduce the risk of mortality, North Carolina should take the necessary steps recommended by the US Secretary of Health and Human Services to implement a statewide universal screening program for CCHD using pulse oximetry screening. Even without a legislative requirement for screening, many birth centers in the state have begun screening because it has little upfront costs, is straightforward to implement, and can lead to substantial improvement in health outcomes. *NCMJ*

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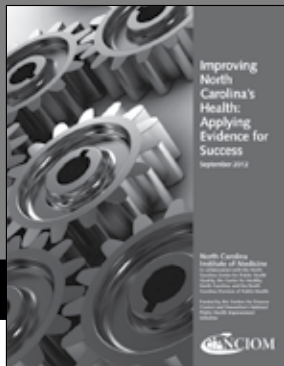
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Potential conflicts of interest. R.E.M. and A.R.K. have no relevant conflicts of interest.

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Improving North Carolina's Health: Applying Evidence for Success

September 2012

In North Carolina, the Division of Public Health (DPH) and the local health departments (LHDs) are charged with working in partnership to “promote and contribute to the highest level of health possible for the people of North Carolina.” To fulfill this mission, DPH and LHDs are tasked with preventing health risks and disease; promoting healthy lifestyles; promoting a safe and healthful environment; promoting the availability and accessibility of quality health care services through the private sector or directly, if not otherwise available. To accomplish this with limited financial resources requires public health practitioners to find ways to optimize the impact of their work. Incorporating scientific evidence about what works into management decisions, program implementation, clinical services, and policy development, is one way to do this.¹

The use of research and evidence to inform public health decision making is gaining momentum across federal, state, and local public health agencies. Evidence-based strategies (EBSs) include programs, clinical interventions, and policies that have been evaluated and shown to have positive outcomes. Researchers agree that evidenced-based strategies should produce positive outcomes when replicated with fidelity. However, wide variation exists among what researchers and practitioners actually define as “evidence-based.” The Task Force adopted a definition that recognized different levels of EBSs, but places emphasis on implementation of the best or leading practices that have the strongest evidence of effectiveness. (See Table 1.)

Using EBSs in public health yields many benefits including increasing the likelihood that programs, clinical interventions, and policies implemented at the state or local level will be successful, and increasing public resource efficiency.² Additionally, using evidence to inform practice can help practitioners avoid implementing programs and policies deemed ineffective or harmful. Investing these limited resources in programs, clinical treatments, and policies that have shown results makes sound economic sense.

Implementing EBSs in public health is an appealing concept, however, selecting, implementing, and evaluating EBSs is not a simple process.¹ Before an EBS can be selected, a community health assessment should be conducted to identify local health needs and priorities so that the intervention or strategy selected is well suited to the context. Once priorities are identified, public health practitioners must then look at the available research

Table 1
Evidence-Based Strategies Continuum

Best (B), Proven, or EBP: These practices are supported by intervention evaluations or studies with rigorous systematic review that have evidence of effectiveness, reach, feasibility, sustainability, and transferability.

Leading (L): These practices are supported by intervention evaluations or studies with peer review of practice that have evidence of effectiveness, reach, feasibility, sustainability, and transferability.

Promising (P): These practices are supported by intervention evaluations without peer review of practice or publication that have evidence of effectiveness, reach, feasibility, sustainability, and transferability.

Emerging (E): These practices are supported by field-based summaries or evaluations in progress that have plausible evidence of effectiveness, reach, feasibility, sustainability, and transferability.

Source: Adopted from the Centers for Disease Control and Prevention Best Practices Workgroup

a. NCGA 130A-1.1(b), Session Law 2012-126

on strategies to address their community's needs. When selecting an EBS, public health practitioners must weigh all the information obtained—about EBSs themselves, the needs and wants of the population they are serving, and the resources available—and make a decision about what will be the best fit for their organization and community.² Although EBSs have been evaluated and shown to produce positive outcomes, those outcomes are specifically tied to the implementation of the strategy. Thus, to replicate success, the strategy must be implemented with fidelity to the original model program, clinical intervention, or policy. Implementing with a high level of fidelity requires careful planning, the alignment of organizational goals and capacity, and continuous staff support.³ Assessing implementation fidelity and monitoring immediate outcomes is a critical step towards achieving the positive outcomes of an EBS. Effective implementation requires the collection of process and outcome measures to ensure that the intervention is achieving its desired purpose.³ Selecting, implementing, and evaluating EBSs often requires skills, knowledge, and resources that LHDs may not currently have. Therefore there is a need for education, training, and other support to help LHDs increase the use of EBSs.

