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North Carolina MEDICAL JOURNAL

a journal of health policy analysis and debate

Quality Of Life Scale

A Measure Of Function
For People With Pain

0 Non-functioning	Stay in bed all day Feel hopeless and helpless about life
1	Stay in bed at least half the day Have no contact with outside world
2	Get out of bed but don't get dressed Stay at home all day
3	Get dressed in the morning Minimal activities at home Contact with friends via phone, email
4	Do simple chores around the house Minimal activities outside of home two days a week
5	Struggle but fulfill daily home responsibilities. No outside activity Not able to work/volunteer
6	Work/volunteer limited hours Take part in limited social activities on weekends
7	Work/volunteer for a few hours daily. Can be active at least five hours a day. Can make plans to do simple activities on weekends
8	Work/volunteer for at least six hours daily Have energy to make plans for one evening social activity during the week Active on weekends
9	Work/volunteer/be active eight hours daily Take part in family life Outside social activities limited
10 Normal Quality of Life	Go to work/volunteer each day Normal daily activities each day Have a social life outside of work Take an active part in family life

Arthritis in North Carolina

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November/December 2007, 68:6

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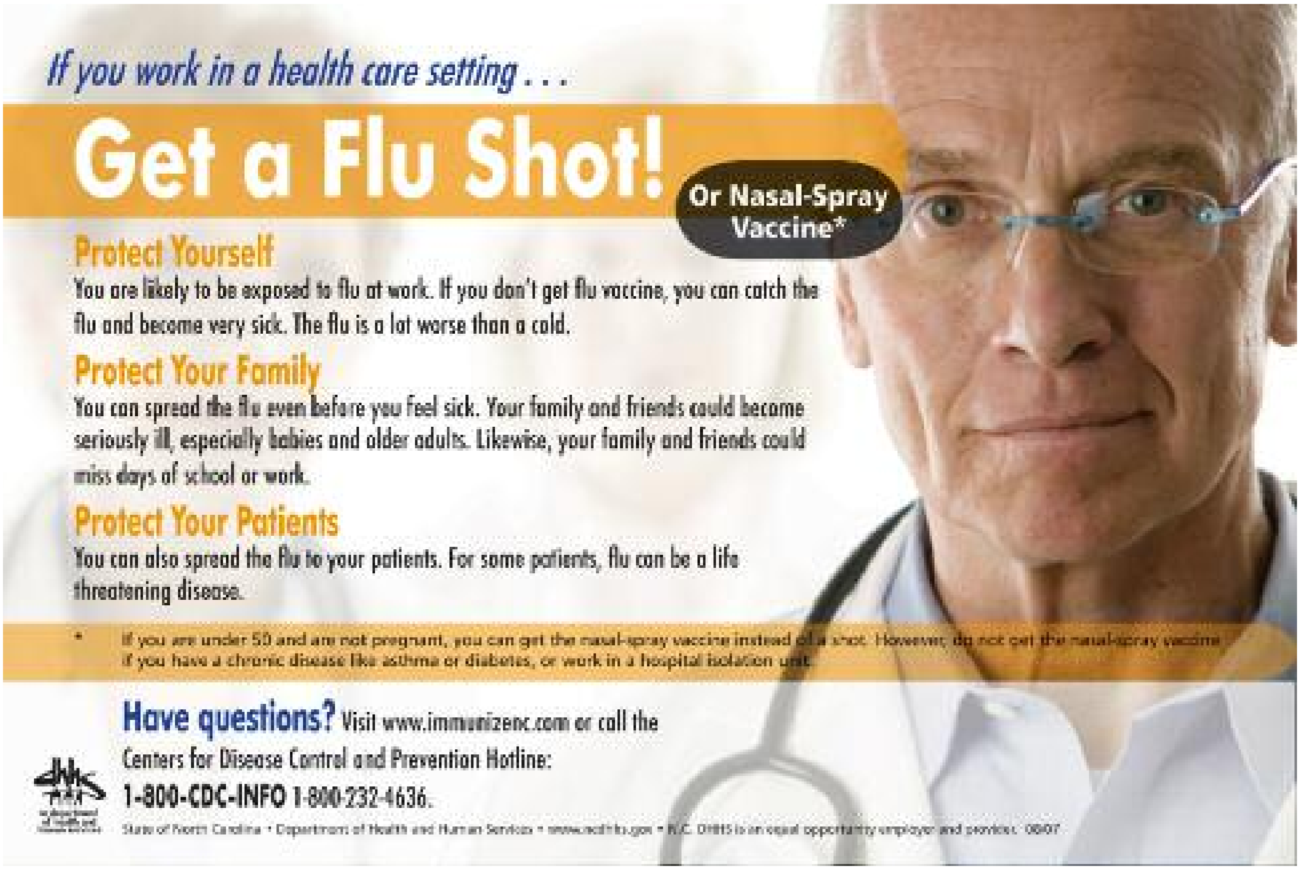
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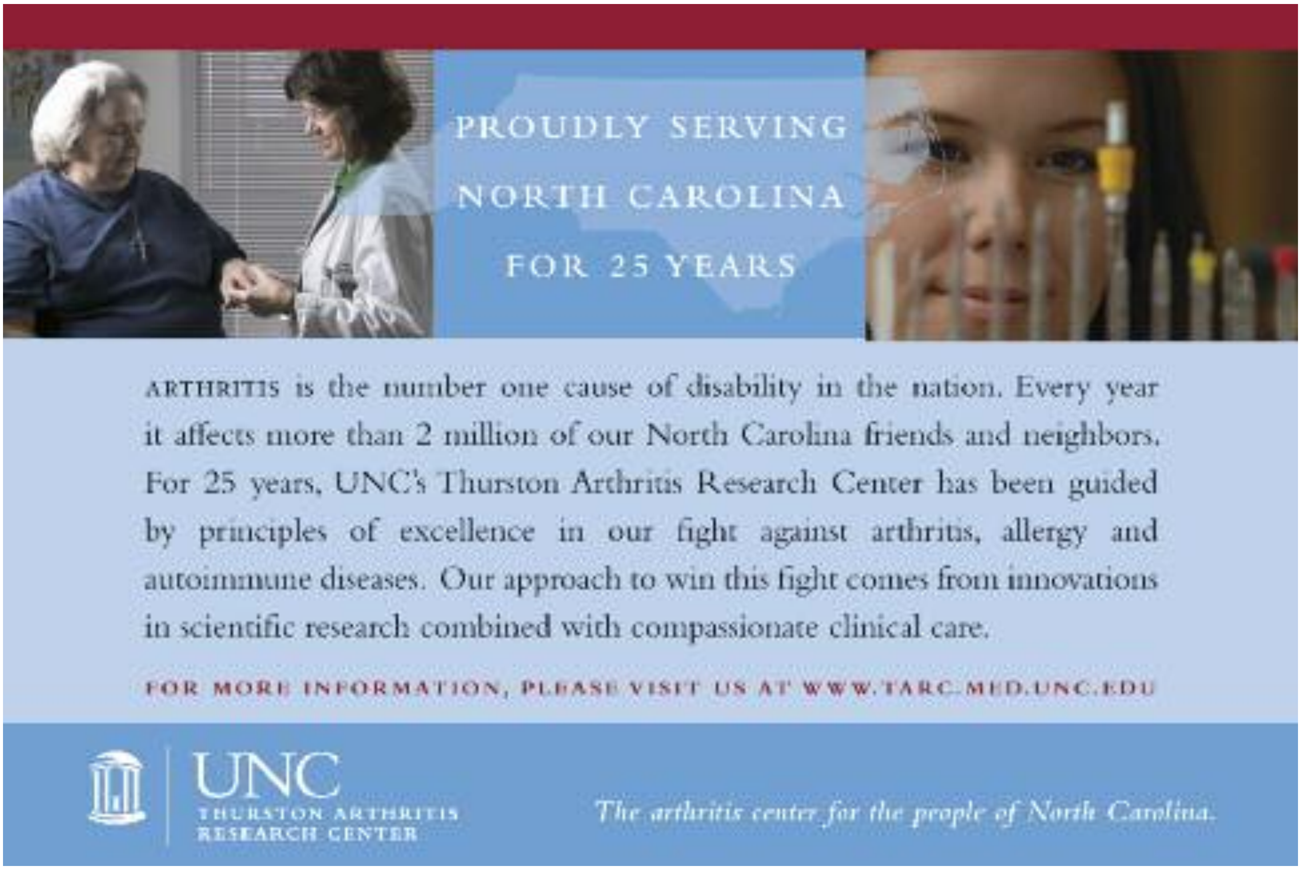
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Tarheel Footprints in Health Care

Recognizing unusual and often unsung contributions of individual citizens who have made health care for North Carolinians more accessible and of higher quality

Recognizing Jean Zoda, BSN, RN

The quote from writer and humorist Leo Rosten, "I cannot believe that the purpose of life is to be happy. I think the purpose of life is to be useful…," could have been attributed to Jean Zoda, registered nurse and arthritis program instructor and advocate. But to those who know her work with the Arthritis Foundation and her advocacy on behalf of people with arthritis, Jean would probably modify the quote to say, "I believe that the purpose of life is to be happy AND to be useful." Jean has found a unique way to blend being useful to others while harvesting joy and good health for herself.

A few years ago Jean found herself 100 pounds overweight, in poor health, and unable to do more than the activities of daily living. Exercise discouraged her because it made her joints sore. Enter the Arthritis Foundation Aquatic Program. Jean decided to give water exercise a try. The water exercise classes helped Jean lose weight, recover her health, and renew her spirit. The instructor was supportive and encouraging and even suggested that Jean train to become a water fitness instructor herself. This ended up giving Jean a new life journey and a new career path.

Because of her own personal journey, her newfound commitment to exercise, and as a testament to the benefits of water exercise, Jean forged ahead with becoming an Arthritis Foundation Aquatic Program instructor. Jean's philosophy from her days of nursing, "seeing the whole person," flows into the classes she teaches. She believes it's important to support the whole person by not only providing the benefits of being in the water and exercising, but by connecting people to support groups, providing resources, and, most of all, having fun. According to Jean, "Water fitness…has to be all about FUN to keep people motivated and coming back."

Jean continues her life journey as she works to become the best instructor she can be. Jean is now a Master Trainer for the Arthritis Foundation Aquatic Program and conducts instructor courses around the state. She has become an instructor for the Arthritis Foundation Exercise Program and is always looking for opportunities to be useful to others. Jean has become an advocate for evidence-based programs for people with arthritis. She wants people to have access to exercise and self-help programs proven to be beneficial for arthritis sufferers so they do not get discouraged by ineffective programs.

Jean continues her usefulness by serving on the NC Arthritis Program Advisory Board and helping to craft the State Arthritis Plan which directs arthritis resources and services for North Carolinians through 2010. Jean also contributed as an aquatic exercise expert and advocate for the UNC TV program HealthWise: Arthritis in July 2006, and her community outreach includes promoting the Triangle Arthritis Walk for 2007. As an Arthritis Foundation volunteer, Jean promotes arthritis programs with a local continuing care retirement community and is a frequent guest speaker at Triangle-area arthritis support groups, school programs, and health fairs. Jean is particularly proud of a tremendously successful Disability Day at an area elementary school where she taught elementary-age children about arthritis and the importance of taking care of their bodies. Jean has also committed to continuing her professional growth as an arthritis advocate by attending arthritis-related conferences and seminars.

Word is getting out about Jean's advocacy and aquatic classes. Many community agencies have contacted her to come and speak. Her expertise in aquatic fitness has now broadened to include being a multiple sclerosis aquatic instructor and American Red Cross lifeguard, lifeguard instructor, and water safety instructor. She is also a member of the Aquatic Exercise Association and is a certified Aquatic Fitness Professional. In addition, she teaches weekly Arthritis Foundation Aquatic exercise classes and works part-time for the NC Arthritis Program providing technical and data support and follow-up with newly trained instructors.

Not everyone has the privilege of combining their passion and their work. Jean is one of the lucky ones. Jean will tell you, "The greatest blessing and reaffirmation of my work comes when a new participant joins my class. For example, one student recently started my arthritis aquatics class saying she couldn't do much. She had tried unsuccessfully with other types of physical activity, suffered with arthritis and fibromyalgia, and had extra weight and other health factors that barely allowed her accomplish the activities of daily living. She heard about the arthritis class at the pool and knew she needed to do something and wondered if this class would help. I just smiled at her, knowing first-hand about her journey and told her that she had come to the right place. And I began my work."

The *North Carolina Medical Journal* is proud to recognize volunteer, advocate, and professional Jean Zoda for her passion, caring, and commitment to citizens in North Carolina living and being physically active with arthritis.

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ARTICLE

Racial/Ethnic Variation in Perceptions of Medical Information Sources in Durham County, North Carolina

Jason E. Williams, MD, MPH; Kevin J. Anstrom, PhD; Joëlle Y. Friedman, MPA; Kevin A. Schulman, MD

Abstract

Background: *Concerns about health and health care disparities have led some groups to promote better communication of medical information as a potential means of empowering patients to overcome barriers to health care and to practice healthy behaviors. We examined the independent effect of race/ethnicity on perceptions of the usefulness of different sources of health information.*

Methods: *We analyzed data from a cross-sectional telephone survey of black, Latino, and white adults (n = 515) in Durham County, North Carolina, in 2002. Respondents rated the usefulness of medical information sources, nonmedical information sources, and media. We used logistic regression to determine the effect of race/ethnicity on ratings of information sources, adjusting for demographic, socioeconomic, and health status factors.*

Results: *Compared to white respondents, Latinos and black respondents were more likely to perceive as useful the local health department, ministers/churches, community centers, television, and radio. Latinos were less likely than white and black respondents to report the pharmacy as a useful source of medical information.*

Limitations: *Some findings may be particular to Durham County, especially those based on the Latino subgroup. Also, the response rate (43%) suggests that nonresponse bias may have affected our results. Finally, perceived usefulness may affect one's intent to act on information but may not correlate with the benefit gained from a particular source.*

Conclusions: *There are substantial racial/ethnic differences in perceptions of certain medical information sources. Medical information designed for minority populations may be more effective if disseminated through particular sources.*

Key Words: *Attitude to health; ethnic groups; health services accessibility; mass media; North Carolina; public opinion; social perception; social support*

Racial/ethnic minorities experience a greater burden of preventable morbidity and mortality and poorer quality of care than white patients in the United States even after controlling for access-related factors.[1-4] Concerns about health and health care disparities have led some groups to promote better communication of medical information as a potential means of empowering patients to overcome barriers to health care and to practice healthy behaviors.[1,3,5] Improved dissemination of medical information may lead to greater demand for and receipt of preventive care and other services; greater awareness and understanding of risk factors, screening tools, and treatments; greater patient and provider satisfaction; and better health outcomes.[3,5-9] Several studies have focused on patient-provider communication, but less is known about patients' attitudes and beliefs about other sources of medical information.[10-13] Because the amount of information, the number of channels employed to disseminate information, and the skills necessary to access information are increasing, enhanced understanding of

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Jason E. Williams, MD, MPH, is a former medical student and research intern at the Center for Clinical and Genetic Economics, Duke Clinical Research Institute, Duke University, Durham, NC, and currently an internal medicine resident at Stanford University.

Kevin J. Anstrom, PhD, is an assistant professor of biostatistics and bioinformatics and a faculty affiliate of the Center for Clinical and Genetic Economics, Duke Clinical Research Institute, Duke University, Durham, NC.

Joëlle Y. Friedman, MPA, is a project leader at the Center for Clinical and Genetic Economics, Duke Clinical Research Institute, Duke University, Durham, NC.

Kevin A. Schulman, MD, is a professor of medicine, the director of the Center for Clinical and Genetic Economics, and an associate director of the Duke Clinical Research Institute, Duke University, Durham, NC. He can be reached at kevin.schulman@duke.edu or PO Box 17969, Durham, NC 27715.

patients' perceptions of information sources is critical.[14-16]

The source of a message and the medium used to deliver the message are key elements of effective communication.[17-19] Furthermore, previous work has suggested there may be race/ethnicity-specific preferences for sources of medical information.[20-26] These studies have suggested that higher proportions of racial/ethnic minorities use medical personnel and electronic media (ie, television and radio) as information sources whereas higher proportions of white persons use print media (ie, newspapers, magazines, and books). Previous studies, however, have some limitations. First, previous studies have investigated the frequency of use of medical information sources but not the usefulness of those sources. Although frequency of use may reflect usefulness, frequency may also be influenced heavily by exposure to information sources. Second, previous studies have evaluated a narrow set of traditional sources of medical information. Given the rapidly increasing use of the Internet as a source of medical information as well as the variety of other information sources such as churches, family, and friends, it is important to analyze responses to these sources. Third, previous studies typically focused on persons with specific medical conditions (usually acquired immunodeficiency syndrome or cancer) and compared only 2 racial/ethnic groups.

If efforts to educate and empower patients are to succeed in helping to eliminate disparities, providers and public health practitioners must consider patients' use and perceptions of various sources of medical information. Minorities' perceptions of information sources are important because they are related to trust. Previous studies have shown connections between race/ethnicity, trust, and interactions in medicine and medical research.[22,27-28] Given new sources of information and recent demographic and health care trends in North Carolina, health practitioners would benefit from studies of medical and nonmedical information sources in a wider spectrum of racial/ethnic groups and asymptomatic individuals. The objective of this study was to investigate independent associations between race/ethnicity and perceptions of the usefulness of various sources of medical information.

Methods

Data for this study are from a cross-sectional, community-based survey designed to assess attitudes, perceptions, and beliefs about access to and quality of health care among black, Latino, and white persons residing in Durham County, North Carolina. The survey contained 40 items addressing a range of issues including personal health, perceptions of various sources of medical information, personal experiences in the health care system, knowledge of racial/ethnic differences in health and health care, and demographic characteristics. Many of the items were adapted from a national survey by the Kaiser Family Foundation.[29] Additional survey items were drawn from the California Health Interview Survey, El Centro Hispano Survey–Proyecto Life, and a literature review.[30-31] We made further modifications after conducting a provider survey (administered through a local independent practice association) and interviewing community leaders. Finally, we conducted interviews with Latino and black community members to assess content validity and to ensure that an exhaustive list of precoded responses was included in the survey. The survey was translated into Spanish and back-translated into English to ensure that the English and Spanish versions were consistent. Due to the survey's length, we split the survey into 3 components (a core survey, a set of questions for split-half sample 1, and a set of questions for split-half sample 2) and asked all participants to complete the core survey and 1 of the split-half set of questions.

Sample

Eligible participants were adults aged 18 years and older residing in Durham County, North Carolina, in households with telephones. The sample was designed to generalize to the Durham County adult population and to allow for analyses stratified by race/ethnicity. Two separate samples were used for all interviews. The first sample was obtained using a standard, list-assisted, random-digit dialing procedure. Active blocks of telephone numbers (area code + exchange + 2-digit block number) that contained 3 or more residential directory listings were selected with probabilities in proportion to the number of listed phone numbers. After selection, 2 more digits were added randomly to complete the number. The resulting numbers were compared with business directories, and matching numbers were removed. Telephone exchanges with greater than average density of black households were oversampled to increase the overall sample of black respondents. For the second sample, to achieve an oversampling of Latino respondents, participants were recruited by random-digit dialing from a list of households with Latino surnames. We selected this approach because Durham has few Latino households.

We used survey weights to adjust for the sample design (ie, oversampling of black and Latino populations) and for any nonresponse bias. Specifically, the survey weights helped to ensure that the study sample resembled the population of Durham County with respect to age, sex, and education level. Additional details of the survey weighting process are available from the authors upon request.

Survey Administration

The telephone interviews were conducted between October 14 and December 16, 2002, in either English or Spanish based on participant preference. A minimum of 15 attempts were made to contact a potential respondent at each sampled telephone number. The interviewers used a standard screening technique used by major policy research organizations and designed to obtain the best distribution of male and female respondents. Interviewers asked to speak to the youngest male at home. If a male was not available, interviewers asked to speak with the oldest female at home. Interviewers contacted 2615 people by phone, and 1415 (54%) agreed to participate. Of the 1415 consenting households, 1175 (83%) met eligibility criteria. Ninety-six percent (1131/1175) of consenting and eligible households completed the survey, either split-half sample 1 or split-half sample 2. The analysis presented here focuses on the

515 participants who responded to split-half sample 1 and identified themselves as black, Latino, or white. The institutional review board of the Duke University Health System approved the study.

Dependent and Independent Measures

The primary outcome of interest was the perception of the usefulness of 12 sources of medical information. Participants were asked, "How useful do you think the following sources are for medical information for yourself?" Possible responses were "very useful," "somewhat useful," "not too useful," "not useful at all." If participants did not use a particular source, they could also choose the responses "don't know" or "refuse to respond." The sources of medical information were medical personnel sources (ie, doctors, nurses, pharmacists, health department personnel), nonmedical sources (ie, ministers and churches, community centers, friends and relatives, libraries), and media (ie, Internet, newspapers and magazines, radio, television).

Self-reported race/ethnicity was the primary independent variable. Participants were asked if they were of Latino descent and then asked to indicate their race (Asian, black, white, or other). Because of small cell sizes, we excluded participants who indicated that their race was Asian or other. In the remaining sample, we coded participants of Latino descent as Latino, and we coded all others as black or white. In addition to race/ethnicity, we collected data on demographic characteristics, socioeconomic characteristics, health status, and health care experience.

Demographic and socioeconomic variables included sex, age, education level, marital status, employment status, financial status, facility with English, and country of origin. Financial status was assessed by asking about participants' current financial situation. Possible responses included "having difficulty paying the bills, no matter what," "enough money to pay the bills, but have to cut back," "enough money to pay bills, but little to spare for extras," "bills are paid and still have enough for extras," and "don't know" or "refused to answer." All participants who were interviewed in Spanish were asked, "If you have to speak in English on the telephone, would you say you can speak in English very well, somewhat well, or not too well?" Country of origin was coded as United States or other.

Health status and health care experiences were assessed by self-reported health (excellent, very good, good, fair, poor), diagnosis of 5 chronic diseases (diabetes mellitus, hypertension, lung disease, heart disease, cancer), type of health insurance, possession of a usual source of care, and time since last physician visit (within the past year, more than 1 year and up to 2 years, more than 2 years and up to 5 years, and more than 5 years).

Statistical Analysis

Weighting was used to adjust for features of the sample design (oversampling of black and Latino populations) and for bias that may have resulted from nonresponse. To determine whether an information source was perceived as useful, the outcome variable was dichotomized. Responses of "very useful" and "somewhat useful" were collapsed into "useful," and responses of "not too useful" and "not useful at all" were collapsed into "not useful." Responses of "don't know" and "refused" were excluded from further analysis due to small cell sizes. We dichotomized age (less than 40 years, 40 years or older), education level (less than high school degree, high school degree or more), marital status (married, other), and employment status (employed, unemployed). We dichotomized financial status as less wealthy (participants reporting difficulty paying bills or those able to pay the bills with cutbacks) and more wealthy (those with "enough for extras" or "little to spare for extras"). We dichotomized health status as more healthy (excellent or very good) and less healthy (good, fair, poor), insurance status as insured (private and Medicare/Medicaid) and uninsured, and time since last physician visit as more recent (within 1 year) and less recent (all responses greater than 1 year).

We then performed univariate analyses to assess differences by race/ethnicity in perceptions of medical information sources. Chi-square tests were used to compare the groups. Next, we performed bivariate analyses to test associations between respondents' race/ethnicity and the perceived usefulness of information sources, calculating unadjusted odds ratios. We also tested for associations between covariates and perceptions of medical information sources.

We then developed multiple logistic regression models to assess the independent association between race/ethnicity and the perceived usefulness of medical information sources. Before conducting multivariate analyses, we assessed collinearity of variables and developed groups of meaningful predictors. We used a sequential modeling approach and arrived at 2 models. The first model included the variables for age, sex, education, marital status, employment status, and financial situation. The second model included the factors above along with perceived health status, insurance status, possession of a usual source of care, and time since last physician visit. Data analysis was performed in STATA (StataCorp, College Station, TX).

Results

Table 1 gives the demographic, socioeconomic, and health characteristics of the survey respondents by race/ethnicity. The sample included roughly equal proportions of black, Latino, and white respondents. The Latino subgroup was younger, had a higher proportion of men, and had less formal education than the black and white subgroups. Most respondents were employed at the time of the interview. The proportion of respondents who reported excellent or very good health was highest for white respondents. The prevalence of chronic conditions was similar among the subgroups. Black and white respondents were more likely than Latinos to have health insurance and a usual source of care.

As shown in Table 2, all subgroups perceived doctors and nurses as useful sources of information. Perceptions of other sources of information varied. For example, black and Latino respondents more often perceived ministers and churches, community centers, and television as useful sources of medical

Table 1.
Characteristics of Survey Respondents by Race/Ethnicity[*]

Characteristic	Race/Ethnicity			*P*
	White (n = 197)	**Black (n = 155)**	**Latino (n = 163)**	
Age, mean (SD), year	45.7 (1.4)	43.3 (1.7)	34.9 (1.4)	< .001
Female	54.2	59.7	42.4	.16
Education				< .001
Less than high school diploma	6.0	25.0	68.9	
High school diploma	19.1	26.4	17.1	
Some college	23.2	27.9	5.9	
College degree	51.7	20.8	7.6	
Married	52.1	29.9	49.0	< .001
Employed	62.8	62.5	71.2	.56
Financial status				< .001
Bills paid, extras	50.0	34.7	9.4	
Bills paid, little extras	34.5	33.8	39.3	
Bills paid, cutbacks	10.2	10.1	24.7	
Difficulty paying bills	3.5	19.3	20.3	
No answer	1.8	2.1	6.3	
Facility with English language[‡]				
Very well			4.3	
Somewhat well			16.4	
Not too well			79.3	
Born in United States	94.9	97.0	4.8	< .001
Self-reported health				< .001
Excellent	26.7	14.8	11.7	
Very good	41.7	30.4	13.5	
Good	22.8	30.4	37.6	
Fair	4.1	21.5	34.1	
Poor	4.7	2.9	3.2	
Diagnosis				
Diabetes mellitus	4.8	13.2	9.0	.03
Hypertension	24.6	30.7	20.7	.31
Lung disease	13.0	16.6	3.3	.10
Heart disease	6.9	6.7	3.5	.59
Cancer	5.7	5.6	0.6	.38
Health insurance status				< .001
Private	75.7	53.6	28.3	
Medicare/Medicaid	15.8	21.0	1.7	
Uninsured	7.7	22.2	69.8	
Uncertain/no answer	0.7	3.2	0.2	
Has usual source of care	90.5	90.9	73.3	.01
Time since last doctor visit				.09
Less than 1 year	82.0	86.1	62.0	
1 to 2 years	8.7	7.8	17.2	
2 to 5 years	4.2	3.5	10.7	
More than 5 years	5.1	2.6	10.1	

* Values are expressed as weighted percentages unless otherwise indicated.

† For some variables, sample size varies due to nonresponse. Total sample size ranged from 511 to 515.

‡ Facility with English was assessed in the 138 respondents who chose to complete the interview in Spanish.

Table 2.
Proportion of Respondents Perceiving Medical Information Sources as "Very Useful" or "Somewhat Useful" by Race/Ethnicity*

Information Source	Race/Ethnicity			*P*
	White (n = 197)	Black (n = 155)	Latino (n = 162)	
Medical Source				
Doctors	95.9	98.8	96.7	.25
Nurses	87.9	95.5	84.9	.04
Pharmacy	88.5	94.8	73.9	.002
Health department	43.6	68.0	88.8	< .001
Nonmedical source				
Minister or church	23.2	63.4	70.1	< .001
Community center	26.8	60.5	86.4	< .001
Friends or relatives	69.9	74.7	77.9	.43
Library	65.8	72.5	76.4	.23
Media				
Internet	66.1	63.8	59.5	.68
Newspapers/magazines	69.1	80.4	68.1	.05
Radio	34.9	62.7	74.8	< .001
Television	52.3	81.4	81.5	< .001

* Values are expressed as weighted percentage unless otherwise indicated.

information, compared to white respondents. Perceptions of print media and the Internet did not vary substantially.

Unadjusted associations between respondent characteristics and perceived usefulness of information sources were also examined. The pharmacy was perceived as useful by respondents who had more education, and the health department was cited as useful by respondents who were younger, less educated, less healthy, and uninsured. The odds of perceiving a minister, church, or community center as a useful source of information were higher for respondents without a high school diploma and those who were less wealthy, less healthy, and uninsured. Radio and television were seen as more useful by respondents who had less education and poorer health and those who were uninsured. Interestingly, respondents with less education and wealth, poorer health, and without insurance found most of these sources (excluding the pharmacy) to be useful as compared to their better educated, wealthier, healthier, and insured counterparts.

As shown in Table 3, controlling for demographic and socioeconomic characteristics and health status, significant differences persisted in the ways Latinos and black respondents perceived the health department, the pharmacy (for Latinos only), ministers and churches, community centers, television, and radio, as compared to white respondents. In most cases, the model controlling for demographic and socioeconomic variables accounted for part of the racial/ethnic difference (data not shown). The model controlling for both demographic and socioeconomic characteristics and health status also did not fully explain the racial/ethnic differences observed in univariate analyses.

Discussion

Although there have been suggestions that we can reduce health disparities by educating and empowering persons from racial/ethnic minority groups, there is little information on the effect of perceptions of the tools used to educate and empower. This study found persistent racial/ethnic variation in perceptions of several sources of medical information. Compared to white respondents, Latinos and black respondents were more likely to rate health departments, ministers, churches, community centers, television, and radio as useful sources. In addition, Latinos were less likely to report pharmacies as useful sources. These differences remained after controlling for demographic, socioeconomic, and health-related factors.

In the literature on race/ethnicity and sources of medical information, most studies have surveyed respondents with specific health conditions and have examined the actual use of information sources rather than perceptions of those sources. Still, these reports have been somewhat consistent with our findings in that they also detected racial/ethnic variations for certain sources of information. Cunningham et al[24] found that black respondents were more likely than white respondents to

Table 3.
Proportion of Respondents Perceiving Medical Information Sources as "Very Useful" or "Somewhat Useful" by Race/Ethnicity[*]

Information Source	Black Respondents			Latino Respondents		
	Unadjusted OR (95% CI)	**Model 1[†]**	**Model 2[‡]**	**Unadjusted OR (95% CI)**	**Model 1[†]**	**Model 2[‡]**
Medical source						
Doctors	3.4 (0.5-23.3)	2.3 (0.2-23.3)	2.1 (0.2-23.7)	1.2 (0.4-4.3)	0.7 (0.2-2.5)	0.4 (0.0-5.4)
Nurses	2.9 (1.0-8.7)	2.6 (0.8-8.7)	2.4 (0.6-8.8)	0.8 (0.4-1.7)	0.5 (0.1-1.5)	0.3 (0.1-1.1)
Pharmacy	2.4 (0.9-6.4)	2.2 (0.8-6.4)	1.9 (0.6-5.6)	0.4 (0.2-0.8)[§]	0.2 (0.1-0.4)[§]	0.1 (0.0-0.3)[§]
Health department	2.8 (1.6-4.7)[§]	2.3 (1.3-4.0)[§]	2.0 (1.1-3.5)[§]	10.3 (5.7-18.4)[§]	5.9 (2.6-13.3)[§]	3.7 (1.4-9.4)[§]
Nonmedical source						
Ministers/churches	5.7 (3.3-9.9)[§]	5.4 (3.0-9.6)[§]	5.0 (2.8-9.1)[§]	7.8 (4.3-14.0)[§]	6.6 (2.8-15.6)[§]	4.7 (1.7-12.6)[§]
Community center	4.2 (2.5-7.1)[§]	3.6 (2.1-6.3)[§]	3.2 (1.8-5.6)[§]	17.4 (9.0-33.3)[§]	9.3 (4.0-21.8)[§]	6.4 (2.4-16.9)[§]
Friends/relatives	1.3 (0.7-2.2)	1.4 (0.8-2.4)	1.3 (0.7-2.3)	1.5 (0.8-3.0)	2.4 (0.8-6.8)	1.7 (0.6-4.8)
Library	1.4 (0.8-2.4)	1.6 (0.9-2.9)	1.4 (0.8-2.8)	1.7 (1.0-3.0)	1.5 (0.7-3.3)	1.1 (0.4-2.7)
Media						
Internet	0.9 (0.5-1.5)	1.1 (0.6-1.9)	1.1 (0.6-2.1)	0.8 (0.4-1.3)	0.7 (0.3-1.7)	0.9 (0.3-2.4)
Newspaper/ magazines	1.8 (1.0-3.3)[§]	2.0 (1.0-4.0)[§]	1.7 (0.9-3.4)	1.0 (0.5-1.7)	1.2 (0.5-2.9)	0.8 (0.3-2.1)
Radio	3.1 (1.9-5.2)[§]	3.4 (2.0-5.9)[§]	3.2 (1.8-5.5)[§]	5.5 (3.2-9.6)[§]	6.4 (3.0-13.7)[§]	4.6 (2.0-10.5)[§]
TV	4.0 (2.3-7.0)§	4.1 (2.3-7.3)[§]	3.9 (2.1-7.2)[§]	4.0 (2.3-7.1)[§]	4.7 (2.0-11.1)[§]	4.0 (1.6-10.7)[§]

* Values are expressed as odds ratio (95% confidence interval). White respondents served as the reference group for both sets of comparisons.
† Model 1 included the variables for age, sex, education, marital status, employment status, and financial situation.
‡ Model 2 included the variables for age, sex, education, marital status, employment status, financial situation, perceived health status, insurance status, possession of a usual source of care, and time since last physician visit.
§ P < .05.
OR indicates odds ratio; and CI, confidence interval.

report using religious organizations, public health agencies, government sources, family, and friends for information about acquired immunodeficiency syndrome. Surveying black and Hispanic respondents, O'Malley et al[21] found variation in the use of health providers and radio as sources of information. Nicholson et al[25] found differences between white and black women in the use of print news media, computer-based resources, and health policy organizations. Other studies dealing with individuals' perceptions of sources of medication information for human immunodeficiency virus, cigarette smoking messages, and cancer treatment have also found racial/ethnic differences.[20,22,26]

Although some of our findings are similar to those of previous studies, the present study offers a number of contributions in this area. First, instead of using frequency of use as a measure of usefulness, we asked about the usefulness of the information sources directly. This allowed us to measure individuals' attitudes toward the sources. Second, we were able to measure an independent effect of race/ethnicity by controlling for demographic, socioeconomic, and health-related factors. Third, our study examined a broader spectrum of individuals and types of information than have other studies. We compared individuals from 3 racial/ethnic groups with different health status and asked about medical information in general rather than about information on one particular disease or health issue. Fourth, we included a wide range of information sources including some newer sources of medical information.

This study has some limitations that may affect the generalizability of the results. First, the study design sought to create a sample that was representative of one county's population rather than of the United States. Thus, some response patterns may be particular to Durham County. Conclusions based on the Latino subgroup are particularly vulnerable to this limitation. The arrival of large numbers of Latinos to Durham County is a relatively recent trend.[32] Ninety-five percent of Latinos in this study were born outside of the United States, compared to 49% in the national study by the Kaiser Family Foundation.[29] Due to recent "hypergrowth" in the Latino population in Durham County, there may not be an adequate supply of culturally and linguistically appropriate resources. In addition, Durham's

Latinos may be less acculturated than Latinos in other areas. Second, we tried to reduce confounding by controlling for demographic, socioeconomic, and health-related factors, but these factors are complex and some residual confounding certainly remained. For example, previous research has suggested that the correlation between self-reported health status and health indicators is less valid in Latino populations.[33] Third, although the response rate in this study was within the range of similar surveys of this type, the response rate increases the likelihood of some degree of bias in the results.[34] We attempted to correct for nonresponse bias by assigning weights to key demographic variables to arrive at a sample that more closely resembled Durham County's population. Finally, perceived usefulness may affect one's intention to act on information but may not always be correlated with the actual benefit gained from a particular source.

