A Comparison of the Cardiovascular Risks of Rural, Suburban, and Urban Women

Pamela Stewart Fahs, DSN, RN[1]

Theresa N. Grabo, PhD, APRN, BC, FNP[2]

Gary D. James, PhD[3]

Martha Neff-Smith, RN[4]

Gale A. Spencer, PhD, RN[5]

[1] Assistant Professor, Decker School of Nursing, Binghamton University, psfahs@binghamton.edu

[2] Associate Professor, Decker School of Nursing, Binghamton University, tgrabo@binghamton.edu

[3] Professor, Decker School of Nursing, Binghamton University, gdjames@binghamton.edu

[4] Research Professor, Decker School of Nursing, Binghamton University, mnsmith@binghamton.edu

[5] Professor, Decker School of Nursing, Binghamton University, gspencer@binghamton.edu

Abstract

The purpose of this study was to compare the cardiovascular risk factors of women 35 years of age and older with primary residence in rural, suburban, and urban areas. Data were collected on 108 women in upstate New York. Rural women exhibited higher systolic blood pressure ($p = .05$) and were older ($p=.01$) than those living in suburban or urban areas. There were no other statistically significant differences in cardiovascular risk factors among the groups. However, all three groups exhibited levels of total cholesterol, weight, and body mass index that indicate strong cardiovascular risk factors among women in this age group regardless of primary residence.

Keywords: rural, women’s health, cardiovascular disease (CVD)

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The notion of cardiovascular disease (CVD) as primarily a killer of men is a myth that must be debunked! In 1997, 40% of deaths of women, regardless of age or race, were from CVD. Diseases of the heart and cerebrovascular diseases including stroke killed 373,215 women over the age of 40 in the United States (U.S.) in 1997 (Hoyert, Kochanek, & Murphy, 1999).

The terminology to indicated diseases pertaining to the cardiovascular system is confusing. The way mortality and morbidity data are analyzed in this country is by disease code. Currently in use is the Ninth Revision of the International Classification of Disease (ICD-9) codes. Total cardiovascular disease (CVD) is inclusive of: diseases of the heart, cerebrovascular diseases, and diseases of the vascular system and lymphatics. The codes for categories of cardiovascular disease may be seen in Table 1.

Table 1
Disease Groups of Cardiovascular System with ICD-9 Codes

Disease Groupings	ICD-9 Codes
Diseases of the Heart	390- 398, 402, 404-429
Hypertension with Renal Disease	401
Atherosclerosis	440
Arteries, Arterioles and Capillaries	441-448
Veins and Lymphatics	451-459

Casper et al. (1999) used the ICD-9 codes 390-398, 402, 404-429 (Diseases of the Heart) to calculated the mortality rate of women 35 years and older on a county level throughout the U.S. The heart disease, age adjusted and spatially smoothed, mortality rate for women 35 years and older residing in New York State at the time of death was 487/100,000 (Casper et al. 1999). The two counties where data were collected in this study had mortality rates of 426/100,000 for Broome and 431/100,000 in Delaware County. On average women are protected from cardiovascular disease for nearly 10 years longer than men, which is thought to be due to the influence of estrogens (Stumpf & Trolice 1994). However, sixty million American women are expected to be experiencing or have experienced menopause by 2010 (Andrews 1995). With increasing life expectancy, women today may expect to live 30 or more years post-menopause, equivalent to a third of their life.

According to the U.S. Department of Agriculture, Economic Research Service, rural people make up 24.8 % of the U.S. population (cited in Ricketts III 1999, p. 8). Over 34 million rural women lived in the U.S. according to the 1990 census data. This number represented 52% of the rural population and 30% of America's women (Bushy 1993) in the early 1990s. Rural communities often have greater representation of older residents and the female to male ratio is higher than in non-rural locals (Coward & Krout 1998).

Healthy People 2010 (U.S. Department of Health and Human Services, 2000) notes that heart disease, cancer, and diabetes rates for rural areas exceed those for urban areas. This report also concludes that people living in rural areas are less likely to use preventive screening services or exercise regularly. Rural women are considered more likely to experience chronic illnesses such as cardiovascular disease and hypertension (Bushy, 1994) and are also less likely to seek treatment for acute illnesses than their urban counterparts. Researchers have focused primarily on health issues of more accessible urban groups of women. However, there is a dearth of epidemiological studies on the actual illness and treatment patterns of rural women.

