



## Prevalence and Risk Factors for Hypertension Among Older Kentucky Farmers

Robin L. Heath PhD , Steven R. Browning PhD & Deborah B. Reed PhD

To cite this article: Robin L. Heath PhD , Steven R. Browning PhD & Deborah B. Reed PhD (1999) Prevalence and Risk Factors for Hypertension Among Older Kentucky Farmers, Journal of Agromedicine, 6:1, 43-58, DOI: [10.1300/J096v06n01\\_05](https://doi.org/10.1300/J096v06n01_05)

To link to this article: [http://dx.doi.org/10.1300/J096v06n01\\_05](http://dx.doi.org/10.1300/J096v06n01_05)



Published online: 11 Oct 2008.



Submit your article to this journal [↗](#)



Article views: 27



View related articles [↗](#)



Citing articles: 1 View citing articles [↗](#)

# Prevalence and Risk Factors for Hypertension Among Older Kentucky Farmers

Robin L. Heath, PhD  
Steven R. Browning, PhD  
Deborah B. Reed, PhD

**ABSTRACT.** This study provides data on the prevalence of self-reported hypertension among actively working, male, Kentucky farmers, aged 55 years and older surveyed in the Kentucky Farm Family Health and Hazard Surveillance Study. In addition, we examined self-reported hypertension prevalence of Kentucky farmers in association with other comorbid chronic health conditions and with selected behavioral and anthropometric risk factors. A two-stage cluster design was used, with a random sample of 998 male Kentucky farmers, aged 55 years and older, selected for a 30-minute telephone interview (response rate = 71%). A

---

Robin L. Heath is affiliated with the Department of Anthropology, University of Kentucky, Lexington, KY.

Steven R. Browning and Deborah B. Reed are affiliated with the Department of Preventive Medicine, University of Kentucky Chandler Medical Center, Lexington, KY.

Address correspondence to: Steven R. Browning, Department of Preventive Medicine and Environmental Health, 1141 Red Mile Road, Suite 102, Lexington, KY 40504.

The authors express their thanks to the Kentucky Agricultural Statistics Service and the Survey Research Center at the University of Kentucky for their assistance in the implementation of this study. They also thank Dr. Richard Kryscio and Dr. Helena Truszczynska for their statistical support, consultation and guidance. Additionally, they thank Susan Westneat, MA, for assistance with data analysis and Carol Donnelly for editorial assistance in the preparation of the manuscript. The authors also thank Pamela Rao, Scott Novak, and Karen Hill for assistance with data entry at various stages of the project. They gratefully acknowledge and extend our appreciation to the Kentucky farmers and their families who participated in this study.

This project was funded through the National Institute for Occupational Safety and Health Cooperative Agreement; Contract grant #U04/CCU406090-07.

logistic regression analysis was performed to determine the magnitude of association between potential risk factors and hypertension. The overall hypertension prevalence among older Kentucky farmers was 38.1% (95% CI: 35.0-41.1). Compared to nonhypertensive older farmers, hypertensive older farmers were at increased risk for diabetes (OR = 3.1), stroke (OR = 2.7), arteriosclerosis (OR = 2.7), and heart attack (OR = 3.7). Logistic regression analysis identified increasing body mass index as a risk factor. The active lifestyle of working farmers may be a factor influencing the prevalence of hypertension in this population. Appropriate intervention efforts should be targeted toward this population with regard to weight reduction and moderate physical activity. [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-342-9678. E-mail address: [getinfo@haworthpressinc.com](mailto:getinfo@haworthpressinc.com)]

**KEYWORDS.** Agriculture, hypertension, geriatrics, occupational health

Hypertension is a major contributor to stroke and heart disease, the two leading causes of death in an older population.<sup>1</sup> Other complications from hypertension include peripheral vascular disease, renal impairment, accelerated malignant hypertension, dissecting aortic aneurysm, and sudden death.<sup>2</sup> Further, elevated blood pressure has been associated with poorer cognitive performance.<sup>3</sup>

Essential hypertension, that is, hypertension that is attributable to familial and genetic metabolic predispositions rather than specific disease processes such as renal disease, has complex socioeconomic, behavioral and biomedical determinants. The known risk factors for hypertension include race,<sup>4,5</sup> genetics,<sup>6</sup> male gender,<sup>4,7</sup> age,<sup>4,7</sup> obesity,<sup>8,9</sup> sodium sensitivity,<sup>10,11</sup> alcohol consumption,<sup>12-14</sup> and sedentary habits.<sup>15</sup> Additionally, previous studies suggest that bone lead levels,<sup>16</sup> sleep apnea,<sup>17</sup> and emotional lability<sup>18</sup> may be risk factors for hypertension.