Using cross-sectional survey data, we found racial/ethnic differences in perceptions of the usefulness of various sources of medical information. Health professionals have struggled to construct high-quality informational messages that reach minorities, augment their health knowledge base, and alter their behaviors. When constructing messages designed for minorities, health professionals have begun to realize they should consider race/ethnicity when creating the format and content of the message. The present study suggests that race/ethnicity should also be considered when selecting the source that will be used to disseminate the message. Sources deemed useful by minorities should be used to spread messages that are particularly relevant to these groups. As an example, health practitioners seeking to reach minorities might consider forming new or stronger partnerships with churches and ministers because both black and Latino respondents seem receptive to health messages from these nontraditional sources of medical information. Health practitioners might also consider increasing the use of media to deliver health messages because these also seem to be trusted sources in some minority communities.

The subject of race/ethnicity and the transmission of medical information is a fertile area for further investigation that has received little previous attention. In our study we found racial/ethnic differences in perceptions of sources of medical information. Future studies should investigate the types of messages received and how these messages are integrated into health behaviors and beliefs about health care services. **NCMJ**

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ARTICLE

Emergency Contraception for Sexual Assault Victims in North Carolina Emergency Departments

Amy Tucker Woodell, MPH; James Michael Bowling, PhD, MA; Kathryn E. Moracco, PhD, MPH; Melissa L. Reed, MA

Abstract

Introduction: *One in 5 women is a victim of sexual assault. This study examines the administration of emergency contraception to victims of sexual assault in North Carolina hospital emergency departments.*

Methods: *One hundred seventeen surveys were mailed to hospital emergency departments across the state to determine their emergency contraception practices for victims of sexual assault. The survey contained 11 questions about emergency contraception practices for victims.*

Results: *Of the 117 surveys, 103 were returned revealing that just over 50% of the hospitals in North Carolina treated victims with emergency contraception without exception. Both dispensing emergency contraception and providing information about emergency contraception were significantly associated with having a sexual assault nurse examiner program.*

Conclusion: *Results from this study demonstrate inconsistent provision of emergency contraception to victims of sexual assault; however, there is greater consistency of emergency contraception use by emergency departments using sexual assault nurse examiners.*

Grants: *None*

Keywords: *Contraception, postcoital; emergency nursing; rape*

Pregnancy resulting from sexual assault is a traumatic experience, but it is preventable with emergency contraception, a high dose oral contraceptive that prevents pregnancy if taken within 120 hours after intercourse, often referred to as the "morning-after pill." Emergency contraception cannot harm or terminate an established pregnancy.

Previous research has shown that hospitals do not consistently provide emergency contraception to victims of sexual assault.[1-5] One study of emergency physicians found 8.4% would not prescribe emergency contraception to sexual assault victims.[1] A 2002 national study of Catholic and non-Catholic hospitals by Harrison found that emergency contraception was not available at 55% of Catholic hospitals and 42% of non-Catholic hospitals.[6] A report by Patel et al[7] found that 55% of Pennsylvania hospitals had emergency contraception available onsite, and 37% offered both counseling for and provision of emergency contraception. Eighty-five percent of the 201 responding hospitals in a NY survey said it is their standard policy to dispense emergency contraception immediately, onsite, to all rape victims who choose it after having been counseled.[8]

Nationally, 1 in 5 women reports being sexually assaulted at some point in her life.[9] Timely provision of emergency contraception prevents the additional psychological and physical trauma an unwanted pregnancy may cause a victim of sexual assault. Five percent of rapes result in pregnancy.[10] This translates to 25 000 rape-related pregnancies each year in the United States, 22 000 of which could be prevented with emergency contraception.[11]

Accordingly, several medical professional organizations, including the American College of Obstetricians and

Amy Tucker Woodell, MPH, is the statewide organizer of NARAL Pro-Choice North Carolina. She can be reached at awoodell@ProChoiceNorthCarolina.org or 514 Daniels Street, #142, Raleigh, NC 27605.

James Michael Bowling, PhD, MA, is a research associate professor in the Department of Health Behavior Health Education, School of Public Health, University of North Carolina at Chapel Hill.

Kathryn E. Moracco, PhD, MPH, is a research scientist at the Chapel Hill Center of the Pacific Institute for Research and Evaluation. She is adjunct associate professor in the Department of Maternal and Child Health and adjunct assistant professor in the Department of Health Behavior and Health Education at the University of North Carolina at Chapel Hill.

Melissa L. Reed, MA, is executive director for NARAL Pro-Choice North Carolina.

Gynecologists,[12] the American College of Emergency Physicians,[13] and the American Medical Association,[14] have recommended that pregnancy prophylaxis, such as emergency contraception, be provided to victims of sexual assault.

Across the state, there are hospitals with sexual assault nurse examiners who are specially trained to provide care to patients who have been sexually assaulted including offering emergency contraception and collecting forensic evidence. Fifty-one percent of North Carolina hospitals have a sexual assault nurse examiner program.

In 2004, the North Carolina Coalition Against Sexual Assault, Planned Parenthood of Central North Carolina, and NARAL Pro-Choice North Carolina, under the umbrella organization of North Carolina Women United, investigated whether emergency contraception was available to sexual assault victims in emergency departments. The purpose of this exploratory study was to present point estimates of emergency contraception use across North Carolina hospitals and then to examine variation in use of emergency contraception by hospital characteristics.

METHODS

Study Design

Self-administered questionnaires were mailed to North Carolina hospitals with emergency departments. The 11-question self-administered questionnaire addressed emergency department policies for dispensing emergency contraception to sexual assault victims and giving referrals to sexual assault victims. Further, hospital representatives were asked, "Is it standard policy for the hospital to dispense emergency contraception onsite to sexual assault survivors?" Participants who responded affirmatively were classified as having an emergency contraception policy.

We also assessed the presence or absence of a refusal clause, or "conscience clause," in the questionnaire. Responders that dispensed emergency contraception were asked, "Are there any exceptions to your policy based on the refusal of the provider on duty to dispense medication?" If hospitals did not provide emergency contraception or there were exceptions to their policy, they were asked if they provide prescriptions for emergency contraception or referrals to other providers.

Hospitals were also asked if they had a sexual assault nurse examiner program. Sexual Assault Nurse Examiners are defined by the North Carolina Coalition Against Sexual Assault as "specially trained Registered Nurses who perform a comprehensive evaluation and assessment, collect high quality evidence, and provide expert testimony in cases of sexual assault." Developing a sexual assault nurse examiner program was not considered as having a program because there is not automatic intervention. In addition, emergency departments were asked if these nurses are available 24 hours a day, seven days a week.

Other data collected included the title of the staff person who completed the questionnaire, hospital name, number of sexual assault victims treated per year in the emergency department, and other questions regarding emergency department practices for the treatment of sexual assault victims.

Hospital size was dichotomized according to bed number based on the median of 143 beds. Hospitals were classified as being located in a metropolitan area, micropolitan area, or neither according to the US Office of Management and Budget definitions of 2003. A metropolitan area has at least one urbanized area of at least 50 000 people, a micropolitan has an urban center of 10 000-49 999 people, and unclassified counties have towns with fewer than 10 000 people.[15] Metropolitan area is referred to as a large population and the micropolitan and "neither" areas were collapsed into one category for statistical analysis and referred to as a small population. Open-ended answers, such as title of hospital responder, were grouped and coded. Answers for "check all that apply" questions were each coded individually as checked or not checked.

Setting and Selection of Participants

Sample and setting were drawn from The North Carolina Hospital Association membership directory excluding hospitals without an emergency department, specialty hospitals, or psychiatric hospitals. Military hospitals (n=4), which are not NC Hospital Association members, were also included in the survey due to a particular interest in the policies of North Carolina military facilities by the survey sponsors. Hospitals were also excluded from the sample if they reported that they routinely transferred sexual assault victims to another emergency department (n=2).

Fifteen nonmember hospitals were not surveyed due to a lack of identifying information for these hospitals. Five of these nonsurveyed hospitals were specialty hospitals, and two others did not have emergency departments, leaving a possible 8 missed hospitals (2 with emergency departments, 6 unknown). Two questionnaires received from emergency departments belonging to hospital systems with one shared policy for the treatment of sexual assault victims were duplicated as representative responses for each of those emergency departments within those hospital systems. In all, we collected data from 117 eligible North Carolina hospital emergency departments. The NC Hospital Association directory data contained the names of hospital administrators, bed numbers, hospital ownership, and county location.

Methods of Measurement

We used data from the Emergency Care for Sexual Assault Survivors Survey collected in late 2004 and early 2005 by North Carolina Women United and the North Carolina Coalition Against Sexual Assault as well as supplemental information retrieved from the 2004 North Carolina Hospital Association Membership Directory.[16] The University of North Carolina at Chapel Hill's Office of Human Research Ethics Public Health Institutional Review Board (IRB) reviewed the application to complete a secondary analysis and determined that it was exempt from IRB governance.

The above mentioned questionnaire, Emergency Care for Sexual Assault Survivors Survey, was developed by the survey sponsors in consultation with Family Planning Advocates of New York state and pretested with 2 hospital individuals

Table 1.
Hospital Policies and Services for Victims of Sexual Assault (n=103)

Hospital	**N**	**%**
Standard policy to dispense emergency contraception onsite without exception	55	53
Standard policy to dispense emergency contraception with exceptions	9	9
Standard policy to dispense with unknown exceptions*	12	12
Not standard policy to dispense emergency contraception	27	26
Hospital Services	**N**	**%**
Have sexual assault nurse examiner coordinator**	52	51
Have sexual assault nurse examiner coordinator available at all times***	28	56

* Due to missing responses to exception question

** Sample size of 102 for this question due to 1 missing response

*** Sample size of 50 for this question due to 2 missing responses

familiar with emergency department policies for sexual assault victims and 2 researchers with survey expertise. A questionnaire with a cover letter from the survey sponsors was mailed to each hospital's chief executive officer, director of nursing, hospital attorney, and medical director of the emergency department. These 4 positions were sent questionnaires to replicate the protocol from the New York survey of emergency departments.[7] Up to 3 calls were made to nonresponders and questionnaires were faxed to nonresponding hospital emergency departments. At the end of the questionnaire, participants could request that a listing of local rape crisis centers and sexual assault nurse examiners, a sexual assault and health care fact sheet, and a fact sheet about emergency contraception in the emergency department be sent to them.

After the data were collected and compiled, data entry was crosschecked with the original questionnaires for accuracy. When more than one questionnaire was received from a hospital (n=12), the questionnaire completed by the higher-ranking staff member (n=6) or the questionnaire filled out more completely was included in the sample (n=6). Comments written in the margins of each questionnaire were used for clarification of responses. Follow-up phone calls were made to allow hospitals to confirm their answers when inconsistencies were found for specific questions of interest. When these attempts to contact hospitals were successful, this resulted in modifications to original questionnaire responses to reflect the most accurate information.

Data Analysis

Data were analyzed using SAS System for Windows Version 8 (SAS Institute Inc, Cary, NC), and frequencies and chi-square analyses were performed.

RESULTS

One hundred three hospitals responded to the survey for a response rate of 88%. More than half of these hospitals are privately owned. The number of beds in each hospital ranged from 6 to 989 with a median of 143 beds. Various staff from hospital emergency departments completed the questionnaires including directors of emergency departments, nurse managers and directors of nursing, registered nurses, sexual assault nurse examiner coordinators, sexual assault nurse examiners, clinical directors, medical directors of the emergency department, and emergency department managers.

The majority of hospitals reported treating 50 or fewer sexual assault patients each year; one hospital reported treating more than 200. Eighty-three percent of hospitals report that it is standard policy to provide information about emergency contraception to sexual assault victims. Seventy-four percent of hospitals dispense emergency contraception onsite to sexual assault victims as standard policy, but 9 of these allow exceptions based on the refusal of the physician on duty and 12 did not answer the exception question. This leaves 53% of hospitals dispensing emergency contraception onsite without exception. (See Table 1.) Seventy percent of hospitals report that emergency contraception is available 24 hours a day. Of the 27 hospitals for which it is not standard policy to dispense emergency contraception, 63% provide prescriptions and 60% refer to another provider. Eighty-nine percent of hospitals refer all sexual assault victims for follow-up counseling, and 88% reported referring specifically to a rape crisis center. Sexual assault nurse examiner programs are established at half of the hospitals, and more than half of these are available 24 hours a day, seven days a week. (See Table 1.) Hospitals with a sexual assault nurse examiner program are significantly more likely to provide information about emergency contraception (92% vs 72%; $p<0.05$) and to dispense emergency contraception (77% vs 46%; $p<0.05$) (see Table 2).

A significant association was also found between a hospital dispensing emergency contraception and its location in an area with a small population versus a large population. Hospitals in areas with small populations are less likely to have a standard policy to dispense emergency contraception compared with hospitals located in large population areas (45% small vs 74% large population hospitals; $p<0.05$). (See Table 2.) Hospitals located in small population areas were less likely than those in large population areas to have a standard policy to provide information about emergency contraception (78.6% vs 86.3%). This association, however, was not significant ($p>0.05$).

Hospitals in large population areas were more likely to have sexual assault nurse examiner programs. In areas with large

Table 2.
Relationship Between Hospital Emergency Contraception Policy and Presence of Sexual Assault Nurse Examiner Program and Population Size (n=91)

Hospital Characteristic	Hospitals with a policy to dispense emergency contraception	Hospitals that allow exceptions	Hospitals that do not dispense
Sexual assault nurse examiner program*			
Yes, No. (%), n=43	33 (77)	4 (9)	6 (14)
No, No. (%), n=48	22 (46)	5 (10)	21 (44)
Population Size*			
Small, No. (%), n=44	20 (45)	5 (11)	19 (43)
Large, No. (%), n=47	35 (74)	4 (9)	8 (17)

* p-value < 0.05 based upon chi-square test of association between emergency contraceptive policy and hospital characteristic

populations, 60.8% of hospitals have sexual assault nurse examiners, and in areas with small populations, 41% have sexual assault nurse examiners (p=0.05).

Limitations

There were several limitations to this study. One potential limitation is that not all hospitals with emergency departments were included; 19 hospitals were not NC Hospital Association members at the time of this survey. However, at most, only 8 of these could have been eligible for this study, which would have resulted in a response rate of 82%. Of the hospitals that did respond, there were several cases in which data were missing due to incomplete data. Item nonresponse occurred on questions regarding how many sexual assault survivors were served (n=1), whether or not the hospital allows exception to their policy to provide emergency contraception based upon the provider on duty (n=12), the availability of emergency contraception 24 hours a day (n=11), the presence/absence of a sexual assault nurse examiner program (n=1), and availability of a sexual assault nurse examiner program 24 hours a day (n=2). However, the strength of the survey was the overall high response rate.

Questionnaires were not anonymous; therefore, responders may have been influenced to answer questions in ways they deemed to be more socially acceptable to the survey sponsors, particularly the North Carolina Coalition Against Sexual Assault. However, survey questions focused on hospital policies and services, not on personal attitudes or behaviors; therefore, the level of social acceptability bias influencing survey responses should be minimal. Personal bias or interpretation poses another question about reliability and validity of the instrument as well as the study.

Different hospital staff members responded to the survey, which may affect the comparability of responses. However, because the information requested was on hospital policy, respondents' differing positions should not have greatly influenced variability in responses. The method of follow-up phone calls introduces the possibility of a mixed-mode effect to responses, as the original survey was a written questionnaire.[17]

CONCLUSION

In North Carolina, a little more than half of hospitals dispense emergency contraception without exception. Both dispensing emergency contraception and providing information about emergency contraception were significantly associated with having a sexual assault nurse examiner. Almost all hospitals that operate emergency rooms offer information on emergency contraception to victims of sexual assault, and most refer victims to some form of counseling. In addition, hospitals in metropolitan areas were also more likely to dispense emergency contraception.

Our findings indicate that timely access to emergency contraception may be limited by hospital policy and practices. For example, it is of concern that in the one-quarter of hospitals that did not dispense emergency contraception onsite, one-half provided either a referral to another provider or a prescription, measures that are not considered adequate alternatives to dispensing onsite, particularly for a time-sensitive treatment such as emergency contraception. Previous research by Harrison[6] found most referrals provided by hospitals that did not provide emergency contraception were ineffective. Furthermore, in this study, 14% of the hospitals that dispense emergency contraception had exceptions based on the preference of the physician on duty, which could also limit timely access to emergency contraception.

This study's results indicate that emergency departments should (a) change hospital policies to meet the needs of the victim rather than the preference of the provider by creating standing orders so that emergency contraception can be provided regardless of the physician on duty and (b) institute sexual assault nurse examiner program affiliation or training to ensure that treatment for sexual assault includes pregnancy prevention prophylaxis. Hospitals, particularly those in rural areas, would benefit from having sexual assault nurse examiners, preferably available 24 hours a day, to ensure that sexual assault victims receive the optimal complement of services.

Several states have taken legislative action to ensure the provision of emergency contraception for sexual assault victims. As of October 2006 11 states[a] required emergency departments to provide emergency contraception-related services or information to sexual assault survivors. Two bills introduced during the 2007-2008 NC General Assembly session (House Bill 961 and NC Senate Bill 968) would require North Carolina hospitals to provide emergency contraception onsite to sexual assault victims in emergency departments. However, measures must be taken to guarantee that any policies and legislation put into place are adhered to and fully implemented. **NCMJ**

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[a] States requiring emergency departments to provide emergency contraception-related services or information to sexual assault survivors as of October 2006 include California, Illinois, Massachusetts, New Jersey, New Mexico, New York, Ohio, Oregon, South Carolina, Texas, and Washington.

ARTICLE

Perceived Barriers to Physical Activity Among North Carolinians With Arthritis:

Findings From a Mixed-Methodology Approach

Kathryn Remmes Martin, MPH; Britta Schoster, MPH; Jack H. Shreffler, PhD; Andrea Meier, PhD; Leigh F. Callahan, PhD

Abstract

Background: *A goal of the North Carolina Arthritis Plan is to reduce arthritis burden through regular physical activity. We identified community and personal factors that influence physical activity in individuals with arthritis.*

Methods: *In 2004 and 2005, 2479 individuals (53% self-reported arthritis) from 22 North Carolina communities completed a telephone survey (59.5% response rate) assessing health status, neighborhood characteristics, health attitudes, and demographic variables. Qualitative discussions (N=32) were conducted to further examine understanding of community and health and were enhanced with photographs.*

Analysis: *Descriptive analyses were conducted. A 2-sided binomial test (for each reason given for not being physically active) was used to test for significance between individuals with arthritis and the general population, using a Bonferroni test for multiple comparisons. Interviews and photographs were analyzed using qualitative software ATLAS.ti Version 5.0.*

Results: *Quantitative results show similar community-level reasons for physical inactivity (rural environment, heavy traffic, and lack of sidewalks) despite arthritis status. Yet personal reasons differed as individuals with arthritis more often cited physical inability and illness. In qualitative discussions, walking surfaces emerged as a primary barrier for those with arthritis.*

Limitations: *Findings from this exploratory study may have limited generalization and warrant further study.*

Conclusions: *The built environment and personal barriers should be considered when examining physical activity in individuals with arthritis.*

Key words: *Physical activity, community, neighborhood, perceived barriers, mixed-methodology, focus groups.*

Currently 27% or 1.75 million North Carolinians report some form of arthritis.[1,2] Estimates suggest that over 46.4 million adults in the United States (21.6%) report doctor-diagnosed arthritis,[3] with an estimated financial burden of $128 billon in 2003.[4] Additionally, about 19 million Americans (8.8%) have activity limitations caused by their arthritis,[3] and in 2005 activity limitations due to arthritis affected approximately 11% of adults in North Carolina.[2] Arthritis is the most frequently cited chronic condition for limiting activity among working-age and older adults.[5]

Both Healthy People 2010 and the North Carolina Arthritis Plan 2007-2010 set goals of increasing the amount of physical activity for the general population and for individuals with arthritis so as to decrease risk of chronic disease and increase both mental and physical benefits.[2,6] People with arthritis are encouraged to engage in regular physical activity to gain benefits of prolonged and increased function, increased mobility, flexibility, and decreased pain.[7-10] Yet recent studies have found that physical inactivity levels range from 24% to 39% in adults with arthritis.[11-15] These high rates of physical inactivity may

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Kathryn Remmes Martin, MPH, is a doctoral candidate in the Department of Health Behavior and Health Education, School of Public Health, a research assistant at the Thurston Arthritis Research Center, and a fellow in the Carolina Program on Health and Aging Research at the Institute on Aging, the University of North Carolina at Chapel Hill.

Britta Schoster, MPH, is a research associate at the Thurston Arthritis Research Center, the University of North Carolina at Chapel Hill.

Jack H. Shreffler, PhD, is a statistician at the Thurston Arthritis Research Center, the University of North Carolina at Chapel Hill.

Andrea Meier, PhD, is a research associate professor at the University of North Carolina at Chapel Hill School of Social Work.

Leigh F. Callahan, PhD, is an associate professor of medicine, orthopedics, and social medicine at the Thurston Arthritis Research Center, the University of North Carolina at Chapel Hill. She can be reached at leigh_callahan@med.unc.edu or 3300 Thurston Building, CB 7280, Chapel Hill, NC 27599.

demonstrate the complexity of a behavior that is influenced not only by individual beliefs and perceptions of personal barriers but also by the built and social environments.

Public health researchers linked the environment to health and health outcomes long ago.[16-21] Recent research has focused on identifying and measuring characteristics of the built environment that influence physical activity levels using both subjective[22-26] and objective[27-29] methods. One review focused on the built environment found that access to facilities, availability of physical activity options, crime and safety, weather, and aesthetics were most often associated with physical activity in adults.[30] Few studies have examined the role of the built environment on physical activity in individuals with arthritis. However, known barriers to physical activity in individuals with arthritis are financial cost and lack of access to exercise facilities,[15] no transportation, lack of programs, and poor environmental conditions (eg, weather, congested parking, concrete surfaces, presence of dogs, lack of sidewalks).[31]

The aims of this study are twofold: (1) to understand the difference between people with and without arthritis when examining the perception of community built environment's influence upon physical activity; and (2) to identify the issues related to the built environment that are influential to the physical activity levels of individuals with arthritis. This study uses mixed methodology to evaluate both quantitative and qualitative data related to physical activity. Data were obtained through telephone surveys about general health and well-being and qualitative discussions.

METHODS

Participants and Data Collection

A cohort of 6700 participants were recruited from the NC Family Medicine Research Network.[32] The NC Family Medicine Research Network is a practice-based patient cohort for primary care research that was established in 2001 and enriched in 2004 and 2005. It currently consists of 25 practice sites. All consecutive patients (for 20 working days) seeking care at a North Carolina Family Medicine Research Network site were informed of the North Carolina Health Project. Eligible participants were those aged 18 years and older who spoke English or Spanish fluently. All study components were approved by the Medical Institutional Review Board of the University of North Carolina at Chapel Hill and all participants gave oral consent. Data sources are depicted in Figure 1.

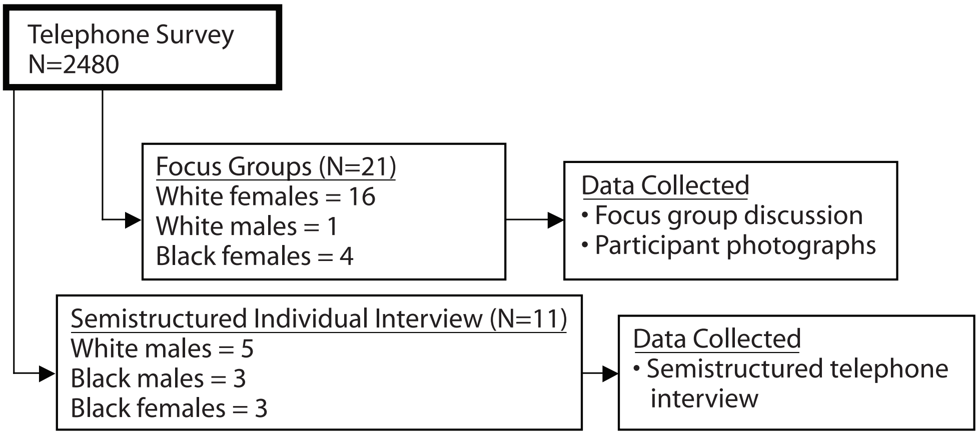
Telephone Survey

Recruitment. Of the 6700 NC Family Medicine Research Network participants enrolled in 2001 and 2004, 4442 gave consent for follow-up. Participants meeting eligibility criteria (current address, telephone number, and the ability to speak English fluently) were initially mailed an introductory letter and later telephoned. A total of 277 individuals were ineligible because they lived outside the US, had no telephone, had a language barrier, were medically unable, were active military, were incarcerated, or had died. The telephone survey was completed by 2479 individuals, 59.5% of eligible participants. The 30-minute survey contained open- and close-ended questions assessing health status, chronic health conditions, community and neighborhood characteristics, health attitudes and beliefs, and demographics.

Measures. For this study, demographic measures, comorbid conditions, body mass index (BMI), community characteristics, and reasons for physical inactivity were analyzed. We calculated age using date of birth and date of the telephone interview. Education was recorded as highest grade of school completed and converted to 5 categories: less than high school, high school degree, some college, college degree, and postgraduate. Race and ethnicity data were categorized as non-Hispanic white, non-Hispanic black, and other. Participants were asked if they had ever seen a health professional for 18 different chronic conditions. The number of comorbid conditions is a sum of all self-reported comorbid conditions including arthritis. Arthritis status was determined according to the Behavioral Risk Factor Surveillance System definition of self-reported doctor diagnosis of arthritis.[33,34] For the purpose of this study, anyone self-reporting any type of doctor-diagnosed arthritis (eg, osteoarthritis, gout, rheumatoid arthritis, fibromyalgia) was included as having arthritis. Body mass index (BMI) was calculated from self-reported height and weight using the US Customary System to Metric (BMI=kg/m^2).

Questions regarding community and personal reasons for physical inactivity came from the 2000 Behavioral Risk Factor Surveillance System Questionnaire. Participants were asked in an

Figure 1.
Data Collection Framework, North Carolina, 2004-2005.



open-ended question to list up to 3 things in their community or neighborhood that kept them from being more physically active. Participants were then asked, "Do you have access to places to be physically active?" with 4 response options.[35] Several questions assessed their perception of safety from crime and the presence of neighborhood characteristics such as sidewalks, walking/jogging/biking trails, heavy traffic, street lights, and unattended dogs.[36]

Focus Groups

Focus groups were conducted to enrich the quantitative telephone survey data by further examining community influences on health.

Recruitment. We recruited participants who had completed a telephone survey from 6 of the 25 sites specifically chosen for geographic and demographic diversity. They were contacted first by letter and then followed up with telephone invitations.

Photograph Component. To prepare for the focus groups, we asked participants to take pictures of objects and scenes in their communities that—on a typical day—either helped or hindered their health. The pictures were used to stimulate discussions of different aspects of community and health. We mailed participants a package containing a disposable camera and camera use instructions. Taking photographs was encouraged but not required for participation.

Conducting the Focus Group. Seven focus groups were held in the southeast, central, and western parts of North Carolina in urban and rural communities with 21 total participants (Range: 2-5 participants per group; average 3). Focus groups lasting 1.5 hours met at well-known community buildings (eg, senior centers, libraries) and were cofacilitated by 2 trained leaders with digital audio-recordings and hand transcription conducted at each session.

Participants were asked to describe their community and neighborhood and then discuss those community factors that they believed influenced their health. They were specifically probed on 7 topics: community connectedness, crime/safety, eating habits, environment, occupation, physical activity, and services/resources available in their community.

Focus group leaders invited participants to share their photographs if the participants believed the picture represented the topic being discussed. Participants received $20 for their participation.

Semistructured Individual Interviews

Recruitment. Because our focus groups were small and composed mostly of white women, we purposefully recruited an additional 11 individuals who were demographically underrepresented (3 black men, 3 black women, and 5 white men) in order to incorporate their perceptions into our qualitative findings. Semistructured interview participants were recruited from the same contact list we used for recruiting focus group members. Prospective interviewees were contacted consecutively by telephone and invited to participate in a semistructured individual (telephone) interview. Study staff described the interview process, discussion topic, and the $20 incentive. Interviews lasted an average of 30 minutes. As with the focus groups, participants were queried on 7 community factors and their relation to health.

Data Analyses

Telephone Survey. Demographic variables for participants with and without arthritis were examined for differences using Pearson chi-square and t-statistics for dichotomous and continuous variables, respectively. (See Table 1.) Descriptive analyses were conducted on community resource variables and key community and personal reasons for not being more physically active. Frequencies were used to numerically rank the community and personal reasons listed by respondents for not being physically active and Bonferroni tests for multiple comparisons were conducted. For a particular reason for not being physically active, a binomial test was used to see if a significant difference existed between the proportions reporting the reason in the general population and those reporting the reason in the arthritis subgroup.

Qualitative Interviews. The focus groups and semistructured individual interviews were transcribed verbatim, and transcripts were uploaded into ATLAS.ti Version 5.0. The questions asked at both the focus groups and semistructured individual interviews served as a basis for the development and definition of codes representative of converging themes. Calibration coding was conducted by independently coding 2 transcripts and comparing results to ensure interrater reliability. Any discrepancies were discussed by 2 coders with a third party brought in for resolution when needed. Transcripts from the focus groups and the semistructured individual interviews were first read independent of each other, and it was determined that there were no major thematic differences in content. Therefore, focus group and semistructured individual interviews were analyzed together and were examined for common themes within and across interviews. The constant comparison method[37] was used to identify other emerging themes, with all transcripts being reread to ensure consistent coding of the emerging themes. In addition, subanalyses were conducted by theme to examine whether differences existed by arthritis status.

RESULTS

The characteristics of the telephone survey sample and the qualitative participants are presented in Table 1 by arthritis status. Telephone survey participants with arthritis significantly differed from participants without arthritis in that they were generally older, had more chronic comorbid diseases, and had a higher body mass index. (See Table 1.) Those with arthritis also had significantly less education and lower income levels. Among the qualitative participants, only the number of chronic comorbid conditions significantly differed by arthritis status.

Telephone Survey. The response frequencies of both community and personal reasons for not being more physically active are ranked for the total group as well as for those with and without arthritis. (See Table 2.) Many participants (n=1749) responded that there was no community reason that

Table 1.
Demographic Characteristics of Study Participants, North Carolina, 2004-2005

		Telephone Survey Participants (N=2479)			Qualitative Participants (N=32)		
	Total Mean (SD, N)	Arthritis Mean (SD, N)	Nonarthritis Mean (SD, N)	p-value	Arthritis Mean (SD, N)	Nonarthritis Mean (SD, N)	p-value
Age (years)	52.8 (15.3, 2454)	57.0 (13.9, 1292)	48.1 (15.4, 1145)	p<0.001	58.8 (11.6, 19)	51.8 (16.0, 13)	p=0.162
Body Mass Index (BMI)	29.4 (7.1, 2349)	30.4 (7.4, 1246)	28.3 (6.6, 1086)	p<0.001	31.2 (8.1, 19)	31.3 (7.7, 13)	p=0.969
Mean # of Comorbid Conditions	3 (2.2, 2479)	4 (2.1, 1307)	2 (1.6, 1154)	p<0.001	4 (1.6, 19)	2 (1.2, 13)	p=0.004
	% (N)	% Arthritis (N)	% Nonarthritis (N)	p-value	% Arthritis (N)	% Nonarthritis (N)	p-value
Female	52.8 (15.3, 2454)	57.0 (13.9, 1292)	48.1 (15.4, 1145)	p<0.001	58.8 (11.6, 19)	51.8 (16.0, 13)	p=0.162
Non-Hispanic White	75.4 (1838)	75.0 (967)	75.7 (858)	p=0.346	68.4 (13)	61.5 (8)	p=0.937
High School Degree and Above	86.7 (2127)	82.1 (1058)	92.1 (1055)	p<0.001	84.2 (19)	92.3 (13)	p=0.512
<$45 000 Annual Household Income	60.5 (1359)	66.9 (796)	53.2 (554)	p<0.001	83.3 (15)	66.7 (8)	p=0.306
Currently Married	62.6 (1538)	61.2 (791)	64.3 (737)	p=0.117	68.4 (13)	53.9 (7)	p=0.419

* N varies due to missing data

kept them from being more physically active. These participants more often cited personal reasons such as being ill, not having enough time, being too tired or being lazy as reasons for not being more physically active. The top 4 most frequently listed community reasons for participants with and without arthritis were not enough sidewalks, a rural environment, not enough recreational facilities, and unattended dogs. Two community reasons for inactivity reached statistical significance for those reporting versus those not reporting arthritis: heavy traffic ($p=0.004$) and high crime ($p=0.008$).

In contrast, ranking of personal reasons greatly differed by arthritis status. Those with arthritis reported that they were ill or otherwise physically unable to be physically active as the most common reason for not being more physically active ($p<0.001$) far more often than those without arthritis. Not enough time ($p<0.001$), already getting enough physical activity ($p<0.001$), and being a caretaker ($p=0.018$) were more often reported by those without arthritis as primary reasons for not being more physically active.

Although many of the pairwise comparisons were significant at the $\alpha=0.05$ level, we adjusted for multiple comparisons. For the 20 community reasons, Bonferroni adjustment would indicate no significant differences for the arthritis group. Similar adjustment for the 13 personal reasons shows "caretaker" losing significance while the other 3 reasons retain significance. Therefore, while the findings for community reasons may be of general interest, the findings for personal reasons are far more compelling.

Focus Group and Semistructured Individual Interview Results. Main themes that emerged from the qualitative interviews were related to accessibility of community resources, community and personal barriers to physical activity, and quality of walking surfaces. Subanalyses by arthritis status revealed that quality of walking surfaces was the only theme unique to individuals with arthritis. Embedded throughout the 7 themes was a discussion of walking for physical activity. Quotations from qualitative discussions that illustrate the primary barriers to physical activity are presented in Table 3.

Availability of Community Resources. There was consensus among members in all focus groups that there were a variety of physical activity options available in their communities. Participants listed community resources such as gyms, pools, exercise classes, and malls, and offered photographs of these resources. In each focus group, members discussed the wide range of outdoor options that were available to them (eg, walking tracks and community areas). The opinions expressed in the focus groups are reinforced by the telephone survey findings. The majority of participants, 67.6% (1647 of 2436), reported having places to be physically active both indoors and out. Few stated that they had access to indoor places only (6.2%), access to outdoors only (14.0%), or did not have access to any places to be physically active (12.2%).