Literature

There is a gap in the literature regarding cardiovascular risks of rural women. Only two studies were found comparing cardiovascular risks of rural and non-rural women (Broda et al. 1996; Edwards et al. 1991) while one study (Chapman et al. 1993) compared winter and summer dietary intake and energy expenditures in a sample of rural women. Broda et al. (1996) studied women and men in the U.S. and Poland. Place of residence within each country, rural or urban, was provided although there were no direct rural to urban comparisons. Data were extrapolated regarding cardiovascular risk factors in the two groups. Subjects ranged from 45 to 65 years of age. This project measured and reported High Density Lipids (HDL) and two sub-fractions, HDL2 and HDL3. Rural U.S. women had lower levels of all types of HDL, which is considered the ‘protective’ cholesterol, than urban U.S. women. Lower levels of HDL in both rural and urban U.S. women were significantly associated with cigarette smoking and Body Mass Index (BMI). The authors concluded that low levels of HDL were directly related to heart disease within the populations studied. Only one study was found in the literature directly comparing the cardiovascular risk factors of U.S. rural and urban women. This was a descriptive, correlational study of 163 women that examined health risk appraisals on measures of blood pressure, cholesterol, diabetes, and smoking among women ranging in age from 20 – 60 years (Edwards et al. 1991). The differences among groups were significant ($p = .03$), with rural black women being most ‘at risk’ on the measure of elevated cholesterol. Cholesterol measures considered at risk were defined as serum cholesterol levels greater than 200 mm/dl. The authors found that 59.4% of the rural black women were at risk on the measure of serum cholesterol compared to 38.3% of the black urban sample. Among white women in this study 35.7% urban and 32.6% rural were considered at risk. Mean values of serum cholesterol were not included in the report. Diabetes and smoking, both known cardiovascular risk factors, were found to be more prevalent in rural than urban women. Chapman et al. (1993) completed a prospective study with two measurement points, summer and winter. The sample consisted of 401 women ages 30-50 years, at the beginning of the study with follow-up including 344 of the original sample. The data were descriptive and measured caloric intake, body mass index (BMI), and basal energy expenditure (BEE) based on height, weight, a three-day diet history and physical activity record. The rural women in this study ingested fewer total calories, and had lower BEE and higher BMI than would be expected given their high activity level. The data collected on dietary intake and physical activity in this study were self report.

The lack of research literature specific to cardiovascular risk of rural women in the Northeast United States and the high mortality heart disease rates for women in New York State led the Women's Health Care Partnership to formulate the following research questions:

1. What are the cardiovascular risk factors of women living in rural, suburban, and urban areas and attending community screenings in upstate New York?
2. Do cardiovascular risk factors vary by area of primary residence (rural, suburban, or urban)?

Method and Design

Approval for this project was granted from the Binghamton University Human Subjects Review Committee in July 1999. Data were collected during three community screenings held in August 1999 in upstate New York. The screenings were widely advertised within the region. All individuals attending the screening were eligible for a free blood pressure reading and health risk appraisal as well as cholesterol screening at cost ($10). Women meeting the inclusion criteria, 35 years of age or older, and willing to participate in the study had the fee for cholesterol screening waived. Women interested in participating in the study were given a letter of explanation of risk and benefits and asked to sign an informed consent prior to participation.

Sample

One hundred and eleven women agreed to participate, however three did not complete the screening process leaving a sample of one hundred and eight (N=108) women in the sample. Data collection occurred at three places in two counties of upstate New York. Participants were asked to complete three questionnaires presented in a single booklet. These three survey instruments took about 15 minutes to complete. In addition each subject had a blood pressure and total cholesterol measurement.

