Focused Community-based Research for Eliminating CVD Risk Disparities in a Rural Underserved Population

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Abstract

Background: Cardiovascular disease (CVD) is the leading cause of death and chronic illness in the U.S. In parts of the rural south disparities in both health care access and CVD health outcomes are pervasive. Descriptive analyses of community-based CVD risk factors are valuable to begin to unfold the complex nature of CVD mortality in specific rural, underserved populations.
Objective: To evaluate the prevalence of cardiovascular disease (CVD) risk factors among patients age 25 and over at a primary rural healthcare setting in a specific rural, medically underserved population to guide the development of community-based CVD treatment and prevention strategies.
Methods: This study used a descriptive retrospective explorative design. Data were collected through chart audits from a random sample of 197 patients at a rural health center in northwest Alabama, U.S. Cardiovascular risk factors were identified using health data, anthropometric measures and ICD-9 codes. Prevalence was evaluated and descriptive statistics were used to describe cardiovascular risk factors as well as socio-demographics variables.
Findings: In this rural medically underserved cohort (n= 197), the prevalence of selected cardiovascular risk factors was: smoking: 39.1%; hypertension: 58.4%; dyslipidemia: 15.1%; diabetes mellitus: 27.9%; and obesity: 44.5%. Smoking, hypertension and diabetes were noted to be higher in men, while women had higher rates of dyslipidemia and obesity. Rates of hypertension and diabetes increased with age as seen in similar studies. More than 48% of the study population ages 41-55 years were noted to have dyslipidemia.
Conclusions: This community-based CVD risk factor assessment can be used to guide future community-based research and interventions. The high prevalence and inadequate control of CVD risk factors seen in this population coupled with an existing shortage of physicians is an opportunity for nursing interventions. The use of advanced practice nurses for CVD assessment and interventions may be one practical strategy for this rural, medically underserved population.

Keywords: Prevalence, Cardiovascular Disease, Risk Factors, Disparities, Community-based research, Rural, Underserved, Appalachian

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Cardiovascular disease (CVD) is the leading cause of death and chronic illness in the United States. More than 79 million Americans,1 in 3, have some form of CVD. In 2004, CVD accounted for 36.3% of all deaths (AHA, 2007). The cost of CVD and stroke for 2007 was estimated at more than $431.8 billion from both healthcare expenditures and lost productivity (AHA, 2007).

Even as cardiovascular mortality rates have shown patterns of decline, patterns of CVD health disparities are pervasive (Mensah & Dunbar, 2006). It is predicted that by 2020 heart

disease will remain the number one cause of death worldwide (AHA, 2007). Furthermore the pattern of decline in CVD is not equal across race, gender, socioeconomic levels, and geographic areas (AHA, 2007; Mensah & Dunbar, 2006; USDHHS, 2008).

The problem is particularly acute in parts of the rural south. Rural areas have challenges associated with resource disparities and the associated health outcome disparities. One disparity that is evident in rural populations is a pattern of higher prevalence of CVD risk factors and CVD mortality (Appel, Giger & Davidhizar, 2005; Hamner & Wilder, 2008; Kettle, Roebotban & West, 2005; McDonald, Hertx, Unger & Lustik, 2009; Taylor, Hughes & Harrison, 2002). In Alabama, heart disease is the leading cause of death and a major health disparity with a mortality rate of 292.2 as compared to the national rate of 241.7 per 100,000 (Alabama Health Statistics, 2007).

Background and Significance

From an epidemiological view, CVD is a complex, multifactorial disease process. Predisposing risk factors of CVD are interrelated within a complex web of causation. Known modifiable risk factors include obesity, smoking, hypertension, dyslipidemia, and diabetes. Consideration of CVD and its associated risk factors must include consideration of the complex relationships that exist among risk factors, geography and social determinants of health.

Differences or "disparities" in access to healthcare services and the resulting adverse health outcomes are major public health priorities. The Institute of Medicine (IOM) and the U.S. Department of Health and Human Services (USDHHS) have identified the need for strategies to improve access to healthcare services and to support the improvement of health outcomes and health disparities (AHRQ, 2008; IOM, 2004). *Healthy People 2010: National Health Promotion and Disease Prevention Objectives* designated the elimination of health disparities as a major goal for our nation's health (USDHHS, 2000). Findings from studies conducted for the purpose of identification of characteristics of health differences indicate that gaps or disparities continue to exist. The literature documents disparities associated with age, education, race and ethnicity, gender, income and socioeconomic status (SES), and place of residence or location of healthcare services (AHA, 2007; Christian, Rosamond, White & Mosca, 2007; Finketstein, Khavjou, Mobley, Haney & Will, 2004; Kanjilal, et al., 2006; Lillie-Blanton, Maddox, Rushing & Mensah, 2004; McDonald, et al., 2009; Mensah, Mokdad, Ford, Greenlund & Croft, 2005; Pilote, et al., 2007; USDHHS, 2008; Yarvi, et al., 2006). Furthermore, from the National Healthcare Disparities Report, it is evident those disparities in health still exist and that many opportunities for improvement remain across racial, ethnic, socioeconomic, and geographical groups (Mensah & Dunbar, 2006).