Accessibility. While participants were in general agreement over the availability of community places to be physically active (especially those at little or no cost), opinions were mixed

Table 2.
Community and Personal Reasons Given in Telephone Survey Interviews for Not Being More Physically Active, North Carolina, 2004-2005

Reasons Given for not Being More Physically Active	Total Group Rank (N**)	Arthritis Rank (N)	Nonarthritis Rank (N)
Community Reasons			
No community reason	1 (1749)	1 (894)	1 (855)
Not enough sidewalks	2 (212)	2 (123)	2 (89)
Rural environment	3 (154)	3 (84)	3 (70)
Not enough recreation facilities	4 (153)	4 (83)	4 (70)
Unattended dogs	5 (126)	5 (74)	5 (52)
Heavy traffic	6 (84)	6 (58)*	8 (26)
Not enough physical activity programs	7 (83)	8 (48)	7 (35)
Bad weather	8 (75)	9 (38)	6 (37)
High crime	9 (71)	7 (49)*	10 (22)
Too many hills	10 (50)	10 (33)	11 (17)
No street lights	11 (47)	11 (24)	9 (23)
Not enough bike lanes	12 (25)	14 (12)	12 (13)
Fearful for safety	13 (18)	13 (13)	14 (5)
Wild animals or pests	14 (13)	15 (8)	15 (5)
Distance to facilities	15 (11)	17 (6)	16 (5)
Roadway issues	16 (8)	18 (2)	13 (6)
Not enough outdoor options	17 (8)	16 (7)	18 (1)
Foul air from cars	18 (3)	19 (2)	19 (1)
Environmental concerns	19 (3)	20 (1)	17 (2)
Poor scenery	20 (1)	21 (1)	20 (0)
Personal Reasons			
Ill or otherwise physically unable	1 (528)	1 (424)*	4 (104)
Don't have enough time	2 (519)	2 (193)*	1 (326)
Already get enough physical activity	3 (455)	3 (192)*	2 (263)
Too tired, no energy	4 (342)	4 (190)	3 (152)
Laziness	5 (190)	5 (89)	5 (101)
No personal reason	6 (140)	6 (76)	6 (64)
Caretaker	7 (41)	10 (14)*	7 (27)
No one to be active with	8 (36)	8 (17)	8 (19)
Don't enjoy being active	9 (33)	7 (18)	9 (15)
Too expensive	10 (22)	9 (15)	11 (7)
Enjoy indoor activities more	11 (21)	11 (9)	10 (12)
Weight	12 (11)	13 (4)	12 (7)
Afraid of injury	13 (10)	12 (8)	13 (2)

* Proportion of those with arthritis that are statistically different from the total population at $\alpha=0.05$

** Telephone survey participants were able to give up to 3 answers for this question, therefore sum of N>2479. Total group N=2479, arthritis group N=1307, and nonarthritis group N=1154.

regarding the accessibility of places for physical activity. Several participants mentioned that while there were private gyms in their community, they were expensive and memberships were prohibitive. In addition, these exercise gyms did not provide childcare for parents who used these facilities. Several participants discussed other places for physical activity (eg, YMCA) that were difficult to access due to their physical disabilities.

Quality of Walking Surfaces. We did not specifically probe participants for differences in community reasons for physical inactivity by arthritis status. However, content analyses revealed that among participants with arthritis, a theme related to quality of walking surfaces emerged as a barrier to physical activity. Many described problems they had walking for long periods on cement, uneven sidewalks (eg, cracks), and gravel and pebbles.

Community Barriers to Physical Activity. Lack of sidewalks, heavy traffic, and living in a rural area were found to be the 3 main community characteristics that acted as barriers to physical activity. While participants discussed walking as a major source

Table 3.
Barriers to Physical Activity Identified by Focus Group and Semistructured Interviewees, North Carolina, 2004-2005

	Age	Arthritis Status	Sex	Quote
Accessiblity				
High Cost	55	Yes	F	There's one gym in town but I checked out those prices and they are out of my price range any way.
	35	No	F	But if you're not employed, if you're a stay at home mom or if you're retired or whatever, you don't get the benefit of an employer subsidy. I don't know how much Curves® is, but it tends to be expensive.
Lack of access for those with disabilities	58	Yes	F	My problem with the Y was they didn't want me to take my chair in there because they said they couldn't protect it. So they wanted me to walk from the parking lot through the lobby, down the hallway, into the dressing room, through the dressing room and out to the pool. Before I got to the front door I'd have to stop and take a sit down break. Five breaks to get to the pool. By the time I got there I was so tired I didn't care about working out in the pool.
Lack of childcare	35	No	F	There are two places in town to exercise as far as gym type things. We have a Curves® and it does not have child care, which is a problem. I like it because it's all female and I like the concept, but whenever you have kids, which is another issue with physical activity, you have to either have somebody to watch them or be able to take them with you.
Community Barriers to Physical Activity				
Rural area, lack of sidewalks and heavy traffic	50	No	F	Actually, to tell you the truth I don't walk in my neighborhood, because the area where I live is not a safe place to walk. It's rural, we don't have sidewalks or it's not wide enough streetwise to be able to do that because most of the time it's two lanes cars are coming up and down, so it's just really not safe to walk.
	48	Yes	F	Well actually there are no local parks nearby, and there's constant traffic, you don't get out on the roads. Actually this road could use some speed knots, it's near an old school, but they don't pay any attention.
Personal Barriers to Physical Activity				
Personal health and comorbid conditions	58	Yes	F	...And it's a very quiet little community. It goes in a circle and it will go for almost completely a mile around if you take the circle around and come back out on the street. Up until a few years ago, my husband and I used to walk that mile every day, but then it got to where it was difficult for both of us.
	56	Yes	F	I used to walk quite a bit and since my knees and my hips are really deteriorating, it's harder to walk long distances. But I still make myself walk as much as possible. I park farther from the building at the office and things like that. And make myself get more steps in, try to get as many steps in in a day as I possibly can. But I can't go out and walk a mile any more.
	63	Yes	F	Well, I can't do too much walking on account of my knees. I had a knee replacement and all, but I get out there and clean out my flowers, I work in my flower yard. I used to have a garden, but I don't have that any more because I can't bend over and pick my stuff.
Family obligations/ care-giving	56	Yes	F	And I need to be home to cook dinner. My husband has severe diabetes and I have to have dinner on time, his insulin and things like that. So, it was a barrier getting to the Y at 7:00 in the evening, and I can't do the morning class.
Walking Surfaces				
Quality of cement surfaces	58	Yes	F	I do my walking at home because concrete and asphalt are really hard on me. I cannot go very far, I can't get from the first handicapped spot to the door at Walmart. That's too much distance. At home, on the sand and soft grass, I can probably walk that far, especially with my canes...So, when I can I walk at home.
	58	Yes	F	I have but not lately because see it's better walking outside than down yonder at the mall because it's cement. But it's cement out there too. It makes a difference whether you're on ground or on cement.
Uneven surfaces	86	Yes	M	Yeah we have sidewalks on one side. So it depends on which side you want to walk on. The sidewalk really is not all that level, so sometimes you get out on the street. And it's a wide street. It's not bad to walk on.
	64	Yes	F	I have a rough uneven, rocky walkway to my doorway. It makes walking hard.

of physical activity, a lack of sidewalks in the neighborhood emerged in all qualitative discussions as a major barrier for getting outside and feeling safe while walking for exercise. When asked in the telephone survey, 76% (1854 of 2452) stated they did not have sidewalks in their neighborhood and 65% (1580 of 2442) did not have walking/jogging/or biking trails in their neighborhood. Further, 36% (874 of 2448) of those surveyed reported heavy traffic in their neighborhood.

Personal Barriers to Physical Activity. While qualitative participants were specifically probed on the environmental factors in the community that made it hard to be physically active, many participants offered unsolicited examples of personal barriers to being physically active. They told us that poor personal health and chronic illnesses such as arthritis, diabetes, obesity, and mental illness kept them from being physically active. Nearly all participants discussed their current physical activity level in relation to their current physical health. Most mentioned that they had been more active in the past, but their health problems now limited what they could do. Participants also mentioned that family obligations often prevented them from being physically active.

Lifestyle Physical Activity. Participants told us that they were often physically active as part of daily activities and interactions with people. Several participants gave examples of gardening and mowing the yard as well as completing household chores and walking their dogs. Several other participants mentioned they considered physically demanding activities on the job as part of their daily physical activity. Some mentioned that children or grandchildren kept them active and showed pictures to illustrate this point.

Strategies to Overcome Barriers. Qualitative participants often discussed what they did to overcome barriers so they could be more physically active. They described how they worked within their physical limitations to maintain and/or increase their physical activity level by keeping active with various lifestyle activities. Some participants mentioned parking further away at shopping centers to increase their daily number of steps and also mentioned driving to places where they could walk safely.

DISCUSSION

Using quantitative and qualitative methodology, this study set out to examine community factors that North Carolinians perceive to influence their physical activity. Overall, participants reported that they had affordable and accessible community places available to them for physical activity. Participants also described community barriers to activity including no easy access for those with disabilities, lack of childcare, and cost of membership to recreational facilities. In fact, cost has been previously found to be a common reason given among adults with arthritis reporting lack of access to a fitness facility.[15] Qualitative discussions confirmed telephone survey results that a lack of sidewalks, rural environment, heavy traffic, and accessibility were community barriers to physical activity. Quality of walking surfaces emerged as a major built environment barrier for those with arthritis. Overall, a major theme that emerged was the importance of illness and physical limitations as a reason for physical inactivity, specifically in participants with arthritis. This supports previous research finding that functional and social limitations, anxiety/depression, and pain act as barriers to physical activity in people with arthritis.[15]

While this exploratory study is unique in using multiple methodologies, a few limitations should be noted. Attendance at focus groups was lower than expected despite our best recruitment efforts. Recruitment of men and minorities was particularly difficult. Adding semistructured individual telephone interviews to our methodologies allowed us to incorporate the perspectives of these underrepresented groups into our study and reach a total qualitative sample size of 32. Researchers have indicated that with adequate representation, regardless of qualitative methodologies used, a sample of 30 individuals is enough to uncover the perceptions of the majority of individuals in a population.[38,39]

Because this study lacked a measure of physical activity level for all participants we could not examine how community resources and characteristics influence physical activity level by arthritis status. Arthritis status was not validated by health care professionals but determined by self-reported doctor diagnosis. This has previously been shown to be a reliable method.[33,34] And, while we recognize that reasons for inactivity might vary due to arthritis type or location of affected joint, subanalyses were not conducted by arthritis type because the majority of participants self-reporting arthritis (60%) had osteoarthritis/degenerative arthritis and arthritis site was not collected.

CONCLUSION

In conclusion, our study suggests that while individuals living with arthritis encounter similar community and personal challenges to being physically active as those without arthritis, they navigate their environment with additional physical limitations. Goals of Healthy People 2010 and the North Carolina Arthritis Plan 2007-2010 are to prevent and reduce the burden of arthritis so as to improve quality of life.[2,6] It is imperative that the complex interactions between personal and community barriers, social networks, and built environments be better understood and discussed as part of health maintenance for individuals with arthritis. **NCMJ**

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North Carolina
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POLICY FORUM

Arthritis in North Carolina

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Gregory F. Schimizzi, MD

> *“North Carolina has a higher rate of arthritis than the US national average and is one of the states with the highest projected increase in arthritis prevalence by the year 2030.”*

INTRODUCTION

Policy Forum:
Arthritis in North Carolina

The aches and pains we feel when we are younger are just a hint of the kind of serious pain and disability that can accompany arthritis at a later age. Arthritis is a term that describes more than 100 different specific diseases, the most common of which are osteoarthritis, fibromyalgia, and rheumatoid arthritis. In North Carolina alone there will soon be more than 2 million adults with doctor-diagnosed arthritis. The Centers for Disease Control and Prevention predicts our state will experience a 40% increase in the number of adults with arthritis by 2030. Nationally, arthritis is now the leading cause of disability in the United States.

The impacts of pain and activity limitations on the lives of people with arthritis can extend well beyond the direct effects to include psychological distress, pressure on family and work life, and diminished ability to cope with adverse events. Fortunately, there are many new interventions and treatments for arthritis patients. Several articles in this issue of the *North Carolina Medical Journal* highlight therapeutic approaches to arthritis including physical activity, surgery, and pharmaceutical options. For some types of arthritis, effective treatments are limited, but there is promising research underway identifying new mechanisms to treat and prevent the disease. With this new information, North Carolina must address its rheumatology workforce shortages, and as the need for care grows, so must the capacity to use new interventions and treatment methods.

Population-based prevention programs have the potential to help alleviate future problems with arthritis. Obesity and arthritis are closely linked, thus obesity interventions and prevention programs could play a critical role in reducing the risk of arthritic diseases while concurrently addressing other serious chronic diseases aggravated by excess weight. North Carolina also has an invaluable source of research and information in the Thurston Arthritis Research Center at the University of North Carolina at Chapel Hill. This issue of the *Journal* is an avenue for disseminating some of the good work being done there.

The National Arthritis Action Plan provides overall guidance for public policy on arthritis prevention and control. The United States Bone and Joint Decade is part of a global plan to set guidelines and measurable objectives in the treatment and prevention of musculoskeletal conditions. These two initiatives outline strategies to reduce the burden of arthritis and to improve future outcomes. We know the direction in which to go, and this issue of the *Journal* is part of an overall effort to spread the word about what we have to do to conquer arthritis and how we need to do it.

Thomas C. Ricketts, III, PhD, MPH
Editor-in-Chief

Kristen L. Dubay, MPP
Managing Editor

ISSUE BRIEF

Arthritis and Its Impact:
Challenges and Opportunities for Treatment, Public Health, and Public Policy

Leigh F. Callahan, PhD; Joanne M. Jordan, MD, MPH

Although literally meaning "inflammation in a joint," the term arthritis is commonly used to describe more than 100 rheumatic diseases and conditions that affect joints, the tissues surrounding joints, and other connective tissue.[1] Conditions such as osteoarthritis, rheumatoid arthritis, fibromyalgia, systemic lupus erythematosus, gout, and bursitis are characterized by musculoskeletal pain and, in some cases, progressive physical impairment of joints and soft tissues.[2] Arthritis is one of the most prevalent chronic conditions in the United States, and the economic, social, and psychological impact associated with it is enormous.[3-6] It has been cited as one of the most pressing public health problems in the US.[3] Some of the effects of arthritis are easily translated into economic terms (eg, lost wages, medical care costs), but many other effects are not easily quantified (eg, pain, reductions in housekeeping activities, inability to enjoy leisure activities).

Although its impact is primarily on quality of life rather than mortality, arthritis significantly affects not only the individuals who have the disease but their families and society as well. Fortunately, over the past several decades there have been dramatic advances in the understanding of risk factors for arthritis and in its treatment. It is important for clinicians and other health care providers, public health officials, and policymakers to understand the burden of arthritis and recent advances in the field so that they can respond to the challenges of arthritis in terms of services and interventions to minimize its impact. In this issue brief, we will review the prevalence and impact of arthritis in terms of pain, activity and role limitations, work disability, and economic, social, and psychological consequences. We will discuss public health strategies and examine what can be done to target arthritis in terms of primary, secondary, and tertiary prevention. Finally, we conclude with some policy implications for North Carolina.

Prevalence

Arthritis affects an estimated 46 million Americans,[4] approximately 1 in 5 US adults. This number is expected to increase to an estimated 67 million individuals by the year 2030.[7] Approximately 21 million people have osteoarthritis,

> *"It will take dedicated financial investment from the public, nonprofit, and private sectors to minimize and prevent arthritis-related disabilities from affecting the state's workforce as well as keeping people living with arthritis active and living independently."*

Leigh F. Callahan, PhD, is associate professor of medicine, orthopaedics, and social medicine at the Thurston Arthritis Research Center, the University of North Carolina at Chapel Hill. She can be reached at leigh_callahan@med.unc.edu or 3300 Thurston Building, CB 7280, Chapel Hill, NC 27599.

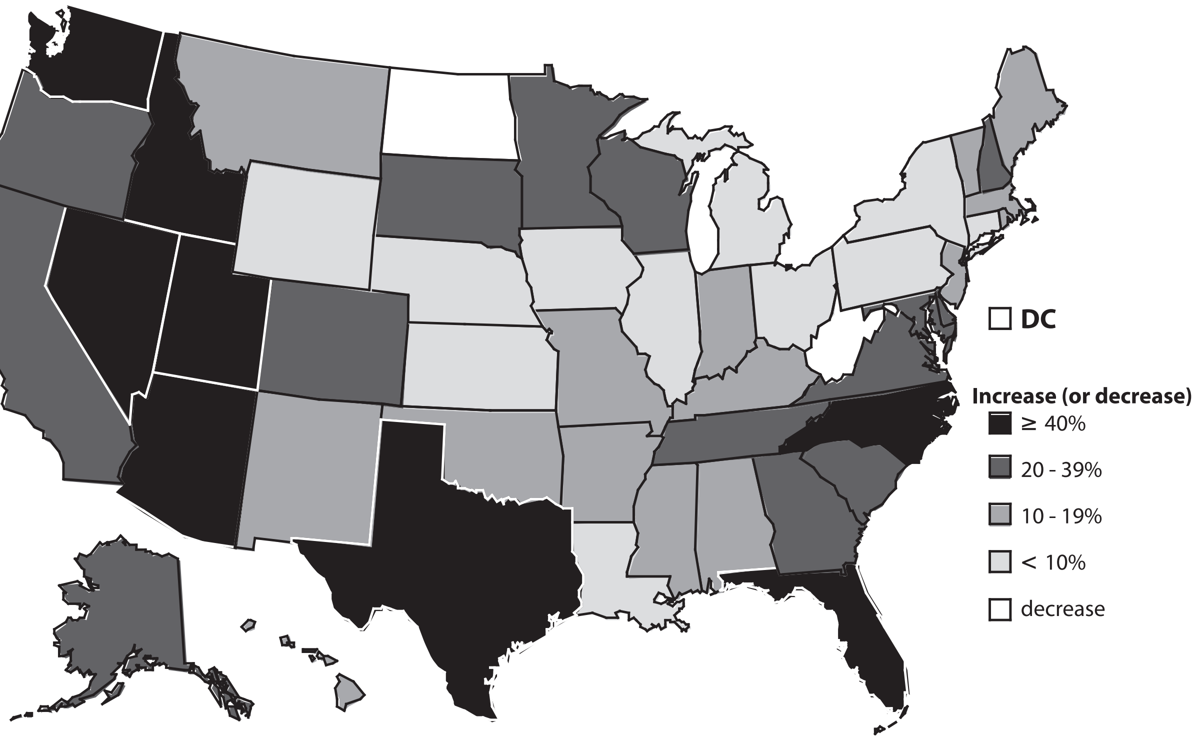
Joanne M. Jordan, MD, MPH, is associate professor of medicine and orthopaedics, chief of the Division of Rheumatology, Allergy, and Immunology, and director of the Thurston Arthritis Research Center at the University of North Carolina at Chapel Hill.

3.7 million have fibromyalgia, and another 2.1 million have rheumatoid arthritis.[2] North Carolina has a higher rate of arthritis than the US national average and is one of the states with the highest projected increase in arthritis prevalence by the year 2030.[8] (See Figure 1.) For this issue of the *North Carolina Medical Journal*, the North Carolina State Center for Health Statistics has provided recent data on the prevalence of self-reported doctor-diagnosed arthritis in North Carolina along with a breakdown by selected demographics and risk factors. (See Running the Numbers.) More than 1.7 million North Carolinians reported having arthritis in 2005, and this number is projected to increase to more than 2.7 million by 2030. Individuals who report arthritis also are more likely to report their health as fair or poor than are individuals without arthritis.

Estimates of the prevalence of knee symptoms and radiographic knee osteoarthritis in African American and Caucasian adults aged 45 years or older were recently reported by our research group at the Thurston Arthritis Research Center at the University of North Carolina at Chapel Hill. Data were collected from the Johnston County Osteoarthritis Project, a population-based study of osteoarthritis in North Carolina.[9] Knee symptoms were present in 43% of participants. Twenty-eight percent had radiographic knee osteoarthritis, and 16% had symptomatic knee osteoarthritis. African Americans had slightly higher prevalence of knee symptoms and both radiographic knee and symptomatic knee osteoarthritis, but significantly higher prevalence of severe radiographic knee osteoarthritis compared to Caucasians. The Johnston County Osteoarthritis Project has been a unique resource for the nation as a population-based laboratory for the study of risk factors for, and racial and gender disparities in, osteoarthritis. This long-standing community-based project is discussed in the commentary by Edwin Hartman and colleagues.

Although some risk factors associated with various forms of arthritis are nonmodifiable (eg, female sex, older age, genetic predisposition), identification of modifiable risk factors is critical to improve the lives of individuals with arthritis or to prevent its occurrence or progression.[10-13] (See Table 1.) Modifiable risk factors include obesity, joint injuries, infections, and certain occupations (eg, shipyard work, farming, heavy industry, any occupation with repetitive knee bending). Several commentaries in this issue discuss arthritis risk factors. Stephen Marshall and Yvonne Golightly discuss the link between sports injuries and osteoarthritis and note the biological basis for such a relationship. Stephen Messier and colleagues describe dietary and physical activity interventions. Individuals with lower levels of formal education and lower income have long been known to be at higher risk for arthritis and poor outcomes. Our commentary on the relationship between arthritis and the environment discusses sociodemographic issues and introduces a novel approach to evaluating potential factors behind these observations.

Figure 1.
Percent Increase From 2005-2006 in the Projected Number of Adults With Self-Reported Doctor-Diagnosed Arthritis, by State.



Source: Centers for Disease Control and Prevention. *MMWR Morbidity and Mortality Weekly Report*. May 4, 2007/56(17);423-425.

Table 1.
Risk Factors for Arthritis

Nonmodifiable	Female sex Older age Genetic predisposition
Modifiable	Obesity Joint injuries Infections Certain occupations Lower levels of formal education Lower income

Impact of Arthritis

Activity and Role Limitations

In addition to its high prevalence, arthritis is the nation's leading cause of disability. Activity limitations due to arthritis were reported by nearly 19 million US adults each year during the period 2003 to 2005.[7] Individuals who are disabled from arthritis have problems in more areas of daily life than do individuals with disability from other conditions.[14,15] Arthritis has negative effects on family role functioning as well.[16] Role limitations associated with rheumatic disease include significant reductions in the amount of time individuals spend engaging in activities such as shopping, visiting the bank and supermarket, homemaking, interacting with friends and family, or participating in hobbies.[6,16,17]

Economic Impact and Work Disability

In comprehensive studies of the economic cost of musculoskeletal disease, Rice and colleagues estimated that the total cost of these conditions is equivalent to 2.5% of the Gross National Product.[6] Total costs for arthritis rose from $65 billion in 1992 dollars to $82.5 billion in 1995 dollars.[6,18] In 1995, the estimated economic impact of musculoskeletal conditions on the US economy was $214.9 billion. (See Table 2.) Of this amount, direct costs accounted for 41% and indirect costs accounted for 59%. For all types of arthritis, the total cost was $82.5 billion or 38% of the cost of all musculoskeletal conditions.[18] (See Table 2.)

The estimated direct costs of medical care for all forms of arthritis totaled $21.7 billion. (See Table 2.) Expenditures for nursing home care were $12.7 billion and accounted for 59% of direct costs. Hospital inpatient care totaled $3.1 billion or 14% of direct costs. According to the National Hospital Discharge Survey, patients hospitalized for arthritis account for approximately 2.6 million days of care. Administration and physician outpatient costs were $1.2 billion and $1.1 billion, respectively, with each approximately 5% of direct costs.[18]

The magnitude of the estimated indirect costs due to arthritis in 1995 dollars was $60 billion[8] or 74% of total cost.[18] (See Table 2.) As noted in previous arthritis cost studies, indirect costs are almost 3 times greater than direct costs.[6] This estimate would be even larger if the costs attributed to loss of homemaking functions could be more easily determined. Also, older women have lower labor force participation rates, resulting in lower estimates of economic impact for the current cohort of women.

As reflected in the indirect costs, the capacity of individuals with arthritis to work is significantly affected.[19-24] In fact, arthritis is a leading cause of work loss and work disability payments.[22,25] In two of the most prevalent rheumatic conditions, osteoarthritis and rheumatoid arthritis, many studies have documented significant work disability.[26] Determinants of work disability in individuals with rheumatic disease exist at both the societal and individual levels. Societal level risk factors include economic conditions, attitudinal and architectural barriers, types of jobs available, employer practices, and the characteristics of disability pension plans.[25] Individual level determinants include work autonomy, social factors, and disease factors.[21,25]

The costs of arthritis extend far beyond the direct medical care costs and the indirect costs associated with work loss. The intangible costs include pain, psychological distress, changes in family structure, limitations in instrumental and nurturing activities, and changes in appearance resulting from deformity.[6,26]

Pain and Psychological Consequences

As noted in the commentary by John Winfield, pain is a major determinant of physician visits for patients with arthritis. It is a significant predictor of patient and physician assessment of general health status as well as an indicator of future level of disability. Pain also has been found to be more important than physical or psychological disability in explaining medication use among patients with rheumatoid arthritis.[27,28] Pain presents challenges to health care providers, and some important suggestions for addressing this problem in arthritis are noted in Winfield's commentary on pain and arthritis.

In addition to the significant economic costs, activity and role limitations, and pain and disability associated with arthritis, the psychological impact of arthritis has been documented in a number of clinical studies.[6] The impact of arthritis on psychological status has been measured in terms of

Table 2.
Total, Direct, and Indirect Costs of All Musculoskeletal Conditions and All Forms of Arthritis in Billions of 1995 Dollars.*

Condition	Direct Costs	Indirect Costs	Total Costs
All musculoskeletal conditions	88.7 (41%)	126.3 (59%)	215
All forms of arthritis	21.7 (26%)	60.8 (74%)	82.5

* Adapted from Praemer, Furner and Rice, Musculoskeletal Conditions in the United States, American Academy of Orthopaedic Surgeons, 1999.

depression, anxiety, learned helplessness, coping strategies, cognitive changes, and self-efficacy. Higher levels of psychological distress have been noted in individuals with arthritis than in members of the general population in most studies. The levels of distress reported in arthritis patients were comparable to levels noted in clinical samples of individuals with other chronic conditions.[29] Higher levels of psychological distress in individuals with arthritis have also been associated with poorer status on clinical outcome variables as well as with increased health services utilization.[30]

Research efforts in depressive symptoms and disorders have focused on osteoarthritis, rheumatoid arthritis, fibromyalgia, and systemic lupus erythematosus.[29] Although depressive symptoms and disorders are more common among clinical samples of individuals with arthritis than in samples of the general population, the majority of individuals with arthritis do not report increased depression. Among persons with rheumatoid arthritis, the loss of valued activities and the self-perception of the ability to do activities are strongly correlated with psychological status.[17] Robert DeVellis and Brenda DeVellis discuss the links between depression and arthritis in their commentary.

Public Health Strategies

Although there is presently no cure for arthritis, there are interventions targeting primary, secondary, and tertiary prevention. (See Table 3.) The aim of primary prevention is to reduce the incidence of symptomatic disease (impairment). In order for primary prevention to be successful or even feasible, the risk factors for the disease must be known. While the risk factors for some types of arthritis and many rheumatic conditions are not known, data from cross-sectional and longitudinal studies reveal that obesity and occupational and sports-related injuries are risk factors for osteoarthritis.[13,31,32] The Framingham Osteoarthritis Study demonstrated that weight change significantly affected the risk for development of osteoarthritis of the knee in women; a weight reduction of 5.1 kilograms (11.2 lb) over a 10-year period reduced the risk of symptomatic knee osteoarthritis by over 50%.[32] Greg Griggs and Marie Shelton highlight the role North Carolina's *Eat Smart, Move More...NC* program can have in reducing obesity in our state and possibly attenuating some of the arthritis epidemic.

The physical demands of an occupation as a risk factor for osteoarthritis of the knee has been observed in several studies.[13,31,33] Data from Framingham and the first National Health and Nutrition Examination Survey indicate that jobs that require knee bending and which have at least medium physical demands are associated with increased rates of radiographic and clinical osteoarthritis of the knee.[13,33] Risk factor modification such as weight reduction and avoidance of occupational and other injuries may prevent the development of osteoarthritis of the knee. Another known target for primary prevention is exposure to ticks that carry the spirochete *Borrelia burgdorferi*, a known risk factor for Lyme disease. Lyme disease is an infectious arthritis which may have chronic manifestations. Avoiding tick-infested areas, checking oneself and one's pets for ticks, and using antitick pesticides are primary preventive measures for Lyme disease.

Secondary prevention is aimed toward early detection and treatment of a disease so that its course may be controlled or favorably altered. (See Table 3.) Secondary prevention is targeted toward reducing disability and generally involves screening for disease. Currently the most appropriate screening test for arthritis is a complete history and physical examination.[34] Arthritis may have a wide variety of clinical presentations which may or may not involve the musculoskeletal system. A complete history and physical examination allow the clinician to develop a differential diagnosis, order the appropriate laboratory studies, and formulate a diagnosis and treatment plan. Since early, aggressive therapy may be associated with improved outcomes in arthritis, it is imperative that the clinician consider these diagnoses when evaluating individuals with musculoskeletal or ill-defined systemic complaints. In order for secondary prevention to be successful in improving the outcomes of persons with arthritis, it will be necessary to increase efforts to educate health

Table 3.
Examples of Prevention Strategies for Persons With Arthritis

	Primary Prevention	Secondary Prevention	Tertiary Prevention
Goal	Reduce incidence of disease	Detect disease at early, treatable stage	Reduce disease complications
Target Population	Susceptible	Asymptomatic	Symptomatic
Examples	■ Weight reduction ■ Avoiding sports & occupational associated injuries ■ Avoiding tick exposure ■ Checking self and pets for ticks (Lyme)	■ History and physical ■ Improved education of health professionals ■ Public education to encourage early diagnosis and treatment ■ HLA/genetic testing (potential)	■ Improved education of health professionals ■ Medication ■ Physical therapy ■ Exercise ■ Occupational therapy ■ Assistive devices ■ Education ■ Use of effective coping strategies ■ Joint replacement surgery

professionals about arthritis. It is also imperative to increase public awareness about the value of early treatment and diagnosis of arthritis, and it is imperative to have sufficient health care professionals to treat people with arthritis. The manpower shortage in rheumatology is reviewed by Gregory Schimizzi, and Kate Queen gives her perspective on the role of nurse practitioners and physician extenders in meeting the manpower shortage challenge.

Tertiary prevention is aimed at reducing the complications and handicaps resulting from the impairment or disease in symptomatic persons. (See Table 3.) Most research efforts in arthritis have focused on tertiary prevention. Treatment of individuals with arthritis is often a multidisciplinary effort that includes medications to reduce pain and inflammation; complementary and alternative medicines; physical exercise and occupational therapy to maintain functional status and prevent disability; and education to develop coping and health management skills. Recent therapeutic advances in the treatment of rheumatoid arthritis, including the biologic therapies, are discussed by Beth Jonas. Esi Morgan DeWitt examines medication safety in children with arthritis, Jayalakshmi Rao reviews the use of complementary and alternative medicine in arthritis treatment, and Victor Goldberg discusses joint replacement therapy later in this issue of the *Journal*.

Despite its importance in reducing disability, exercise is a frequently neglected part of the treatment plan. Arthritis is now being incorporated into public health messages regarding the benefits of exercise. In contrast to the traditional belief that those with arthritis should avoid vigorous physical activity, recent studies have demonstrated that people with arthritis can benefit from appropriate aerobic exercise without exacerbating their disease.[35,36] Compared to their peers without arthritis, people with arthritis are often deconditioned and this may worsen their disability. Prolonged inactivity can produce muscle weakness, decreased flexibility, poor endurance, osteoporosis, cardiovascular deficit, fatigue, depression, low pain threshold, and other problems which historically have been accepted as either the natural progression of arthritis or the consequences of therapy.[37]

In a trial of supervised fitness walking, people with osteoarthritis of the knee who were randomized to the walking group had significant improvement in walking distance and functional status and a decrease in pain and medication usage compared to the control group.[36] Similarly, in a trial of people with rheumatoid arthritis and osteoarthritis of weight-bearing joints, those randomized to aerobic exercises had a significant improvement over controls in aerobic capacity, 50-foot walking time, depression, anxiety, and physical activity.[37] In a 5-year follow-up study of a conditioning program for people with rheumatoid arthritis, study participants who reported more than 5 hours of exercise per week showed less radiographic progression of joint damage, less hospitalization, and less work disability than those who exercised less than that amount.[38] The Arthritis, Diet, and Activity Promotion Trial found that the combination of modest weight loss plus moderate exercise provides better overall improvements in self-reported measures of function and pain and in performance of mobility in older overweight and obese adults with knee osteoarthritis compared with either intervention alone.[39]

Studies of community-based exercise programs sponsored by the Arthritis Foundation (eg, Aquatics Program) have shown significant positive changes in participants' pain levels and their ability to perform activities of daily living. This indicates the benefits of regular aerobic exercise in persons with arthritis may extend beyond improved physical functioning. These benefits are discussed in-depth in the commentary by Stephen Messier.

Patient education programs such as the Arthritis Self-Help Course are another adjunct in the treatment of people with arthritis. A meta-analysis of 15 controlled evaluations of psychoeducational interventions for people with rheumatoid arthritis or osteoarthritis showed beneficial improvements in pain, depression, and disability.[40] There is an emphasis on educational processes which increase self-efficacy and empower the participants to make appropriate health decisions. In a 4-year follow-up study, participants in the Arthritis Self Management Course retained improvements in pain level and self-efficacy and had a 43% decrease in physician visits compared to nonparticipants.[41] Based on a reach of just 1% of the population with rheumatoid arthritis and osteoarthritis, the projected cost savings to society that would result from a broader implementation of the program would be $33 000 000. Effective self-management programs with similar content and self-efficacy enhancing processes are also available for people with systemic lupus erythematosus and fibromyalgia.

Conclusions and Policy Implications

In 1998 a consortium of national organizations produced "The National Arthritis Action Plan: A Public Health Strategy," which is a comprehensive and ambitious plan for addressing the looming epidemic of arthritis.[42] This inspiring plan was developed under the leadership of the Centers for Disease Control and Prevention, the Arthritis Foundation, and the Association of State and Territorial Health Officials. These 3 organizations were joined by nearly 90 other organizations including academic institutions, professional societies, governmental agencies, voluntary health agencies, and others with an interest in arthritis prevention.

The National Arthritis Action Plan is based on the principles that the disability and chronic pain associated with arthritis reduce quality of life and that arthritis can be prevented. The plan is based on a growing recognition that public health must shift its emphasis to include diseases that destroy quality of life and not just those that kill.

The National Arthritis Action Plan outlines a public health strategy with emphasis in 3 areas: (1) surveillance, epidemiology, and prevention research; (2) communication and education; and (3) programs, policies, and systems. Activities in the surveillance and epidemiology area address the need to establish a solid scientific base of knowledge about the prevention of arthritis. The communication and education activities are designed to raise awareness of arthritis as a public health problem and to stimulate creative responses to this problem. The emphasis in the area of program, policies, and systems is on developing approaches for systematic change based on recognition that arthritis affects individuals in a social context and that this context can be changed in ways that promote health and prevent disease.

