

ORIGINAL ARTICLE

A Comparison of Health, Health Behavior, and Access Between Farm and Nonfarm Populations in Rural New York State

Giulia Earle-Richardson, PhD;¹ Melissa Scribani, MPH;² Erika Scott, MS;¹ John May, MD;^{1,2} & Paul Jenkins, PhD²

¹ New York Center for Agricultural Medicine & Health, Bassett Medical Center, Cooperstown, New York

² Bassett Medical Center Research Institute, Bassett Medical Center, Cooperstown, New York

Abstract

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For further information, contact: Erika E. Scott, MS, New York Center for Agricultural Medicine & Health, Bassett Medical Center, One Atwell Road, Cooperstown, NY 13326; e-mail: erika.scott@bassett.org.

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Background: Recent technological and demographic changes in US agriculture raise questions about whether the previously observed benefits of the agricultural lifestyle persist.

Methods: In 2009, researchers conducted a household survey of 9,612 adults (aged 20+) in a rural region of Upstate New York. Data on health status, health behaviors, and health care access among farmers and rural nonfarm residents were compared.

Results: After adjustment for age, gender, education, and having a regular health care provider, male farmers had elevated prevalence of asthma (OR: 1.82, 95% CI: 1.05-3.16) and untreated chronic obstructive pulmonary disease (COPD) (OR: 3.17, 95% CI: 1.12-9.01). Farmers had significantly lower hypercholesterolemia (OR: 0.70, 95% CI: 0.50-0.99), but not lower prevalence of heart disease or stroke. Farmers had lower rates of smoking (OR: 0.60, 95% CI: 0.40-0.89) and higher rates of hard physical labor (OR: 2.61, 95% CI: 1.83-3.72) than nonfarmers, but they had notably worse health behavior prevalence relative to various types of screening, vaccinations, and having a regular medical care provider (OR: 0.53, 95% CI: 0.39-0.71).

Conclusions: The farm population is becoming more like the rural nonfarm population with regard to health outcomes and lifestyle, yet it remains notably poorer with regard to prevention. Targeted outreach is needed to increase prevention within the agricultural community.

Key words agriculture, health disparities, observational data, social determinants of health, utilization of health services.

The health and safety hazards associated with agricultural work are well documented.¹ In addition to injury resulting from machinery, animals and chemicals, farmers experience elevated incidence of respiratory disease, musculoskeletal disorders, and some types of cancer.^{2,3} Other studies have found lower rates of mortality and disease among farm populations, suggesting a protective effect of farming.^{4,5} Certain characteristics of farm life—high levels of physical activity, low smoking prevalence, and early exposures to allergens—are believed to result in lower mortality and morbidity. In New

York State, several studies conducted between 1987 and 2003 found such a protective effect relative to chronic disease.⁶⁻⁹

However, now 10-15 years later, it is uncertain whether this so-called protective effect persists. Agriculture has been undergoing a major shift over the last half century, with a declining number of farm operations, farmers getting older on average,¹⁰ and the nature of farm work itself changing to a more mechanized process.^{11,12} These fundamental changes could affect disease incidence in the farm population.

Moreover, during the past 20 years, our health care system has also changed significantly in ways that may put farmers at a significant disadvantage for maintaining good health. As health care has become more expensive overall, the type of health insurance coverage increasingly impacts the extent and quality of medical care received. While past research has shown farm populations to have levels of health insurance coverage comparable to rural nonfarm populations,¹³⁻¹⁵ farm families have been shown to have employer-based insurance less frequently.¹⁶ Privately purchased insurance has historically had higher out-of-pocket costs, which seems likely to discourage health care utilization. As a number of advances in disease prevention bring forth more and more recommendations for screening and vaccination, those with extensive coverage for preventive care reap the benefits disproportionately.

Last, with the recent emergence of e-mail and the electronic medical record, Internet connectivity has become an important component of health care access,¹⁷ and again the farm population seems to be left behind. While the proportion of New York farms with Internet access is growing,^{18,19} it still lags behind that of the general population significantly.