In consideration of healthcare disparities, geography may be destiny (Lin, Allan & Penning, 2002). Access to quality healthcare is an ongoing problem for rural populations. Financial, socio-cultural, and structural features of the rural environment create barriers to healthcare. These factors affect healthcare access, health-seeking behaviors, and ultimately health outcomes for rural populations (Bushy, 2000; NCHS, 2003; Ricketts, 1999). The loss of community health services, healthcare professional shortages, rapidly rising cost, hospital closures, homecare cut backs, and tighter government payment schedules are just a few of the changes that have led to resource disparities for rural populations (NCHS, 2003; USDHHS, 2000). Rural areas are often identified as medically underserved areas (MUAs) and medically underserved populations (MUPs) and have a disproportionate burden of health disparities. Because the burden of poor health is great in terms of cost and disability, research into specific healthcare disparities for specific rural communities is needed.

Communities have identities developed from their unique strengths and resources. Health is relevant to this identity. Israel, Schulz, Parker, and Becker (2001) conducted a review of literature regarding community-based research. From this seminal review comes a collaborative approach to research that can serve to "enhance understanding of a given phenomenon and the social and cultural dynamics of the community, and integrate the knowledge gained with action to improve the health and well-being of community members" (Israel, Schulz, Parker & Becker, 2001, p. 177). Empowerment of a community can generate knowledge and interventions to solve a community's health problems. Furthermore, the literature supports the use of small-area analysis to allow an opportunity to evaluate community patterns of disparities (Gatrell, 2002). It is important to learn as much as possible about the ecology of health and disease within the context of specific rural communities.

According to Feigin and Howard (2008) population-based epidemiology research is important as a starting point in the "spectrum of evidence" to guide healthcare decisions. Even though descriptive studies provide the lowest level of evidence, they can serve as the basis for specific population-based research (Feigin & Howard, 2008). From this basis, hypotheses can be generated and research can advance to higher levels of evidence (descriptive – cohort – experimental – clinical trials) designed to address specific health disparities for specific communities.

The prevalence of cardiovascular risk factors has been reported in many large U.S. and international studies. But what is now needed is community-specific risk factor identification for this rural, underserved Appalachian population with known excess CVD mortality. Research at the community-specific level can promote a better understanding and guide interventions aimed at the reduction of risk, disparities and mortality.

The purpose of this retrospective, descriptive, explorative study was to examine and describe the prevalence of CVD risk factors in a specific rural, underserved Appalachian population. Gender-related and age-related differences in risk factors are described and compared to state and national data and to Healthy People 2010 Targets. Results specific to this population can provide evidence to support proposal of randomized trials. This progression of evidence can be instrumental in development grassroots community-based prevention and treatment strategies.

Methods

Data Collection Procedure

The study population consisted of approximately 1,500 medical records of approximately 500 patients seen at a rural health center in an underserved area of north Alabama between January 2008 and March 2008. Because we know men and women have different CVD risk factors a quota sampling method was used. Using population characteristics of the rural health center the sample was stratified on the basis of gender. This method prevents the over-representation of either gender. A random numbers list was used to select patient visits for inclusion in the study. Because the patient base of the rural health center was almost equal when stratified by gender the goal was to select approximately 100 male and 100 female patients. Inclusion criteria for this study are as follows:

- Age 25 or older (patients born before 1983)
- Established patient (more than one visit to the center)
- Health center visit within a 3 month time period (January 2008 and March 2008)

Data was collected using medical record numbers to allow for organization and inclusion of all pertinent records. A dummy identifier was created and the medical record number was removed from the data. Data was collected from a sample of 197 patients' electronic medical records. Data was entered and stored in an electronic database protected by passwords. Data included weight and height (for the calculation of body mass index (BMI), systolic and diastolic blood pressure and diagnosis of hypertension, lipid profiles when available and diagnosis of dyslipidemia, smoking status, and diagnosis of diabetes. Demographic data were collected on date of birth (for calculation of age), race/ethnicity and gender.