The National Arthritis Action Plan followed 2 historic national efforts to address arthritis. The first was the National Arthritis Act of 1975 which led to the development of Multipurpose Arthritis and Musculoskeletal Disease Centers. The second was the establishment of a separate arthritis institute at the National Institutes of Health in 1986, the National Institute of Arthritis, Musculoskeletal, and Skin Diseases. The National Arthritis Action Plan, a third milestone, provided a framework for new partnerships and collaborations to address the important issues and challenges of arthritis. These partnerships helped ensure that Healthy People 2010, the nation's blueprint for improving population health, contained a chapter on Arthritis, Osteoporosis, and Chronic Back Conditions.[43] This chapter has specific objectives related to pain reduction, activity limitations, and racial disparities in the rate of knee replacements. The North Carolina Arthritis Program, discussed in the commentary by Denise Brewster and Mary Altpeter, uses these Healthy People 2010 objectives to guide much of its work.

In addition to the incorporation of arthritis-specific objectives in Healthy People 2010, the launch of the Decade of Bone and Joint Disease in the year 2000 has further enhanced society's understanding of the burden of arthritis.[44] The Bone and Joint Decade is a global, multidisciplinary initiative targeting the care of people with musculoskeletal conditions and bone and joint disorders. Its focus is on improving quality of life as well as advancing the understanding and treatment of those conditions through research, prevention, and education. Worldwide more than 750 organizations have endorsed the Bone and Joint Decade initiative. More than 50 countries, including the US, have established multidisciplinary National Action Networks to plan activities in their respective countries. All 50 states have endorsed the Bone and Joint Decade, and over 85 health care organizations have pledged their support to the US Bone and Joint Decade Network. This network supports the current efforts of the Arthritis Foundation to pass the Arthritis Prevention, Control, and Cure Act of 2007 (S.626, H.R. 1283).[45] This Act proposes to strengthen arthritis public health initiatives, which would ensure that more people are diagnosed early and avoid pain and permanent disability. It also proposes to ensure that limited federal funding for arthritis research is used in the most strategic manner possible through the formation of a federal interagency coordinating committee. Additionally, it authorizes a remedy to help address the shortage of pediatric rheumatologists as well as a prevalence study of arthritis in children and a patient registry. Neither North Carolina senator was a cosponsor of the Senate bill in the fall of 2007, but Representatives Butterfield, Etheridge, Price, and Hughes are all cosponsors of HR 1283.

Given its high prevalence and significant economic, functional, social, and psychological consequences, arthritis should receive considerable attention from a societal perspective. The burdens of arthritis will increase dramatically in the near future due to the aging of the population, and this underscores the need for a public health approach. As highlighted in this issue of the *North Carolina Medical Journal*, what we know about the prevention and treatment of arthritis has advanced considerably over the past few decades. There is much that can be done on an individual and societal level to reduce the burden of arthritis, and our challenge is to deliver that message broadly. **NCMJ**

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Arthritis:
The Public Health Partnerships for Improving Health

Denise G. Brewster, MEd, CHES; Mary Altpeter, PhD, MPA, MSW

For many North Carolinians, dealing with the aches and pains and limited mobility of arthritis and joint conditions often takes a back seat to health issues such as diabetes and heart disease which may be seen as more life threatening. Many people with arthritis believe they cannot or should not be physically active with their aching joints, making management of other chronic diseases even harder. North Carolina public health professionals, the Centers for Disease Control and Prevention, and the National Arthritis Foundation recommend that people with arthritis can and should be physically active—the correct and safe way. There are proven methods for how they can successfully manage their condition, decrease pain, stay productive, improve quality of life, and reduce health care costs. To that end a collaborative public health approach to preventing and treating arthritis has been developed in the state, the North Carolina Arthritis Program.

> *"Many people with arthritis believe they cannot or should not be physically active with their aching joints, making management of other chronic diseases even harder."*

The North Carolina Arthritis Program was revitalized in 1999 with a vision and a shoestring budget of only $70 000 from the Centers for Disease Control and Prevention to build state infrastructure and capacity to reduce the burden of arthritis across the state. Given this daunting challenge, it was clear that the Arthritis Program needed to reach out to build interdisciplinary and interorganizational community partnerships to strategically pool resources, build infrastructure capacity, and help carry out programs and advocacy efforts. An Arthritis Program Advisory Board was created with membership of key stakeholders in aging services, public health, medical care, community-based services, advocacy groups, and academia. Aging services representatives include key staff and leaders from Senior Games, AARP, Area Agencies on Aging, NC Division of Aging and Adult Services, and the Cary Senior Center. Medical community members include representatives from Vocational Rehabilitation, Sprain Strain Treatment Center, Rex Senior Health Center, WakeMed, Wilson Medical, Blue Cross Blue Shield of NC, and NC Division of Medical Assistance. Community-based organizations include the Arthritis Foundation, Pitt County Community Schools and Recreation, NC Citizens for Public Health, City of Raleigh Parks and Recreation, Mid-Carolina Council of Government, and local health departments. Academic partners include the University of North Carolina (UNC) at Chapel Hill (Schools of Public Health and Nursing, Institute on Aging, Department of Health Policy and Administration, and Thurston Arthritis Research Center), NC Office on Disability and Health, East Carolina University Brody School of Medicine, Duke University Divisions of Community Health and Rheumatology, UNC Charlotte School of Nursing, and Wake Forest University School of Medicine.

This broad-based advisory board serves as the driving force of the Arthritis Program. The board has reviewed the statistics and services available in our state (documented in the North Carolina Arthritis Report 2002) and crafted the North

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Denise G. Brewster, MEd, CHES, is acting NC Arthritis Program coordinator in the Physical Activity and Nutrition Branch, Chronic Disease Section, NC Division of Public Health. She can be reached at denise.brewster@ncmail.net or 1915 Mail Service Center, Raleigh, NC 27699-1915.

Mary Altpeter, PhD, MPA, MSW, is associate director for program development at the Institute on Aging, the University of North Carolina at Chapel Hill, and NC Arthritis Advisory Board member.

Carolina Arthritis Plan,[1] a 3-goal, 3-year road map for decreasing the burden of arthritis. The NC Arthritis Plan is consistent with NC General Statute 130A-222 which mandates a state arthritis program and the Healthy Aging People 2010 national health objectives.

The first goal is to increase the number and accessibility of evidence-based arthritis programs and to increase the number of people participating in them. There are 5 programs nationally recognized as effective in helping manage arthritis. Three programs are oriented to physical activity: the Arthritis Foundation Exercise Program, the Arthritis Foundation Aquatics Program, and the EnhanceFitness exercise program. Two programs focus on self-management skills and patient-physician communication strategies: the Arthritis Foundation Self-Help Program and the Stanford University Chronic Disease Self-Management Program. These evidence-based programs have proven to provide benefits in symptom management, improved mobility, and reduction in depression among participants in study groups.[2,3]

To achieve the goal of reducing the arthritis burden, the North Carolina Arthritis Program and its lead partner agency, the Arthritis Foundation Carolinas Chapter, work together to identify organizational networks in areas where evidence-based programs are currently unavailable or underutilized. Most of the evidence-based programs in the state are clustered around the largest metropolitan areas and about half of the counties have no evidence-based arthritis programs at all. Community members and participants of the regional senior centers in rural communities can, however, be trained to lead Arthritis Foundation exercise, aquatics, and self-help programs.

Leading a key partnership effort, the NC Division of Aging and Adult Services has embarked on a 3-year project to train volunteers in Stanford University's Chronic Disease Self-Management Program and deliver the program in 46 counties. The program has been shown to provide the same benefits (managing their disease, continuing activities of daily living, and coping with emotions) to people with arthritis as arthritis only self-help programs.[4] The Division of Aging and Adult Services project will reach over 3000 North Carolinians living with chronic diseases such as arthritis. This effort is crucial—nationally, less than 1% of people with doctor-diagnosed arthritis participate in self-help programs.[5]

The second goal in the Arthritis Plan is to conduct community campaigns to raise public awareness that physical activity is an effective way to manage arthritis symptoms. To begin to address this statewide goal, the Arthritis Program has conducted 3 regional communication campaigns in North Carolina saturating 15 counties with media messages. The key message of the campaigns has been "Physical Activity. The Arthritis Pain Reliever." The communication campaigns have been pivotal opportunities for identifying community interest and commitment to establishing local exercise, aquatics, and self-help programs. For example, during the 6-week communication campaign in Pitt County, a special one day "Move More with Arthritis" event was held along with Arthritis Foundation aquatic program leader training. The two components, educating community members about the benefits of physical activity and building community capacity to meet the demands of an informed citizenry, depend upon community-based partnerships like Pitt County Community Schools and Recreation who hosted the event and the aquatic leader training.

Since arthritis affects people of all ages and is also a leading cause of disability and work-related disability,[6] senior communities are not the only focus of the Arthritis Program's efforts. Key arthritis messages are shared with participants of all wellness programs to encourage them to see their doctor, stay active, watch their weight, and protect their joints. Information about the evidence-based Arthritis Foundation Exercise Program will be included in the web-based menu of activities available in the "Worksites Eating Smart and Moving More" materials available to every workplace with a wellness program. The Arthritis Program is also working to make evidence-based program information available to all NC State Health Plan enrollees through the more than 150 state wellness committees currently established. The exercise program is an ideal fit for employees who have permanent disabilities that prevent participation in more vigorous physical activities or who have been sedentary and need a graduated approach to becoming more physically active. Families also benefit from learning to protect the joints of their children to reduce the possibility of future arthritis.

The third goal of the Arthritis Plan is directed toward creating policies and environments supportive of arthritis management in North Carolina by working with state legislators and local elected officials and organizations. Although some health savings accounts recognize the value for enrollees participating in evidence-based programs to maintain health and reduce medical costs, not all employers and insurance policies recognize this. Other types of plans and actions for supportive policies and environments are multi-faceted and long term in scope. For example the Arthritis Program hopes to increase the use of prescriptive physical activity recommendations from health care providers, but such prescriptions demand the availability of community resources for safe and effective physical activity opportunities.

What does the future hold for citizens living with arthritis in North Carolina? There are 3 major challenges. First, with the continuing momentum toward a dedicated plan to reduce the burden of arthritis, more evidence-based programs need to be available throughout communities. Citizens should have the opportunity to engage in physical activity that is safe, effective, and close to home. Persons living with arthritis will gain greater control over their lives and condition from participating in chronic disease self-management programs. Our challenges are to increase the number of master trainers, identify organizational sites for programs, and train program leaders. Currently there are only 8 Arthritis Foundation master trainers in North Carolina. The number of Arthritis Foundation exercise, aquatic, and self-help program leaders varies from year to year (currently around 100) due to attrition. There are only 8 Chronic Disease Self-Management Program trainers in the state who have completed Stanford University's intensive training preparation.

Second, employers need to recognize that supporting physical activity for employees with arthritis keeps them on the job and performing better. A major challenge will be to create and implement strategies to address people with arthritis who may experience periodic or increasing functional impairment. We need to work with employers to examine how the work environment, employee tasks, and schedules may be adapted to offer flexibility for workers with arthritis while at the same time maintaining expected performance levels and overall productivity.

Third, these challenges cannot be met without cooperative efforts and dedicated funding. Strong collaborative partnerships are the biggest asset in accomplishing the goals of the Arthritis Plan. The biggest challenge is the cost of building infrastructure with severely limited dollars. Currently the Arthritis Program budget for fiscal year 2007-2008 is supported by a grant of $135 000 from Centers for Disease Control and Prevention, an increase of only $65 000 from its initial funding 9 years ago. With a 2005 estimate of 1 754 000 North Carolina citizens diagnosed with arthritis,[7] that means less than 8¢ per person is available for evidence-based programming, raising community awareness, and creating supportive policies and environments. It will take dedicated financial investment from the public, nonprofit, and private sectors to minimize and prevent arthritis-related disabilities from affecting the state's workforce as well as keeping people living with arthritis active and living independently. Basic funding and partner agencies working together through the comprehensive, multi-faceted public health response to arthritis can build a state in which all citizens enjoy the high level of wellness and quality of life that all tarheel citizens deserve. **NCMJ**

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Recent Therapeutic Advances in the Treatment of Rheumatoid Arthritis

Beth L. Jonas, MD

Rheumatoid arthritis is a systemic disease which targets the joints as well as other organ systems. It is the most prevalent of the inflammatory arthropathies and is estimated to affect about 1% of the world's population. The clinical presentation is varied, but most patients have a progressive disease that leads to joint destruction and the associated disability if left untreated. There is significant morbidity associated with some of the extra-articular manifestations of the disease including pulmonary disease, osteoporosis, inflammatory eye disease, and in rare cases a systemic vasculitis. Recent studies have highlighted the role of chronic inflammation in the development of cardiovascular disease which leads to excess mortality in patients with rheumatoid arthritis.

Rheumatoid arthritis is thought to occur in a genetically susceptible host in response to some antigenic trigger. While the factors that initiate this process are poorly understood, the pathogenesis of the disease is beginning to be understood. Pathologic changes in the joint begin in the synovial lining of the diarthroidal joints. Early pathologic changes include neovascularization and thickening of the normally thin and delicate synovial membrane. There is infiltration of the tissues with leukocytes, increased expression of adhesion molecules, proteolytic enzymes, and cytokines and other inflammatory mediators. Together, these factors lead to the development of a pannus, a localized tissue that invades articular cartilage, bone, and the supporting structures of the joint.

It has been known for some time that joint damage can occur early in the course of the disease, and a majority of rheumatoid arthritis patients have erosion of bone within the first 2 years of disease onset.[1] It has also been established that treatment with disease modifying antirheumatic drugs during this early phase of rheumatoid arthritis can result in improved outcomes.[2] An appreciation of the importance of early intervention prior to the development of erosive disease has led to an algorithm of early detection and aggressive intervention. However, until recently the therapeutic options were limited to single or combination therapies with only modest benefits in most patients. Medications such as intramuscular gold, cyclosporine, azathioprine, sulfasalazine, hydroxychloroquine, and methotrexate comprise the majority of oral agents used to treat rheumatoid arthritis, yet only hydroxychloroquine, sulfasalazine, and methotrexate are currently in wide use. Combinations of oral therapies may be beneficial in some patients, and the addition of a newer oral agent, leflunomide, has added to the armamentarium of therapeutic options. Despite this, oral therapies are clearly inadequate for the majority of patients with rheumatoid arthritis.

> *"Although the precise etiology of rheumatoid arthritis is not known for certain, significant advances in understanding the pathogenesis of the disease have led to new and more effective therapies."*

Although the precise etiology of rheumatoid arthritis is not known for certain, significant advances in understanding the pathogenesis of the disease have led to new and more effective therapies. The most significant breakthrough over the last 10 to 15 years has been the development of the tumor necrosis factors (TNF) - inhibitors Etanercept, Infliximab, and Adalimumab. Each drug has a unique mechanism of action, but they all inhibit the biologic action of TNF, a cytokine known to play a role in the pathogenesis of joint inflammation in rheumatoid arthritis. Tumor necrosis factors has myriad effects that may

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Beth L. Jonas, MD, is an assistant professor of medicine in the Departments of Medicine and Orthopedics at the University of North Carolina at Chapel Hill. She can be reached at bjonas@med.unc.edu or 3300 Thurston Building, CB #7280, Chapel Hill, NC 27599-7280.

initiate or perpetuate inflammation in rheumatoid arthritis including regulation of other proinflammatory cytokines, growth of new blood vessels, activation of endothelial cells and osteoclasts, and induction of metalloproteinases. Etanercept is a fusion protein of a TNF receptor linked to the Fc portion of IgG1. Its action prevents TNF from interacting with cell surface receptors. Infliximab is a chimeric mouse/human monoclonal antibody which binds TNF, thus inhibiting its biologic activity. Adalimumab is a fully humanized monoclonal antibody which has a similar mechanism of action to Infliximab. These drugs have had a profound impact on the ability to treat patients who had previously shown little or no response to traditional disease modifying antirheumatic drugs. Numerous studies of these agents have confirmed their ability to control signs and symptoms of disease, improve quality of life, and retard, or in some cases halt, the progression of erosive disease. Clinical studies also indicate that the combination of TNF inhibitors with Methotrexate yields better outcomes than either drug alone.[3]

Despite the therapeutic advances demonstrated by the TNF inhibitors, there remains a subset of patients who have an inadequate response to available therapies. These patients may continue to have evidence of disease activity with tender and swollen joints or may have progressive radiographic changes despite a good clinical response. Two newer agents approved by the FDA, Abatacept and Rituximab, may be effective with these patients. Abatacept is a T cell inhibitor which acts by blocking the second signal necessary for effective T cell stimulation. Rituximab is an anti-CD20 chimeric monoclonal antibody which selectively depletes pre-B, naïve, mature, and memory B cells, leaving stem cells and mature plasma cells unaffected. Both drugs, given by intravenous infusion, have been shown in well-controlled clinical trials to decrease signs and symptoms of rheumatoid arthritis as well as retard the structural progression of the disease.[4]

Research and investigation of the next generation of biologic therapy continues with agents aimed at new targets. Anticytokine therapies targeting IL-1, Il-6, Il-15, and IL-17 are currently under development. Tocilizumab, an anti-IL-6 monoclonal antibody, is currently in phase III clinical trials for rheumatoid arthritis, and preliminary results suggest that it has good efficacy. In addition, second generation drugs targeting TNF and B cells are also in clinical trials. Some investigators believe that gene therapy may someday play a role in the treatment of the most aggressive disease, but there are many hurdles to overcome.

Primary care physicians are often the first point of care for patients with early rheumatoid arthritis. With the recent advances in understanding the importance of early diagnosis and aggressive management of the disease, primary care physicians are in a position to take that knowledge and apply it to clinical practice. It is critical to consider the diagnosis and pursue the workup since intervening early can make a significant impact on the long-term outcome. Working closely with their rheumatology colleagues and remaining vigilant for signs of early inflammatory joint disease, the primary care provider plays a most important role for patients with rheumatoid arthritis. **NCMJ**

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COMMENTARY

Medication Safety in Children with Arthritis

Esi Morgan DeWitt, MD, MSCE

Chronic arthritis affects approximately 1 out of 1000 children, many of whom will be affected into their adulthood.[1] Over the past decade the advent of potent biological therapies such as tumor necrosis factor-alpha (TNF-alpha) antagonists has altered our expectations for the outcomes of polyarticular arthritis for the better. It is now rare to see arthritis leave a child wheelchair-bound, and measures such as serial casting and bracing to treat fixed joint flexion contractures are now infrequently needed. These advances are due in part to maturation of the field of pediatric rheumatology but also due in large part to available therapeutic options that are more effective than were the agents used in the past. However, by virtue of their novelty, these biologic medications lack much data on long-term safety. The safety data are limited in adults, and they are even sparser in children given smaller numbers of patients, less data collection, and fewer studies performed. When we consider that individuals affected with chronic arthritis from childhood will be exposed to various immunomodulatory and other medications (eg, nonsteroidal anti-inflammatory drugs, nonbiologic disease-modifying antirheumatic drugs) over the course of many years, it is important to be systematic in our study of the possible long-term side effects in children. Extrapolating from adult studies is inadequate because there are unique safety considerations in children.

> *"Treating children with arthritis on the basis of studies in adults is not sufficient and arguably not ethical."*

Lack of safety data for medications in children is not confined to novel biologic therapeutics. In the past the lack of systematic drug testing in pediatric therapeutics has resulted in widespread off-label use—across primary and specialty care—of an estimated 75% of medications and well-publicized examples of resultant harm done to children.[2] Despite the knowledge that children are not little adults in terms of therapeutic regimens, it has long been practice to treat children with medications studied only in adults by adjusting dosage for weight. Due to differences in pharmacokinetics and the added complexity of metabolism changes with age, growth, and development, treatment of children based on studies in adults could result in harm from underdosing and exposing patients to potential side effects without therapeutic benefit, from potentially overdosing, or from unknown pediatric-specific adverse effects.[3]

Recent legislation has stimulated and mandated more widespread testing in children. The Best Pharmaceuticals for Children Act of 2002 and the Pediatric Research Equity Act of 2003 were recently reauthorized for another 5 years as Public Law 110-85.[4] The first act creates an incentive for pharmaceutical companies to study existing medications in children by granting an additional 6 months of marketing exclusivity (ie, pediatric exclusivity).[5] The Pediatric Research and Equity Act requires drug manufacturers applying for a new product or new product indication to submit data on testing the product in children. These acts served to expand the knowledge of appropriate medication use in children with subsequent pediatric label changes for over 130 medications resulting from the Best Pharmaceuticals for Children Act[6] and more than 60 new listings resulting from the Pediatric Research and Equity Act.[7] The Best Pharmaceuticals for Children Act also has resulted in mandatory study of adverse events specific to children for 12 months postexclusivity which has provided some new information on pediatric-specific adverse events.[8]

The resultant increase in clinical trials for pediatric patients spurred by these legislative acts has implications for the practice of rheumatology. They have expanded the evidence base with which to prescribe and set expectations of therapeutic effectiveness. The successful pursuit of clinical trials in pediatric patients also has practical implications from the standpoint of being able to seek

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Esi Morgan DeWitt, MD, MSCE, is a medical instructor of pediatric rheumatology at Duke University Medical Center. She can be reached at esi.morgandewitt@duke.edu or DUMC Box 3212, Durham, NC 27710.

insurance coverage for therapeutics that have a pediatric indication. Even so, the challenge to conduct pediatric rheumatology clinical trials remains daunting. The relative rarity of these conditions in children generally requires a multisite, multinational effort over a lengthy enrollment period to reach sample sizes necessary to adequately power a study. Despite the best of planning, this may still result in a negative study. For example, a recent clinical trial of the TNF-alpha antagonist infliximab in juvenile rheumatoid arthritis failed to reach the primary endpoint despite the apparent benefit observed in the clinical practice setting.[9] Such a frustration does not mean that similar studies should not be performed, but rather that the pediatric rheumatology research community needs to redouble its efforts in the conduct of randomized clinical trials of novel therapeutics with improved study design and identification of more effective trial endpoints.

Treating children with arthritis on the basis of studies in adults is not sufficient and arguably not ethical. Just as children are not small adults, rheumatoid arthritis is a distinct entity from the various forms of childhood arthritis.[10] In addition to studying results of drug manufacturers' 12-month safety extension of clinical trials under pediatric exclusivity, it behooves pediatric rheumatologists to pursue independent means of better assessing medication safety through the development of safety registries to capture larger numbers of treated patients, to promote more systematic adverse event reporting through the Food and Drug Administration Med Watch system (www.fda.gov/medwatch), and to conduct studies of administrative claims data for evidence of adverse events as has been done in several studies of TNF-alpha antagonists safety in treatment of adult rheumatoid arthritis.[11-13]

When information was released on the adverse cardiovascular risk profile of the selective Cox-2 inhibitor VIOXX in adults and it was withdrawn from the market (ironically just 6 weeks after its approval for treatment of juvenile rheumatoid arthritis), there were few data to provide parents about long-term cardiovascular risk in children. The reply in response to questions about possible ill effects of these medications with long term use, "There have been no such reports in children," while true to the best of our knowledge is not a rigorously studied answer. For this reason, once childhood arthritis is under control, it is often a goal of the pediatric rheumatologist to try and taper off systemic medications in order to limit cumulative exposure.

From the standpoints of the individual primary care provider, parent, and pediatric rheumatologist, there are practical steps to advance safe medication use in children with arthritis. One of the key steps to promoting patient safety in children with arthritis is a strong partnership between the prescribing rheumatologist and the child's primary care provider. There are 3 primary threads to this relationship. First, collaboration to ensure patient compliance with routine laboratory testing (often performed locally every 4-8 weeks) to monitor for medication toxicity[14] and communicating these results to the rheumatologists for review; second, maintenance of up-to-date immunization status including yearly influenza vaccination with inactivated virus vaccine (live vaccines are currently contraindicated in children on immunosuppressive medications);[15] and third, prompt evaluation and treatment of patients on immunosuppressant medications who present with suspected bacterial infection due to the decreased ability to contain the infection.

Information on Arthritis in Children:

Readers interested in more information on arthritis in children or specific therapeutics are encouraged to consult the Web resources listed below. The Pediatric Education Drug Safety (PEDS) project underway at the University of North Carolina at Chapel Hill (UNC) is developing online continuing medical education for primary care providers along with downloadable provider resources. One of 3 PEDS modules is devoted to medication use and safety in childhood arthritis. The resource will be free to all and available in 2008 (http://harryguess.unc.edu/index.htm).

Web Resources:

UNC PEDS:
http://harryguess.unc.edu/index.htm

American College of Rheumatology:
http://www.rheumatology.org/

Arthritis Foundation:
http://www.arthritis.org/index.php

Childhood Arthritis & Rheumatology Research Alliance:
http://www.carragroup.info/

Food and Drug Administration Pediatric Drug Development:
http://www.fda.gov/cder/pediatric/index.htm

MedWatch:
http://www.fda.gov/medwatch/index.htm

The partnership between primary care providers and rheumatologists extends in other ways. For example, in some cases the primary care provider's office administers subcutaneous injection arthritis medications for the patients where the parent or guardian is unable. This partnership in care is particularly important in our state because many patients travel long distances across North Carolina to see a pediatric rheumatology specialist located at an academic medical center. The local medical provider will be the first responder to these children in case of infection or disease flare. Good communication between the local treating physician and the pediatric rheumatologist in the care of children with arthritis is invaluable.

The partnership extends to patient education, acceptance of the diagnosis, and comfort with the treatment plan. Pediatric rheumatologists face hurdles with new patients. They begin with overturning the misconception that the child will simply outgrow the arthritis. When parents arrive with this notion, it takes some convincing to explain that medication is indicated and that the known benefits of averting disability and pain from untreated arthritis outweigh the potential risks, some of which are unknown. The primary care provider may use the trust resultant from a long-term relationship with the family to help cope with the diagnosis and facilitate care.

The family may be preoccupied by the child's pain, worried by his or her present functional limitations, and concerned that the child is standing on the sidelines instead of participating with peers. Although they may be eager for their child to get better, many parents are anxious about giving their child any medications because they fear side effects, although not infrequently these same individuals may administer a host of natural supplements that are not regulated or scientifically tested. Time and care are necessary for patient education. It is important to review the medications, indications, the administration process, known and potential side effects, and toxicity monitoring. This helps make the family more comfortable with the treatment plan and enhances compliance. In rare instances parents have reported that the pediatrician told them the medications prescribed by the rheumatologist for arthritis are too strong for a child and advised against taking them. On occasion even some pharmacists have told parents their child should not have been prescribed a medication recommended by the rheumatologist. As a pediatric rheumatologist, I would rather discuss the rationale for prescribing a medication with the pharmacist or local care provider than have a child return to the office for his or her follow-up appointment with untreated ongoing inflammation, risking permanent joint damage. Partnership along the chain of medical care will result in more effective treatment.

The future is bright in arthritis care. Increasing numbers of new therapeutics will be available, particularly new biologic therapeutics currently under development. Indeed, a number of emerging biologic treatments studied in arthritic adults remain to be studied in children. It is imperative that clinical trials proceed in children to ultimately allow for evidence-based rather than experimental medication use in children. Until we routinely and systematically collect safety data on children using medications for arthritis, we will be left with anecdotal reports, the lowest level of scientific evidence. **NCMJ**

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COMMENTARY

Sports Injury and Arthritis

Stephen W. Marshall, PhD; Yvonne M. Golightly, MS, PT

"…Then come home my children, the sun is gone down
And the dews of the night arise…"
William Blake, 1757–1827

A major theme in William Blake's poetry is the transformation of youth's innocence and simplicity into disfigurement, pain, and bitterness in old age. The "dews of the night" that arise in today's society are largely chronic diseases such as arthritis. In this commentary, we explore the connection between acute sports injury, which occurs during the playful period of early life, and arthritis, a widely prevalent later-life chronic condition with high impact on quality of life.

Relationship Between Sports Injury and Arthritis

It is helpful to begin by comparing the basic descriptive epidemiology of these two apparently divergent conditions. Nationally, the incidence of sports injury rises dramatically through the middle and high school years and then subsides throughout adult life.[1] (See Figure 1.) This is largely a reflection of the fact that children and youth play a greater amount of high-intensity sports than adults. Likewise, the incidence is higher in males than females in large part because boys have greater participation in full-contact sports (eg, football, wrestling, and some martial arts) and these sports have a higher risk of injury.

Trauma from sports injury is most closely linked with osteoarthritis. Reliable national data for osteoarthritis is not readily available, but national prevalence data for overall arthritis is available. Osteoarthritis comprises over 50% of the more than 100 types of arthritis in the United States, and thus arthritis prevalence is a reasonable proxy for osteoarthritis prevalence. The prevalence of arthritis is essentially zero for adolescents and young adults (when sports injury incidence is at its peak), but steadily rises with increasing age. (See Figure 2.) Arthritis is more prevalent in women than in men.

How are the curves in Figures 1 and 2 related? It is widely believed that if we could drive down the spike in sports injury incidence during adolescence (eg, through prevention programs), the arthritis curve would be shifted further to the right—that is, pushed further into later life—because there would be less early-onset osteoarthritis.

Is this belief correct? A strong association between injury and osteoarthritis is widely acknowledged in the biomedical community, but the epidemiologic evidence for this relationship is surprisingly sparse. For the knee, several epidemiologic studies have suggested that a history of injury is positively associated with an increased occurrence of knee osteoarthritis.[2-4] However, the few studies published on injury and osteoarthritis of the

"… based on the available evidence, it appears that programs addressing the prevention and care of sports injury will pay dividends in terms of preventing early onset of osteoarthritis."

Stephen W. Marshall, PhD, is an associate professor in the Department of Epidemiology, associate professor in the Department of Orthopedics, adjunct associate professor in the Department of Exercise and Sport Science, and senior biostatistician in the Injury Prevention Research Center, the University of North Carolina at Chapel Hill. He can be reached at smarshall@unc.edu or the University of North Carolina at Chapel Hill, Campus Box 7435, Chapel Hill, NC 27599-7435.

Yvonne M. Golightly, MS, PT, is a doctoral student in the Department of Epidemiology and a graduate research assistant in the Thurston Arthritis Research Center, the University of North Carolina at Chapel Hill.

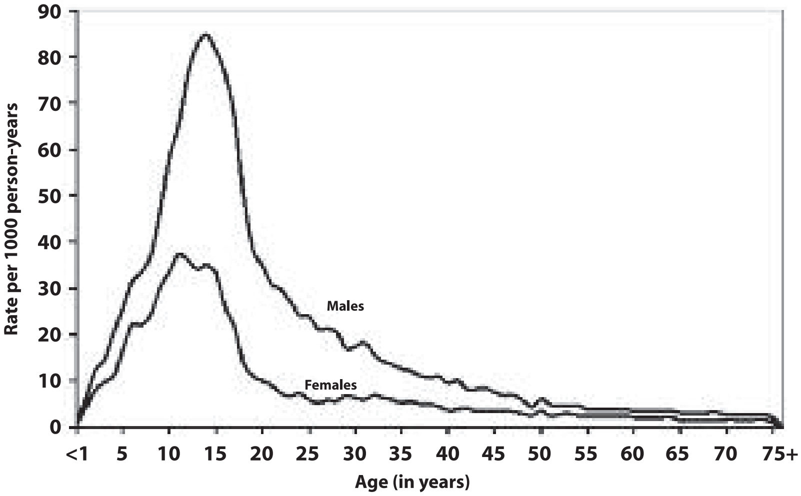
hip[5,6] and the hand[2,7] present conflicting results. There is no research on the association between injury and osteoarthritis at body sites other than the knee, hand, and hip.

Despite the limited epidemiologic data, there is a strong biological basis for linking injury to early onset of osteoarthritis, at least at load-bearing joints. Trauma to the soft tissues (eg, tendons, ligaments, cartilage, and muscles) that surround and support a load-bearing joint such as the knee erodes their ability to absorb and dissipate impact forces. Thus, the cumulative force transmitted to the joint surfaces from simple everyday activities such as walking, running, and jumping is increased. Breakdown of cartilage could result in narrowing of the joint space or fragments of cartilage or other tissues in the joint, common radiographic features of osteoarthritis. Further loss of cartilage may lead to greater contact between the joint surfaces, and bone may respond to this stress by developing osteophytes, another radiographic feature of osteoarthritis. Animal models of meniscus damage[8] and human studies of surgical removal of the meniscus after knee injury[9] support the biological rationale of load-bearing tissue defects contributing to knee osteoarthritis.

Youth Sports Injury in North Carolina

Despite the fact that the epidemiologic data is underdeveloped, it is reasonable to assume a causal relationship between sports injury and osteoarthritis based on the available biological information. Thus, from a public health standpoint, we need to ask, *What do we know about sports injury in North Carolina?* There is no surveillance system that adequately captures the extent of the youth sports injury problem in our state. However, by combining data from various sources some portions of the picture come into focus. Some key statistics are presented in the accompanying sidebar.

Figure 1.
Incidence of Injury from Sports and Recreational Physical Activity, by Age and Sex



Source: Emergency Department Records (National Electronic Injury Surveillance System All Injury Program), United States, July 2000-June 2001 (reproduced from *MMWR* 2002;51:736-740).

The problem of sports injury is concentrated in youth and in males. Important facts to note are:

- For boys ages 10 to 14 years, sports injuries account for over 50% of all emergency department visits for treatment of an unintentional injury.[1]
- For girls ages 10 to 14 years, sports injuries account for nearly 40% of all emergency department visits for treatment of an unintentional injury.[1]
- Boys account for 60% of high school athletes in North Carolina but sustain nearly 75% of high school athletic injuries.
- Football accounts for 16% of high school athletes in North Carolina but over 40% of high school athletic injuries.

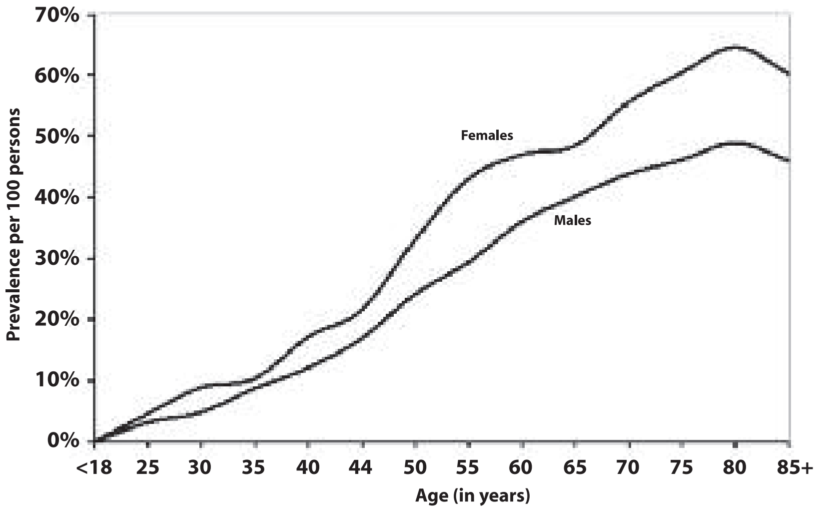
Statistics such as these have stark implications for the burden of osteoarthritis in later life and underscore the need for prevention programs aimed at youth sport injury. Recommendations for preventing youth sports injury include correct preparation and care of playing surfaces, improved physical fitness and conditioning of athletes, care and maintenance of playing equipment, and a requirement for the provision of qualified health care professionals (preferably certified athletic trainers) in all schools. The American Academy of Pediatrics' Committee on Sports Medicine has an extensive set of recommendations on preventing injury in specific youth sports including soccer, hockey, baseball/softball, and horseback riding.[10] The National Athletic Trainer's Association also has an extensive set of online resources addressing youth sports injury prevention.[11]

Sports medicine professionals are very concerned about the increasingly competitive nature of youth sports. Over the past few decades, youth sport has evolved from informal neighborhood pick-up games into highly-structured and financially-lucrative competitive leagues that, in the case of at least one sport, are nationally televised. Parents are progressively more focused on collegiate scholarships and the high salaries earned in some professional sports, although only a tiny fraction of youth athletes ever compete at the collegiate or professional level.[12]

As an example of this trend, it is worrisome that weight gain is now being emphasized at the junior levels of football. The combination of more weight being placed on weight-bearing joints (such as the knee) and a higher risk of joint trauma (due to increased competitiveness) is likely to be a "double whammy" for developing osteoarthritis in later life.