For all of these reasons, in 2014, there is a need to re-evaluate the health status of the farm population relative to the general rural population. As part of its service planning process, an agricultural health and safety nonprofit in rural New York analyzed data from a rural health survey conducted in 2009 in order to obtain an up-to-date and comprehensive picture of the agricultural population's health, behavior, and health care access. The research presented here compares the farm to the rural nonfarm population on a range of demographic, health, and health care access measures. With this analysis, we can determine whether the farm population in rural New York differs in health behavior and health outcomes, and better target community outreach and prevention activities.

Methods

Study Population

In 2009, a household survey of residents in a rural 7-county region (Chenango, Delaware, Herkimer, Madison, Montgomery, Otsego, and Schoharie) of Upstate New York was undertaken by a regional health care network. These 7 counties were selected because they were the 7 of 9 counties served by a large rural hospital network that do not contain metropolitan areas of 50,000 or more persons. This definition of rural is consistent with that used by the US Census.²⁰

Study Design

The survey collected both household- and individual-level health data. Details of the methodology are described elsewhere.^{6,21,22} Briefly, the survey was mailed to 18,339 eligible households (permanent noncommercial residences) and could be completed and returned by mail or via the Internet. The random sample of eligible households was drawn from a commercially available sampling frame (Genesys Corporation, Fort Washington, Pennsylvania).

Survey Instrument

The survey was structured so that 1 individual answered household-level questions (Internet access, well vs municipal water, etc.) and also reported on individual-level health indicators for all household members. Human subjects' protection approval was obtained from the Bassett Medical Center Institutional Review Board.

Survey recipients who did not return the replacement survey were termed "nonresponders." This nonresponder group was divided into households with and without published telephone numbers. A random sample of nonresponders with telephone numbers was selected for contact by telephone. Nonresponders without published telephone numbers were sampled and recontacted by mail. Both groups were this time offered \$20 to complete the survey. The data from the initial responders were combined with the data from the 2 separate nonresponder groups to form single estimates of prevalence using a simple extension of the weighting methodology for multistage sampling described by Neyman,²³ Hanson et al.,²⁴ and Jenkins et al.²²

Survey questions were modeled after the CDC-Behavioral Risk Factor Surveillance Study (Centers for Disease Control and Prevention, 2013).²⁵ Body mass index (BMI) was calculated using self-reported height and weight. Smoking was asked relative to being a current smoker. The condition of untreated chronic obstructive pulmonary disease (COPD) was defined as a respondent who reported either going to the ER for a COPD-related problem or was admitted to the hospital for a COPD-related problem.

Farmer Definition

Respondents were defined as "farmers" if their response to: "Industry worked in most of life (please check one):" was "agriculture." Thus, retired or unemployed workers who had worked in agriculture most of their lives were included. In addition, if the subject chose "other" industry and wrote in an agriculturally related industry, they

were also classified as a farmer. All other respondents were classified as “rural nonfarm” since the study region was an almost entirely rural area.

Survey Data Analysis

Once the 2 respondent groups were created, simple univariate comparisons of age, gender, and education were made (a simplified “college/no college” variable was created). Unadjusted odds ratios for all health conditions, health-related lifestyle, health screenings, and health care access were calculated using logistic regression models with 1 independent variable. The use of logistic regression models makes it possible to control potential confounding variables, such as age, sex, and educational attainment. Variables with such low overall prevalence that no stable models could be created were removed from further consideration. Based on extreme differences of age, gender, education, and “Having a regular doctor or other health-care provider,” odds ratios were all adjusted using these factors and multivariate logistic regression. “Having a regular doctor or other health care provider” was included as an adjustor because so many of the variables were related to having received a diagnosis by a medical care provider. Multivariate logistic models were constructed separately for men and women to explore the possibility that some of these relationships may differ between genders. Race/ethnicity was not considered in this analysis since the sample is over 95% white. As a further test of the possible association between insurance type and health screening behavior, a second set of logistic regression models was created including insurance type (“self-paid insurance” yes/no) in the adjustment variables.

Results

Across the 7 study counties, there were a total of 9,612 individuals aged 20 or over, of whom 536 were classified as farmers. While the initial response rate was 29.3%, the use of 2 additional waves of random sampling from among nonresponding households using incentives increased the percentage of the population represented by the sample to 48.3%. In addition, because the sample was found to be significantly older than the 7-county population, the subjects' responses were further weighted to more accurately represent the age distribution of the 7-county region. Table 1 shows the demographic characteristics of the survey sample. While all participants had the option of responding via Internet, overall the utilization was so low (5.3%) that response mode was removed from further consideration.