Over the past few years, the North Carolina Institute of Medicine (NCIOM), DPH, and other state partners have worked together to develop a vision and roadmap for improving public health efforts to save lives, reduce disability, improve quality of life, and, potentially, decrease costs. The *Prevention Action Plan for North Carolina* includes evidence-based strategies to improve population health.⁴ *Healthy North Carolina 2020: A Better State of Health* includes 40 objectives to improve population health by 2020 as well as EBSs to help achieve the objectives.⁵ Together, the *Prevention Action Plan for North Carolina* and *Healthy North Carolina 2020: A Better State of Health* provided the vision, goals, and an evidence-based roadmap for improving the health of North Carolinians. The Task Force on Implementing Evidence-Based Strategies in Public Health builds on these previous efforts by focusing on what can be done at the state and local level to improve outcomes for the HNC 2020 objectives.

Improving North Carolina's Health: Applying Evidence for Success, the report of the Task Force on Implementing Evidence-Based Strategies in Public Health, presents a way to improve the health of North Carolinians that can occur

if DPH and LHDs, as well as other state partners, work together collaboratively to effectively select, implement, and evaluate EBSs. This idea of collaborative leadership, built on a foundation of reciprocal accountability that recognizes and builds on the responsibilities, assets, and strengths of DPH and LHDs was at the forefront of the Task Force's deliberations and the development of the recommendations. The Task Force believes that DPH and LHDs have reciprocal obligations to one another that must be met in order to advance the widespread adoption of EBSs at the local level. Therefore, the recommendations include steps that must be taken by both DPH and LHDs and reflect the belief that, for every increment of performance demanded from local health departments, the state has an equal responsibility to provide local health departments with the capacity to meet those expectations.

The NCIOM, in collaboration with the North Carolina Center for Public Health Quality, the Center for Healthy North Carolina, and DPH, convened the Task Force in the spring of 2012. The Task Force on Implementing Evidence-Based Strategies in Public Health was charged with developing recommendations to assist public health professionals in the identification and implementation of EBSs within their communities to improve population health. Funding support for the Task Force was provided by the Centers for Disease Control and Prevention's National Public Health Improvement Initiative, which provides grant funding to state, tribal, local, and territorial health departments to enhance the nation's public health infrastructure and strengthen the public health workforce. The Task Force on Implementing Evidence-Based Strategies in Public Health included 37 Task Force and Steering Committee members including representatives of state and local agencies, key health care leaders, public health experts, foundation leaders, and other interested individuals. The Task Force met six times between March and September of 2012.

Recommendations for Selecting, Implementing, and Evaluating Evidence-Based Strategies in Public Health

Education is needed to ensure key public health staff understand the importance of focusing limited public health resources on implementing strategies that have been shown to be effective in producing positive health outcomes. DPH and LHD staff need a basic understanding of what EBSs are, why it is important to implement EBSs,

and the need to implement these strategies with fidelity to their tested design. More detailed trainings and coaching are needed for people who are charged with implementing specific EBSs. *To effectuate this broader paradigm shift to support implementation of EBS, the Task Force recommends state public health staff, in partnership with other state agencies and other partners offer trainings on EBSs to state, regional, and local staff. In return, LHDs should ensure that appropriate staff receive EBS training.*

When selecting an EBS to implement, public health practitioners need information about the different EBSs including the level of evidence supporting the various EBSs, staffing needs, the costs of implementation, and whether or not the program offers technical assistance and/or coaching to implement the program with fidelity. They also need to consider whether they have, or could obtain, the appropriate staff and/or resources to be able to implement the EBS with fidelity. Local health directors identified selecting appropriate EBSs for their community as an area in which they could use help. The Task Force explored ways DPH and other partners can help support LHDs in this process. *To support selection of appropriate EBS, the Task Force recommends that DPH work with local health directors, academic institutions, and partnering organizations to identify 2 state-selected EBSs for 10 of the priority Healthy North Carolina 2020 (HNC 2020) objectives identified by LHD action plans, and at least one expert contact for each selected EBS.*

Once an EBS is selected, the LHD must ensure that the program, policy, or clinical intervention is implemented with fidelity. Evidence-based strategies have achieved positive health outcomes by following certain key programmatic, clinical, or policy guidelines. A community cannot expect to achieve the same outcomes unless it follows the core components of an evidence-based program, policy, or clinical intervention. Successful implementation requires leadership, organizational commitment, staff training and coaching, quality improvement efforts, data collection, and performance assessment as well as fidelity to the core implementation components of the selected EBS.³ *To facilitate implementation of EBSs the Task Force recommends that, DPH utilize a quality improvement approach to support and encourage LHD implementation of EBSs, pursue and publicize funding opportunities, promote learning collaboratives and provide more detailed EBSs training, technical assistance, and coaching. In return,*

LHD leadership should serve as champions to implement EBSs and ensure that appropriate staff receive necessary training.