Parents and coaches need to remember that winning and excelling should be secondary goals in youth sport. Personal development, increased physical fitness, skills development, and simply having fun are the primary goals.

Figure 2.
Prevalence of Self-Reported Arthritis, by Age and Sex



Source: National Health Interview Survey, United States, 2001.

Obesity Prevention Through Youth Sports

Aside from trauma due to sports injury, another major factor that increases joint loading is body weight. North Carolina, like the rest of United States, has experienced an alarming increase in prevalence of obesity and overweight over the past few decades.[13,14] The rapid increase in sedentary recreational activities, such as home computers and electronic games, has fueled an equally spectacular growth in our children's body mass index.[14,15] Increasing academic pressures from schools further limit leisure time for children and youth. Obese/overweight children grow into obese/overweight adults who are more likely than the rest of the population to develop osteoarthritis of the hip and knee in addition to diabetes, cardiovascular disease, and other chronic conditions.[16,17]

One obvious solution to the obesity epidemic is to encourage kids to participate in youth sports. In addition to obesity prevention, youth sports are widely surmised to have beneficial effects in terms of personal development and team skills. But not all youth sports are created equal; some carry a high risk of injury. The expected reductions in arthritis from increased promotion of youth physical activity could be negated if we do not also devote resources to preventing and caring for youth sports injuries. Even when sports injuries cannot be prevented completely, proper treatment and rehabilitation of these injuries is important to restore optimal movement patterns, likely reducing the risk of both reinjury and developing osteoarthritis. Thus, the public health equation is not:

More sports in early life = Fewer adults with
lower extremity osteoarthritis

but rather:

More sports in early life + fewer sports injuries
+ maintenance of healthy body weight
+ good rehabilitation after sports injuries
= Fewer adults with lower extremity osteoarthritis

Additionally, injury often forces participants into reducing their level of activity. Uninjured participants, on the other hand, are more likely to maintain their activity program.[18,19] Thus, programs addressing the prevention of sports injury will increase the public health benefit of physical activity promotion campaigns. Sports injury prevention advice should always be incorporated into physical activity health promotion campaigns.[20]

Future Directions for Research and Policy

Epidemiologically, the relationship between injury and osteoarthritis needs to be further clarified through additional research. However, based on the available evidence, it appears that programs addressing the prevention and care of sports injury will pay dividends in terms of preventing early onset of osteoarthritis. Reductions in osteoarthritis prevalence can also accrue from obesity prevention through increased sports participation. However, increasing participation in youth sports without addressing the potential for a resultant increase in injury incidence may fail to attain the overall goal of arthritis prevention. One sport of particular concern in this regard is football, not only for its high incidence of injury, but because the sport is increasingly associated with weight gain during the high school years. **NCMJ**

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Sports Injury in North Carolina Youth—Key Statistics

- Total number of North Carolina high school athletes … 175 582
  - Girls: 67 774 (39%)
  - Boys: 107 807 (61%)
  - Football: 28 074 (16% of total)
- Annual number of North Carolina high school sports injuries …10 531
  - Girls: 2864 (27%)
  - Boys: 7667 (73%)
  - Football: 4381 (42% of total)
- Annual number of emergency department visits for sports injury in North Carolina…123 000
- Proportion of all emergency department visits for treatment of unintentional injury that is due to sport:*
  - Across all age groups: 16%
  - Girls ages 10 to 14 years: 38%
  - Boys ages 10 to 14 years: 52%

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Depression and Arthritis

Brenda M. DeVellis, PhD; Robert F. DeVellis, PhD

The onset of symptoms and eventual diagnosis of chronic disease typically cause emotional distress. In most cases this distress subsides over time as psychological adaptation to the condition occurs.[1] A significant minority of people, however, develop less transient, more severe psychological distress that can result in significant additional disability and suffering. The comorbidity of depression and arthritis is a major problem compromising the health of a significant number of Americans. This type of comorbidity is far more prevalent than previously thought and can have a negative impact greater than the sum of the 2 illnesses separately.[2] Thus, failure to appreciate the presence of depression in patients with arthritis can significantly compromise not only diagnosis and treatment of the affected patient but the impact of both illnesses and the health of the public overall.

Depression: Prevalence and Impact

In a lead editorial in the *American Journal of Public Health* in 1999, Neugebauer called for increased attention by the medical and public health communities to the devastating personal and economic impact of mental illness.[3] He cited findings from the 1994 National Comorbidity Survey showing that 17% of a national probability sample of US noninstitutionalized adults aged 15 years to 54 years had experienced one or more episodes of major depressive disorder in their lifetime.[4] Of equal concern were the 12-month prevalence findings; in the previous year, 10% of adults had experienced one or more depressive disorders. In a replication study of the 1994 survey, Kessler found that the prevalence numbers from 2001-2002 for a new population sample of 9282 were similar for lifetime prevalence (16.6% of people with one or more episodes of major depression in their lifetime) and somewhat lower (6.6%) for those experiencing an episode in the past year.[5,6] These findings are important because of the intense suffering and the significant morbidity and mortality associated with depression. One of the most tragic consequences of depression is suicide. In 2004, 32 439 people died by suicide in the US making it the 11th most frequent cause of death. In contrast, the number of homicides in 2004 was almost half this number at 17 357.[7] Further, more than 90% of people who commit suicide have a diagnosable mental disorder, most commonly a depressive disorder or a substance abuse disorder.

When Schulz et al examined mortality in adults over 65 years of age, they found that depressive symptoms at baseline were an independent risk factor for all cause mortality 6 years later even after controlling for multiple sociodemographic, disease, and health risk factors.[8] Pennix et al also studied the relationship of earlier self-reported depressive symptoms to later morbidity in older adults (age greater than 64 years) who were initially free of disability. Of these 6247 disability free people, 496 had scores greater than 20 out of 60 on the Center for Epidemiologic Symptoms Depression Scale, scores suggestive of depression.[9] At follow-up, instances of new heart attacks and new hip fractures occurred more frequently among those with more initial depressive symptoms but no initial disability. In addition, incident activities of daily living and mobility disability were higher in the initially-depressed group which, by 6 years of follow-up, had an activities of living disability rate of 36% and a mobility disability rate of 67% compared to those with fewer or no initial depressive symptoms (24% and 48% for activities of daily living and mobility disability, respectively). This significant difference in activities of daily living scores between those with more versus fewer depressive symptoms emerged after the first year of the study and steadily increased over the following 5 years. Almost half of this increased disability risk was explained by sociodemographic (gender, education, and income) factors, and a smaller part of the increase was explained by physical activity and having close contacts with relatives. However, after controlling for all of these factors, arthritis and angina were the 2 health conditions that contributed the most to the increased risk for disability in depression.

Depression and Arthritis

Increasing recognition of the importance of studying psychiatric and medical comorbidity has emerged over the past 15 years due to several large scale and pivotal studies in the areas of health services research and psychiatric epidemiology.

Brenda M. DeVellis, PhD, is a professor in the Department of Health Behavior and Health Education and a member of the Thurston Arthritis Research Center at the University of North Carolina at Chapel Hill.

Robert F. DeVellis, PhD, is a professor in the Department of Health Behavior and Health Education and a member of the Thurston Arthritis Research Center at the University of North Carolina at Chapel Hill.

The Medical Outcomes Study involved over 22 000 patients who visited 523 different medical providers during a specified period of time in 1986.[2] The major focus of this 4-year prospective study was on the consequences (outcomes) of chronic illness; it was the first large scale study "to include a psychiatric condition (depression) on equal footing with chronic medical conditions." Of the many important findings that have emerged from the Medical Outcomes Study, 4 are particularly relevant. First, Wells et al found that depression was associated with the same level or more of disability than 6 of the major medical chronic conditions studied and that only myocardial infarction in the previous year or current congestive heart failure and arthritis were associated with greater morbidity in any domain of functioning when compared with the functioning of people with depression.[2] Moreover, this finding was maintained over time in the longitudinal analyses. Second, Wells et al concluded that when arthritis was comorbid with depression, the resulting disability exceeded the disability level one would expect from simply combining disability due to depression with disability due to arthritis. That is, the negative effects of depression and arthritis are multiplicative rather than additive. Third, the negative consequences of subthreshold depression (ie, having some depressive symptoms without reaching the threshold for a depressive disorder diagnosis) were similar to consequences for people whose symptoms did reach diagnostic criteria. And, fourth, people's subthreshold depressive symptoms "remained unchanged in functioning and well-being over two years," which suggests that subthreshold depressive symptoms are not transient.

Other studies underscore the negative impact of comorbid depression and arthritis. Ang et al followed 1290 consecutive outpatients with rheumatoid arthritis over an 18-year period and found that depressive symptoms at baseline increased the risk of mortality many years later.[10] Stang et al used National Comorbidity Survey Replication data to examine the relationship between major depressive disorder and self-reported arthritis.[11] When controlling for age and other sociodemographic factors, they found that arthritis and major depressive disorder were significantly associated. Finally, Lin et al did the first, and to our knowledge only, major intervention study aimed at decreasing depression in patients with arthritis.[12] Their randomized controlled trial included 1801 depressed older adults (aged 60 years or older) from 18 primary care clinics in 5 states. The intervention consisted of antidepressant medications and/or 6 to 8 sessions of psychotherapy (Problem Solving Treatment in Primary Care). At 12 months they found a significant decrease of depressive symptoms in the intervention group compared to the usual care treatment control group as well as lower mean pain scores. In addition, they found improved activities of daily living and improved quality of life.

Overall, the pattern of findings from research indicates a substantial impact of depression on the trajectory of comorbid arthritis. In addition, the pain and loss of function associated with arthritis can contribute to depression. Both arthritis and depression have substantial prevalence rates. Thus, patients presenting with comorbid arthritis and depression are fairly common. It is important that health care providers recognize the presence and effects of depression as they treat patients with arthritis. Better control of depressive symptoms should be an integral component of treating people with arthritis who also experience depression. Helping arthritis patients obtain relief from their depression promises both to mitigate the added risk associated with depression and to enable the patient and physician to manage the arthritis itself more effectively. A first step to optimal treatment may simply be an awareness of the role that depression can play in the course of arthritis and its treatment. A second achievable step is screening for depression using one of several brief instruments developed for use in primary medical care settings. Finally, physicians should assist patients who have depression in finding appropriate care. Doing so will not only reduce unnecessary suffering arising from the depression itself but will also improve arthritis outcomes. **NCMJ**

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COMMENTARY

Physical Activity and Weight Loss Interventions in Older Adults With Knee Osteoarthritis

Stephen P. Messier, PhD

Osteoarthritis is a degenerative disease that affects articular cartilage and the underlying subchondral bone. The cartilaginous surfaces become pitted resulting in hypertrophic changes along the joint margins and reactive changes in the subchondral bone. Severe osteoarthritis is characterized by joint space narrowing, absence of articular cartilage, increased density and stiffness of the subchondral bone, and osteophyte formation along the joint margins.[1,2]

The knee is the most commonly affected weight-bearing joint. The major symptoms of knee osteoarthritis are pain and stiffness. Decreased mobility leading to muscle atrophy, an accelerated decline in physical function, and the inability to engage in activities of daily living such as walking and climbing stairs are clinical consequences that often lead to a loss of independence and a poor quality of life.[2-6]

The etiology of primary (idiopathic) osteoarthritis is unknown, although biomechanical and inflammatory mechanisms have been proposed as causative factors. Biomechanically, either structural abnormalities such as obesity or neuromuscular dysfunction may cause increased joint loads during walking. Failure to absorb these loads properly may cause microcracks in the subchondral tissue leading to increased stresses and cartilage degradation.[7]

Recent studies demonstrate that low-grade inflammation plays a pathophysiological role in osteoarthritis. The inflammatory cytokine interleukin-1 beta (IL-1ß) is present in the joint fluids of osteoarthritis patients.[8] Interleukin-1 beta is believed to play a role in mediating joint inflammation and cartilage degradation in osteoarthritis.[9] Likewise, an inflammatory component associated with osteoarthritis can be detected in the circulation since serum concentrations of inflammatory markers such as cytokines (interleukin-6, IL-6; tumor necrosis factor alpha, TNFα) and the acute-phase reactant C-reactive protein are higher in persons with knee or hip osteoarthritis compared to those without osteoarthritis.[10-13] Longitudinal studies demonstrate that high serum levels of C-reactive protein and TNFα predict increased radiographic progression of knee osteoarthritis as much as 5 years later.[11,14,15] Moreover, a few studies associate osteoarthritis severity and physical function with higher inflammatory markers in the blood.[10,16,17] Thus, severity, mobility, pain, stiffness, and radiographic progression are at least partly mediated by the level of chronic inflammation in osteoarthritis patients. Diffusion of cytokines from the synovial fluid into the cartilage could contribute to the cartilage matrix loss observed in osteoarthritis by stimulating chondrocyte catabolic activity and inhibiting anabolic activity.

> *"Several studies have shown that pain and disability improve with short-term (3 to 6 months) exercise."*

Obesity is a major risk factor for knee osteoarthritis.[18] Weight change and the risk of developing knee osteoarthritis are significantly associated. Felson et al showed that a 5.1 kg loss in body mass over a 10-year period reduced the odds of developing osteoarthritis by more than 50%.[19] Obese individuals have higher concentrations of inflammatory markers than lean people, and a large percentage of people with knee osteoarthritis are overweight or obese. Hence, obese individuals with knee osteoarthritis may have an even greater contribution of inflammation to functional limitation and disease progression.[20] Besides direct effects on the joint, inflammatory mediators can also affect muscle function and lower the pain threshold.

Unfortunately, treatments that affect the underlying biomechanical and inflammatory disease pathways are limited. The primary aim of therapies currently available is pain relief.

Stephen P. Messier, PhD, is a professor and director of the J.B. Snow Biomechanics Laboratory in the Department of Health and Exercise Science, Wake Forest University. He can be reached at messier@wfu.edu or Department of Health & Exercise Science, Wake Forest University, Winston-Salem, NC 27109.

Antiinflammatory medications and orthopaedic procedures are primary methods of treatment. More recently, exercise and weight loss have been used as therapeutic modalities for knee osteoarthritis patients.

The difficulty patients with knee osteoarthritis have with activities of daily living often result in activity avoidance.[21] Physical exercise, however, is an effective nonpharmacologic treatment. Several studies have shown that pain and disability improve with short-term (3 to 6 months) exercise. Short-term walking programs improve aerobic capacity, walking time, and self-reported function.[22,23] Similarly, lower extremity resistance training increases strength, decreases pain, and improves function in patients with osteoarthritis.[24,25] More recently, long-term walking and resistance training programs have been effective in slowing the decline in physical function commonly seen in this disabled population. A randomized clinical trial of 18-month walking and resistance training programs in 439 community-dwelling older adults with knee osteoarthritis reduced disability and pain and improved balance and mobility relative to a health education control group.[26] In a similar population, greater adherence to a physical activity program was associated with better physical performance and self-reported physical function.[27] Exercise also has been shown to improve late-life minor depression.[28]

Short- and long-term aerobic and resistance training programs are safe and effective treatments for knee osteoarthritis.[21] Traditional 3 days per week, 1 hour per day programs have been the most common regimens studied. Unfortunately, little is known regarding the dose response to exercise in the older, mostly female, sedentary, and predominately overweight population. Continuous weight-bearing aerobic exercise such as walking can initially be difficult for patients with knee osteoarthritis who experience significant pain. Starting with short bouts of exercise and inserting several rest periods when the patient has progressed to 30 or 40 minutes of walking improves adherence. Adding several resistance training exercises between periods of walking has proven effective and popular with patients.[8,29] The intensity of the exercise intervention may differ depending on the desired outcomes. If the goal is making exercise a part of a healthy lifestyle, then continued participation is more important than intensity. The exercise prescription should be flexible enough to accommodate periods of greater pain.

An important component of treatment for knee osteoarthritis is the reduction of body weight in patients who are overweight or obese. Results of a randomized, controlled clinical trial have shown that a program of diet and exercise results in greater improvements in self-reported function, mobility, and pain than exercise only, diet only, or healthy lifestyle interventions.[29] A dose response to weight loss indicated that participants who lost between 7.5% and 11.0% of their body weight exhibited significantly better self-reported function than participants who exhibited more modest weight loss (2.5% to 7.5%) or no weight loss (gained to 2.5%).[2] Christensen et al[30] recently found that an 11% weight loss in an intensive diet group over an 8-week period produced a 3-fold improvement in function in older, obese adults with knee osteoarthritis relative to a control diet group that lost 4% of their body weight.

Studies have shown that weight loss decreases inflammation, reducing the cytokine activity that may be related to cartilage degradation. Nicklas et al[20] showed that a 5% weight loss over 18 months significantly reduced C-reactive protein, IL-6, and TNFα receptor 1 concentrations compared with a weight stable group. However, it is not yet known whether a specific amount of weight loss maximally reduces inflammation or whether improvements in physical function, pain, and osteoarthritis progression are related to a decline in chronic inflammation with weight loss.

Weight loss also has a beneficial effect on knee joint loads. Messier et al[31] found that every 1 lb in weight loss was related to a 4 lb decrease in knee compressive forces per step. These results imply that if an average weight knee osteoarthritis patient (about 200 lb) lost 10 lb, each knee would be subjected to 48 000 lb less in knee compressive forces per mile walked. Accumulated over thousands of steps per day, a reduction of this magnitude would appear to be clinically meaningful.

Both exercise and weight loss interventions improve pain and self-reported function, reduce inflammation, and enhance balance and mobility in older, obese adults with knee osteoarthritis. While effective, neither exercise nor weight loss interventions have attenuated disease progression. We suggest that a weight loss of 10% to 15% of baseline body weight, or 2 to 3 times greater weight loss than achieved in recent long-term studies, may provide the necessary stimulus to reduce inflammation and knee joint loads to levels that result in less cartilage degradation and a slowing of disease progression. **NCMJ**

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Community and Environmental Factors and Arthritis Outcomes

Joanne M. Jordan, MD, MPH; Leigh F. Callahan, PhD

Great strides have been made in the past century in preventing disease and reducing early mortality, but disparities in health between and within countries are still pervasive.[1-3] The National Institutes of Health defines disparities broadly as "differences in the incidence, prevalence, mortality, and burden of diseases and other adverse health conditions that exist among specific population groups in the United States."[4]

The national health care research agenda places high priority on reducing disparities in health outcomes among persons of different socioeconomic and racial/ethnic groups through examining the mechanisms for disparities and proposing prevention strategies.[5] There is now an increasing interest in more explicit investigations of the complex issues regarding disparities and health outcomes. The urgency of understanding the effects of external forces at multiple levels including individuals and their behaviors, communities and environments, and social policies was made vividly apparent in the wake of Hurricane Katrina. The same could be illustrated in how we reacted to the fall 2007 California wildfires. We cannot deny that place can have a significant impact on outcomes regardless of an individual's resources. We also cannot deny that there are racial and ethnic differences in communities in the US.

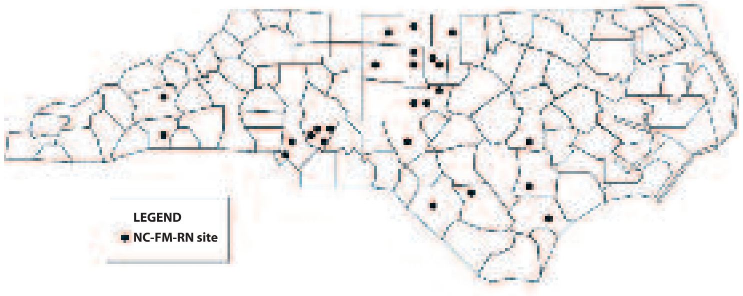
The association between lower levels of individual socioeconomic status and poorer health outcomes has been documented for centuries in various parts of the developed world.[6-9] Associations between lower socioeconomic status and increased prevalence of disease, morbidity, and mortality in persons with arthritis and rheumatic conditions have been demonstrated in a number of population-based and clinical studies.[10-13] The role of individual socioeconomic status has been studied examining variables such as formal education level, income, occupation, and home ownership. Health outcomes have been shown to be associated with the socioeconomic environment of an individual's neighborhood,[14-16] independent of the individual's socioeconomic status.[15-17] Although there is a long tradition of public health research relating community factors to patterns of health and disease,[18,19] this has traditionally been in the context of hygiene, clean water, and the presence/eradication of infectious disease-bearing vectors. Increasingly, research findings are beginning to focus on the upstream determinants related to the community in the context of chronic diseases. These include place of residence, work environment, or wider social and economic policies. These community variables often are described as "social context," a catch-all phrase referring to the spectrum of societal factors that may not be directly measured at the individual level. The socioeconomic context of communities may affect characteristics of the social, service, and physical environments to which all residents are exposed regardless of their own socioeconomic position[20,21] and may have a greater negative impact on those with fewer individual resources.[22,23]

> *"In preliminary data from the Johnston County Osteoarthritis Project, we observed higher blood lead levels were associated with knee osteoarthritis severity in men and women..."*

Joanne M. Jordan, MD, MPH, is an associate professor of medicine and orthopaedics, chief of the Division of Rheumatology, Allergy, and Immunology, and director of the Thurston Arthritis Research Center at The University of North Carolina at Chapel Hill. She can be reached at Joanne_Jordan@med.unc.edu or 3300 Doc J. Thurston, Jr Building, CB#7280, Chapel Hill, NC 27599.

Leigh F. Callahan, PhD, is an associate professor of medicine, orthopaedics, and social medicine at the Thurston Arthritis Research Center, the University of North Carolina at Chapel Hill.

Figure 1.
Map of the 25 North Carolina Family Medicine Research Network (NC-FM-RN) Sites



We at the Thurston Arthritis Research Center at the University of North Carolina also have been very interested in the role of individuals' community and socioeconomic environments on health outcomes in people with arthritis throughout the state of North Carolina. We have examined the associations of community poverty level with arthritis prevalence and health status.[24,25] (L. F. Callahan, T. Mielenz, B. Schoster, et al, unpublished data, 2007; L. F. Callahan, J. Schreffler, T. Mielenz, et al, unpublished data, 2007) We have also embarked on a novel research agenda that examines one particular aspect of the environment—chronic environmental metal exposures—in relationship to osteoarthritis in Johnston County, the site of a longitudinal community-based research study of racial/ethnic disparities in osteoarthritis and disability outcomes between African Americans and whites.[26]

Community Poverty Level and Health Outcomes in North Carolina

In one study using patients from the North Carolina Family Medicine Research Network, a research consortium of 25 family medicine sites in rural, urban, and suburban practices across the state[27] (see Figure 1), we observed that white patients with low educational attainment (defined as less than a high school degree) and who lived in high poverty areas (defined for the block group using the 2000 Census as the percentage of the population in households with income below the poverty level) had 1.56 times the odds of reporting arthritis compared to white patients with higher educational attainment who lived in low poverty areas. African-American patients with low education living in an area with high poverty levels were more than twice as likely to report arthritis compared to African-American patients with high education levels living in low poverty areas. (L. F. Callahan, T. Mielenz, B. Schoster, et al, unpublished data, 2007)

We have also examined associations between education and census-based community-level measures of socioeconomic status in 4565 whites and African Americans in the Research Network. We used health-related quality of life assessed by the SF-12v2 Physical Component Summary and Mental Component Summary and 3 Centers for Disease Control and Prevention health-related quality of life measures to summarize the impacts of the environments.[28,29] Analyses also were conducted on subgroups of arthritis and cardiovascular disease patients. In whites, all 5 health-related quality of life outcomes had significant and meaningful associations for those with the lowest education and poorer outcomes; and 4 outcomes associated high community poverty level with poorer status. Four outcomes had associations with poorer status for the lowest education and high community poverty levels in the African-American group. Arthritis and cardiovascular disease subgroup analyses showed parallel findings. (L. F. Callahan, J. Schreffler, T. Mielenz, et al, unpublished data, 2007) These findings indicate that even using crude environmental measures, community level variables are important.

Environmental Exposures as Potential Explanations of Community and Social Determinants of Outcome

What could explain geographic, socioeconomic, and community variation in arthritis outcomes? One potential explanation is environmental exposures to harmful substances in areas that are economically depressed. Many of the rheumatic illnesses such as systemic sclerosis, systemic lupus erythematosus, and rheumatoid arthritis are autoimmune in nature with both genetic and environmental components. Environmental exposures in relationship to autoimmune conditions have usually been examined in response to report of a cluster of affected persons surrounding an environmental pollution source or a common occupational exposure.[30-34] Such exposures have included organic solvents, petroleum products, mercury, and silica dust,[35-37] all of which can affect the immune system. However, interest in the role of *routine* environmental exposures, including those from childhood or throughout the lifecourse, is gaining traction. There is concern that routine environmental exposures could act as "triggers" to induce or maintain an autoimmune response or poor health outcome in individuals not exposed to overt environmental disasters. These include risk factors such as prior infections and tobacco and hormone use.[38,39] Since some of these hypotheses are preliminary, their penetration into clinical practice has not yet widely occurred; nonetheless, the impact of treating these exposures as potentially modifiable targets for primary and secondary prevention could be significant.

Examination of environmental causes of nonautoimmune musculoskeletal conditions such as osteoarthritis has been limited. Some occupations, particularly those requiring heavy physical labor or repetitive knee bending, are more likely to be associated with osteoarthritis presumably through their physical demands and the biomechanical loads they entail.[40] Dietary intake and use of hormones and tobacco have also been examined in relationship to osteoarthritis[41-45] but few other environmental exposures have been examined.

We have recently begun examination of metal exposures, many of which occurred throughout the lifetime, and osteoarthritis using data from the Johnston County Osteoarthritis Project, a longitudinal community-based research study of racial/ethnic disparities in osteoarthritis and disability outcomes between African Americans and whites.[26]

Environmental Metal Exposures as Potential Risk Factors for Osteoarthritis

Heavy metals are ubiquitous, and exposure through drinking water, contaminated food, pesticides, and other means is widespread in our society[46-51] and remains a significant public health problem particularly in high-risk sociodemographic groups and certain geographic locations.[46,51] The varied and sometimes subtle health effects of low-level, chronic exposures to multiple elements such as lead, mercury, arsenic, and cadmium have only recently been recognized.[52-61] Many metals are divalent or trivalent cations with a tropism for bone and the potential to bind to negatively charged components of proteoglycans in cartilage.[55,62-65] Yet little attention has been directed at the possible roles of these metals in relationship to osteoarthritis, a condition accompanied by profound disruption in both bone and cartilage.[66-69]

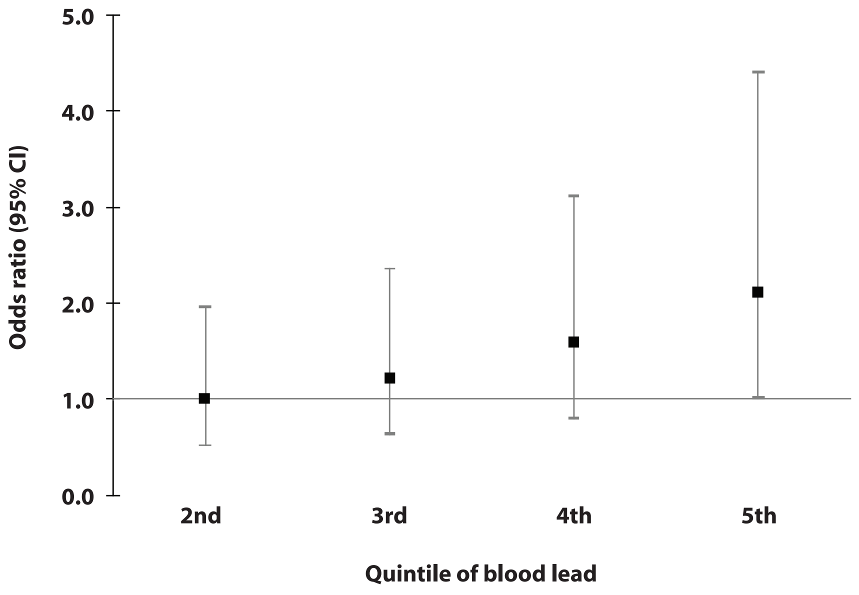
Lead and Osteoarthritis

Approximately 95% of total body lead burden in adults is stored in bone with accumulation occurring into the 7th decade. Bone lead is released into blood chronically, making bone a target tissue for lead toxicity and an endogenous source of persistent lead toxicity particularly after menopause.[70-73] Lead affects bone formation and resorption, and recent data suggest that lead affects cartilage as well.[74] In preliminary data from the Johnston County Osteoarthritis Project, we observed higher blood lead levels were associated with knee osteoarthritis severity in men and women (see Figure 2) and with serum and urine osteoarthritis biomarkers in women with possible racial differences in effect.[75,76]

Selenium and Osteoarthritis

One potentially protective environmental exposure is selenium. Selenium is an essential trace element and a required cofactor for glutathione peroxidase and antioxidant defense against free radicals and peroxide.[77,79] It has been evaluated for its protective role in cardiovascular disease, cancer, and other conditions of aging.[77,79] Animals with selenium deficiency have irregular bone formation, decreased bone strength, and abnormalities in types I and II collagen in cartilage.[80-82] In areas of China and eastern Asia where selenium levels in the soil are among the lowest in the world, low selenium, among other risk factors, has been associated with Kashin-Beck Disease, an endemic, early onset osteoarthropathy. Early intervention regarding deficiency in this environmental factor has decreased the incidence of this disease.[83,84] Selenium levels may be low in the southeastern United States as well,[85] leading us to investigate the role of selenium in osteoarthritis. Interestingly, preliminary data showed that those with low selenium levels, measured in toenails, were more likely to have knee osteoarthritis and more severe knee osteoarthritis,[86] and women with low selenium were more likely to have hip osteoarthritis. (J. M. Jordan, F. Fang, J. B. Renner, et al, unpublished data, 2007).

Figure 2.
Blood Lead Levels and Severity of Radiographic Knee Osteoarthritis



These results are compelling in that they suggest there may be modifiable environmental factors that could influence the onset and progression of osteoarthritis with the potential for intervention. We suspect these factors interact with genetic and other risk factor susceptibility, and future studies of these issues are planned.

Examination of the role of both individual and community social determinants of health outcomes in arthritis and rheumatic conditions is overdue. Future studies will be needed to verify cross-sectional associations longitudinally and to tease out explanatory factors behind observations. Arthritis and autoimmune conditions are areas in need of further research in the role of environmental exposures in etiology and maintenance of disease. The possibility that environmental exposures could contribute to these conditions and to ethnic disparities in these conditions would likely lead to changes in clinical practice and public policy. **NCMJ**

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Pain and Arthritis

John B. Winfield, MD

Arthritis is virtually synonymous with pain. Arthritis-associated pain is the number one reason patients visit a doctor. For the past 8 years, I have been practicing rheumatology in western North Carolina. Before that, my entire career had been in academic or medical research institutions, most notably at the University of North Carolina at Chapel Hill. The current foray into the "real world" of medicine has been enlightening, to say the least, and has allowed some insight into how arthritis pain is approached in North Carolina that could come only from being part of a local medical community. In this commentary, I will make some suggestions as to how we could do a better job. In addition to medical practice issues such as diagnosis, classification, and management, I will touch upon several less conventional topics such as physician attitude and behavior in the approach to pain.

Chronic pain is an extremely important aspect of illness, yet it is woefully neglected at all levels of training and practice starting with medical school curricula. The public health burden of chronic pain falls mostly on the primary care physician. It has been my experience in "the real world" that there is enormous variability in the willingness and effectiveness of the primary care physician to manage chronic pain in his or her patients. All too often there is a direct "punt" of the entire problem to the local anesthesia pain clinic where after a series of epidural blocks—which don't help—the patient is "punted" back to the primary care physician and then to me.

Suggestion 1

Address pain as a disease entity, not as a sensory entity.[1] Not infrequently in office-based practice, treatment of pain is secondary to diagnosis and treatment of the disease state. This is unfortunate because pain, especially chronic pain, is among the most disabling and costly medical problems in Western countries.[2] Patients suffering with chronic diffuse pain who lack objective clinical and laboratory findings (ie, fibromyalgia) are especially likely to be dismissed as not having "real" pain, which only perpetuates their illness. Presence of pain should be specifically sought and evaluated in all patients and, if present, relief of pain should be a primary focus of the physician's efforts.

> *"Presence of pain should be specifically sought and evaluated in all patients and, if present, relief of pain should be a primary focus of the physician's efforts."*

Suggestion 2

Classify pain immediately after recognition. Pain classification is not difficult. Nociceptive pain is due to stimulation of peripheral pain receptors on thinly myelinated Ad and/or unmyelinated C afferents during inflammation or injury of tissues. The pain experienced generally matches the noxious stimulus. Both peripheral and central nervous system processes play a role in neuropathic pain, which may occur with direct nerve injury. There are 3 common types: (1) peripheral neuropathic pain (eg, postherpetic neuralgia, painful diabetic neuropathy, radiculopathic pain due to injury to spinal nerve roots); (2) central neuropathic pain (eg, central poststroke pain, spinal cord injury pain); and (3) cancer-associated neuropathic pain. Complex regional pain syndrome (reflex sympathetic dystrophy), while very rare, is another neuropathic pain syndrome. Neuropathic pain may be paroxysmal, with unusual characteristics such as electric shock-like shooting or burning, and may be

John B. Winfield, MD, is the Herman and Louise Smith Distinguished Professor of Medicine in Arthritis Emeritus at the University of North Carolina at Chapel Hill School of Medicine and currently is a practicing rheumatologist with Appalachian Regional Rheumatology. He can be reached at john_winfield@med.unc.edu or 400 Shadowline Drive, Suite 100, Boone, NC 28607.

associated with hyperpathia (persistence after the stimulus has ended, spreading or worsening in crescendo-fashion with repeated touching). Chronic pain of complex etiology occurs in fibromyalgia and a large number of substantially overlapping regional pain syndromes such as migraine headache, temporomandibular disorders, irritable bowel syndrome, and atypical chest pain, to name a few. Previously termed "functional pain syndromes" on the basis of absent structural pathology, these illnesses share very close relationships etiologically and pathophysiologically. Recent advances in the understanding of the psychophysiologic/neurophysiologic dysregulation in such illnesses is impelling a unifying reclassification as central sensitivity syndromes.[3] More purely psychogenic pain is seen in somatoform and somatization disorders and hysteria and is quite rare.