Instrumentation

Physiologic Measures

The Joint National Committee VI (1997) recommended method of assessing blood pressure was used in this study. This consisted of 3 measurements in the left arm and averaging the last two readings. Pre-data collection, inter-rater reliability was established in a session of blood pressure assessments with a consistency of reading within 5mmHg among data collectors. Total Cholesterol was assessed through a non-fasting, capillary blood test. Due to a change in the equipment used by the supporting laboratory services during the study, two types of analyzers were used. The desk top analyzers used in this study, ProAct™ & Cholestech L*D*X™ are typical of analyzers used in community screening because of their portability and ease of testing. A correlation coefficient was run on paired samples using both machines with $r = 0.97$, indicating a strong positive correlation between readings from the two machines. The laboratory completing the cholesterol test holds a Clinical Laboratory Improvement Amendment (CLIA) certificate from New York State Department of Health. The individual technicians drawing blood and performing the analysis had undergone competency testing by the supporting laboratory as required by the New York State Department of Health. Serum total cholesterol on capillary blood samples was reported in mg/dl.

Survey Instruments

Demographic and Health History

This survey was used to gather information on area of primary residence: rural, suburban, or urban. In addition to the self-report of area of residency, individuals were asked about the presence of three defining characteristics of rural residency. These characteristics included water supply, access to public transportation, and county of residency. The instrument contained questions on status of cardiovascular diseases including myocardial infarction, strokes, hypertension, and dislipidemia. In addition, there were questions about use of medications that might effect cardiovascular risks such as antihypertensives, cholesterol lowering agents, hormone replacement therapy, and over-the-counter or "natural" supplements used to ease symptoms of menopause.

Health Risk Appraisal

Healthier People Health Risk Appraisal© is an educational tool designed by The Carter Center of Emory University. It identifies choices the individual can make to promote good health and describes how to avoid the most common causes of death for a person based on age and gender. This instrument was designed to give an individual some ideas for lowering the risk of lifestyle-affected illnesses or injury in the future. Questions on the Health Risk Appraisal included but were not limited to: age, gender, race, years of education, occupation, height, weight, chronic illnesses, and dietary use of grains and fats.

Hormone Replacement Profile

Ali (1998) developed the Hormone Replacement Profile. This fourteen item, Likert scale instrument measures self-efficacy and outcome beliefs regarding hormone replacement therapy. The higher the score on the self-efficacy portion of the instrument, the greater the tendency of the individual to be self-efficacious in continued use of HRT. The higher the score on the outcome belief items the greater the tendency to perceive greater positive outcomes to using HRT.

Results

Residency

Using the operational definition of rural residency as living in a county of 50,000 or less or having no access to city water or public transportation there were 33 subjects classified as rural. There were 48 suburban subjects, using self-definition of suburban plus those that self-identified as rural but did not meet the research definition of living in a rural area. The remainder (n=27) self-selected urban as their place of residency.

Age and Blood Pressure

Mean age for the entire sample (N=108) was 53 years with a range of 35 to 80 years. The mean age for the rural group was 58 years, which was higher than the age of the suburban or urban groups (see Table 2 for comparison of mean age and blood pressures by group). There was a statistically significant difference among the three groups F=4.16 (2), p=. 01* on the measure of age. The mean blood pressure for the three groups was 124 mmHg systolic and 77.22mmHg diastolic (N=108). The range on systolic blood pressure was 87 to 169 mmHg and diastolic readings ranged from 58 to 100 mmHg. There was a statistically significant difference among the three groups on systolic blood press with the rural group having the highest systolic readings (F=3.60, df2, p=. 03*). Although the average diastolic blood pressure for the rural group was 3 points higher than either the suburban or urban group, differences among the groups did not reach significance (F=1.29, df =2, p=. 28).

Table 2
Mean Age, Mean and Standard Deviation of Systolic and Diastolic Blood Pressures by Area of Residency

Residency	Mean Age	Mean Systolic BP	SD Systolic BP	Mean Diastolic BP	SD Diastolic BP
Rural	58 years	129 mmHg	16 mmHg	79 mmHg	10 mmHg
Suburban	51 years	121 mmHg	12 mmHg	76 mmHg	8 mmHg
Urban	52 years	122 mmHg	15 mmHg	76 mmHg	7 mmHg

Eight (24% of rural sample) rural women, nine suburban (19%), and six (22%) of urban subjects reported having a history of hypertension on screening. Six of the 8 (75%) rural known hypertensive subjects were using antihypertensives compared to 15 (100%) of their more urban counterparts. Reasons for not using antihypertensives among the rural women reporting hypertension included: not prescribed, or did not feel medication was needed, concern about side effects, or frequent forgetting to take medication. There was no information collected on level of hypertension for subjects.