Evaluation is also an important component of effective implementation of EBSs in LHDs. Collection of both process and outcome measures is critical.³ Without knowing if the initiative was implemented with fidelity, it is difficult to interpret the success or failure of a given EBS on changing health outcome measures. LHDs may also need data about program effectiveness to support ongoing funding. *To ensure that EBSs are being implemented appropriately and achieving desired outcomes, the Task Force recommends that DPH identify or develop evaluation and data collection tools for each state-selected EBS and provide training and coaching to local staff to enable them to collect the appropriate data. LHDs should ensure staff receive necessary training to collect requisite process and outcome data.*

Reciprocal Obligations

The Task Force identified many ways in which DPH and collaborating partners could assist LHDs in implementing evidence-based programs, policies, and clinical interventions, including education, assistance identifying appropriate EBSs, technical assistance and coaching to insure EBSs are implemented with fidelity, and evaluation support. If the state provides this assistance, then LHDs have reciprocal obligations to implement evidence-based strategies. *The Task Force recommends that if DPH fulfills the obligations outlined, then DPH should revise the 2013 Consolidated Agreement to require LHDs to identify and implement two new EBSs to address HNC 2020 priority objectives from different HNC 2020 focus areas as identified through the community health assessment.*

Partnering Organizations

The Task Force recognized that the Division of Public Health may not have sufficient resources or expertise to support LHDs with selection, implementation, and evaluation for all the state-selected EBSs. Nonetheless, everyone recognized the importance of moving as forcefully as possible towards implementation of EBSs to improve population health. One way to expand DPH's capacity to support LHDs is by working with state and national partners. *To support and extend the work of DPH, the Center for Training and Research Translation should convene academic and other appropriate organizations*

to assist the state, to the extent possible, in identifying appropriate EBSs to address priority HNC 2020 objectives; providing implementation support; and assisting with the collection and analysis of data.

Conclusion

The Division of Public Health and LHDs can help improve the health and well-being of North Carolinians by increasing efforts to provide evidence-based programs, policies, and clinical interventions. The Task Force

on Implementing Evidence-Based Strategies in Public Health developed strategies that provide a roadmap for how DPH, LHDs, and other state and national partners can work together to facilitate the adoption or expansion of EBSs by LHDs, with the goal of improving HNC 2020 health outcomes in local communities. By working together to make such changes, DPH, LHDs, and other partners can help make North Carolina a healthier state.

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A copy of the full report, including the complete recommendations, is available on the North Carolina Institute of Medicine website, <http://www.nciom.org>. North Carolina Institute of Medicine. In collaboration with the North Carolina Center for Public Health Quality, the Center for Healthy North Carolina, and the North Carolina Division of Public Health. Funded by the Centers for Disease Control and Prevention's National Public Health Improvement Initiative



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Universal Design and Community Health

Otto Rogers

To the Editor—I scanned the July/August issue on Promoting Healthy and Sustainable Communities and could not find anything in it on a subject near and dear to my heart: universal design. The simplest way to implement universal design is to build with handicapped users in mind. It is very inexpensive to build using universal design, whereas it can be very expensive to adapt an existing structure.

At least a part of community health promotion is keeping people in their homes when they become handicapped. As a retired emergency physician, I long ago lost count of the number of patients I took care of who could not return to their homes because of structural design flaws in their homes. Had they only considered simple changes when they built or purchased their home, they would have been able to stay there for many years after they became handicapped.

Then there is the problem of community space. Because my wife is in a wheelchair from childhood polio, I have also seen firsthand the large number of barriers that have not come down, or been removed, in spite of the Americans with Disabilities Act (ADA) having been in place for 20 years. Although individual buildings or developments may be ADA-compliant, my wife oftentimes must go from one com-

mercial development to another in a street full of cars. Try that in a wheelchair! Neighborhoods do not connect, most homes have no handicap access, large parking lots force those in wheelchairs to fend for themselves, and parks seem to be planned for cars.

The North Carolina State University School of Design has been a pioneer in universal design. They are a valuable resource. Please consider adding their expertise to community development. When the ADA was passed in the early 1990s, there were an estimated 40 million Americans with some kind of disability. As we age, our chances of becoming handicapped greatly increase. **NCMJ**

Otto Rogers, MD Cameron, North Carolina.