Previous research has indicated an increased prevalence for hypertension among farmers<sup>19</sup> and among persons living in the southeastern United States.<sup>20-23</sup> Brackbill, Cameron and Behrens compared white, male, working farmers aged 65 years and over with other same aged, white male, currently employed workers. They found a statistically significant excess of hypertension after age adjustment among the farmers (prevalence risk ratio = 1.4).<sup>19</sup> The southeastern United States has long been recognized as a geographic concentration of high age-adjusted rates of stroke for both whites and African Americans.<sup>20,22,23</sup>

An increase of 23% in all cause mortality has been reported for hypertensive males from Veterans Administration Hypertension Screening and Treatment Program (HSTP) clinics located in the southeastern United States when compared to similar patients attending other HSTP clinics ( $n = 11,936$ ).<sup>21</sup> Increased rates of hypertension, cigarette smoking, obesity, lack of exercise, poor diet, and less effective medical care may contribute to the higher mortality rates.<sup>21</sup>

Our specific research aim was to determine the self-reported prevalence of hypertension and associated risk factors in a sample of older, male, actively working, Kentucky farmers. Within the context of the hypertension literature, our study makes two unique contributions—it focuses on farmers and on older workers. Aside from the study by Brackbill et al.,<sup>19</sup> few investigations have been conducted on the chronic health conditions of workers in the U.S. farming population. Further, our study is located in the southeastern U.S., a geographic region that reports a higher hypertension prevalence than other regions. Although research has demonstrated the ameliorating effect of physical activity on hypertension,<sup>15,24,25</sup> little research has been conducted on hypertension and other chronic cardiovascular conditions among persons engaged in physically oriented occupations beyond the normal retirement age, as is the case among these Kentucky farmers.

## METHODS

Actively working, male farmers aged 55 years and older comprised the study population for this investigation. The study used data from the National Institute of Occupational Safety and Health (NIOSH)-sponsored Farm Family Health and Hazard Surveillance Project (FFHHSP), a multi-mode effort to assess the health status of persons living on family-owned and operated farms. Farms were defined as any establishment that sells, or would normally sell, \$1,000 or more agricultural products in a year.<sup>26</sup>

Details regarding the sampling design are provided elsewhere.<sup>27</sup> In brief; a two-stage cluster sampling was used to construct the sampling frame. At the first stage, a sample of 60 counties was selected from the 120 counties in Kentucky using probability proportional to size (PPS) sampling, where size was the number of farms in each of the counties based on the 1987 Census of Agriculture for Kentucky. Several counties in the eastern portion of the state were excluded from the study

prior to sampling due to logistical considerations, including the availability of telephones, and the relatively few farms per county. At the second stage, approximately 125 farm households in each of the 60 counties were selected from a listing maintained by the Kentucky Agricultural Statistics Service. A short telephone survey was conducted with each of these farm households to identify male farmers aged 55 years and older who were actively engaged in farm work. A sample frame of 3,585 older farmers was derived from farms that had working telephones and household members who agreed to a longer telephone interview. A simple random sample was then selected from farm households within each county, which yielded a total sample of 1,416 older farmers to be contacted for the 30-minute interview.

A 30-minute telephone survey (Farm Health Interview Survey—FHIS) was designed that included standard questions from the National Health Interview Survey.<sup>28</sup> The questionnaire included items covering chronic medical conditions such as myocardial infarction, hypertension, cerebrovascular accident, arteriosclerosis, diabetes, and selected demographic characteristics of the farmer. Telephone interviews were conducted between June, 1994, and September, 1995, by the University of Kentucky Survey Research Center. A computer-assisted telephone interviewing (CATI) system was used to conduct the interviews. The telephone interviewers' training consisted of administration of the phone survey and the definition of agricultural terms and questions. Interviewers were monitored by the Survey Research Center over the course of the data collection. No proxy respondents were used in the study. During the telephone interview, respondents were assured of the confidentiality of their responses.

### *Definition of Variables*

Hypertension, diabetes, arteriosclerosis, heart attack, and stroke were self-reported and were defined as the respondent having being advised by a physician that he had the particular medical condition. The time of the last clinic visit was not obtained during the interview, and consequently, the length of time since the last clinic visit could not be included in the analysis. Body mass index (BMI) was calculated from self-reported questions on the farmers' height and weight without shoes and calculated as weight in kilograms over height in meters squared. BMI quartiles were developed from the continuous variable,

with the first quartile as the smallest BMI category and the fourth quartile as the largest.