Total Cholesterol

Non-fasting total cholesterol was checked for each subject. Rural subjects had higher averages on the total cholesterol levels, 227, S.D. 35 mg/dl than those living in suburban areas 220, S.D. 42 mg/dl, or urban areas 212, S.D. 42 mg/dl. There was no statistically significant difference among groups on the measure of total cholesterol (F = .94, df = 2, p = .39). Cholesterol readings were collapsed into normal (^{2} 199mg/dl), borderline (200-239 ml-dl), and high (^{3}240 ml/dl). Numbers of individuals and percentage of group with readings in each of these categories can be seen in Table 3.

Table 3

Frequency and Percentage of Normal, Borderline, and High Cholesterol Levels by Area of Residency

Residency	Normal	Borderline	High
	(> 199mg/dl)	(200-239 ml/dl)	(<240 ml/dl)
Rural	8 (24%)	13 (39%)	12 (37%)
Suburban	19 (40%)	10 (21%)	19 (39%)
Urban	10 (37%)	8 (30%)	9 (33%)

In order to assess the "at risk" individuals on the measure of total cholesterol in each group the data were further collapsed into categories of normal (^{2} 199mg/dl) and at risk (^{3}200 ml/dl). Twenty-five (76%) of the rural sample were considered at risk on measure of cholesterol. Twenty-nine (60%) and 17 (63%) of the suburban and urban sample were placed in the cholesterol at risk category. Again the mean number of individuals at risk for heart disease by virtue of their elevated cholesterol levels was highest in the rural sample but significance was not reached ($r = -.11$, $p = .27$).

There was no attempt in these community screenings to measure HDL (high-density lipid) or LDL (low-density lipid) values. Prohibitive cost as well as an inability to have participants fast prior to the testing made the measure of HDL and LDL unrealistic for this study. Subjects were asked to self-report their HDL if known from previous testing. Only one of the 108 subjects reported a previously known HDL.

Only 6(19%) of the rural women were on medication to lower cholesterol despite 25 (76%) having above normal levels of cholesterol and 15 (46%) self-reporting elevated cholesterol. However there were no significant differences in medication use to lower lipids by rural, suburban, or urban women (Table 4).

Table 4

Use of Lipid Lowering Medications by Area of Residency, Self Report of High Cholesterol, and Above Normal Cholesterol

Residency	Self Report of High Cholesterol	Cholesterol Above Normal on Testing "At-Risk"	Taking Medication to Lower Cholesterol? Yes	Taking Medication to Lower Cholesterol? No
Rural	15 (46%)	25 (76%)	6 (19%)	26 (81%)
Suburban	22 (46%)	29 (60%)	8 (18%)	37 (82%)
Urban	9 (33%)	17 (63%)	6 (23%)	20 (77%)

Other Cardiovascular Risk Factors

Weight and smoking are two well-known risks for cardiovascular disease. The mean weight for the entire sample was 158 pounds (lbs.), with a S.D. of 36 lbs. Body Mass Index (BMI) is often a better indicator of cardiovascular risk than weight alone since it considers height in the calculation. BMI of 24 or less is considered within normal limits. BMI of 25-29.9 is considered overweight and 30 or above is categorized as obese. Individuals with BMI of above 25 are considered to be at risk for CVD. The average BMI for the sample (N=108) was 28 with a minimum of 19 and a maximum of 109. One outlier with a BMI of 109 in the suburban group was removed for calculating BMI differences among groups. Without the outlier, the mean BMI for the sample as a whole was 27 with a range of 19 to 56. Without the outlier, there was little variance in mean BMI among the three groups. Rural and urban women each had a mean BMI of 27, with SD of 6 and 8 respectively. Suburban women had a mean BMI of 26, S.D. 5. However, the group with the largest percent of the sample at risk of cardiovascular disease using BMI as a measure was the rural group. The numbers and percentage of women at risk for cardiovascular disease from above normal BMI can be seen in Table 5.