As shown in Table 1, there were important demographic differences between farmers and rural

Table 1 Demographics and Education Level—Farm Versus Nonfarm Rural Comparisons, Central New York State, 2009^a

	Farm Sample	Nonfarm Rural Sample
Sample size	536	9,076
Median age	55.2	51.2
Male, n (%)	388 (74.8)	4,228 (47.3)
Female, n (%)	146 (25.2)	4,812 (52.7)
Education (%)		
Less than high school	12.9	4.6
High school	56.1	42.4
2-year college	18.5	21.9
4-year college or higher	11.6	28.8
Vocational school	0.9	2.3

^aAnalysis included adults 20+ years to correspond to the 7-county census population categories used in weighting. All percents are weighted.

nonfarmers. The farm sample was somewhat older and considerably more likely to be male. The nonfarm rural population was also twice as likely to have completed 4 years of college (11.6% among farmers vs 28.8% among rural nonfarmers), while farmers were 3 times as likely to have left school before high school graduation (12.9% among farmers vs 4.6% among rural nonfarmers).

Access to Health Care

As shown in Table 2, farmers were less likely to have a regular doctor or health care provider (OR: 0.53, 95% CI: 0.39-0.71), and they also were significantly less likely to visit a dentist for routine care (OR women: 0.50, OR men: 0.79). They were also less likely to have health insurance through an employer (OR: 0.41, 95% CI: 0.31-0.53) and more likely to have individually purchased insurance (OR: 2.77, 95% CI: 1.94-3.96). While the crude odds ratio for having Medicare is elevated for farmers (OR: 1.38, 95% CI: 1.04-1.83), when adjusted for age and other demographic factors, this difference was eliminated.

Lifestyle and Vaccinations

Table 3 shows lifestyle and disease prevention behaviors. Adjusted, farmers smoked significantly less (OR: 0.60, 95% CI: 0.40-0.89) and had significantly more days of hard physical labor (OR women: 3.97, OR men: 2.27). There were no differences in overweight, obesity, or leisure exercise.

Screening Behavior

All of the screening indicators in Table 3 showed odds ratios of less than 1 for farmers for both genders, indicating

Table 2 Farm Versus Nonfarm Rural Comparisons of Insurance and Health Care Access, Central New York State, 2009

	Crude	Adjusted ^a	Adjusted ^a Women Only	Adjusted ^a Men Only
Insurance/Health Care Access				
Has a regular doctor or health care provider	0.53 (0.39-0.71)	0.58 (0.42-0.79)	0.39 (0.22-0.71)	0.64 (0.44-0.93)
Self-paid insurance	2.77 (2.02-3.80)	2.77 (1.94-3.96)	2.53 (1.31-4.89)	2.90 (1.90-4.42)
Medicare	1.38 (1.04-1.83)	0.90 (0.57-1.40)	0.78 (0.34-1.78)	0.93 (0.54-1.59)
No insurance	1.34 (0.93-1.95)	1.16 (0.77-1.75)	1.34 (0.60-2.98)	1.11 (0.69-1.80)
Did not obtain care due to cost	1.15 (0.70-1.88)	0.90 (0.53-1.55)	1.12 (0.40-3.12)	0.83 (0.44-1.58)
Medicaid	0.96 (0.58-1.57)	1.05 (0.63-1.78)	0.93 (0.37-2.37)	1.10 (0.58-2.06)
Insurance from other source	0.82 (0.41-1.62)	0.68 (0.33-1.37)	0.79 (0.21-2.98)	0.66 (0.29-1.51)
Internet in the home	0.48 (0.37-0.63)	0.64 (0.47-0.86)	0.70 (0.39-1.26)	0.61 (0.43-0.87)
Insurance through employer	0.41 (0.31-0.53)	0.53 (0.39-0.70)	0.48 (0.27-0.86)	0.54 (0.38-0.75)

Statistically significant at $P < .05$ in bold.

^aAdjusted for age, sex, college/no college, and having a regular medical care provider.