Categories for education were based on the highest grade attended in school and classified as those with less than a high school education, a high school education, or greater than a high school education. In order to be included in the analysis, farmers had to have reported that they were actively involved in farm work within the 12 months prior to the interview. Current work status was dichotomized based on a question that asked whether the farmer considered himself completely retired, partially retired, or not retired at all from farming. Farmers who responded that they were completely or partially retired were classified as part-time farmers, while those who responded that they were not retired at all were classified as full-time farmers.

Smoking status was classified into categories of those who never smoked, were former smokers, or were current smokers. Alcohol consumption categories were based on the number of drinks consumed per day on the days that the farmers drank based on usage in the previous month. Categories were grouped into none, one or fewer drinks, two drinks, and more than two drinks per day. One drink was defined as a can or bottle of beer, one glass of wine, one can or bottle of wine cooler, one cocktail, or one shot of liquor.

### ***Data Management and Analysis***

Data from the 30-minute telephone interviews (FHIS) provided the basis of the results reported in this study. Data entry for the FHIS was performed with the CATI system. Data management and analysis were executed using SAS.<sup>29</sup> Prevalence rates of hypertension rates were calculated and stratified by demographic, behavioral, and health status variables. The data analyses for this report are unweighted and unadjusted for the design characteristics of the study. The unweighted results reflect the characteristics of the sample; previous analyses have demonstrated that the unweighted prevalence estimates are not materially different from the design-adjusted, weighted estimates. The associations between hypertension and potential risk factors were assessed by calculating adjusted prevalence odds ratios using logistic regression.<sup>30,31</sup> Independent variables included in the multivariable logistic regression model were selected on the basis of a review of the epidemiologic literature on hypertension and on associations between the

potential risk factor and hypertension status from the bivariate analyses conducted with our data.

## RESULTS

A total of 998 actively working male farmers aged 55 years and older, drawn from a sample of 1,416, completed the telephone interview (response rate = 71%). Table 1 presents the demographic characteristics of the sample of 998 older male farmers in Kentucky. The mean age of the farmers was 68 years. Most were married (91%) and

TABLE 1. Demographic characteristics of Kentucky farmers

| Characteristic                | Farmers in Sample | Percent |
|-------------------------------|-------------------|---------|
| Age (years)                   |                   |         |
| 55-59                         | 115               | 12.3    |
| 60-69                         | 462               | 45.6    |
| □ 70                          | 421               | 42.0    |
| Race                          |                   |         |
| White                         | 977               | 98.1    |
| Other                         | 21                | 1.9     |
| Education                     |                   |         |
| < High School                 | 497               | 49.8    |
| High School                   | 331               | 33.2    |
| > High School                 | 170               | 17.0    |
| Household Income              |                   |         |
| < 10,000                      | 118               | 11.8    |
| 10,000-20,000                 | 229               | 22.9    |
| 21,000-30,000                 | 319               | 31.9    |
| 31,000-50,000                 | 198               | 19.8    |
| > 50,000                      | 134               | 13.4    |
| Marital Status                |                   |         |
| Married                       | 893               | 90.8    |
| Other                         | 105               | 9.2     |
| Health Status (self-reported) |                   |         |
| Excellent/Very Good           | 321               | 32.0    |
| Good                          | 319               | 32.1    |
| Fair/Poor                     | 358               | 35.8    |
| Work Status                   |                   |         |
| Full-Time                     | 392               | 39.3    |
| Part-Time                     | 606               | 60.7    |

of white race (98%). Slightly more than 50% had a twelfth grade education or above. Sixty-four percent considered their general health to be good to excellent, and nearly two-thirds (61%) worked part-time on the farm.

The age-specific prevalence estimates of hypertension for older male Kentucky farmers are given in Table 2. To place these prevalence results into a statewide and national context, we compared the estimates for Kentucky farmers to same aged, nonfarming males surveyed in the Kentucky Behavioral Risk Factor Surveillance System (BRFSS; 1996)<sup>32</sup> and to same aged males surveyed in the National Health Interview Survey (NHIS; 1993).<sup>33</sup> The prevalence of hypertension among Kentucky farmers aged 55-64 years (37%) was slightly less than for nonfarming males in the state (40%); data from the NHIS were not available for this age group. Kentucky farmers aged 65-74 years (40%) reported a lower prevalence of hypertension than nonfarming Kentucky males (50%), although their rates were higher than estimates of hypertension from males in the national data (32%). Finally, Kentucky farmers aged 75 years and older (35%) had lower rates than nonfarming males in the state (42%), but reported rates in excess of the rates from same aged males from the national sample (31%). (Data from the Kentucky BRFSS and NHIS are not shown in the Tables.)