There was no at risk population in this study. No subject identifiers were maintained, therefore, the identification of human subjects was not possible and no manipulation of variables occurred. The research presented no more than minimal risk of harm to subjects and involved no procedures for which written consent is normally required. The Institutional Review Board (IRB) of the University of Alabama granted approval of the research protocol as well as consent wavier (IRB# 08-OR-092-ME).

Data Analysis Procedure

Demographic characteristics and cardiovascular risk factors were identified by personal data, anthropomorphic measures, biochemical parameters, and diagnostic codes from the *International Classification of Diseases, Ninth Revision [ICD-9]*. These included age, gender, race/ethnicity, smoking, hypertension, dyslipidemia, diabetes mellitus, and obesity. Risk factors were entered dichotomously as "yes" or "no". Differences by gender and age were compared after dividing into age tertiles (25-40 years, 41-55 years, and 56-72 years). Chi-square tests were used to compare categorical variables. SPSS® was used for all calculations.

Results from this study were compared with state and national level data on cardiovascular risk factors. Both state and national level heart disease risk factor prevalence data for 2007 was obtained from the National Center for Chronic Disease Prevention and Health Promotion, Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is a state-based telephone survey of U.S. civilian population aged $\geq$ 18 years.

Results

A total of 197 patients were included for analysis. Patient characteristics, biochemical variables and other CVD risk factors are shown in Table 1. The study sample was predominately Caucasian (87.6%) which is consistent with the demographics of this area. The range of ages was 25 to 72 years of age. There were no differences in age between men (49.4 years) and women (49.7 years) in this cohort.

Differences in prevalence of risk factors by gender are presented in Table 2. The men had a higher frequency of smoking (47.1%) and hypertension (61.8%) than the women (30.5% and 54.7%, respectively). Women were more likely to have dyslipidemia (45.2%) than men (27.3%).

To compare age differences in the prevalence of CVD risk factors the following age tertiles were used: 25-40 years, 41-55 years, and 56-72 years. Table 3 summarizes these analyses. Patients age 41 to 55 years old were more often smokers and had dyslipidemia (48.4%) than patients in the 56 to 72 years range. Both diabetes and hypertension showed a gradient effect with prevalence increasing across age ranges and this was found to be statistically significant for hypertension ($p<.001$).

Table 1

Characteristics of the sample (n= 197)

Personal and anthropomorphic characteristics	
Caucasian subjects	87.6%
Gender (W/M)	95/102
Height (cm)	169.9 ± 11(124.5 – 203.2)
Weight (kg)	91.3 ± 23 (41 – 161.5)
Age (years)	49.4 ± 12.1 (26 - 74)
Waist circumference (cm)	104.2 ± 18.5 (63.5 – 182.9)
BMI (kg/m^2)	31.6 ± 7.6 (16.7 – 62.9)
Biochemical parameters	
Total cholesterol (mg/dl)	186.9 ± 39.2 (89 – 310)
Triglycerides (mg/dl)	188.8 ± 147.9 (45 – 1170)
HDL Cholesterol (mg/dl)	41.7 ± 12.1 (10 – 89)
LDL Cholesterol (mg/dl)	109.7 ± 30.5 (52 – 225)
Blood pressure (BP)	
Systolic (mmHg)	132.5 ± 21.8 (90 – 224)
Diastolic (mmHg)	82.8 ± 12.2 (56 – 120)
Hypertension diagnosis	
Yes	115 (58.4%)
No	82 (41.6%)
Tobacco Use	
Yes	77 (39.1%)
No	63 (32%)
Not Known	57 (28.9%)
Diabetes diagnosis	
Yes	55 (27.9%)
No	142 (72.1%)

Note: Data are *n* or M ± SDs (Range) or percentages (%)

Table 2

Gender-Related Differences in CVD Risk Factors

	Men	*Women*	*p value*
Mean age (yrs)	49.4	49.7	.896
Smoking	47.1%	30.5%	.075
Hypertension	61.8%	54.7%	.317
Diabetes	28.4%	27.4%	.868
Dyslipidemia	27.3%	45.2%	.038
Obesity	53.9%	57.1%	.671

The following sections present discussion of the results from this study as well as a comparison with state and national data and *Healthy People 2010* Target Goals. For comparison

of state and national level heart disease risk factor prevalence the National Center for Chronic Disease Prevention and Health Promotion, Behavioral Risk Factor Surveillance System (BRFSS-2007) was used. Comparisons are presented in Table 4.