Suggestion 3

Invest some time catching up on recent developments in fibromyalgia. Forget the disparaging and dismissive comments of your professors and senior residents. These patients are not crocks or neurotic whiners. Rather, they have a complex neurosensory disorder manifest by multiple abnormalities in how the central nervous system processes and interprets sensory input. At least 5% of adult females have fibromyalgia. Approximately 25% of patients with rheumatoid arthritis and perhaps 50% of patients with lupus also have fibromyalgia, and both illnesses must be treated for optimum therapeutic response. In fibromyalgia, altered central nociceptive processing results in a decrease in the pain perception threshold and in the threshold for pain tolerance. Except for pain with palpation of tender points, the physical examination and all routine laboratory tests are normal yet the pain is very real, as can be demonstrated by sophisticated quantitative sensory testing methods and functional MRI studies. Multiple genes[4,5] that increase vulnerability to this and related disorders have been identified. These genes encode molecules involved in nociceptive processing, and their identification is proving to be invaluable in new drug discovery. Very effective management strategies have evolved,[6,7] and for the first time a drug, pregabalin (Lyrica), has been specifically approved by the Food and Drug Administration for treatment of pain in fibromyalgia. Several more (eg, duloxetine/Cymbalta and sodium oxybate/Xyrem) should receive Food and Drug Administration approval shortly.

Suggestion 4

Apply some simple approaches for measuring pain, fatigue, sleep, psychological well-being, and daily functioning in your patients. This sounds complicated and time-consuming, but it is not. Pain intensity can be measured with either a verbal or numerical rating scale or a visual analog scale. Observation of pain behaviors such as guarding, rubbing, grimacing, and sighing provides insight into self-efficacy for control of chronic pain—more prominent pain behavior equates to low self-efficacy—which in turn greatly compromises a patient's capacity to cope with chronic pain conditions. A number of measurement tools can be applied in just a few minutes while the patient is in the waiting room through use of a multidimensional health assessment questionnaire. This instrument combines simple self-report forms that incorporate validated scales for physical and psychological health status (modified health assessment questionnaire); visual analog scales for pain, fatigue, and patient global self-assessment; a checklist of current symptoms; and scales for helplessness and cognitive performance.[8] Easily adaptable to a busy practice, such information is invaluable for the psychosocial assessment of pain both diagnostically and in monitoring response to therapy.

Suggestion 5

Do not be afraid of opioids. It is my experience that certain primary care physicians or even entire practice groups have a policy of not prescribing narcotics, period! This is ridiculous, bad medicine, and perhaps even malpractice. Some chronic noncancer pain can be managed only with opioids including pain in occasional patients with fibromyalgia. Not every patient who requests hydrocodone is a drug-seeker. Low-dose opioids taken concurrently with nonsteroidal anti-inflammatory drugs or Cox-2 inhibitors for patients with osteoarthritis who fail acetaminophen are not only effective when used as part of a multimodal approach to pain control, but may have fewer potentially life-threatening complications.[9] Reasonable guidelines for use of opioids in more severe musculoskeletal pain include exclusion of substance abusers, concomitant attention to psychological and social perpetuators of pain, use of an opioid treatment contract, a one physician-one dispensing pharmacy policy, and close monitoring. It should be remembered that drug-seeking behavior (pseudoaddiction) may indicate that pain is not being controlled adequately.

Summary

Address arthritis-associated pain as a disease entity, not as a sensory entity. Attempt to classify chronic pain as nociceptive pain, neuropathic pain, fibromyalgia-type pain, or psychogenic pain (very uncommon); specific treatment approaches are required for these different types of pain. Overcome your negative bias against fibromyalgia and review recent discoveries that have led to classification of fibromyalgia as a biologically-based neurosensory disorder. Use the simple and convenient ways that are available to measure pain and its concomitants (fatigue, poor sleep, depression, anxiety, and impaired physical functioning) both at initial evaluation and in follow-up visits as a guide to therapy. Do not fear use of opioids; just be careful with this class of drug. **NCMJ**

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Contemporary Total Joint Arthroplasty

Victor M. Goldberg, MD

Total joint arthroplasty has become a successful and reproducible surgical treatment for significant arthritis. Both pain relief and functional outcomes have been excellent. In 2004 over 475 000 total knee replacements and more than 230 000 total hip replacements were performed in the United States, and this number is increasing at a rate of 11% for knee replacement and 2.5% for hip replacements each year. Although joint replacements have an excellent outcome, there still has been a small although disturbing incidence of mechanical and biological failures. The causes of these failures include implant surface wear, loosening, and instability. Infection remains a long-term concern.[1,2]

Early in the history of joint arthroplasty, younger, more active patients and very elderly patients were discouraged from having replacements because of the increased incidence of failures in these populations. Recent advances in implant design, materials, and surgical techniques have widened the indication for total joint arthroplasty in all patients with end stage arthritis. For example, alternative bearing surfaces such as metal-on-metal articulations have significantly reduced wear and its associated bone loss and implant loosening.[3-6] Minimally invasive surgical procedures have accelerated patient rehabilitation, and enhanced instrumentation has provided excellent restoration of joint anatomy.[7-9] An understanding of the present state of the art of joint arthroplasty is critical in order to provide physicians and patients with the basis of contemporary indications and expected realistic outcomes of the procedure.

Total Knee Arthroplasty

Enhanced designs and techniques have improved the long-term survival rates of total knee replacements so that 90% to 95% of active patients can expect a satisfactory result for 15 to 20 years. Implant fixation can be accomplished by either cementless or cemented methods. The success of cementless fixation depends upon a stable implant with a porous surface composed of either titanium or cobalt chromium alloys configured to support bone regrowth. Stability of the components can be achieved by using screw fixation and press-fit stems and/or pegs.[10-12] Precise surgical instruments provide close implant-bone interface. Studies indicate that component movement of less than 75 to 100 micrometers will support bone ingrowth, whereas motion of greater than 150 micrometers encourages fibrous tissue ingrowth.[4]

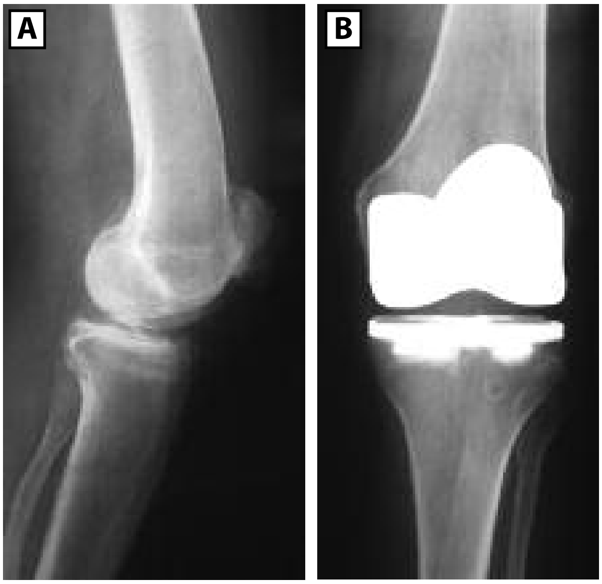
> *"Recent advances in implant design, materials, and surgical techniques have widened the indication for total joint arthroplasty in all patients with end stage arthritis."*

Contemporary knee component designs have closely reproduced knee anatomy. Recently gender-specific implants have been introduced to better match the size and geometric dimensions of the female distal femur. (See Figure 1.) This should improve patellar tracking and ligament balancing. Knee flexion is important for functional activities. Newer designs are now available that allow as much as 140° to 150° of knee flexion.[12] This is especially important in patient populations that require kneeling activities.

Wear of contact surfaces is a significant cause of failure of total knee replacement. Improvement in the manufacturing technique of polyethylene has reduced wear debris from the articulating surface. These advances include processes to reduce oxygenation of polyethylene to improve fatigue wear of the material.[4] The use of thicker polyethylene tibial inserts and optimization of component designs has also reduced wear failures in total knee arthroplasty.[12] Another approach to reducing stress on polyethylene has been to increase conformity between

Victor M. Goldberg, MD, is a professor in the Department of Orthopedic Surgery at Case Western Reserve University. He can be reached at vmgoldbg@aol.com or 11100 Euclid Avenue, Cleveland, OH 44106.

Figure 1.
(A) Lateral Radiograph of a Female Patient With Significant Osteoarthritis
(B) Arthroplasty Radiograph Demonstrating the Anatomical Relationship of the Component With the Femur Using an Implant Specifically Designed for Females



surfaces. Mobile bearing prostheses have been developed that provide conformity without sacrificing rotational movements of the knee.[13] Although the results are satisfactory with a follow-up of 9 to 12 years, there is still an incidence of periprosthetic bone loss as a result of wear-induced osteolysis.

Traditional total knee arthroplasty has been highly successful in pain relief and functional long-term survivorship. Patients, however, have expressed dissatisfaction with the postoperative pain and prolonged rehabilitation. These issues have encouraged surgeons to adopt minimally invasive surgical techniques which use smaller skin incisions and muscle-sparing approaches.[8] The early results of minimally invasive surgical techniques are encouraging, but usually by 6 months to 1 year after surgery there is no difference in results when compared to traditional approaches. Longer term data will be necessary to substantiate the early results of minimally invasive techniques which are inherently more difficult and have the potential for increased complications.

Optimizing surgical techniques in total knee arthroplasty has been reported to improve long-term survivorship of the procedure.[7] Adapting computer assisted navigation to the total knee arthroplasty surgical technique may improve knee alignment and component position. The early results indicate that these outcomes can be accomplished using this technique, but extensive exposure is necessary and the instrumentation is complex and difficult to master.[7] Ultimately this approach combined with a minimally invasive technique will assure anatomically aligned knees with the least intrusion on bone and soft tissues.

Total Hip Arthroplasty

Since total hip arthroplasty was introduced into the United States in 1969, there have been extensive changes in implant designs, materials, and surgical techniques. Using contemporary designs, hip implant survival rates have approached 90% to 95% at 15 to 20 years after surgery.[14] Early concerns focusing on perioperative infection have largely disappeared due to the use of perioperative antibiotics, ultraclean operating rooms using laminar flow methods, and exhaust exclusion hoods that isolate the surgeon from the patient. Implant breakage has virtually been eliminated by the use of high strength materials such as titanium and forged cobalt chromium stems. Newer hip stem designs use more flexible materials that match the stem's material characteristics with the surrounding bone to enhance implant integration with the patient's femur and also preserve native bone.[15] (See Figure 2.) Fixation methods have evolved so that either cemented or cementless modes of fixing the component to bone have been highly successful.[14,16,17] Major advances in this area have included methods of assuring excellent cementing techniques to provide optimum fixation of the implant to the host bone.[18] Porous surfaces have been redesigned to closely mimic the structure of the surrounding bone.[15] These newer surfaces provide the best geometric configuration to enhance bony ingrowth and long-term component fixation.

The major focus of research and development over the past decade has been directed towards reduction of bearing surface wear and the biologic reaction to this periprosthetic debris.[3]

Figure 2.
Arthroplasty Radiographs of a Hip Six Years After Replacement With a Component Stem Made of Flexible Materials Demonstrating Excellent Bone Preservation

The resulting bone loss or osteolysis may compromise implant fixation and ultimately result in component loosening. Alternative bearing surfaces have been developed which may reduce wear of the articulating surfaces and prolong the longevity of the total hip replacement.[4-6] Hard surfaces include metal-on-metal or ceramic-on-ceramic. Although wear is reduced significantly with these surfaces, there still are potential problems that could compromise the replacement. For example, metal-on-metal surface wear results in the release of metal ions which circulate systemically and could have long-term consequences.[5] Ceramic surfaces have the potential to fracture if any impingement results because of even minor implant malposition.[6] The recent introduction of highly cross-linked polyethylene as a counter surface to the femoral head also has significantly reduced the generation of wear particles.[4] However, the ultimate role of each of these bearing surfaces requires longer term follow-up, so that the choice of the best articulating surface can be adapted cost-effectively to the appropriate patient.

Computer assisted navigation and minimally invasive surgical techniques have also been used at selected centers to improve implant positioning and early rehabilitation. Initial experience with both of these approaches has been encouraging, but long-term follow-up is necessary to assess the real value of these approaches compared to established methods.[9]

The use of total hip replacement in young, active patients has always been controversial considering the reported increased failure rate in these patients.[16] Revision total hip replacement is significantly more complicated than the primary procedure because of the bone and soft tissue loss seen with the failed total hip replacement. Recently metal-on-metal surface replacement arthroplasty has been introduced to replace the hips of this younger, active patient population.[19] (See Figure 3.) This replacement preserves bone and resurfaces the acetabulum and femoral head. The larger ball size may enhance range of motion and hip function without the risks of hip dislocation. The early results have been good, however, an additional complication not seen in classical total hip replacement has been observed.[20] Femoral neck fractures have been reported which require an early revision, perhaps because the surgical procedure itself compromises the blood supply to the femoral head. The reported incidence of this complication varies from 1.5% to 3%. Prevention of this early failure requires surgeon education and improved sophisticated instrumentation. Longer follow-up is necessary to define the role of this replacement compared to a standard total hip replacement with large heads, now available with the new alternative bearing surfaces.

Total Ankle Arthroplasty

The reported results of the first generation total ankle arthroplasty were significantly poorer than total hip and total knee replacement. Loosening and mechanical failure were the primary reasons for failure of the total ankle replacement.[21,22] As a result, ankle arthrodesis, inducing ossification between bones, was the preferred treatment for end-stage ankle arthritis.

Recently contemporary implants have been introduced with improved designs, surgical techniques, and materials, and early results have been encouraging.[21] Both mobile bearing designs and fixed bearing implants have reported satisfactory intermediate clinical results. One recent systematic review of the literature comparing ankle arthrodesis with total ankle replacement indicated that each procedure had about 25% poor results, and the revision rate was 9% for arthrodesis compared to 7% for total ankle replacement.[22] However, these results are predominantly retrospective and uncontrolled without direct comparison between the 2 procedures. The major difficulties in designing implants for total ankle replacement are a lack of complete understanding of the complex kinematics of this joint, material properties of the tibia compared to talus, and the very thin and poorly vascularized soft tissues. By contrast to total knee arthroplasty, the surgical techniques required to obtain anatomical alignment of the ankle and soft tissue balance are not well established. Indications for this procedure are still being refined. It appears that with the second generation total ankle replacement the optimal patient is older with lower demands. Patients who exhibit significant arthritis in the subtalar or midtarsal joints may be better functionally after an ankle replacement compared to arthrodesis. Absolute contraindications for the procedure include active infection and inadequate soft tissues or vascularity. Marked ankle instability, poor bone, or osteonecrosis of the talus are relative contraindications. Presently there are a number of ongoing clinical trials in the United States evaluating the different design philosophies.[21] Each of the 4 new total ankle replacements being studied do have some clinical concerns such as subsidence and/or dislocation of the components. Wear of the surfaces still remains a long-term worry. Current recommendations are for the procedure to be performed for low-demand patients by surgeons who have completed special training for the technique.

Figure 3.
Arthroplasty and Lateral Radiographs Demonstrating Surface Replacement

Summary

Total joint arthroplasty is a highly successful procedure for end-stage lower extremity arthritis. Excellent pain relief and significantly improved function is usual after surgery when used for appropriate indications by highly skilled surgeons using contemporary designed components. Future improvement in design and materials to reduce wear will further enhance clinical outcomes and long-term implant survival. **NCMJ**

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COMMENTARY

Eat Smart and Move More to Combat Arthritis

Greg Griggs, MPA, CAE; Marie Shelton, MPH, RD

The statistics are alarming. In the recent publication *F as in Fat: How Obesity Policies are Failing in America, 2007*, North Carolina was ranked 17th in the nation in adult obesity.[1] In fact, nearly 2 out of 3 older North Carolinians (aged 65 years and above) are either overweight or obese. This excess weight has enormous health implications for diabetes, cardiovascular disease, and, yes, arthritis.

Arthritis is often overshadowed by other conditions related to obesity, but the fact remains that 70.4% of obese North Carolinians over the age of 65 years have been diagnosed with arthritis. In comparison, only 49.8% of our state's older citizens who are considered normal weight or underweight have been diagnosed with this disease.[2] These numbers make it clear: we cannot address arthritis without addressing the issue of weight.

Obesity is considered a risk factor for arthritis and can exacerbate already existing conditions. According to the Centers for Disease Control and Prevention, the prevalence of arthritis increases as weight does. Maintaining a healthy weight can help prevent onset and help slow the progression of this condition. Persons who are overweight or obese are also more likely to incur activity limitations due to arthritis. In North Carolina, of those 65 years and older who have been diagnosed with arthritis and are also obese, 46.5% report that their activity is limited by joint pain. On the other hand, only 32.6% of normal and underweight persons report such limitations.[2] However, even a small weight loss can have a significant positive impact. Research has shown that losing only 11 pounds can reduce the incidence of knee arthritis.[3]

> *"Persons who are overweight or obese are also more likely to incur activity limitations due to arthritis."*

Ironically, one of the key behaviors to weight management also has positive outcomes for arthritis. Physical activity not only helps with weight loss and maintenance, but regular activity also has been shown to improve the health of muscles and bones, reduce pain, and increase flexibility of joints and ease of movement. Despite these health benefits, in North Carolina only 1 in 3 adults over the age of 65 years who have been diagnosed with arthritis achieve the recommended amounts of physical activity.[2]

Eat Smart, Move More…NC is a statewide movement to reduce the rising tide of obesity and related chronic disease among North Carolinians by helping them to eat smart, move more, and achieve a healthy weight. The *Eat Smart, Move More…NC* Leadership Team representing over 40 academic, government, nonprofit, health care, and private organizations helps to guide the movement and ensure that healthy eating and physical activity choices become easier to make in North Carolina.

The *Eat Smart, Move More…NC* Leadership Team executive committee provides guidance to the leadership team and includes chairs of the various committees. Greg Griggs, MPA, CAE, from the North Carolina Academy of Family Physicians, serves as chair of the leadership team. Carolyn Dunn, PhD, of North Carolina State University and the North Carolina Cooperative Extension Service, assists as vice chair. Dave Gardner, DA, of WakeMed Health and Hospitals, leads the advocacy committee in its efforts to recommend legislation, regulations, policies, and funding to enhance physical activity and healthy eating in North Carolina. The communications committee is headed by Patrick Gibbons of RTI International. This committee is responsible for communicating the need for physical activity and healthy eating opportunities particularly as they relate to policy and environmental change.

Greg Griggs, MPA, CAE, is executive vice president of the North Carolina Academy of Family Physicians and chair of the *Eat Smart, Move More...NC* Leadership Team. He can be reached at ggriggs@ncafp.com or PO Box 10278, Raleigh, NC 27605.

Marie Shelton, MPH, RD, is a healthy weight communication specialist in the Physical Activity and Nutrition Branch of the Chronic Disease and Injury Section, NC Division of Public Health.

Maggie Sauer, MS, MHA, is chair of the implementation committee which supports and promotes programs and efforts that enhance physical activity and healthy eating opportunities.

Through *Eat Smart, Move More…NC* citizens gain knowledge, resources, and support needed to achieve and maintain a healthy weight. A consumer Web site at *www.MyEatSmartMoveMore.com* provides tools and tips for incorporating good nutrition and physical activity into daily life. Advertisements on billboards, in print media, and on the radio and television encourage North Carolinians of all ages to spend less time in front of the television and computer, be active every day, drink fewer sugar-sweetened beverages, prepare more meals at home, decrease portion sizes, and eat more fruits and vegetables. These messages serve as a reminder of how simple changes in daily lifestyle can have a large impact on weight management.

Eat Smart, Move More…NC increases healthy eating and physical activity opportunities wherever North Carolinians live, learn, earn, play, and pray. In order to make healthy behaviors the norm, rather than the exception, appropriate policies and environmental changes must be put into place at both the state and local level to encourage eating smart and moving more. Examples of these polices and environmental changes include creating healthy worksites or faith communities that encourage and facilitate these behaviors as well as building walking trails and greenways that provide opportunity for moving more.

Helping our citizens reach a healthy weight and maintain healthy eating and physical activity behaviors will have a profound impact on the health of our state. Eating smart and moving more also may be key to addressing the incidence and severity of arthritis in North Carolina. **NCMJ**

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Complementary and Alternative Medicine for Arthritis

Jaya K. Rao, MD, MHS

Since the mid-1990s, the prevalence and costs associated with the use of complementary and alternative medicine have attracted the interest of health care organizations, policy makers, providers, and consumers. Complementary and alternative medicine is usually defined as medical interventions that are neither taught widely in US medical schools nor generally available in US hospitals[1] and includes modalities such as herbal medicine, spiritual healing, and aromatherapy. It is important to remember, however, that with data from efficacy studies complementary and alternative medicine treatments have the potential to become part of mainstream medicine. For example, digitalis and colchicine were once considered "alternative" but are now prescribed by mainstream practitioners. In this commentary, I will briefly review the epidemiology of complementary and alternative medicine use by patients with rheumatologic conditions and highlight recent data on selected complementary and alternative medicine treatments for arthritis.

Epidemiology

It is well documented that people with chronic conditions use complementary and alternative medicine to treat their symptoms. Depending on the study population and how it is defined, the estimated prevalence of complementary and alternative medicine use by Americans ranges from 33% to 90%.[1-5] In a landmark study, Eisenberg and colleagues reported that 33% of Americans used an alternative therapy in 1990.[1] By 1997 the percentage of Americans reporting complementary and alternative medicine use increased to 42%, and 46% reported visiting a complementary and alternative medicine practitioner.[2] While most individuals use complementary and alternative medicine to supplement conventionally-prescribed treatment, many do so without informing their doctor,[1,2,6] raising concerns about the potential for adverse interactions with prescribed treatments.

Complementary and alternative medicine use is particularly common among people with musculoskeletal disorders.[1,3] Population- and clinic-based data indicate that 28% to 90% of people with arthritis and other rheumatologic conditions use complementary and alternative medicine.[4-8] Studies of patients with specific rheumatologic conditions (eg, fibromyalgia, osteoarthritis, systemic lupus erythematosus) demonstrate a similar degree of use. In general, people with a higher educational level, a longer duration of disease, poorer functional status, and higher levels of pain are more likely to use complementary and alternative medicine.[4,7] Data also indicate that use (and the specific types used) varies by race and ethnicity.[9,10]

> *"While most individuals use complementary and alternative medicine to supplement conventionally-prescribed treatment, many do so without informing their doctor, raising concerns about the potential for adverse interactions with prescribed treatments."*

Data From North Carolina

Population-based data document a geographic variation in complementary and alternative medicine use with higher rates

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Jaya K. Rao, MD, MHS, is an adjunct clinical associate professor of medicine in the Division of Rheumatology at Emory University School of Medicine. She can be reached at jkrao@mindspring.com or Emory University School of Medicine, Division of Rheumatology, 49 Jesse Hill Jr Drive SE, Atlanta, GA 30303.

reported by residents of the western United States.[1,3] While the variation in rates may relate to the definition of complementary and alternative medicine used in the survey, it is also important to note, however, that complementary and alternative medicine use is not uncommon in the South.[3]

Data from studies of North Carolina residents underscore this point. In a study of 1059 adult residents of western North Carolina, nearly one-half (45.8%) reported using complementary and alternative medicine to treat their chronic conditions.[11] Although its use was not associated with the number of chronic conditions or health care utilization, people with less education were more likely to use honey-lemon-vinegar-whiskey combinations while people with greater education were more likely to have visited a complementary and alternative medicine practitioner. In a study of 211 rural community-dwelling adults with arthritis, Arcury and colleagues reported that complementary and alternative medicine use was common and they found differences in the types used based on race and ethnicity. African Americans were more likely to rely on prayer and topical treatments (eg, liniments, turpentine) than European Americans.[9] Finally, in a study of 752 arthritis patients who were seen in 16 primary practices in rural and urban North Carolina, 89% reported using at least one complementary and alternative medicine.[5] Interestingly, 71% of those who used at least one treatment discussed this behavior with the physician.[5]

Given the widespread interest in complementary and alternative medicine, it is not surprising that medical universities have developed integrative medicine programs. Three medical universities in North Carolina (Duke University, the University of North Carolina at Chapel Hill, and Wake Forest University) have established such programs to provide selected forms of complementary and alternative medicine treatment to patients and to conduct research.

Recent Data on Selected Complementary and Alternative Medicine Treatments for Arthritis

Complementary and alternative medicine is big business in the United States. Since the passage of the Dietary Supplemental Health and Education Act of 1994, dietary supplements and herbal products have become widely available. In 1997 an estimated 165 million adults (18.4% of all prescription users) used herbal medicines along with conventionally prescribed medications, and they spent $5.1 billion dollars out-of-pocket on these remedies.[2] Furthermore, they made 629 million visits to alternative practitioners, far exceeding the total number of visits made to primary care providers in 1997.[2] An extensive review of complementary and alternative medicine therapies is beyond the scope of this commentary. Instead, I will highlight data on 2 treatments used for arthritis symptoms that have been the focus of recent investigation: glucosamine/chondroitin sulfate and acupuncture.

Since the 1980s glucosamine and chondroitin have been used to treat osteoarthritis, primarily in European countries.[12] Notably, in Europe and other countries, glucosamine sulfate is approved as a prescription treatment for osteoarthritis.[13] Glucosamine is a precursor to the glycosaminoglycan molecule, and chondroitin is the most abundant glycosaminoglycan found in cartilage.[13] Short-term (4 to 6 week) controlled trials indicate that patients treated with glucosamine experience modest improvements in pain and function compared to those receiving placebo[14] and experience treatment effects comparable to nonsteroidal anti-inflammatory drugs.[15]

Two recent meta-analyses that examined randomized trials of glucosamine and chondroitin report mixed conclusions regarding efficacy which may relate to the specific formulations of glucosamine used in the trials, methodologic concerns, and industry bias.[12,16] A large multicenter trial was designed to address some of these concerns: patients with symptomatic knee osteoarthritis were randomized to glucosamine, chondroitin, glucosamine plus chondroitin, celecoxib, or placebo treatment for 24 weeks.[17] Patients who were treated with glucosamine and chondroitin sulfate alone or in combination did not experience a significant improvement in pain compared to controls.[17] Unfortunately, this trial involved treatment with glucosamine hydrochloride, a formulation that other investigators have concluded is not effective compared to the glucosamine sulfate formulation.[16,18] At this time, patients who are considering using glucosamine for their osteoarthritis symptoms should be advised to take glucosamine sulfate rather than glucosamine hydrochloride, and those with severe pain might consider adding chondroitin sulfate to this regimen.[18]

Acupuncture is an important modality in traditional Chinese medicine that involves the transcutaneous placement of needles, sometimes with ancillary electrical current, heat, or moxibustion (ie, incense burning), to specific sites in order to restore the person's balance of vital energy (also known as qi or chi).[19] Acupuncture, which is often used for pain relief, has been the focus of several recent trials. These trials have highlighted the methodological dilemma of finding an appropriate comparison to acupuncture. Sham acupuncture may stimulate pain inhibitory fibers or endorphin release while positive comparisons to a wait list control may be due to treatment expectations or placebo effects.[20]

Witt and colleagues reported significant improvements in outcome among those who received acupuncture compared to a wait-list control group.[21] These investigators also performed a 3-arm randomized trial in which one group received sham acupuncture.[22] Compared to the sham acupuncture or wait-list control groups, the group who received acupuncture experienced significant improvements in pain and function immediately after receiving the entire intervention (12 acupuncture sessions over 8 weeks), but these improvements declined over time.[22] Another study reported significant improvements in outcome when the acupuncture and sham acupuncture groups were compared to a wait list control group, but no differences when the acupuncture group was compared to the sham acupuncture group.[23] Given the heterogeneity of study findings and clinically minimal effects when acupuncture is compared to sham therapy, a recent meta-analysis concluded that it is premature to recommend this treatment as part of routine care for knee osteoarthritis and suggested that clinicians and patients might consider acupuncture as one option in a multidisciplinary treatment approach.[20]

Managing Patients Who Also Use Complementary and Alternative Medicine

Regardless of their particular beliefs about complementary and alternative medicine, physicians have an ethical obligation to discuss treatment alternatives with their patients. Although physicians should acknowledge their level of knowledge regarding complementary and alternative medicine during these discussions, they should also make sure that the patient has received information about the safety (eg, potency, drug interactions) and efficacy of these treatments.[24] Because patients' complementary and alternative medicine usage may change over time,[25] physicians should periodically review their patients' current regimens.

Since most alternative therapies are unproven, physicians may have legal concerns when they are asked to recommend specific complementary and alternative medicine treatments, provide referrals to practitioners, or tolerate continued use of these therapies. As a general rule, the mere referral to a complementary and alternative medicine practitioner does not expose the referring physician to liability unless the referral itself deprives the patient of receiving appropriate care (ie, referral delays or eliminates an opportunity to receive important care).[26] On the other hand, the physician could be held liable if he or she recommends a complementary and alternative medicine that is associated with serious risks or is known to be ineffective.[27] Thus, when recommending specific complementary and alternative medicine, physicians should review the literature to determine the level of risk for the treatment, discuss the potential risks and benefits with the patient, document this discussion, and continue to monitor the patient conventionally.[27] When referring patients to complementary and alternative medicine practitioners, physicians should also inquire about the practitioner's credentials, competence, and practices.[27]

Final Thoughts

People with rheumatologic conditions often use complementary and alternative medicine to treat their symptoms. To date, epidemiologic studies have focused on describing patients' use of complementary and alternative medicine and identifying predictors of this behavior. Given that many patients do not discuss their use of complementary and alternative medicine with their physicians, future investigations might focus on developing methods such as office-based tools to facilitate patient-provider communication regarding complementary and alternative medicine. Furthermore, complementary and alternative medicine is an evolving field as results emerge from efficacy studies of specific treatments. Clinicians should keep abreast of the findings of these trials because these data will be helpful in managing and advising patients who use such therapies. **NCMJ**

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COMMENTARY

Use of Nurse Practitioners and Physician Extenders in Rheumatology:

A Western North Carolina Perspective

Kate T. Queen, MD, FACR, CCD

Western North Carolina enjoys tremendous popularity. For years it has been a vacation and recreation destination, but today young and old alike are attracted to the mountains and find our communities an ideal place to consider calling home. Residents of western North Carolina have benefited from a long tradition of excellence, depth, and diversity in the medical community historically centered in Asheville. However, over the past 25 years the demand for quality specialty care closer to home has escalated in smaller, surrounding communities. A growing need for clinicians skilled in the evaluation and treatment of patients with rheumatic diseases and musculoskeletal complaints reflects this demand.

My experience is that of a solo rheumatologist practicing within a multispecialty internal medicine group in a rural mountain community. I struggled unsuccessfully to recruit a second rheumatologist for years and discovered that an alternative strategy for success in meeting the needs of my region was the integration of a midlevel practitioner. The development of collaborative practices with nurse practitioners or physician assistants has been an effective way for others to respond to this sometimes overwhelming demand for care. As we face the challenge statewide of meeting the needs of a "graying" North Carolina and embrace the opportunity to address issues related to health and aging, this model deserves serious consideration.

Who Benefits?

Patients are the most important beneficiaries of this collaborative approach to care. Improved access is a high priority to anyone with pain or impairment in independent function. Collaborative practices have the flexibility to develop strategies to not only expedite the evaluation of new patients but also deal with the needs of established patients promptly when new problems or concerns arise.

Patient satisfaction also improves. Nurse practitioners and physician assistants attracted to outpatient care typically have a special interest in patient education and teaching. This skill and focus is invaluable to patients with rheumatologic conditions who need to learn what to expect from their illness as well as how to avoid, recognize promptly, and respond to complications of their treatments.

> *"… as the demand for care increases and the financial pressures for efficient and effective service intensify, rheumatologists working collaboratively with nurse practitioners and physician assistants have real opportunities to build rewarding relationships."*

Kate T. Queen, MD, FACR, CCD, is a consulting rheumatologist at Mountain Medical Associates. She can be reached at katequeen@charter.net or 600 Hospital Drive, Suite 9, Clyde, NC 28721.

Rheumatologists who adopt this style of practice have much to gain. For a solo rheumatologist like me, the addition of a midlevel practitioner facilitated a healthier balance between the desire to provide quality patient care and follow-up and my own need for personal time and a balanced lifestyle.

It has been demonstrated in a wide variety of clinical settings that the utilization of a midlevel practitioner to maximize productivity has enhanced financial rewards as well. According to the Medical Group Management Association's *Physician Compensation and Production Survey: 2006 Report Based on 2005 Data*, physician assistants and nurse practitioners are able to generate practice income well above their costs.

In a practice setting of mutual respect and collaboration, midlevel practitioners can find great rewards. They have the opportunity to practice within the scope of their training and experience with the back-up and support of their physician. The expansion of new knowledge and therapeutic options makes this a particularly exciting time to be part of a rheumatology team. In addition, the freedom to focus on patient care and supervision without the burden of managing the financial and accounting aspects of practice contributes to the professional satisfaction inherent in their role.

Is There a Significant Difference Between Nurse Practitioners and Physician Assistants?

The background and training of nurse practitioners and physician assistants are not identical. Nurse practitioners are registered nurses who have attended accredited programs to pursue both advanced academic and clinical training. Physician assistants may come from a variety of prior experiences including work in other allied health roles and the military. Physician assistants typically have a baccalaureate degree as well as a degree from an accredited physician assistant training program.

In North Carolina, physician assistants are licensed by the North Carolina Medical Board (www.ncmedboard.org). Nurse practitioners receive their authorization to practice from both the North Carolina Medical Board and the North Carolina Board of Nursing (www.ncbon.com). State laws, including the Medical Practice Act of the North Carolina General Statutes, and the rules of the North Carolina Medical Board clearly delineate many facets of the primary supervising physician's responsibilities.

Individual physicians have substantial autonomy to decide how best to use an extender in their practice. It is important to the successful integration of a midlevel practitioner that his or her scope of practice be identified and that the delegation of medical tasks is appropriate to the skills of the supervising physician as well as the competence level of the physician assistant or nurse practitioner. It is not surprising that this role often expands and evolves over time as the midlevel practitioner matures and demonstrates his or her competency.

Enhancing Success

In the field of rheumatology there are no training programs designed to help a nurse practitioner or physician assistant specifically prepare to join a rheumatology practice. Such training has traditionally been left to the individual physician who seeks to integrate a midlevel practitioner. The Allied Rheumatology Health Professionals, a sister organization to the American College of Rheumatology, has had a strong interest in recent years in providing continuing education opportunities for advanced practice nurses and other midlevel practitioners. However, at the present time, standardized preceptorships to develop the skills and knowledge base unique to rheumatology have not been developed.

Preparing your patients as well as your medical community for the addition of a nurse practitioner or physician assistant is critical to their acceptance, particularly if you are in a region where these practitioners are not found in specialty practices. Your confidence in their knowledge and skills is key to building a foundation for years of successful collaboration.

In addition, this model requires not only an initial commitment to training and integration but an ongoing willingness to review the care they provide and serve as a mentor. I have found this to be one of the most rewarding aspects of collaborative practice but cannot deny that to do this well requires an input of real time and energy. A commitment to provide ongoing supervision of care, to enhance opportunities for learning and professional growth, and to consistently be available to address questions or concerns is, I believe, fundamental to a long-term successful relationship

While a collaborative approach to practice will not appeal to all, as the demand for care increases and the financial pressures for efficient and effective service intensify, rheumatologists working collaboratively with nurse practitioners and physician assistants have real opportunities to build rewarding relationships. It has been my experience that practicing rheumatology with a midlevel practitioner can improve access to care, enhance patient satisfaction and clinical outcomes, and at the same time expand productivity and secure financial success. **NCMJ**

The Johnston County Osteoarthritis Project:
An Illustration of a Community-University Partnership for Population-Based Research

Edwin L. Hartman, MD; Janice Woodard, BS; Carol Patterson, MA; Joanne M. Jordan, MD, MPH

Community-based participatory research has been defined as "an approach to health and environmental research meant to increase the values of studies for both researchers and the community being studied."[1] This cooperative approach to research continues to gain recognition and popularity and has particular potential for the future of epidemiological studies.[2] Investigators from the University of North Carolina at Chapel Hill (UNC) and residents in Johnston County, North Carolina have worked together in and benefited from community-focused research for over 23 years. This partnership was an early adopter of the community-based approach to research through formation of the Rural Health Research collaboration, just the beginning of many "firsts" for this partnership.