The prevalence estimates, expressed as percentages, and unadjusted odds ratios by risk factors levels (BMI, smoking, alcohol consumption, education level, and physical activity level) in older, Kentucky farmers are given in Table 3. Our data indicate a consistent increase in the risk of hypertension with increasing BMI across all age groups of farmers, with this variable achieving statistical significance for the fourth quartile of BMI for the age categories of 55-64 years and 65-74 years. Part-time work status was shown to be statistically significant

TABLE 2. Estimates of prevalence rates for hypertension (CI = 95%) among Kentucky male farmers (1995)

| Age               | Prevalence Rate | Confidence Interval |
|-------------------|-----------------|---------------------|
| 55-64 Years       | 36.6            | 30.9-42.1           |
| 65-74 Years       | 39.9            | 35.7-44.3           |
| 75 Years and Over | 35.3            | 28.5-42.6           |
| Total             | 38.1            | 35.0-41.1           |

TABLE 3. Prevalence estimates and odds ratios of risk factors by age in older Kentucky farmers with hypertension

|                             | 55-64<br>(n = 295) |      |           | 65-74<br>(n = 511) |      |           | 75+<br>(n = 190) |      |          |
|-----------------------------|--------------------|------|-----------|--------------------|------|-----------|------------------|------|----------|
|                             | Prev               | OR   | 95% CI    | Prev               | OR   | 95% CI    | Prev             | OR   | 95% CI   |
| <b>BMI</b>                  |                    |      |           |                    |      |           |                  |      |          |
| 1st Quartile                | 24.6               | 1.00 | -         | 29.4               | 1.00 | -         | 28.1             | 1.00 | -        |
| 2nd Quartile                | 27.9               | 1.19 | .51-2.76  | 33.6               | 1.22 | .68-2.19  | 31.7             | 1.19 | .49-2.90 |
| 3rd Quartile                | 35.1               | 1.65 | .75-3.68  | 39.4               | 1.57 | .89-2.77  | 45.7             | 2.16 | .88-5.33 |
| 4th Quartile                | 51.8               | 3.29 | 1.53-7.10 | 55.0               | 2.94 | 1.66-5.21 | 45.2             | 2.11 | .82-5.42 |
| <b>Smoking</b>              |                    |      |           |                    |      |           |                  |      |          |
| Never                       | 32.4               | 1.00 | -         | 39.9               | 1.00 | -         | 32.8             | 1.00 | -        |
| Former                      | 39.0               | 1.20 | .67-2.17  | 42.2               | 1.06 | .73-1.54  | 40.0             | 1.22 | .64-2.35 |
| Current                     | 35.1               | 1.08 | .55-2.14  | 32.9               | .83  | .47-1.44  | 19.1             | .58  | .12-2.02 |
| <b>Alcohol (drinks/day)</b> |                    |      |           |                    |      |           |                  |      |          |
| None                        | 37.9               | 1.00 | -         | 39.9               | 1.00 | -         | 36.6             | 1.00 | -        |
| □ 1                         | 25.9               | .55  | .20-1.43  | 46.7               | 1.32 | .68-2.55  | 42.9             | 1.16 | .32-3.84 |
| 2                           | 36.4               | .94  | .34-2.50  | 34.1               | .78  | .38-1.56  | *16.7            | .35  | .01-3.22 |
| > 2                         | 33.3               | .73  | .16-2.71  | 28.0               | .60  | .14-2.14  | *0.0             | .00  | .00-2.71 |
| <b>Education</b>            |                    |      |           |                    |      |           |                  |      |          |
| > High School               | 38.8               | 1.00 | -         | 42.1               | 1.00 | -         | 34.9             | 1.00 | -        |
| High School                 | 42.1               | .77  | .45-1.31  | 35.5               | .84  | .57-1.25  | 42.6             | 1.22 | .63-2.35 |
| < High School               | 44.2               | 1.14 | .61-2.13  | 41.8               | .99  | .62-1.58  | 22.2             | .64  | .22-1.79 |
| <b>Work Status</b>          |                    |      |           |                    |      |           |                  |      |          |
| Full-Time                   | 31.7               | 1.00 | -         | 37.6               | 1.00 | -         | 32.6             | 1.00 | -        |
| Part-Time                   | 43.6               | 1.67 | 1.00-2.78 | 41.1               | 1.17 | .79-1.75  | 36.1             | 1.17 | .55-2.51 |

\*Statistics unreliable due to small number of individuals in the group

factor for farmers aged 55-64 years. There was an increased risk of hypertension for former smokers in the age categories of 55-64 years and 75 years and older. Although the association was not statistically significant, our data indicate a suggestion of a protective effect of current smoking among farmers aged 64-74 years and 75 years and older. A protective effect of alcohol consumption was evident across all age categories for farmers who consumed two or greater than two drinks per week, although this association, again, was not statistically significant. There was no consistent pattern between the reported level of education and the risk of hypertension.