Table 3

Age-Related Differences in CVD Risk Factors

	25-40 years	*41-55 years*	*56-72 years*	*p value*
Smoking	35.4%	42.8%	36.9%	.623
Hypertension	27%	58.3%	81.5%	.000
Diabetes	16.6%	26.1%	38.4%	.034
Dyslipidemia	17.7%	48.4%	33.6%	.748
Obesity	58.1%	50.7%	59.3%	.568

Table 4

Comparison with State, National, and International Data

	Study Sample	*State*	*National*	*HP 2010 Target*
Smoking	39.1%	22.5%	19.7%	12%
Hypertension	58.4%	33.1%	27.5%	14%
Diabetes	27.9%	10.3%	8.1%	2.5%
Dyslipidemia	34.9%	39.4%	37.5%	17%
Obesity	44.5%	30.9%	26.3%	15%

Discussion

Smoking

In this study cohort, 39.1% of patients gave information that they currently smoked or used tobacco. One large national study of trends in CVD risk factors from 1999 – 2002 reported a prevalence of smoking among adults ages 25 to 74 years ranging from 13.9% to 37 (Kanjilal, et al., 2006; Kettle, et al., 2005). Kettle et al., (2005) reported a high 43.0% prevalence of smoking in a rural population. Women in the current study were less frequently identified as smokers than men (30.5% versus 47.1%). Other investigators found rates for men: 40.6% versus women: 34.6% in a similar white, low education, predominately Caucasian sample (Mensah & Dunbar, 2006). No studies reviewed reported that more women smoke than men. However, it cannot be ruled out that smoking among women could be underreported. Smoking was consistent across age groups with no significance differences noted between age tertiles. The frequency of smoking was more than two times the national average (19.7%) and greater than three times the national target goal (12%), which speaks strongly for its importance as a risk factor for CVD in this population as well as in the general population.

Hypertension

In this rural underserved population 58.4% of the patients had a diagnosis of hypertension. In contrast, Kanjilal et al., (2006) found the prevalence of hypertension to range from 16.4% to 22.6%. Also, in this cohort the prevalence of hypertension was greater than the rest of the state of Alabama (33.1%) and the United States as a whole (27.5%). Age gradients were observed with increasing prevalence of hypertension with increasing age as seen in other similar studies (McDonald, et al., 2009). More men (61.8%) were hypertensive than women (54.7%), but the difference was not statistically significant supporting nearly equal prevalence between men and women as demonstrated in the NHANES data (CDC, 2007). This study supports the possibility that the potency of hypertension as a risk for the development of CVD varies by geography, community and culture. The overwhelmingly high prevalence of hypertension further supports the need for more research to identify community-specific strategies to reduce the prevalence of hypertension.

Diabetes

Diabetes mellitus was observed in 27.9% of patients in this study. Other studies show the prevalence of diabetes ranges from 3.5% to 9.7% (AHA, 2007). No evidence of significant gender/gender differences was found in the current study (men: 28.4%; women: 27.4%) which supports similar studies reporting men: 11.9%; women: 13.3% (Menah & Dunbar, 2006) and men: 33.0%; women: 29.4% (Pilote, et al., 2007). Age-related differences follow a gradient pattern of increasing prevalence of diabetes with increasing age as seen in other studies (McDonald, et al., 2009).

Dyslipidemia

Evidence shows that elevated cholesterol levels increase CVD risk (Expert Panel on Detection, 2001). In this cohort, 34.9% of patients had a diagnosis or cholesterol level evident of dyslipidemia as compared to 37.5% in the US general population. Data show that 39.4% of the general population of Alabama 18 years or older have indicators of dyslipidemia. A significant difference was noted in this cohort in dyslipidemia prevalence of 49.5% in women compared to 27.3% in men. Overall, national data shows that mean serum total cholesterol vary significantly between men and women with the highest prevalence rates seen in women 65 years or older (CDC, 2007). McDonald et al. (2009) noted similar results. Using national-level data from The National Health and Nutritional Examination Survey (NHANES) for 1999 – 2004 their analysis revealed dyslipidemia prevalence 58.7% in women and 62.3% in men 65 years of age and older.

Petrella, et al. (2007) found a high prevalence of dyslipidemia in Canadian primary care that was largely untreated in family practice settings. Lipid determinations are not a standard of care for all patients seen in a rural health center. It is possible that dyslipidemia is underreported in the general populations as well as in this rural, underserved population due to cost constraints and the lack of insurance coverage. Therefore, it is difficult to ascertain true prevalence of dyslipidemia and the association with cardiovascular risk in this population. Future research regarding dyslipidemia in women is warranted.