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Sun Exposure and Skin Cancer Are Important Issues in Agricultural Health

Mary Lou Courregé

To the Editor—I recently ran across the Agricultural Health (November/December 2011) issue of the NCMJ as I was clearing off my desk. Reading back through it, I was hoping and expecting to find a discussion of sun damage and skin cancer among farm workers. I found the sun mentioned only a few times and skin cancer discussed in just one paragraph of the entire issue (p. 485). While I certainly understand the importance of all the other issues presented (accidents, pesticides, other chemical exposure, infection, etc.), I expected to see more extensive information regarding sun exposure and the prevention of sun-related problems.

As a dermatologist living and practicing medicine in Eastern North Carolina since 1987, I have seen and treated many farmers for skin cancers. This is particularly true among small, family-operated farms where the families have Celtic heredity. My aim (besides treating the skin cancer) has been to educate my patients about protective measures (physical protection, hats, and sunscreen) to prevent future problems. Most of the time, I am just addressing problems that occur secondarily to past chronic sun exposure.

So often, these patients have worked on a farm their

entire lives and were not aware of the damage to fair skin over time. Many do not think they need sunscreen in the winter, and some think they do not need it at all!

I urge health care professionals working with farm workers to include sun protection and skin cancer education and treatment as part of their day-to-day work. Free health screenings, such as the Healthy Living for a Lifetime Initiative (discussed in the issue), are great venues for dermatologists to evaluate for sun-damage and the presence of skin cancer and pre-cancerous lesions among farm workers. **NCMJ**

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Shocking Salt-tistics

Did you know?

- ▶ Eating too much salt increases blood pressure.
- ▶ Most of the salt in your diet comes from foods that might not even taste salty, such as breads, meats, and dairy products.
- ▶ The salt shaker is not the main issue—almost 80% of salt is already in the food you buy, particularly in processed and restaurant foods.

| Food group | Range of sodium per serving |
|--|-----------------------------|
| Tomato soup | 700–1,260 mg |
| Frozen pizza, plain, cheese | 450–1,200 mg |
| Pretzels, regular flavor, salted | 290–560 mg |
| Salad dressing, regular fat, all types | 110–505 mg |
| Breads, all types | 95–210 mg |
| Frozen vegetables, all types | 2–160 mg |

Hidden sources of salt

Salt is hidden in foods you might not expect to be salty. And the salt content of similar items can vary widely. Read nutrition and menu labels to compare sodium levels. (Sodium, which is listed on the Nutrition Facts panel, is the component of salt that raises blood pressure.)

Source: Agricultural Research Service Nutrient Database for Standard Reference, Release 17, and recent manufacturers' label data from retail market surveys. Pizza and bread slices vary in size and weight across brands. Note: None of the examples provided were labeled low-sodium products.

What can you do?

Small changes can make a big difference in how much salt you eat. Here are practical steps you and your family can take to reduce your salt intake:

- ▶ Know your recommended limit for daily sodium intake. Most Americans should consume no more than 1,500 milligrams per day.
- ▶ Choose fresh fruits and vegetables and products labeled as “low sodium” or “no salt added.”
- ▶ Read the Nutrition Facts panel on the foods you buy, and choose products that are low in sodium.



- ▶ At restaurants, ask for foods with no or low salt.
- ▶ Talk to your school, worksite, local grocer, and favorite restaurants about providing more lower-sodium options.

Resources

- CDC Salt Web Site: <http://www.cdc.gov/salt>
- CDC High Blood Pressure Web Site: <http://www.cdc.gov/bloodpressure>
- National Heart, Lung, and Blood Institute Heart Healthy Cookbook: <http://hp2010.nhlbi.nih.net/healthyating>

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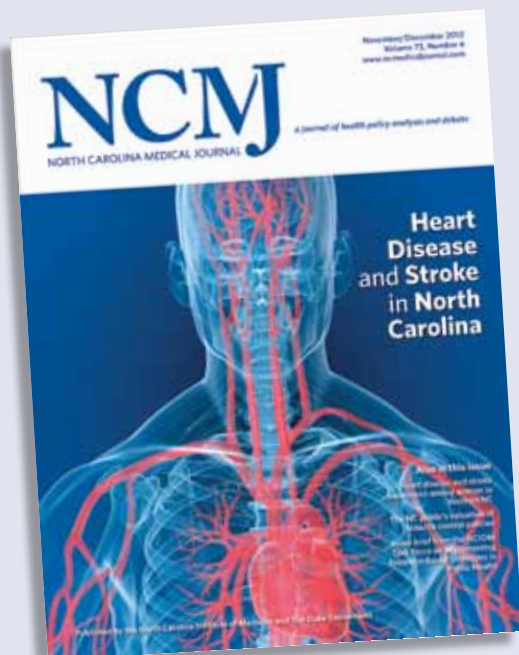
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