Table 4 presents prevalence estimates for several comorbid conditions—diabetes, arteriosclerosis, heart attack and stroke—among older

TABLE 4. Prevalence estimates of percentage of comorbid conditions among older Kentucky farmers with and without hypertension

|                         | With Hypertension |           | Without Hypertension |          |
|-------------------------|-------------------|-----------|----------------------|----------|
|                         | Prevalence        | 95% CI    | Prevalence           | 95% CI   |
| <b>Diabetes</b>         | 15.6              | 12.1-19.7 | 5.5                  | 3.9-7.7  |
| <b>Arteriosclerosis</b> | 10.0              | 7.3-13.6  | 4.0                  | 2.7-6.0  |
| <b>Heart attack</b>     | 21.1              | 17.2-25.6 | 11.2                 | 8.8-14.0 |
| <b>Stroke</b>           | 7.1               | 4.8-10.0  | 2.8                  | 1.7-4.5  |

Kentucky farmers by hypertension status. The data indicate that hypertensive older male Kentucky farmers are at 3 times the risk for diabetes, 2.5 times the risk for arteriosclerosis, 2 times more likely to have had a heart attack, and 2.6 times more likely to have had a stroke.

Table 5 presents the adjusted odds ratios and confidence limits from the logistic regression analyses of potential risk factors for hypertension. Adjusting for smoking, education, alcohol consumption, age and work status, increasing body mass index yielded a dose-response relationship with the risk of hypertension. When other potential risk factors were controlled, the association between increasing body mass index and hypertension risk became statistically significant in the third and fourth quartiles.

## *DISCUSSION*

This study is one of few investigations to examine chronic health conditions among an actively working group of older Kentucky farmers. The overall prevalence of hypertension (38.1%) reported among the older Kentucky farmers warrants the attention of the public health and medical communities. Given that previous research has demonstrated that self-reported hypertension tends to be under-reported,<sup>34,35</sup> the true prevalence of this health condition may be greater than the data from this survey would indicate. The results concerning the comorbid conditions were as expected; arteriosclerosis and diabetes are generally accepted as aggravating hypertension, and heart attacks and stroke are a possible consequence of hypertension.

Our research suggests that older Kentucky male farmers may be at greater risk for hypertension compared to their national counterparts,

TABLE 5. Logistic regression analysis of potential risk factors for hypertension

| Risk Factor                  | Odds Ratio | 95% CI    | p-Value |
|------------------------------|------------|-----------|---------|
| <b>Body Mass Index</b>       |            |           |         |
| 1st Quartile                 | 1.00       | -         | -       |
| 2nd Quartile                 | 1.10       | 0.74-1.63 | .63     |
| 3rd Quartile                 | 1.52       | 1.04-2.22 | .03     |
| 4th Quartile                 | 2.69       | 1.84-3.94 | < .01   |
| <b>Work Status</b>           |            |           |         |
| Full Time                    | 1.00       | -         | -       |
| Part Time                    | 1.32       | 0.98-1.76 | .06     |
| <b>Age</b>                   |            |           |         |
| 55-64 years                  | 1.00       | -         | -       |
| 65-74 years                  | 1.08       | 0.79-1.49 | .62     |
| ≥ 75 years                   | 0.95       | 0.63-1.44 | .82     |
| <b>Alcohol (drinks/day)</b>  |            |           |         |
| None                         | 1.00       | -         | -       |
| □ 1                          | 0.97       | 0.61-1.54 | .91     |
| 2                            | 0.74       | 0.43-1.25 | .27     |
| > 2                          | 0.56       | 0.23-1.25 | .17     |
| <b>Education</b>             |            |           |         |
| < High School                | 1.00       | -         | -       |
| High School                  | 0.80       | 0.54-1.20 | .28     |
| > High School                | 0.98       | 0.68-1.43 | .93     |
| <b>Cigarette Consumption</b> |            |           |         |
| Never Smoked                 | 1.00       | -         | -       |
| Former Smoker                | 0.95       | 0.63-1.44 | .82     |
| Current Smoker               | 1.19       | 0.88-1.61 | .26     |

but are less likely to be at risk than older, nonfarming males in the state. Compared to nonfarming Kentuckians, the lower hypertension prevalence rate demonstrated by the actively working Kentucky farmers was particularly marked in the age 65-74 year group, the age at which most workers retire. Health status is likely a primary contributing factor to work status, although the direction of causation is unclear. Of those responding that their health was excellent to very good, 27% were part-time farmers and 40% were full-time. In the 1995 Kentucky BRFSS, approximately 75% of persons aged 55 years and older reported a sedentary life-style, a factor that contributes to the higher risk of hypertension in the general population.<sup>32</sup>