Obesity

Over the past decade there has been a significant increase in obesity prevalence in the U.S. Obesity is one of the modifiable risk factors of CVD with important implications. In 2007, state

level obesity (BMI>30kg/m^2) prevalence ranged from19.3% to 32.6% (CDC, 2007). Alabama is near the top of the range with almost one third of all Alabamans being obese (30.9%) compared to a national prevalence (26.3%). The results of this study showed an overwhelming 44.5% of this rural, underserved sample classified as obese by having a BMI > 30 kg/m^2. Other national studies have reported the prevalence of obesity prevalence at 28.6% (Sundaram, Ayala, Greenlund & Keenan, 2005) and 32.2% (Ogden, et al., 2006). Women in the cohort had a higher occurrence of obesity than men (57.1% versus 53.9%) which was consistent with other studies. Ogden et al. (2006) demonstrated no significant difference in obesity between women (33.2%) and Men (31.1%).

The prevalence of obesity in this rural underserved population is overwhelmingly high. Addressing the growing epidemic of obesity could positively impact obesity as well as other CVD risk factors such as hypertension, dyslipidemia, and diabetes mellitus, leading to decreased CVD risk and mortality. Nurses can provide interventions to change patterns of excess obesity.

Limitations

In this study, a descriptive, community-based research approach was used to identify and describe the prevalence of CVD risk factors in a cohort of patients seen at a rural health center in northwest Alabama. One limitation of this study was the nature of the sample. Patients seen at a rural health center are less likely to seek routine and preventative care and are more likely to delay visits even when they are ill (Bushy, 2000). People who live in rural areas also have a lack of financial resources and insurance and are less likely to accept CVD screening (Ricketts, 1999). Another limitation of concern is possible errors in recording data from medical records, leading to inaccurate prevalence rates of risk factors. The lack of quantification of some risk factors (ie, severity and control of hypertension, dyslipidemia, obesity, or diabetes mellitus, number of cigarettes smoked or pack years) is a possible threat to the validity of the study. These are areas for future study.

Data was obtained exclusively from a cohort of patients seen at a rural health center in north Alabama. While these results may not be generalized to all other communities, they can be beneficial in the development of community-based interventions. Specific descriptions and characterization of this rural underserved community can guide strategies to reduce CVD disparities in this and similar communities.

Summary

In the United States today CVD is the leading cause of death. Reducing disparities in CVD and its risk factors is a major challenge. Cardiac care disparities are evident in excessively high rates of CVD mortality seen in the rural south. Movement toward the elimination of health disparities (IOM, 2004) will require description of specific patterns of CVD risk within a community, allowing targeted preventive and treatment interventions.

Central to the issues of CVD and its associated excess mortality is the progressive decline in access to healthcare services. Despite the fact that *Healthy People 2010: National Health Promotion and Disease Prevention Objectives* (USDHHS, 2000) identified as a national priority that all people should have health that allows them a productive life by 2010, healthcare policy changes continue to decrease access to healthcare services. Rural populations have fewer healthcare resources than urban populations, which lead to adverse health outcomes and rural health disparities.

Decreasing access may contribute to the excessively high CVD mortality observed in rural populations. Community-based research is needed to identify specific patterns of CVD in

specific underserved, rural Appalachian populations and to place this pattern into cultural context for designing community-based CVD prevention and intervention strategies. Nurses, living and working in the community, can bridge the gap in access to quality healthcare.

Regional disparities in CVD mortality observed in rural Alabama provided for an opportunity to understand the complex nature of CVD mortality in a rural underserved Appalachian population. This descriptive analysis has documented excess CVD risk factor prevalence for this rural, medically underserved population. Studies such as this can provide valuable insight into the specific nature of CVD mortality in rural, underserved populations.

Conclusions

High prevalence of CVD and cardiovascular risk factors, apparent in this rural underserved population, suggest the need for nurses to incorporate cardiovascular assessment as a part of routine care and the development of community-specific CVD interventions. Nurses who practice in rural communities are in a position to impact CVD disparities. As providers of cardiovascular care, it is important for nurses and especially advanced practice nurses to step up and contribute to CVD health promotion, disease prevention, and disease management. Furthermore, community-specific research results can provide information for those responsible for the development of healthcare policy and healthcare allocations toward the elimination of CVD disparities.

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