Table 3 Lifestyle and Screening Behaviors, Farm Versus Nonfarm Rural Comparison, Central New York State, 2009

	Crude	Adjusted ^a	Adjusted ^a Women Only	Adjusted ^a Men Only
Lifestyle and Vaccinations				
Current smoker (yes/no)	0.79 (0.55-1.15)	0.60 (0.40-0.89)	0.74 (0.33-1.69)	0.55 (0.34-0.87)
Overweight (BMI < 25/BMI ≥ 25)	1.37 (1.00-1.88)	1.06 (0.76-1.47)	1.33 (0.75-2.39)	0.97 (0.65-1.43)
Obesity (BMI < 25/BMI ≥ 30)	0.92 (0.68-1.24)	0.96 (0.71-1.31)	0.95 (0.53-1.71)	0.97 (0.67-1.38)
Leisure exercise (days ≤3/days >3)	0.97 (0.66-1.45)	1.10 (0.73-1.65)	1.56 (0.74-3.27)	0.95 (0.58-1.55)
Hard physical labor (days ≤3/days >3)	2.99 (2.13-4.20)	2.61 (1.83-3.72)	3.97 (1.91-8.27)	2.27 (1.51-3.41)
Pneumonia shot (5 years)	1.33 (0.97-1.83)	1.02 (0.70-1.50)	0.75 (0.36-1.57)	1.14 (0.72-1.80)
Flu shot (12 months)	0.88 (0.67-1.15)	0.89 (0.65-1.20)	0.85 (0.49-1.49)	0.88 (0.60-1.27)
Screening Behaviors				
Visited dentist for routine care (12 months)	0.51 (0.39-0.66)	0.70 (0.52-0.93)	0.50 (0.29-0.88)	0.79 (0.56-1.11)
BP checked (2 years)	0.62 (0.44-0.85)	0.64 (0.44-0.94)	0.48 (0.24-0.97)	0.71 (0.45-1.14)
Colonoscopy (5 years)	0.71 (0.52-0.95)	0.55 (0.39-0.78)	0.56 (0.29-1.06)	0.55 (0.37-0.84)
Fasting glucose test	0.80 (0.58-1.11)	0.77 (0.54-1.08)	0.90 (0.49-1.65)	0.70 (0.46-1.06)
Nonfasting glucose test	0.58 (0.29-1.16)	0.61 (0.30-1.25)	0.70 (0.19-2.56)	0.54 (0.23-1.29)
Glucose tolerance test	0.32 (0.08-1.36)	0.45 (0.11-1.91)	0.59 (0.08-4.40)	0.33 (0.04-2.59)
Rectal exam (2 years)	0.82 (0.60-1.12)	0.69 (0.47-1.02)	–	0.69 (0.47-1.02)
PSA test (2 years)	0.86 (0.62-1.19)	0.71 (0.47-1.07)	–	0.71 (0.47-1.07)
Mammogram (2 years)	0.85 (0.51-1.42)	0.76 (0.43-1.36)	0.76 (0.43-1.36)	–
Pap smear (3 years)	0.58 (0.34-0.99)	0.85 (0.48-1.51)	0.85 (0.48-1.51)	–

BMI, body mass index; BP, blood pressure; PSA, prostate-specific antigen. Statistically significant at $P < .05$ in bold.

^aAdjusted for age, sex, college/no college, and having a regular medical care provider.

that farmers had poorer screening behaviors. However, only blood pressure (BP) checked (OR women: 0.48, 95% CI: 0.24-0.97), colonoscopy (OR men: 0.55, 95% CI: 0.37-0.84), and Pap smear (OR women: 0.58, 0.34-0.99) were statistically significant.

Chronic Health Conditions

As shown in Table 4, while farmers had higher prevalence of several health conditions (OR > 1.0), most were not statistically significant. Only asthma in men (OR: 1.63, 95% CI: 1.04-2.75) and untreated COPD in men (OR: 2.75, 95% CI: 1.11-6.82) were significant after adjustment. Poor mental health days among men

(OR: 1.77, 95% CI: 0.90-3.50) had an elevated OR that approached but did not reach statistical significance. Farmers had significantly lower prevalence of only 1 health condition, hypercholesterolemia (OR: 0.70, 95% CI: 0.50-0.99). This was only significant when genders were pooled.

The odds ratios for visiting the dentist for routine care (BP check, colonoscopy, and Pap smear) were not affected by controlling for insurance type (data not shown). Further, controlling for smoking status, self-reported body mass index (BMI), leisure physical activity, and hard physical labor (data not shown) also did not affect the crude odds ratios for disease, lifestyle, and screening behavior.