The finding of a dose-response association between increasing

body mass index and risk of hypertension has been well documented in the medical literature. In our sample, farmers in the fourth quartile of body mass index are at three times the risk of hypertension in comparison to those in the lowest quartile. This is indicative of the importance of this factor in the epidemiology of hypertension and has implications for interventions directed toward weight reduction. The finding in the bivariate analyses of a greater prevalence of hypertension among part-time farmers compared to full-time farmers at the age of 55-64 years may either be reflective of the protective effect of full-time work, and the likely greater level of physical activity that accompanies it, or may reflect that less healthy farmers need to reduce their time commitment from full-time farming. The ability to investigate these relationships would require a prospective approach to the evaluation of cardiovascular risk factors in this group of workers.

The results of our bivariate analyses and logistic regression on alcohol consumption did not demonstrate the characteristic J-shaped curve shown in previous research.<sup>36,37</sup> However, interpretation of alcohol consumption data is complicated by questions as to the reliability of self-reported alcohol consumption, lack of consistent categories for amounts consumed, and the fact that alcohol consumption is not normally distributed. It has been suggested that the risk for hypertension begins at the higher levels of alcohol consumption, such as 3 to 5 drinks a day.<sup>12,36</sup> Only 7.3% of our sample consumed more than 3 drinks per day, the level at which previous research has indicated risk for hypertension begins.<sup>12,36</sup> Based on data available from other sources for the state, the overall reliability of the self-report of alcohol consumption in this telephone survey is somewhat suspect.

### **STRENGTHS AND LIMITATIONS**

This study characterizes the prevalence and risk factors for hypertension among male farmers aged 55 years and older living on family-operated farms and who were still actively working on the farm at the time of the telephone survey. Little research attention has been directed toward the health status of older workers, especially those engaged in physically oriented occupations that extend well past the usual retirement age. As this sample was composed of predominantly

white, male farm operators, we could not examine differences in the prevalence of chronic health conditions by race.

One of the primary limitations to the data is the self-report of all information from the telephone surveys. As previously mentioned, self-reports tend to underestimate the prevalence of hypertension;<sup>34,35</sup> therefore we would expect the prevalence estimates of hypertension and comorbid conditions may be greater than this study indicates. Likewise, the self-reporting of height and weight may have resulted in an underestimation of body mass index. However, self-reported height and weight errors tend to be systematic and less than 2%.<sup>38,39</sup>

While the potential exists that the our finding of a relationship between increasing body mass index and an increasing risk for hypertension may be the result of an unmeasured confounder, this is unlikely as the magnitude of the association is relatively strong and the dose-response relationship consistent across all age categories. The variable for work status (part-time versus full-time farming) may serve only as a crude proxy for physical activity; therefore we are unable to distinguish actual levels of physical exertion.

Although the older farmers interviewed in this survey were demographically comparable to all farmers in the state, there was an indication that the survey captured farmers from slightly larger acreage farms and who were more likely to be full-time farmers.<sup>27</sup> Generally, persons in the lower socioeconomic levels, who are least able to afford medical care, are also the most likely to be missed in a survey due to the lack of household telephones. This, however, is likely to be of minor consequence in this study.

Although the response rate was good for a telephone survey (71%), there may be increased percentage of individuals among the nonrespondents who were unable to complete a questionnaire due to illness. Since hypertension aggravates many chronic health conditions, farmers with severe hypertension may not be included in the sample because they will have retired at an earlier date due to ill health and not meet the criteria to have actively performed farm work in the past year. The prevalence estimates of comorbid conditions may be elevated, as those diagnosed with hypertension are more likely to be aware of other chronic conditions.

The comparison of our prevalence data with the state BRFSS data and the NHIS data may not be strictly comparable given the usual issues associated with ecologic comparisons including the diverse

approaches to population sampling, distinct populations, time of survey administration, and other unmeasured characteristics of the study design. However, the basic characteristics of obtaining the self-reported data from well-designed telephone surveys using the same question for the assessment of the outcome are comparable.

The results of this study apply only to older male Kentucky farmers and should not be extended to younger or migrant farmers in the area. Standard limitations regarding the use of prevalence data to assess the relationship between risk factors and hypertension are applicable to this surveillance data; that is to say, the temporal sequence between the putative risk factors and hypertension may be unclear.