Table 5
BMI Above Normal, At-Risk for CVD

Residency	At-Risk for CVD
Rural	20 (61%)
Suburban	24(50%)
Urban	12(44%)

Rural women self-reported a mean weight of 160 lbs., S.D. 35 pounds, suburban women reported an average 155, S.D. 33 pounds, while urban women reported a mean weight of 160 lbs., S.D. 44 pounds. An ANOVA on differences in weight did not reach a level of significance in this study ($F = .29$, $df = 2$, $p = .75$).

Only 15 women (14%) in this study reported current smoking. Seven (21%) of the rural sample reported current smoking compared to six (13%) suburban women and 2(7%) of the urban group. There was not a significant difference among groups in smoking status ($r=3.96$, $p = .41$). Those rural women that did smoke reported significantly fewer cigarettes per day (9.60) compared to the non-rural smokers (20.44), $t= -2.30$, df 17, $p=.03$.

Menopause and Use of Hormone Replacement Therapy

Twenty-six (79%) of the rural sample reported having gone through menopause at the time of data collection. Only 7 (25%) of the 26 rural women reporting menopause had undergone hysterectomy. Although the difference in percentage of surgically induced menopause appears clinically remarkable this difference failed to reach a level of significance. See Table 6 for the numbers of women whom reported being menopausal or post menopause and those who had hysterectomy.

Table 6
Menopause and Hysterectomy by Area of Residency

Area of Residency	Menopausal (%) of Group Sample	Hysterectomy (%) of Menopausal Women
Rural	26 (79%)	7 (25%)
Suburban	28 (58%)	16 (57%)
Urban	13 (48%)	5 (39%)

Eleven (35%) of the rural sample reported using Hormone Replacement Therapy (HRT). Twenty-nine (37.7%) of non-rural women used HRT. Twenty-one (44%) of the suburban women and 7 (26%) of the urban women used HRT. There was no significant difference overall in the use of HRT among women living in rural, suburban, or urban areas (_2 = 2.37, df 2, p = .31). There was a significant difference in both efficacy beliefs in HRT and outcome expectations of HRT between women who reported using HRT and those who did not use HRT (efficacy beliefs t=6.73, df 105, p = .000*; outcome expectations t=6.80, df 104, p=. 000*). Users of HRT had higher mean scores on both efficacy beliefs and outcome expectations than non-users.

Discussion

Limitations of the Study

This convenience sample was very homogenous with a primarily Caucasian sample. The homogeneity is reflective of the racial makeup of the region where data were collected. Only one rural region was represented in the sample. In addition, the non-fasting cholesterol measurements did not provide data on HDL and LDL ratios. The age difference between the rural and non-rural groups could account for the difference in systolic blood pressures. However, this difference is consistent with finding of other studies and needs further study with possible age matched data sets. A power analysis was calculated prior to data collection with an estimated need for 42 subjects per group for a power of .80, a=.05. Unfortunately only the suburban group included a large enough sample among the three groups. Limited funding prohibited further data collection in this study. Future projects need to focus on subject enrollment of assure power and thus avoid the possibility of type II errors.

Conclusions

This study does provide a description of cardiovascular risks of rural, suburban, and urban women in one region of upstate New York and indicates the need for further study of the health risks of women, particularly those living in rural areas. Rural women in this sample were significantly more likely to have elevated systolic blood pressure on screening. However, it is unclear whether this difference is due to lifestyle factors present in rural living or if the age difference between the subgroups accounts for the difference. Those rural women self-reporting hypertension were less likely to be using antihypertensive medications than their non-rural counterparts. This rural group also showed tendency toward higher cholesterol, body weight, and BMI yet these measures did not meet levels of significance, indicating the need for a larger rural sample. All groups in this study had a higher mean BMI than found in Chapman et al. (1993) sample at either the summer or winter measurement.

Unlike the Edwards et al. (1991) study, these rural women were no more likely to report current smoking than women living in suburban and urban areas and those that did smoke reported approximately half the number of cigarettes per day as the non-rural women in the sample. The Edwards et al. (1991) study included black and white low-income women with an age range of 20 to 60 years. The women in this study were primarily white, with ages ranging from 35–80 and data were not collected on income. The differences in racial make-up and age of the samples could account for the differences in findings in the two studies. This work needs to be replicated and extended. Future studies of cardiovascular risk of rural women would be enhanced if women from various racial backgrounds and rural regions were included in data collection.

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