> *"In order to foster and maintain long-standing grassroots support for the work of Rural Health Research, it is critical for residents to feel that Rural Health Research is serving the interests and needs of the county. In keeping with this, it has been our long-standing philosophy and policy to give back to the community."*

History of Rural Health Research

Rural Health Research is a community-based, university-affiliated research center in Johnston County, a mostly rural county in eastern North Carolina. Preliminary work in the community by UNC investigators began in the late 1970s. A multidisciplinary group of researchers came together with Johnston County residents to develop an ongoing research presence in the county. The participants included the directors of the Thurston Arthritis Research Center, the Center for Health Promotion and Disease Prevention, the Injury Prevention Research Center, and the Cecil G. Sheps Center for Health Services Research. The office of the Vice Chancellor for Health Affairs also provided vitally important input and support. Local

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Edwin L. Hartman, MD, attending medical staff at Johnston Memorial Hospital, Smithfield, North Carolina, and medical liaison, The Johnston County Osteoarthritis Project, Thurston Arthritis Research Center.

Janice Woodard, BS, Janice Woodard, BS, is project director at Rural Health Research, Smithfield, North Carolina, and research associate at Thurston Arthritis Research Center, the University of North Carolina at Chapel Hill.

Carol Patterson, MA, Carol Patterson, MA, is research associate at Thurston Arthritis Research Center, the University of North Carolina at Chapel Hill.

Joanne M. Jordan, MD, is associate professor of medicine and orthopaedics, chief of the Division of Rheumatology, Allergy, and Immunology, and director of the Thurston Arthritis Research Center at The University of North Carolina at Chapel Hill. She can be reached at Joanne_Jordan@med.unc.edu or 3300 Doc J. Thurston, Jr Building, CB#7280, Chapel Hill, NC 27599.

advisers and participants have included lay and professional community leaders, state and national government officials, county managers, education superintendents, hospital and county health department personnel, and nonprofessional constituents with an interest in health issues.

A critical next step toward the establishment of this endeavor as a local entity came with an award from the Centers for Disease Control and Prevention to the UNC Health Promotion and Disease Prevention Center in 1987. This enabled Rural Health Research to incorporate and open a local research field office in Johnston County, directed and staffed by Johnston County residents. In order to determine the interests of the people in the county, 65 focus groups were held throughout the county with broad representation by race, gender, and age (ranging from 45 to 54 years, 55 to 64 years, and 65 years and older). The medical community was involved and kept informed through a local medical liaison, and awareness of Rural Health Research and its goals was increased through presentations given by the researchers to the county medical society in a meeting held at Johnston Memorial Hospital.

Over the years community-based research has flourished in Johnston County. Rural Health Research benefits from dedicated local volunteers who bring vitality and support to the studies. Local participants are involved in helping to map and enumerate streets for statistical sampling, assisting with project management duties both in and out of the Johnston County office, and serving as key study ambassadors to the county and other local organizations. In 2002 an adjoining research clinic was opened, including a fully-functional radiology suite, a bone density/body composition suite, facilities for phlebotomy and frozen storage of specimens, and multiple examination rooms.

Currently, the local staff includes 9 full-time employees, all Johnston County residents, including the director, administrative assistant, interviewers, data collectors, radiology technologist, and phlebotomist, and a cadre of fully-trained part-time and intermittent employees available for substudies and other tasks as necessary.

Over the years, Rural Health Research has been the site of studies in injury prevention, health care access and utilization, cardiovascular disease, nutrition, and dizziness and physical activity in frail elders. Arthritis and disability have been the primary focus of Rural Health Research since 1990, with over 25 studies conducted. (See Figure 1.) The first of these began in 1985 with an award from the National Institute of Arthritis and Musculoskeletal and Skin Diseases to the Thurston Arthritis Research Center to evaluate the reliability and validity of selected arthritis psychosocial measures used to assess arthritis beliefs, self-care practices, use of health services, and psychosocial health status of lower-income African American and white residents. This study provided the foundation for all subsequent research carried out in Johnston County.

A prospective cohort of osteoarthritis of the knee and hip in Johnston County, known as the Johnston County Osteoarthritis Project, has received continuous funding by the Centers for Disease Control and Prevention since 1990 (recently renewed through 2010) and by the National Institutes of Health since 1993. This study has facilitated the development of additional projects funded by multiple federal agencies, foundations, private philanthropic sources, and industry groups. (See Figure1.) The scope of these studies ranges from the biomedical (eg, development and validation of serum and urine biomarkers of joint metabolism, proteomics, metabolomics, and, most recently, genome-wide association studies) to the psychosocial (eg, the role of psychiatric comorbidity in the pain and disability of arthritis, individual and community social determinants of arthritis outcome, and spirituality). The Johnston County Osteoarthritis Project has been a part of research studies with investigators throughout the nation and the world. Collaboration has served not only to advance science but also to support the continued work of Rural Health Research which would be impossible without the financial backing of numerous investigations.

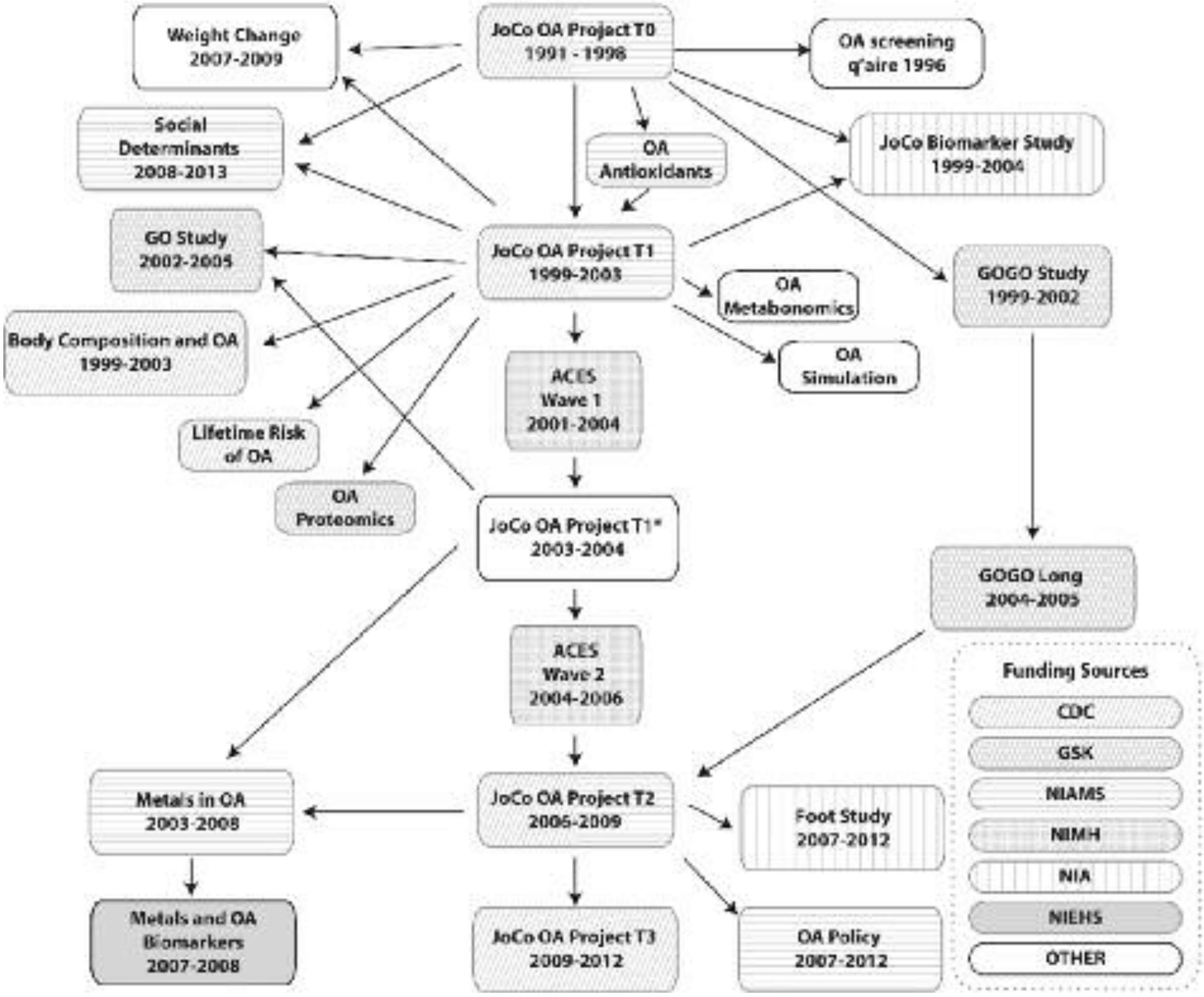
The Johnston County Osteoarthritis Project has contributed other notable "firsts." It was the first longitudinal study of osteoarthritis to include African Americans and it remains the only such study in a rural setting. The study revealed early on that osteoarthritis and its resultant disability were more common than expected.[3-6] Pursuing an explanation for this observation led to the examination of data on overweight and obesity in the study group.[7,8] The Johnston County Osteoarthritis Project also revealed that African Americans were not spared from hip osteoarthritis as had generally been thought.[9,10]

With this history of pioneering into new areas, this study is the largest biracial population-based study to describe associations between radiographic osteoarthritis and osteoarthritis biomarkers and blood and urine markers of the osteoarthritis disease process. It also is the first to recognize that values of these markers, and factors associated with them, varied by gender and racial groups.[11-14] Recognizing that the experience of osteoarthritis has significant psychosocial consequences, the Johnston County Osteoarthritis Project partnered with the Arthritis, Coping and Emotions study to generate one of the largest psychosocial databases for an osteoarthritis cohort of African Americans and Caucasians in the world.[15,16]

Research into the role common environmental exposures play in osteoarthritis over a lifetime produced preliminary results showing that higher blood lead levels are associated with more severe osteoarthritis,[17] and low selenium levels are also associated with osteoarthritis presence and severity.[18,19] The examination of selenium and osteoarthritis was suggested by studies of Kashin-Beck Disease, an endemic osteoarthropathy in China associated with low selenium levels in the soil among other things.[20] The Johnston County analysis was the first large epidemiologic investigation into this relationship in a Western population. These observations have given birth to a new interdisciplinary field of "environmental rheumatology" currently being developed at the Thurston Arthritis Research Center at UNC.

Today, the community connection for the Johnston County Osteoarthritis Project and Rural Health Research remains alive and strong. As one county staff person said, "What impressed me the most about this study was that it came to the community. It

Figure 1.
The Johnston County Osteoarthritis Project and Related Studies



Legend:

JoCo OA Project = Johnston County Osteoarthritis Project
OA screening q'aire = Osteoarthritis screening questionnaire
GO Study = Genetics of Osteoarthritis Study
ACES = Arthritis, Coping, and Emotions Study
GOGO = Genetics of Generalized Osteoarthritis Study
GOGO Long = Genetics of Generalized Osteoarthritis Study, Longitudinal Follow-up
CDC = Centers for Disease Control and Prevention
GSK = GlaxoSmithKline
NIAMS = National Institute of Arthritis, Musculoskeletal, and Skin Diseases
NIMH = National Institute of Mental Health
NIA = National Institute on Aging
NIEHS = National Institute of Environmental Health Science

was more accessible to people who would not have had such an opportunity if they were required to travel. As an interviewer I see how participants begin to think about their arthritis perhaps in new ways as they have the chance to talk about their experiences with us. I think it has to make a positive difference for these people in our community." As the concept of community-based research has evolved to embrace more of the social impact of disease and public health, the Johnston County Osteoarthritis Project has collaborated with other researchers interested in the individual and community social determinants of health and disease.

Giving Back to the Community

In order to foster and maintain long-standing grassroots support for the work of Rural Health Research, it is critical for residents to feel that Rural Health Research is serving the interests and needs of the county. In keeping with this, it has been our long-standing philosophy and policy to give back to the community. This takes many forms. For example, all local employees receive considerable and continuing education in methods of field research, and full-time employees become permanent employees of UNC with its attendant benefits. As much as is possible, we utilize and support local businesses for the work of the center. In addition, the Thurston Arthritis Research Center publishes an annual newsletter in Johnston County (*Johnston County Osteoarthritis Project Update*), and UNC and local colleagues give talks to local groups (eg, Smithfield Veterans of Foreign Wars, Kiwanis, Rotary, Lions Club, Civitan, Johnston Memorial Hospital) to keep the 2-way flow of information active. Project participants receive regular study updates and are invited to open houses in which they have an opportunity to meet with research staff and UNC faculty to learn about arthritis and the progress of the many studies ongoing in the center.

Rural Health Research is a member of the Chamber of Commerce, the Human Services Council, and other local groups. Each year for the past 20 years, the Rural Health Research director has attended the Chamber of Commerce Washington Issues Seminar in Washington, DC. This meeting is sponsored by North Carolina's US senators and representatives and is attended by state representatives, mayors, town managers, other Chambers of Commerce members throughout the state, national representatives and senators, and other national government officials. It is a highly effective forum for bringing local issues to the attention of elected officials in Congress. We have been able to increase awareness of arthritis and disability issues, inform officials about research studies underway in the county, and advance the mission of Rural Health Research as well as the community-based research role of UNC among these representatives and other government officials. **NCMJ**

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COMMENTARY

Manpower Shortage in Rheumatology

Gregory F. Schimizzi, MD

Several articles have appeared in the literature regarding the looming shortage of various specialties.[1-5] It is surprising that some of the projected shortages in professional manpower include highly visible specialties such as neurosurgery, cardiology, and pediatrics. While shortages in these specialties are a newly recognized problem, a decline in rheumatology manpower has been expected for many years despite an increase in demand for services. The number of fellows in rheumatology has been steadily declining since 1995. In a survey and analysis of manpower in rheumatology done in 2000, the American College of Rheumatology projected a steady decline in the number of clinical rheumatologists until the year 2030.[6] For the year 2010, the needs estimate for rheumatologists is 7500 physicians. The current number of practicing rheumatologists is 2200, and the projected number of practicing rheumatologists for the year 2010 based on new fellows entering practice and those rheumatologists leaving the field is estimated to be 2500.[6]

As the population of the United States ages, there has been an expected increase in the number of people afflicted with arthritis. The Centers for Disease Control and Prevention recently announced that according to their most recent data over 46 million Americans are afflicted with arthritic diseases which are the most frequently occurring chronic illnesses. Arthritic diseases of all types are the leading cause of disability in our country. Rheumatoid arthritis alone affects 1 in 200 Americans and costs the United States approximately $80 to $85 billion dollars per year. It has been projected that by the year 2030 an estimated 67 million Americans will be affected by chronic arthritic diseases.[7]

Ask any rheumatologist or medical group about the difficulty of recruiting a new physician in rheumatology, and you will likely get the same answer from coast to coast. In an era of new and promising therapies and with an increasing number of patients in need of rheumatology care, it seems counterintuitive that a decline in manpower is upon us in this field. But the reasons for our predicament are not as simple or straightforward as one might think. A detailed study commissioned by the American College of Rheumatology and published earlier this year enumerated and analyzed causes for the manpower crisis in rheumatology. According to this report, factors affecting the manpower crisis in rheumatology include technological advances, limited advances in practice design and organization, minimal increases in training positions, changes in population characteristics, low reimbursement rates, and workload capacity changes.[6]

> *"In an era of new and promising therapies and with an increasing number of patients in need of rheumatology care, it seems counterintuitive that a decline in manpower is upon us in this field."*

Technological Advances

An increase in technological sophistication has occurred in the practice of rheumatology just as in other fields of medicine. This technology is very costly and has added to other cost centers (eg, malpractice rates, insurance costs, labor costs, increased costs due to workload) which are contributing to a rapid rise in overhead expenses. The American Medical Association has estimated that in the same years that the Medicare Modernization Act 2003 mandates drastic reductions in physician reimbursements there will be a 25% increase in overhead expenses for physicians.

Gregory F. Schimizzi, MD, is a board certified rheumatologist at Carolina Arthritis Associates, assistant clinical professor of medicine at New Hanover Regional Medical Center, and president of the Coalition of State Rheumatology Organizations. He can be reached at gfschimizzi@carolinaarthritis.com or 1710 S 17th Street, Wilmington, NC 28401.

Practice Design and Organization

There has been little change in practice organization and efficiency in delivering rheumatologic care. Utilization of family nurse practioners and physician assistants has not increased dramatically over the last decade. This may in part be due to the nature of the specialty. Adoption of electronic medical records systems has been very slow in rheumatology possibly due to the complicated nature of the subspecialty as well as the associated expenses. Furthermore, a high energy of initial activation is associated with electronic medical records, and rheumatologists may not be interested in investing their time or financial resources to install an expensive system when retirement may be only a few years away.

Training Positions

The number of new fellowship-trained rheumatology positions has not kept pace with the demand for rheumatologists over the last 1 to 2 decades relative to the number of older physicians leaving the field and the demand for services. Physicians leave rheumatology primarily due to retirement or death. A few rheumatologists leave active rheumatology practices to accept industry positions. The average age of rheumatologists is approximately 57 years of age. The median age for rheumatologists is 53 years for male physicians in adult rheumatology and 46 years for the female physicians. For pediatric rheumatology the median ages are 51 years and 47 years respectively. There are 378 adult rheumatology fellowship training positions in 105 programs in this country and the fill rate for these positions was about 88% in 2004-2005.

One of the reasons for the reduced supply of new rheumatologists as well as other specialties can be traced back to several previously published reports such as the Graduate Medical Education National Advisory Committee's 1981 recommendation to reduce the number of medical schools and medical school positions based upon forecasts for a 23% surplus of physicians (approximately 145 000) by the year 2000. In response to this and other similar reports, Congress reduced support for medical school education.

Changes in Population Characteristics

Demand for rheumatology services is increasing due to the aging of our population, the increased sophistication of the populace, and the rise in per capita gross domestic product. Richard Cooper and his colleagues observed a strong correlation between the size of the economy measured in gross national product per capita and the demand for specialty physician services. Cooper argued this correlation was indicative of a pending increase in the demand for health care services to the extent that a physician shortage of 50 000 physicians would occur by 2010.

Reimbursement Rates

Reimbursements for rheumatology services have historically been the lowest of all subspecialties. This began to change in 1998 with the introduction of more sophisticated and complex services provided by rheumatologists in their offices. Despite the fact that reimbursements for rheumatology services increased 28% between 1998 and 2002, reimbursements are on the decline again after passage of the Medicare Modernization Act in 2003 and recent changes in reimbursement for ancillary services. These latest changes make rheumatology a less attractive field to prospective fellows. This is especially true for those who have accumulated large loans during their education and training.

Maximal Workload Capacity Changes Among Rheumatologists

Workload capacities for rheumatologists vary with age and sex of the practitioner. Female rheumatologists (whose numbers have been increasing) tend to see fewer patients than male rheumatologists at all ages. Females have peak workload capacities when they are between 40 and 49 years of age. Male rheumatologists have a peak workload capacity between the ages of 50 and 59 years. To some extent, the increase in the number of female fellows entering practices in rheumatology will accentuate the shortage of rheumatology supply.

Solutions

The remedies for the shortage of rheumatologists will not be easily implemented and likely will not be rapidly achieved. Four possible solutions are outlined here.

(1) It will be necessary to increase the number of fellowship positions or add new rheumatology programs. Finding funding for expanding programs will be difficult in times of overall health care cutbacks and without a will on the part of government to not only recognize the problems facing rheumatology and other specialties but to act upon the problems in a meaningful way.
(2) Adoption of newer technologies and/or increased use of physician extenders in the practice of rheumatology will help improve efficiency and increase practice visit capacities.
(3) Inherent in adopting more widespread use of physician extenders there will need to be a commensurate increase in the number of training programs for these professionals.
(4) There must be a concerted effort to advocate for medical liability reform, fair reimbursements, and removal of clerical workloads in an attempt to improve patient access to care while reducing overhead costs that accompany excessive interferences from multiple sources. Reduction of costs and fair reimbursements for services will create an incentive for younger physicians and trainees to consider rheumatology.

The goal of any resolution to a potential shortfall in physicians in any subspecialty should include, above all else, a desire to deliver the highest quality care possible to our patients as efficiently as possible with the best choice of therapies available based on medical evidence. No solution should occur at the expense of continued efforts to find cures for these diseases that disfigure and deform. Treatment must be continued since inadequate or delayed treatment of arthritic diseases not only decrease the quality of life for millions of our patients but also creates hardship for families and late complications that will increase disease management costs. We must never forget that mortality is also increased in many of these patients, and this may be even more significant in those patients who are inadequately treated. **NCMJ**

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North Carolina
MEDICAL JOURNAL

Spotlight on the Safety Net

A Community Collaboration
Kimberly M. Alexander-Bratcher, MPH

Community Health Centers

Across North Carolina, communities have come together to form nonprofit health centers governed by the people that use them. For over 30 years these community health centers have ensured that no one is left without a place to turn to when they are in need of medical care, regardless of their ability to pay. The focus of community health centers is quality and comprehensive primary care with a strong emphasis on disease prevention and health maintenance.[1]

What Is a Community Health Center?
Federally qualified health centers, also known as community health centers, are public or private nonprofit, charitable, tax-exempt organizations. They receive funding from the Public Health Service Act or are deemed by the US Department of Health and Human Services to meet requirements to receive funding without actually receiving a grant. They serve medically underserved areas and are governed by a board whose majority must be users of the center's services and representative of the service area's demographics. They provide, either directly or by contract, a comprehensive scope of preventative and primary health services including translation, transportation, and other support services regardless of the ability to pay. Community health centers have a schedule of charges designed to cover the reasonable costs of operation and consistent with locally prevailing rates that are adjusted based on a patient's income and family size.

Community health centers facilitate access to comprehensive health and social services including outreach, transportation, interpretive, and case management services; services to assist the health center's patients gain financial support for health and social services; referrals to other providers of medical and health-related services; and substance abuse and mental health services.

Community health centers assess the full health care needs of their target populations, form a comprehensive system of care incorporating appropriate health and social services, manage the care of their patients throughout the system, and maintain ongoing referral arrangements with one or more hospitals. Clinicians have admitting privileges and hospital staff membership at their referral hospital(s).

They assure quality special medical, diagnostic, and therapeutic services are available to patients through a system of organized referral arrangements. Community health centers form or join integrated delivery systems and provide comprehensive and continuous care including hours in which the health center is closed. They also educate patients and the community regarding the availability and appropriate use of health services.

Table 1.
Federally Mandated Services Provided by Community Health Centers

Primary medical care
Diagnostic laboratory and radiological services
Preventive Services
- Prenatal
- Perinatal
- Well child

Cancer and other disease screening
Immunizations
Screening for hazards
- Elevated blood levels
- Communicable diseases
- Cholesterol
- Eye, ear, and dental screening for children

Family planning services
Preventive dental services
Emergency medical and dental services
Pharmaceutical services

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Current Statistics

North Carolina's community health centers are comprised of 26 health center grantees, 1 migrant voucher program, 104 clinical services sites, 20 migrant voucher program sites, 7 migrant health center grantees, 3 healthy schools/healthy community grantees, 4 homeless health care grantees, and 2 federally qualified health center look-alike organizations with 6 clinical service sites. In 2006 there were 139 physicians, 80 nurse practitioners and physician assistants, 311 nurses and other medical personnel, and 42 dentists working at community health centers statewide. Those providers saw 333 283 patients for 1 109 600 patient visits. Of those patients, 52% were uninsured, 22% receive Medicaid, 71% live below the 200% of the federal poverty guidelines, and 54% live below 100% of the federal poverty guidelines. There were also 56 585 migrant and seasonal agricultural workers who received services.[2]

Within the past 5 year, community health center patients increased by 36%, patient visits increased by 36%, and uninsured patients increased by 53%. These programs prove to be extremely cost effective by serving these patients for just over $1 per day per patient. North Carolina's community health centers also create jobs and an economic base. They employ more than 1692 full-time employees.[2]

North Carolina Community Health Center Association

Alone, community health centers would struggle for resources, training, and a medium to express their concerns. Collectively, health centers have banded together to secure their common mission through the North Carolina Community Health Center Association (formerly known as the North Carolina Primary Health Care Association).

The NC Community Health Center Association was created in 1978 so that health centers across the state would have a collective voice and representation at the federal, state, and local levels. The NC Community Health Center Association also seeks support from foundations, corporations, and other private entities to increase the access of primary health care to all North Carolinians. Its staff serves on state and national coalitions and task forces to foster collaboration, leverage resources, and avoid duplication of services.

The NC Community Health Center Association is a valuable resource to health centers, providing training and technical assistance in areas such as clinical service delivery, governance, workforce development, and administration. It regularly presents workshops, trainings, and conferences to keep health center staff on the cutting edge of effective and cost-efficient service delivery. The NC Community Health Center Association consistently analyzes key issues facing health centers and provides members with critical information in a timely fashion and helps communities to create new health centers or expand existing ones.

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Running the Numbers

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

*From the State Center for Health Statistics, NC Department of Health and Human Services
http://www.schs.state.nc.us/SCHS*

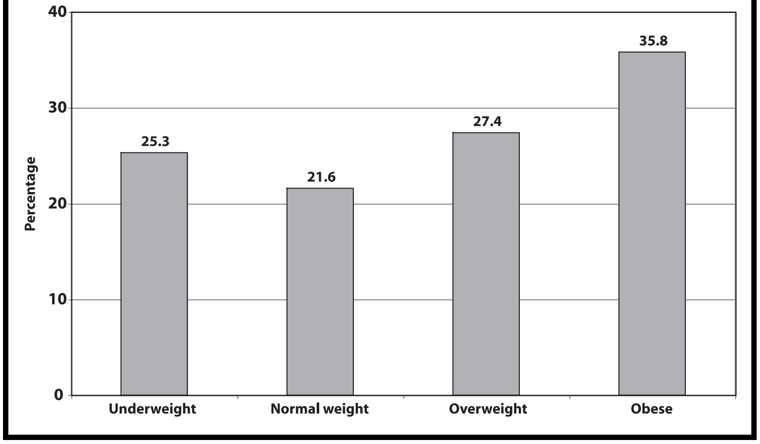
Arthritis Prevalence and Risk Factors in North Carolina

Arthritis is one of the most common chronic diseases and is the leading cause of disability in the United States.[1] Arthritis refers to more than 100 different conditions affecting the joints, surrounding tissues, and other connective tissues. Several common forms of arthritis are gout, osteoarthritis, rheumatoid arthritis, and juvenile arthritis. People with these diseases experience pain, stiffness, and/or limitation of motion. The cause of most types of arthritis is unknown.

The number of adults in North Carolina in 2005 with doctor-diagnosed arthritis (diagnosed by a physician or other health professional) is estimated at 1 754 000; this number is projected to increase to 2 761 000 in 2030.[2] In 2005, there were an estimated 681 000 adults in North Carolina with arthritis-attributable activity limitation.[2] While arthritis is not a leading cause of death in North Carolina, it is an important cause of hospitalization. In 2005 in North Carolina, there were 23 921 hospital discharges with a principal diagnosis of arthropathies (joint diseases) and related disorders (ICD-9-CM codes 710-719). The average length of stay for these hospitalizations was 4.1 days and the associated hospital charges were $675 748 000. Approximately 90% of these charges resulted from hospitalizations with a principal diagnosis of osteoarthritis (degenerative joint disease).

The Behavioral Risk Factor Surveillance System (BRFSS) is a random telephone survey of adults (aged 18 years and older) that collects information on health conditions, health risk factors, and use of health services. It is conducted in all US states and the data are self-reported. In the 2005 North Carolina BRFSS, a number of questions related to arthritis were asked of more than 17 000 adult respondents. According to the 2005 BRFSS, 38.4% of adults in North Carolina had symptoms of pain, aching, or stiffness in or around a joint in the past 30 days. Of these adults whose joint symptoms began more than 3 months earlier, 74.4% had ever seen a doctor or other health professional for their joint symptoms. And 33.0% were limited in any of their usual activities because of their joint symptoms.

Figure 1.
Percentage of Adults With Doctor-Diagnosed Arthritis by Weight Categories, 2005 North Carolina BRFSS



In 2005, 27.3% of adults in North Carolina had doctor-diagnosed arthritis, an increase from 24.8% in 2000. North Carolina's rate was slightly above the 2005 US average of 26.9%. Table 1 shows the 2005 prevalence of self-reported doctor-diagnosed arthritis in North Carolina by selected respondent characteristics. Prevalence is higher among females, American Indians, non-Hispanics, older adults, adults with lower education and income, adults who report a disability, veterans, and adults who report having diabetes or asthma. Figures 1 and 2 show the association of doctor-diagnosed arthritis prevalence with body mass

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index and level of physical activity. Obese adults have a higher rate of arthritis as do adults with lower levels of physical activity.

Figure 3 indicates that adults with doctor-diagnosed arthritis are much more likely than adults without arthritis to report their health as fair or poor and much less likely to report their health as very good or excellent. This association may be partly because adults with arthritis are older and thus have a higher rate of other health problems, too.

The associations shown here do not indicate cause and effect. For example, veterans may have a higher rate of arthritis in part because they are much older on average than other North Carolina adults. Hispanics in North Carolina who speak primarily Spanish are much younger than average and also much less likely than other population groups to have health insurance or a personal doctor, which reduces the chance for a diagnosis. Though physical activity can maintain joint health and reduce the risk of arthritis, the presence of arthritis may lead to lower levels of physical activity. The data shown in this report do indicate population subgroups that can be targeted by arthritis prevention and management programs.

Figure 2.
Percentage of Adults With Doctor-Diagnosed Arthritis by Level of Physical Activity, 2005 North Carolina BRFSS

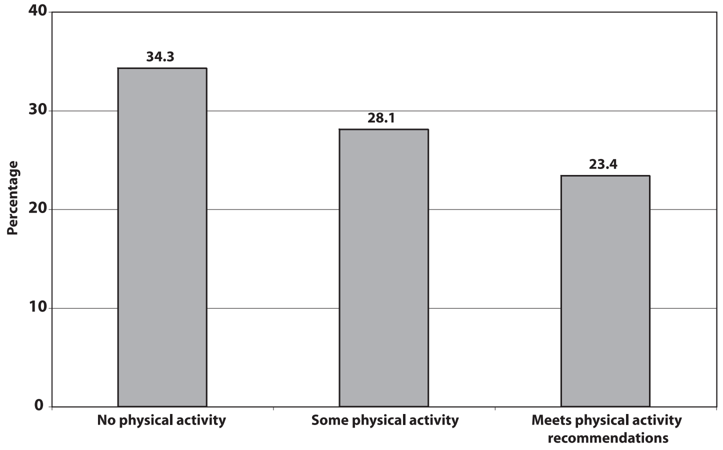

Figure 3.
Percentage of Adults Who Reported That Their Health Was Excellent, Very Good, Good, Fair, or Poor, by Presence/Absence of Doctor-Diagnosed Arthritis, 2005 North Carolina BRFSS

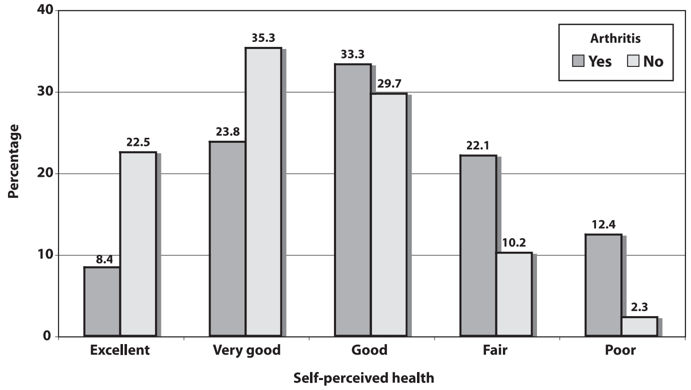

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Table 1.
Percentage of Adults Reporting Doctor-Diagnosed Arthritis by Selected Respondent Characteristics, 2005 North Carolina BRFSS

Characteristic	Percent	Characteristic	Percent
Total Population	27.3	**Education**	
Gender		Less than high school	31.8
Male	22.7	High school or GED	30.2
Female	31.7	Some post high school	27.6
Race		College graduate	21.4
White	29.2	**Household Income**	
African American	27.5	Less than $15 000	38.7
Asian	9.9	$15 000 - $24 999	28.1
American Indian	40.3	$25 000 - $34 999	29.1
Other minorities	7.8	$35 000 - $49 999	25.5
Ethnicity		$50 000 - $74 999	23.5
English-speaking Hispanic	23.8	$75 000+	20.9
Spanish-speaking Hispanic	3.8	**Disability**	
Non-Hispanic	29.2	Yes	52.8
Age (years)		No	18.0
18-24	5.5	**Veteran**	
25-34	9.7	Yes	36.3
35-44	16.2	No	26.0
45-54	33.0	**Diabetes**	
55-64	46.3	Yes	54.6
65-74	55.5	No	24.6
75+	59.0	**Asthma**	
		Yes	43.1
		No	26.2

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Contributed by Paul A. Buescher, PhD,
State Center for Health Statistics, North Carolina Division of Public Health

Hospital Quality and Patient Safety

Notable News from The North Carolina Center for Hospital Quality and Patient Safety

The North Carolina Surgical Care Improvement Project

Substantial variations in the rates of surgery and outcomes of surgical care are well demonstrated.[1] Failure to apply standards of care known to prevent adverse events results in harm to the patient. Research shows that a significant percentage of the 30 million operations performed in the United States each year result in preventable, often life-threatening, complications.

The 1999 Institute of Medicine of the National Academies report *To Err is Human* highlighted a study from a large medical center which found that 5.4% of 44 000 patients who underwent surgery suffered complications; nearly one-half of those complications were attributed to error.[2] Therefore, with 30 million surgical procedures performed each year in the United States, an estimated 1.6 million patients suffer complications as a result of surgical care. In North Carolina alone, 221 326 nonobstretical operations at nonfederal acute care hospitals were performed in fiscal year 2005[3] and if the proportions from the national study hold, approximately 12 000 patients may have suffered surgical complications.