### ***IMPLICATIONS AND CONCLUSIONS***

In summary, our study supports the previous finding that rates of hypertension are generally elevated in the southeastern U.S. We found that the prevalence of self-reported hypertension was higher for both Kentucky nonfarming males and actively farming males compared to same aged males in the national sample. In accordance with previous conclusions regarding all cause mortality in the southeast U.S.,<sup>21</sup> the increased prevalence of hypertension in this geographical region may be due to the higher rates of smoking, obesity, lack of physical activity, and inadequate medical care.

Hypertension is controllable, and public awareness of the condition is on the rise. Successive reports from the National Health and Nutrition Examination Survey study (NHANS) have indicated that hypertensive individuals are becoming increasingly aware of their overall cardiovascular status.<sup>41</sup> Mild essential hypertension, which comprises 90% of all hypertension,<sup>2</sup> may be successfully controlled with life style modifications and pharmacological intervention.

As our finding of a statistically significant risk of hypertension for the fourth quartile of body mass index in the age categories of 55-64 and 65-74 years supports previous studies regarding the positive association of hypertension to body mass index,<sup>8,9</sup> we advocate the established recommendations concerning life style changes as a means of hypertension control. In addition, previous research has demonstrated that physical activity reduces the risk of hypertension;<sup>15,24,25</sup> therefore, the active life style of working farmers may be protective for hypertension by promoting a better overall physical condition. Further

research is needed in the area of the impact of ongoing farm work activities on hypertension. In conclusion, we suggest that medical intervention programs target self-efficacy regarding the two remediable areas, obesity and physical activity.

## REFERENCES

1. Bots ML, Grobbee DE, Hofman A. High blood pressure in the elderly. *Epidemiol Rev* 1991;13:294-314.
2. Futterman LG, Lemberg L. Hypertension, stroke, and noncompliance: an avoidable triad. *Am J CritCare* 1996;5:227-33.
3. Elias PK, D'Agostino RB, Elias MF, Wolf PA. Blood pressure, hypertension, and age as risk factors for poor cognitive performance. *Exp Aging Res* 1995;21:393-417.
4. Burt VL, Cutler JA, Higgins M, Horan MJ, Labarthe D et al. Trends in hypertension, awareness, treatment, and control of hypertension in the adult US population: data from the Health Examination Surveys, 1960 to 1991. *Hypertension* 1995;26:60-9.
5. Saunders E, Brest AN (Eds). *Cardiovascular Diseases in Blacks*. Philadelphia: F. A. Davis; 1991.
6. Williams RR, Hunt SC, Hopkins PN, Stults BM, Wu LL et al. Familial dyslipidemia hypertension: evidence from 58 Utah families for a syndrome present in approximately 12% patients with essential hypertension. *JAMA* 1988;259:3579-86.
7. Kannel WB, Gordon T. Evaluation of cardiovascular risk in the elderly: the Framingham Study. *Bull NY Acad Med* 1978;54:573-91.
8. Gillum RF. The association of body fat distribution with hypertension, hypertensive heart disease, coronary heart disease, diabetes and cardiovascular risk factors in men and women aged 18-79 years. *Journal of Chronic Diseases* 1987;40:421-8.
9. Selby JV, Friedman GD, Quesenberry CP. Precursors of essential hypertension: the role of body fat distribution pattern. *Am J Epidemiol* 1989;129(1):43-53.
10. Haddy FJ. Mechanism, prevention and therapy of sodium-dependent hypertension. *Am J Med* 1989;69:746-758.
11. Stamler J, Rose G, Elliott P, Dyer A, Marmot M et al. Findings of the International Cooperative INTERSALT Study. *Hypertension* 1991;17(Suppl.I):I-9-I-15.
12. Jackson R, Stewart A, Beaglehole R, Scragg R. Alcohol consumption and blood pressure. *Am J Epidemiol* 1985;122:1037-44.
13. Potter JF, Beevers DG. Pressor effect of alcohol in hypertension. *Lancet* 1984;1:119-122.
14. Puddey IB, Beilin LJ, Vandongen R, Rouse IL, Rogers P. Evidence for a direct effect of alcohol consumption on blood pressure in normotensive men: a randomized controlled trial. *Hypertension* 1985;7:707-13.
15. Blair SN, Goodyear NN, Gibbons LW, Cooper KH. Physical fitness and incidence of hypertension in healthy normotensive men and women. *JAMA* 1984;252:487-90.
16. Hu H, Aro A, Payton M, Korrick S, Sparrow D et al. The relationship of bone and blood lead to hypertension. *JAMA* 1996;275:1171-6.

17. Fletcher EC. The relationship between systemic hypertension and obstructive sleep apnea: facts and theory. *Am J Med* 1995;98:118-28.
18. Spiro III A, Aldwin CM, Ward KD, Mroczek DK. Personality and the incidence of hypertension among older men: longitudinal findings from the Normative Aging Study. *Health Psychol* 1995;14:563-9.
19. Brackbill RM, Cameron LL, Behrens V. Prevalence of chronic diseases and impairments among US farmers, 1986-1990. *Am J Epidemiol* 1994;139:1055-65
20. Borhani NO. Changes and geographic distribution of mortality from cerebrovascular disease. *Am J Public Health* 1965;55:673-81.
21. Miller JP, Perry HM, Rossiter JE, Baty JD, Carmody SE, Sambhi MP. Regional differences in mortality during 15-year follow-up of 11, 936 hypertensive veterans. *Hypertension* 1994;23:431-8.
22. Soltero I, Liu K, Cooper R, Stamler J, Garside D. Trends in mortality from cerebrovascular diseases in the United States, 1960 to 1975. *Stroke* 1978;9:549-58.
23. Roccella EJ, Lenfant C. Regional and racial differences among stroke victims in the United States. *Clin Cardiol* 1989;12:IV-18-IV-22.
24. Paffenbarger Jr RS, Wing AL, Hyde RT, Jung DL. Physical activity and incidence of hypertension in college alumni. *Am J Epidemiol* 1983;117:245-57.
25. Thune I, Njolstad I, Lochen ML, Forde OH. Physical activity improves the metabolic risk profiles in men and women: the Tromso Study. *Arch Intern Med* 1998;158:1633-40.
26. Census. 1992 Census of Agriculture Part 17 Kentucky State and County Data (Volume 1 Geographic Area Series No. AC92 A-17). Washington, D.C.: Superintendent of Documents; 1992.
27. Browning SR, Trusczyńska H, Reed DB, McKnight RH. Agricultural injuries among older Kentucky farmers: the Farm Family Health and Hazard Surveillance study. *Am J Indust Med* 1998;33:341-353.
28. Massey JT, Moore TF, Parsons VL, Tadros W. Design and estimation for the National Health Interview Survey, 1985-1994. National Center for Health Statistics, Vital Health Statistics 1989; Series 2 No. 110, DHHS No. (PHS) 89-1384.
29. SAS Institute, Inc. SAS/STAT User's Guide, 6th ed. Cary, North Carolina: SAS Institute, Inc.
30. Hosmer Jr DW, Lemeshow S. Applied Logistic Regressions. New York: John Wiley & Sons, Inc.; 1989.
31. Kleinbaum DG, Kupper LL, Morgenstern H. Epidemiologic Research: Principles and Quantitative Methods. Belmont, CA: Lifetime Learning Publications; 1982.
32. Kentucky Behavioral Risk Factor Surveillance System Data. The Kentucky Department for Public Health: Kentuckians at Risk, Frankfort, Kentucky. 1995.
33. Benson V, Marano A. Current estimates from the National Health Interview Survey, 1993. National Center for Health Statistics, Health, United States. Hyattsville, Maryland: Public Health Service; 1994 Series 10 No190, DHHS No. (PHS) 95-1518.
34. Bowlin SJ, Morrill BD, Nafziger AN, Jenkins PL, Lewis C, Pearson TA. Validity of cardiovascular disease risk factors assessed by telephone survey: the behavioral risk factor survey. *J Clin Epidemiol* 1993;46:561-71.

35. Giles WH, Croft JB, Keenan NL, Lane MJ, Wheeler FC. The validity of self-reported hypertension and correlates of hypertension awareness among blacks and whites within the stroke belt. *Am J Prev Med* 1995;11:163-9.

36. Friedman GD, Selby JV, Quesenberry CP, Armstrong MA, Klatsky AL. Precursors of essential hypertension: body weight, alcohol and salt use, and parental history of hypertension. *Pre Med* 1988;17:367-402.

37. Gordon T, Kannel WB. Drinking and its relation to smoking, BP, blood lipids, and uric acid: the Framingham Study. *Arch Intern Med* 1983;143:1366-74.

38. Stewart AW, Jackson RT, Ford MA, Beaglehole R. Underestimation of relative weight by use of self-reported height and weight. *Am J Epidemiol* 1987;125:122-6.

39. Palta M, Prineas RJ, Berman R, Hannan P. Comparison of self-reported and measured height and weight. *AM J Epidemiol* 1982;115:223-30.

40. Camagro CA. Case-control and cohort studies of moderate alcohol consumption and stroke. *Clin Chim Acta* 1996;246:107-19.

41. Roccella EJ, Burt V, Horan MJ, Cutler J. Changes in hypertension awareness, treatment, and control rates-20-Year trend data. *AEP* 1993;3:547-9.