Surgical site infections and cardiovascular, respiratory, and thrombolic complications represent some of the most common postoperative problems. Despite an abundance of scientific knowledge in the medical literature providing evidence-based guidance for prevention of many of these complications, there is substantial evidence that these standards aren't applied reliably in health care today.[4]

As stated in the 2001 Institute of Medicine Report *Crossing the Quality Chasm*, "Between the healthcare we have and the care we could have lies not just a gap, but a chasm."[5] For example, evidence that properly timed antimicrobial prophylaxis is effective has existed for more than 30 years. However, only 56% of Medicare patients received prophylaxis within the appropriate time frame.[6]

Patients who experience postoperative complications have increased lengths of hospital stay, increased readmission rates, and increased mortality.[7,8,9] Recently a number of successful projects have shown that implementation of evidence-based practices can have a significant impact on surgical complications.[10] As a result, over 30 national organizations, including the Centers for Medicare and Medicaid, Centers for Disease Control and Prevention, Department of Veterans Affairs, American College of Surgeons, American Hospital Association, Institute for Healthcare Improvement, and the Joint Commission have aligned efforts aimed at reducing surgical complications and mortality. This collaboration is called the Surgical Care Improvement Project (SCIP).[11]

The Surgical Care Improvement Project is a national quality partnership committed to improving the safety of surgical care through the reduction of postoperative complications. Launched in 2005, the goal of SCIP is to reduce the incidence of surgical complications 25% by the year 2010. The Surgical Care Improvement Project identifies evidence-based processes of care related to prevention of cardiovascular events, surgical site infections, postoperative pneumonia, and venous thromboembolism.[12] (See Table 1.)

In North Carolina, 48 hospitals are working together to improve surgical care processes by participating in the NC SCIP collaborative. These hospitals are committed to reducing complications associated with surgical care; through collaborative participation, they will design systems to reliably implement the care processes of SCIP. In August the 160 hospital representatives came together in Chapel Hill to learn about the SCIP network, share best practices, and begin the work of designing reliable processes of care related to SCIP.

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Table 1.
NC SCIP Process of Care Measures

Prevention of infection	Prophylactic antimicrobial initiated 1 hour before surgical incision (2 hours for vancomycin or fluoroquinolone)
	Prophylactic antimicrobial consistent with published guidelines
	Prophylactic antimicrobial discontinued within 24 hours of surgery end time (48 hours for cardiac patients)
	Blood glucose control in patients undergoing cardiac surgery
	Proper hair removal
	Maintenance of normothermia in colorectal surgery patients
Prevention of venous thromboembolism (VTE)	VTE prophylaxis ordered consistent with current guidelines
	Appropriate VTE prophylaxis administered within 24 hours before and after
Prevention of cardiac events	Administration of peri-operative β-blockers to patients on β-blockers prior to admission

The North Carolina Surgical Care Improvement Project collaborative is led in partnership by the North Carolina Center for Hospital Quality and Patient Safety, the Carolinas Center for Medical Excellence, and the North Carolina Chapter of the American College of Surgeons. Participating hospitals receive consultative support and secure online data collection tools and reports from the partners in addition to networking meetings, teleconferences, and other resources. The North Carolina Area Health Education Centers Program and the Southern Atlantic Healthcare Alliance provide additional support by coaching collaborative hospitals.

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Without the voluntary assistance and carefully executed reviews of a number of anonymous reviewers, no journal can offer the kind of peer-review for submitted manuscripts that can assure its readers the highest quality of published articles. We are fortunate for the service of a number of individuals who have given generously of their time and expertise in service to the *North Carolina Medical Journal* this past year, and we are pleased to have this annual opportunity to acknowledge their efforts.

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Marking A Milestone

Highlighting a long-term commitment to improving health care services for North Carolina communities and citizens

A Milestone in Arthritis Care
Alvin Daughtridge

Alvin Daughtridge always held the philosophy that businesses and communities flourish if relationships are built on integrity, cooperation, and trust. According to Daughtridge, "When people park their ego at the door and engage in face-to-face dialogue, problems frequently become opportunities and win-win solutions emerge." In 1999, while serving on the boards of both the Thurston Arthritis Research Center at the University of North Carolina at Chapel Hill (UNC) and Caldwell Memorial Hospital in Lenoir, North Carolina, the vice president of Fairfield Chair Company and life-long community advocate saw an opportunity to put his philosophy into action.

Recognizing the need for Caldwell Memorial to add more specialists at the same time the Arthritis Center was looking for opportunities to expand its outreach efforts across the state, Daughtridge immediately began work to build just such a win-win partnership between the two entities. He knew, however, that opportunity does not always result in success. The newly formed partnership would need to show a strong return on investment in order to succeed and thrive in the long term. To help accomplish that, Daughtridge worked closely with Thurston and Caldwell Memorial to ensure arthritis care would be provided in the area and that the area primary care physicians would offer referrals.

His efforts paid off. In 2001, a new clinic opened its doors and was named the Alvin W. Daughtridge Arthritis Clinic in honor of his vision. Dr John Winfield, retired founding director of Thurston Arthritis Research Center and rheumatologist at the clinic, says, "Alvin was instrumental to bringing arthritis care to Caldwell County and has continued to be a staunch supporter of arthritis research. Alvin has been active in arthritis care and research for many years and the dedication of the arthritis clinic in his name was a much deserved tribute to his efforts." The clinic quickly grew from a 1 to 2 day a month operation to 3 days a week. It also expanded from clinical care to a site location for drug studies and grand rounds.

"I can personally attest that Alvin's efforts have resulted in greater access to improved arthritis care for Caldwell County residents," says Dr Winfield. Daughtridge, a man well-known for his gentle and humble nature, is quick to deflect the credit and offers his own praise of Dr Winfield. "John's effectiveness with his patients is outstanding," he says. "He has made a marvelous difference in the lives of arthritis patients here in Caldwell County."

Throughout his life, Daughtridge has been a tireless community volunteer and advocate in multiple areas including health, business, and education. He has served on the boards of Caldwell County's Cancer Society, Red Cross, and Board of Health and as chairman of the Caldwell County Blood Mobile. He is a former president of the Lenoir/Caldwell Chamber of Commerce and a member of the Lenoir Jaycees, the American Furniture Manufacturer's Association, and the Furniture Shippers Association. A former Caldwell Community College and Technical Institute board member, he has served on the Caldwell Schools Career Center Advisory Council and the Planning Team. Founding chair of Communities in Schools of Caldwell County, other educational endeavors include work with the King Creek Parent Teacher Association, Communities in Smart Start Program, Children's Advocacy Council, and Preschool Interagency Council. Additional civic activities include Caldwell County's United Way, Planning Board, and City/County Services Committee, and the Lenoir Recreation Commission. A member of the Caldwell Baptist Association, Daughtridge is a deacon and Sunday school teacher at Lenoir First Baptist Church.

Daughtridge has described the clinic as a "godsend" to the people of Caldwell County. He was perhaps most pleased, however, to see his philosophy of win-win relationships between business and community come to fruition. "Because of the clinic, more people in North Carolina became aware of the University of North Carolina at Chapel Hill and its arthritis expertise through the Thurston Arthritis Research Center," he said. Dr Joanne Jordan, director of Thurston and chief of the Division of Rheumatology, Allergy, and Immunology at the UNC School of Medicine, says, "Every member of the Thurston staff works to ensure better arthritis care and improved outcomes for the people of North Carolina. We thank community advocates like Alvin Daughtridge who make such efforts possible."

Contributions from Randall Mounce, Thurston Arthritis Research Center, the University of North Carolina at Chapel Hill.

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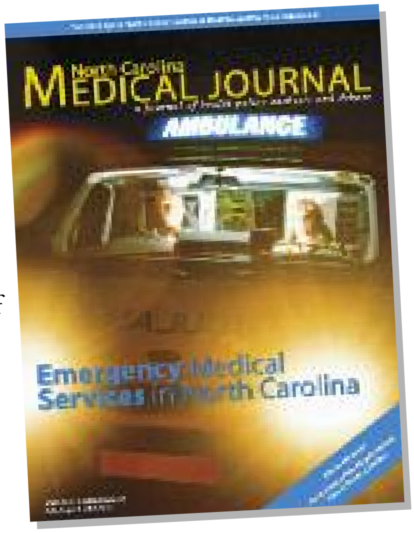
Readers' Forum



To the Editor:

I was delighted to see the research article in your July/August issue on "Awareness of the Bicycle Helmet Law in North Carolina." Hopefully, it will serve as a reminder to the primary care providers in your readership that a little guidance to children and parents alike on the efficacy of helmets can save lives and reduce serious injuries.

Interestingly, the authors seem more pessimistic about compliance with the law than those of us on the NC Child Fatality Task Force who pushed for passage of the law in 2000-2001. The authors seem disappointed that regular helmet use in Pitt County increased in the 5 years after passage from less than 10% just before passage to 40%. Though much more improvement is needed, those of us involved with children's safety issues are encouraged by this significant increase in helmet use, especially since the law does not require those age 16 and older to wear helmets. Thus, parents often are not the role models they need to be.

While acknowledging the limitations of a one-county study, the authors neglect to present statewide data on the measure of greatest importance to the Task Force: bicycle-related deaths in children. In the 6 years prior to consideration and passage of the law (1994-1999) there were 71 bicycle-related deaths among children in North Carolina. In the 6 years since then (2000-2005), there were 43. That's a remarkable 40% reduction in such deaths. Given that the number of children has been increasing each year, it is likely that the death rate has dropped by almost half!

While these data are particularly encouraging, the research article makes it clear that we have a long way to go. Raising awareness is critical. Let's hope the article does just that.

Tom Vitaglione, Chair
NC Child Fatality Task Force
1300 St. Mary's Street, Suite 500
Raleigh, NC 27605
919-834-6623 Ext. 235
tom@ncchild.net

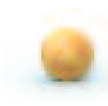
To the Editor:

Concern has been raised recently by both consumers and physicians about the safety of drugs and implants after release to the market and the widespread television advertising of these new medications and devices. These two issues are important and closely interrelated. Last year, the Institute of Medicine of the National Academies issued a report calling for the Food and Drug Administration (FDA) to increase vigilance for possible drug complications after release. This report also recommended that direct marketing of a new medication to consumers should be restricted for two years after release of the new drug.

There has been an explosion of new and expensive technology in total hip and knee replacement devices. With the increasing prevalence of arthritis in the maturing baby-boomer generation, the orthopaedic device companies have also increased direct marketing of joint replacement products to consumers. Some examples include ceramic hip bearings, metal on metal hip resurfacing, rotating plastic knee replacements, knee devices designed for women only, and computer assisted surgery. Obviously, the orthopaedic device companies must be getting a good return for their advertising budgets. However, do consumer-patients truly benefit from this new expensive technology?

At a recent national meeting of orthopaedic surgeons in San Diego, data were presented on all these new devices. There is yet no proven benefit from these new, more expensive devices compared to standard hip and knee implants. Computer-assisted orthopaedic surgery has yet to improve patients' outcomes. The American Academy of Orthopaedic Surgeons, the Hip Society, and the Knee Society have again called on the Centers for Medicare and Medicaid Services to establish a national registry for hip and knee replacements. Such a registry would identify, at an earlier time, problematic or less effective devices. The United States has a much higher rate of revision (redo) hip and knee replacement surgery than other countries such as Canada, Sweden, and Norway, which have such national registries. With patients changing insurance plans and physicians frequently, only a national registry will detect the problematic devices early. At present, patients and

READERS' FORUM—continued on page 477



The pill is little. But it can make a
difference on your patients' heartburn
and other symptoms of acid reflux disease.

Call **1-800-969-8526** today to get free patient education materials about ACIPHEX for your practice!

ACIPHEX 20 mg is indicated for: treatment of daytime and nighttime heartburn and other symptoms of GERD; short-term, up to 4 weeks, treatment in the healing and symptomatic relief of duodenal ulcers; short-term, 4 to 8 weeks, treatment in the healing and symptomatic relief of erosive GERD; and maintenance of healing and reduction in relapse rates of heartburn symptoms of erosive GERD (controlled maintenance studies do not extend beyond 12 months).

Important Safety Information: In clinical trials the most common side effect assessed as possibly or probably related to ACIPHEX with a frequency greater than placebo was headache (2.4% vs 1.6% for placebo).

Symptomatic response to therapy does not preclude the presence of gastric malignancy. ACIPHEX is contraindicated in patients with known hypersensitivity to rabeprazole, substituted benzimidazoles, or to any component of the formulation. Patients treated with a proton pump inhibitor and warfarin concomitantly may need to be monitored for increases in INR and prothrombin time.

Please see brief summary of full prescribing information on adjacent page.

Manufactured
& Marketed by
Eisai
Woodcliff Lake, NJ 07677

Marketed by
PriCara™
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Raritan, NJ 08869-0602

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AcipHex®
rabeprazole sodium
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AcipHex®
rabeprazole sodium

ACIPHEX® \a-sa-feks\
(rabeprazole sodium)
Delayed-Release Tablets

BRIEF SUMMARY
Before prescribing ACIPHEX®, please see full prescribing information.

INDICATIONS AND USAGE
Healing of Erosive or Ulcerative Gastroesophageal Reflux Disease (GERD)
ACIPHEX® is indicated for short-term (4 to 8 weeks) treatment in the healing and symptomatic relief of erosive or ulcerative gastroesophageal reflux disease (GERD). For those patients who have not healed after 8 weeks of treatment, an additional 8-week course of ACIPHEX® may be considered.

Maintenance of Healing of Erosive or Ulcerative Gastroesophageal Reflux Disease (GERD)
ACIPHEX® is indicated for maintaining healing and reduction in relapse rates of heartburn symptoms in patients with erosive or ulcerative gastroesophageal reflux disease (GERD Maintenance). Controlled studies do not extend beyond 12 months.

Treatment of Symptomatic Gastroesophageal Reflux Disease (GERD)
ACIPHEX® is indicated for the treatment of daytime and nighttime heartburn and other symptoms associated with GERD.

Healing of Duodenal Ulcers
ACIPHEX® is indicated for short-term (up to four weeks) treatment in the healing and symptomatic relief of duodenal ulcers. Most patients heal within four weeks.

***Helicobacter pylori* Eradication to Reduce the Risk of Duodenal Ulcer Recurrence**
ACIPHEX® in combination with amoxicillin and clarithromycin as a three drug regimen, is indicated for the treatment of patients with *H. pylori* infection and duodenal ulcer disease (active or history within the past 5 years) to eradicate *H. pylori*. Eradication of *H. pylori* has been shown to reduce the risk of duodenal ulcer recurrence. (See **CLINICAL STUDIES** and **DOSAGE AND ADMINISTRATION** in full prescribing information.)

In patients who fail therapy, susceptibility testing should be done. If resistance to clarithromycin is demonstrated or susceptibility testing is not possible, alternative antimicrobial therapy should be instituted. (See **CLINICAL PHARMACOLOGY, Microbiology** in full prescribing information and the clarithromycin package insert, **CLINICAL PHARMACOLOGY, Microbiology**.)

Treatment of Pathological Hypersecretory Conditions, Including Zollinger-Ellison Syndrome
ACIPHEX® is indicated for the long-term treatment of pathological hypersecretory conditions, including Zollinger-Ellison syndrome.

CONTRAINDICATIONS
Rabeprazole is contraindicated in patients with known hypersensitivity to rabeprazole, substituted benzimidazoles or to any component of the formulation.

Clarithromycin is contraindicated in patients with known hypersensitivity to any macrolide antibiotic.

Concomitant administration of clarithromycin with pimozide and cisapride is contraindicated. There have been post-marketing reports of drug interactions when clarithromycin and/or erythromycin are co-administered with pimozide resulting in cardiac arrhythmias (QT prolongation, ventricular tachycardia, ventricular fibrillation, and torsade de pointes) most likely due to inhibition of hepatic metabolism of pimozide by erythromycin and clarithromycin. Fatalities have been reported. (Please refer to full prescribing information for clarithromycin.)

Amoxicillin is contraindicated in patients with a known hypersensitivity to any penicillin. (Please refer to full prescribing information for amoxicillin.)

WARNINGS
CLARITHROMYCIN SHOULD NOT BE USED IN PREGNANT WOMEN EXCEPT IN CLINICAL CIRCUMSTANCES WHERE NO ALTERNATIVE THERAPY IS APPROPRIATE. If pregnancy occurs while taking clarithromycin, the patient should be apprised of the potential hazard to the fetus. (See **WARNINGS** in prescribing information for clarithromycin.)

Amoxicillin: Serious and occasionally fatal hypersensitivity (anaphylactic) reactions have been reported in patients on penicillin therapy. These reactions are more likely to occur in individuals with a history of penicillin hypersensitivity and/or a history of sensitivity to multiple allergens.

There have been well-documented reports of individuals with a history of penicillin hypersensitivity reactions who have experienced severe hypersensitivity reactions when treated with a cephalosporin. Before initiating therapy with any penicillin, careful inquiry should be made concerning previous hypersensitivity reactions to penicillins, cephalosporins, and other allergens. If an allergic reaction occurs, amoxicillin should be discontinued and the appropriate therapy instituted. (See **WARNINGS** in prescribing information for amoxicillin.)

SERIOUS ANAPHYLACTIC REACTIONS REQUIRE IMMEDIATE EMERGENCY TREATMENT WITH EPINEPHRINE. OXYGEN, INTRAVENOUS STEROIDS, AND AIRWAY MANAGEMENT, INCLUDING INTUBATION, SHOULD ALSO BE ADMINISTERED AS INDICATED.

Pseudomembranous colitis has been reported with nearly all antibacterial agents, including clarithromycin and amoxicillin, and may range in severity from mild to life threatening. Therefore, it is important to consider this diagnosis in patients who present with diarrhea subsequent to the administration of antibacterial agents.

Treatment with antibacterial agents alters the normal flora of the colon and may permit overgrowth of clostridia. Studies indicate that a toxin produced by *Clostridium difficile* is a primary cause of "antibiotic-associated colitis".

After the diagnosis of pseudomembranous colitis has been established, therapeutic measures should be initiated. Mild cases of pseudomembranous colitis usually respond to discontinuation of the drug alone. In moderate to severe cases, consideration should be given to management with fluids and electrolytes, protein supplementation, and treatment with an antibacterial drug clinically effective against *Clostridium difficile colitis*.

PRECAUTIONS
General
Symptomatic response to therapy with rabeprazole does not preclude the presence of gastric malignancy.

Patients with healed GERD were treated for up to 40 months with rabeprazole and monitored with serial gastric biopsies. Patients without *H. pylori* infection (221 of 326 patients) had no clinically important pathologic changes in the gastric mucosa. Patients with *H. pylori* infection at baseline (105 of 326 patients) had mild or moderate inflammation in the gastric body or mild inflammation in the gastric antrum. Patients with mild grades of infection or inflammation in the gastric body tended to change to moderate, whereas those graded moderate at baseline tended to remain stable. Patients with mild grades of infection or inflammation in the gastric antrum tended to remain stable. At baseline 8% of patients had atrophy of glands in the gastric body and 15% had atrophy in the gastric antrum. At endpoint, 15% of patients had atrophy of glands in the gastric body and 11% had atrophy in the gastric antrum. Approximately 4% of patients had intestinal metaplasia at some point during follow-up, but no consistent changes were seen.

Steady state interactions of rabeprazole and warfarin have not been adequately evaluated in patients. There have been reports of increased INR and prothrombin time in patients receiving a proton pump inhibitor and warfarin concomitantly. Increases in INR and prothrombin time may lead to abnormal bleeding and even death. Patients treated with a proton pump inhibitor and warfarin concomitantly may need to be monitored for increases in INR and prothrombin time.

Information for Patients
Patients should be cautioned that ACIPHEX® delayed-release tablets should be swallowed whole. The tablets should not be chewed, crushed, or split. ACIPHEX® can be taken with or without food.

Drug Interactions
Rabeprazole is metabolized by the cytochrome P450 (CYP450) drug metabolizing enzyme system. Studies in healthy subjects have shown that rabeprazole does not have clinically significant interactions with other drugs metabolized by the CYP450 system, such as warfarin and theophylline given as single oral doses, diazepam as a single intravenous dose, and phenytoin given as a single intravenous dose (with supplemental oral dosing). Steady state interactions of rabeprazole and other drugs metabolized by this enzyme system have not been studied in patients. There have been reports of increased INR and prothrombin time in patients receiving proton pump inhibitors, including rabeprazole, and warfarin concomitantly. Increases in INR and prothrombin time may lead to abnormal bleeding and even death.

In vitro incubations employing human liver microsomes indicated that rabeprazole inhibited cyclosporine metabolism with an IC_{50} of 62 micromolar, a concentration that is over 50 times higher than the C_{max} in healthy volunteers following 14 days of dosing with 20 mg of rabeprazole. This degree of inhibition is similar to that by omeprazole at equivalent concentrations.

Rabeprazole produces sustained inhibition of gastric acid secretion. An interaction with compounds which are dependent on gastric pH for absorption may occur due to the magnitude of acid suppression observed with rabeprazole. For example, in normal subjects, co-administration of rabeprazole 20 mg QD resulted in an approximately 30% decrease in the bioavailability of ketoconazole and increases in the AUC and C_{max} for digoxin of 19% and 29%, respectively. Therefore, patients may need to be monitored when such drugs are taken concomitantly with rabeprazole. Co-administration of rabeprazole and antacids produced no clinically relevant changes in plasma rabeprazole concentrations.

In a clinical study in Japan evaluating rabeprazole in patients categorized by CYP2C19 genotype (n=6 per genotype category), gastric acid suppression was higher in poor metabolizers as compared to extensive metabolizers. This could be due to higher rabeprazole plasma levels in poor metabolizers. Whether or not interactions of rabeprazole sodium with other drugs metabolized by CYP2C19 would be different between extensive metabolizers and poor metabolizers has not been studied.

Combined Administration with Clarithromycin
Combined administration consisting of rabeprazole, amoxicillin, and clarithromycin resulted in increases in plasma concentrations of rabeprazole and 14-hydroxyclarithromycin. (See **CLINICAL PHARMACOLOGY, Combination Therapy with Antimicrobials** in full prescribing information.)

Concomitant administration of clarithromycin with pimozide and cisapride is contraindicated. (See **PRECAUTIONS** in prescribing information for clarithromycin.) (See **PRECAUTIONS** in prescribing information for amoxicillin.)

Carcinogenesis, Mutagenesis, Impairment of Fertility
In a 88/104-week carcinogenicity study in CD-1 mice, rabeprazole at oral doses up to 100 mg/kg/day did not produce any increased tumor occurrence. The highest tested dose produced a systemic exposure to rabeprazole (AUC) of 1.40 μg•hr/mL which is 1.6 times the human exposure (plasma $AUC_{0-\infty}$ = 0.88 μg•hr/mL) at the recommended dose for GERD (20 mg/day). In a 104-week carcinogenicity study in Sprague-Dawley rats, males were treated with oral doses of 5, 15, 30 and 60 mg/kg/day and females with 5, 15, 30, 60 and 120 mg/kg/day. Rabeprazole produced gastric enterochromaffin-like (ECL) cell hyperplasia in male and female rats and ECL cell carcinoid tumors in female rats at all doses including the lowest tested dose. The lowest dose (5 mg/kg/day) produced a systemic exposure to rabeprazole (AUC) of about 0.1 μg•hr/mL which is about 0.1 times the human exposure at the recommended dose for GERD. In male rats, no treatment related tumors were observed at doses up to 60 mg/kg/day producing a rabeprazole plasma exposure (AUC) of about 0.2 μg•hr/mL (0.2 times the human exposure at the recommended dose for GERD).

Rabeprazole was positive in the Ames test, the Chinese hamster ovary cell (CHO/HGPRT) forward gene mutation test and the mouse lymphoma cell (L5178Y/TK+/-) forward gene mutation test. Its demethylated-metabolite was also positive in the Ames test. Rabeprazole was negative in the *in vitro* Chinese hamster lung cell chromosome aberration test, the *in vivo* mouse micronucleus test, and the *in vivo* and *ex vivo* rat hepatocyte unscheduled DNA synthesis (UDS) tests.

Rabeprazole at intravenous doses up to 30 mg/kg/day (plasma AUC of 8.8 μg•hr/mL, about 10 times the human exposure at the recommended dose for GERD) was found to have no effect on fertility and reproductive performance of male and female rats.

Pregnancy
Teratogenic Effects. Pregnancy Category B: Teratology studies have been performed in rats at intravenous doses up to 50 mg/kg/day (plasma AUC of 11.8 μg•hr/mL, about 13 times the human exposure at the recommended dose for GERD) and rabbits at intravenous doses up to 30 mg/kg/day (plasma AUC of 7.3 μg•hr/mL, about 8 times the human exposure at the recommended dose for GERD) and have revealed no evidence of impaired fertility or harm to the fetus due to rabeprazole. There are, however, no adequate and well-controlled studies in pregnant women. Because animal reproduction studies are not always predictive of human response, this drug should be used during pregnancy only if clearly needed.

Nursing Mothers
Following intravenous administration of ^{14}C-labeled rabeprazole to lactating rats, radioactivity in milk reached levels that were 2- to 7-fold higher than levels in the blood. It is not known if unmetabolized rabeprazole is excreted in human breast milk. Administration of rabeprazole to rats in late gestation and during lactation at doses of 400 mg/kg/day (about 195-times the human dose based on mg/m²) resulted in decreases in body weight gain of the pups. Since many drugs are excreted in milk, and because of the potential for adverse reactions to nursing infants from rabeprazole, a decision should be made to discontinue nursing or discontinue the drug, taking into account the importance of the drug to the mother.

Pediatric Use
The safety and effectiveness of rabeprazole in pediatric patients have not been established.

Use in Women
Duodenal ulcer and erosive esophagitis healing rates in women are similar to those in men. Adverse events and laboratory test abnormalities in women occurred at rates similar to those in men.

Geriatric Use
Of the total number of subjects in clinical studies of ACIPHEX®, 19% were 65 years and over, while 4% were 75 years and over. No overall differences in safety or effectiveness were observed between these subjects and younger subjects, and other reported clinical experience has not identified differences in responses between the elderly and younger patients, but greater sensitivity of some older individuals cannot be ruled out.

ADVERSE REACTIONS
Worldwide, over 2900 patients have been treated with rabeprazole in Phase II-III clinical trials involving various dosages and durations of treatment. In general, rabeprazole treatment has been well-tolerated in both short-term and long-term trials. The adverse events rates were generally similar between the 10 and 20 mg doses.

Incidence in Controlled North American and European Clinical Trials
In an analysis of adverse events assessed as possibly or probably related to treatment appearing in greater than 1% of ACIPHEX® patients and appearing with greater frequency than placebo in controlled North American and European trials, the incidence of headache was 2.4% (n=1552) for ACIPHEX® versus 1.6% (n=258) for placebo.

In short and long-term studies, the following adverse events, regardless of causality, were reported in ACIPHEX®-treated patients. Rare events are those reported in ≤1/1000 patients.

Body as a Whole: asthenia, fever, allergic reaction, chills, malaise, chest pain substernal, neck rigidity, photosensitivity reaction. Rare: abdomen enlarged, face edema, hangover effect. *Cardiovascular System:* hypertension, myocardial infarct, electrocardiogram abnormal, migraine, syncope, angina pectoris, bundle branch block, palpitation, sinus bradycardia, tachycardia. Rare: bradycardia, pulmonary embolus, supraventricular tachycardia, thrombophlebitis, vasodilation, QTC prolongation and ventricular tachycardia. *Digestive System:* diarrhea, nausea, abdominal pain, vomiting, dyspepsia, flatulence, constipation, dry mouth, eructation, gastroenteritis, rectal hemorrhage, melena, anorexia, cholelithiasis, mouth ulceration, stomatitis, dysphagia, gingivitis, cholecystitis, increased appetite, abnormal stools, colitis, esophagitis, glossitis, pancreatitis, proctitis. Rare: bloody diarrhea, cholangitis, duodenitis, gastrointestinal hemorrhage, hepatic encephalopathy, hepatitis, hepatoma, liver fatty deposit, salivary gland enlargement, thirst. *Endocrine System:* hyperthyroidism, hypothyroidism. *Hemic & Lymphatic System:* anemia, ecchymosis, lymphadenopathy, hypochromic anemia. *Metabolic & Nutritional Disorders:* peripheral edema, edema, weight gain, gout, dehydration, weight loss. *Musculo-Skeletal System:* myalgia, arthritis, leg cramps, bone pain, arthrosis, bursitis. Rare: twitching. *Nervous System:* insomnia, anxiety, dizziness, depression, nervousness, somnolence, hypertonia, neuralgia, vertigo, convulsion, abnormal dreams, libido decreased, neuropathy, paresthesia, tremor. Rare: agitation, amnesia, confusion, extrapyramidal syndrome, hyperkinesia. *Respiratory System:* dyspnea, asthma, epistaxis, laryngitis, hiccup, hyperventilation. Rare: apnea, hypoventilation. *Skin and Appendages:* rash, pruritus, sweating, urticaria, alopecia. Rare: dry skin, herpes zoster, psoriasis, skin discoloration. *Special Senses:* cataract, amblyopia, glaucoma, dry eyes, abnormal vision, tinnitus, otitis media. Rare: corneal opacity, blurry vision, diplopia, deafness, eye pain, retinal degeneration, strabismus. *Urogenital System:* cystitis, urinary frequency, dysmenorrhea, dysuria, kidney calculus, metrorrhagia, polyuria. Rare: breast enlargement, hematuria, impotence, leukorrhea, menorrhagia, orchitis, urinary incontinence.

Laboratory Values: The following changes in laboratory parameters were reported as adverse events: abnormal platelets, albuminuria, creatine phosphokinase increased, erythrocytes abnormal, hypercholesteremia, hyperglycemia, hyperlipemia, hypokalemia, hyponatremia, leukocytosis, leukorrhea, liver function tests abnormal, prostatic specific antigen increase, SGPT increased, urine abnormality, WBC abnormal.

In controlled clinical studies, 3/1456 (0.2%) patients treated with rabeprazole and 2/237 (0.8%) patients treated with placebo developed treatment emergent abnormalities (which were either new on study or present at study entry with an increase of 1.25 x baseline value) in SGOT (AST), SGPT (ALT), or both. None of the three rabeprazole patients experienced chills, fever, right upper quadrant pain, nausea or jaundice.

Combination Treatment with Amoxicillin and Clarithromycin: In clinical trials using combination therapy with rabeprazole plus amoxicillin and clarithromycin (RAC), no adverse events unique to this drug combination were observed. In the U.S. multicenter study, the most frequently reported drug related adverse events for patients who received RAC therapy for 7 or 10 days were diarrhea (8% and 7%) and taste perversion (6% and 10%), respectively.

No clinically significant laboratory abnormalities particular to the drug combinations were observed.

For more information on adverse events or laboratory changes with amoxicillin or clarithromycin, refer to their respective package prescribing information, **ADVERSE REACTIONS** section.

Post-Marketing Adverse Events: Additional adverse events reported from worldwide marketing experience with rabeprazole sodium are: sudden death; coma and hyperammonemia; jaundice; rhabdomyolysis; disorientation and delirium; anaphylaxis; angioedema; bullous and other drug eruptions of the skin; severe dermatologic reactions, including toxic epidermal necrolysis (some fatal), Stevens-Johnson syndrome, and erythema multiforme; interstitial pneumonia; interstitial nephritis; and TSH elevations. In most instances, the relationship to rabeprazole sodium was unclear. In addition, agranulocytosis, hemolytic anemia, leukopenia, pancytopenia, and thrombocytopenia have been reported. Increases in prothrombin time/INR in patients treated with concomitant warfarin have been reported.

OVERDOSAGE

Because strategies for the management of overdose are continually evolving, it is advisable to contact a Poison Control Center to determine the latest recommendations for the management of an overdose of any drug. There has been no experience with large overdoses with rabeprazole. Seven reports of accidental overdosage with rabeprazole have been received. The maximum reported overdose was 80 mg. There were no clinical signs or symptoms associated with any reported overdose. Patients with Zollinger-Ellison syndrome have been treated with up to 120 mg rabeprazole QD. No specific antidote for rabeprazole is known. Rabeprazole is extensively protein bound and is not readily dialyzable. In the event of overdosage, treatment should be symptomatic and supportive.

Single oral doses of rabeprazole at 786 mg/kg and 1024 mg/kg were lethal to mice and rats, respectively. The single oral dose of 2000 mg/kg was not lethal to dogs. The major symptoms of acute toxicity were hypoactivity, labored respiration, lateral or prone position and convulsion in mice and rats and watery diarrhea, tremor, convulsion and coma in dogs.

Rx only

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Manufactured and Marketed by Eisai Inc., Teaneck, NJ 07666
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Readers' Forum continued

physicians can rely only on institutional (Mayo Clinic) or personal surgeon (UNC) databases for this information. Individual problems with devices such as squeaking ceramic hip replacements are likely underreported to the FDA at present. Patients should also realize that the experience and skill of the surgeon is more important for the long-term success of a hip or knee replacement than the use of the newest or most advertised product.

Patients should write their national legislators this year to encourage the FDA and the Centers for Medicare and Medicaid Services to enact a national registry for hip and knee replacements. Television and print advertising of these devices to patients should be discouraged. Until this system is functional, patients with hip and knee replacements should have regular checkups of their artificial joints by their surgeon.

Paul F. Lachiewicz, MD
Professor of Orthopaedics
The University of North Carolina at Chapel Hill

Coming in the January/February 2008 issue of the

North Carolina Medical Journal

a look at:

Health Concerns for Returning Military Personnel

The Arthritis Foundation, Carolinas Chapter

PHILANTHROPY PROFILES

Forty-six million Americans have doctor-diagnosed arthritis. Arthritis is one of the most common diseases in the United States and the leading cause of disability among people 15 years of age and over. By the year 2020, an estimated 60 million people in the US will be affected. North Carolina ranks ninth among the 50 states in estimated prevalence, and arthritis is the most common cause of chronic disease in the state.

The Arthritis Foundation is the only nationwide, not-for-profit health organization providing people with arthritis the resources to control and manage their disease. Through evidence-based exercise programs and educational resources, the Arthritis Foundation is providing help to those who are in need. The Arthritis Foundation Carolinas Chapter serves more than 1.8 million people in North Carolina who have arthritis. The Carolinas Chapter works in collaboration with the North Carolina Arthritis Program to increase awareness of arthritis in the state. The Chapter's main office is located in Charlotte with staff also located in the Triangle and Triad to serve those areas of the state. In addition to offering the Arthritis Foundation's aquatic, exercise, tai chi, and self-help programs, the Carolinas Chapter funds arthritis research.

Over the past 2 years the Arthritis Foundation Carolinas Chapter has funded over $2 million dollars of research at institutions in the Carolinas. At Duke University, Arthritis Foundation-funded researcher Kelly K. Anthony, PhD, and her colleagues are investigating the social and emotional impact of having juvenile arthritis. Juvenile arthritis affects over 300 000 children in the United States and is one of the most common chronic diseases of childhood, occurring nearly as often as insulin-dependent juvenile diabetes. The results of this study at Duke will assist in the development of an early intervention program for the families of children living with juvenile arthritis. It will also provide physicians a better understanding of how to care for children with the disease.

The Arthritis Foundation Carolinas Chapter raises funds for such research with the support of thousands of committed volunteers and sponsors who participate in chapter events such as the signature Arthritis Walks and the Jingle Bell Run. These events are held in cities across the Carolinas including Wilmington, Asheville, Winston-Salem, Greensboro, Raleigh, Durham, Lenoir, and Charlotte. The money raised by these events supports research as well as public policy and public health initiatives, and the events focus on the importance of exercise in the management and treatment of arthritis. People with arthritis need to know they do not face this disease alone. For information or to get involved, call the Arthritis Foundation at 1-800-883-8806.

Gail Norman is president and CEO of the Arthritis Foundation Carolinas Chapter. She can be reached at gnorman@arthritis.org or 4530 Park Road, Suite 230, Charlotte, NC 28209.

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North Carolina MEDICAL JOURNAL

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