Table 4 Male Farmers Have Elevated Frequency of Untreated COPD and Asthma, Few Other Differences—Farm Versus Nonfarm Rural Central New York State, 2009

	Crude	Adjusted ^a	Adjusted ^a Women Only	Adjusted ^a Men Only
Health Conditions				
Untreated COPD	3.26 (1.37-7.78)	2.75 (1.11-6.82)	1.67 (0.21-13.13)	3.17 (1.12-9.01)
Emphysema	1.75 (0.84-3.64)	1.17 (0.54-2.53)	0.77 (0.10-5.85)	1.24 (0.53-2.90)
Stroke	1.71 (0.91-3.24)	1.31 (0.67-2.57)	0.65 (0.10-4.09)	1.57 (0.76-3.24)
Heart disease	1.46 (0.96-2.13)	0.96 (0.61-1.51)	1.49 (0.62-3.58)	0.84 (0.50-1.42)
COPD	1.42 (0.74-2.72)	1.12 (0.57-2.21)	1.72 (0.54-5.46)	0.91 (0.39-2.10)
Asthma	1.23 (0.79-1.91)	1.63 (1.04-2.57)	1.36 (0.61-3.04)	1.82 (1.05-3.16)
Arthritis	1.22 (0.90-1.65)	1.03 (0.73-1.46)	1.63 (0.88-3.01)	0.84 (0.55-1.29)
Injured in last 12 months	1.21 (0.78-1.88)	1.14 (0.73-1.79)	1.29 (0.49-3.37)	1.14 (0.69-1.90)
Lost 1+ permanent teeth	1.17 (0.87-1.58)	0.93 (0.67-1.27)	0.90 (0.49-1.67)	0.91 (0.63-1.32)
High blood pressure	1.04 (0.78-1.38)	0.77 (0.56-1.07)	0.56 (0.28-1.13)	0.88 (0.61-1.27)
Diabetes	1.01 (0.63-1.62)	0.71 (0.43-1.18)	1.07 (0.42-2.74)	0.61 (0.33-1.12)
Chronic back pain	0.94 (0.65-1.35)	0.81 (0.55-1.17)	0.62 (0.28-1.38)	0.88 (0.58-1.36)
Poor mental health days	0.92 (0.49-1.73)	1.08 (0.57-2.05)	0.10 (0.004-2.19)	1.77 (0.90-3.50)
High cholesterol	0.88 (0.64-1.20)	0.70 (0.50-0.99)	0.67 (0.34-1.32)	0.73 (0.49-1.08)
Depression	0.70 (0.43-1.13)	0.88 (0.54-1.44)	0.54 (0.21-1.43)	1.13 (0.63-2.02)
Anxiety disorder	0.60 (0.32-1.13)	0.75 (0.39-1.44)	0.67 (0.23-1.96)	0.84 (0.37-1.90)

COPD, chronic obstructive pulmonary disease. Statistically significant at $P < .05$ in bold.

^aAdjusted for age, college/no college, and has a regular doctor or health care provider.

Discussion

Having a Regular Health Care Provider

The most dramatic difference between the farm and non-farm population was the prevalence of having a regular doctor or health care provider. This indicator was selected because it is a marker of regular, consistent utilization of health care, and it has been shown to be related to better health.²⁶ This question was modeled after one from the CDC Behavioral Risk Factor Surveillance System. It is related to the Healthy People 2010 indicator "Having a regular doctor or health care provider." The existing nationwide estimate (2007) for this factor is 76.3%, while the goal is 83.9%.²⁷ The subjects in this study (both farming and nonfarming) had levels slightly below these goals.

While "Having a regular doctor or health care provider" is used by the CDC, few other studies have collected data on this indicator, and none have examined it within the farm population. Because having a regular health care provider is to some extent mediated by one's health (individuals with chronic disease have more reason to have a regular health care provider), we examined prevalence of having a regular health care provider among those not reporting any chronic disease. While roughly one-quarter of the farmers without disease (males: 25.2%, females: 28.6%) reported having a regular health care provider, among the rural nonfarm population it was closer to one-third (males: 32.8%, females: 36.7%). This finding suggests that the rural nonfarm population may be more willing to engage with

the health care system for prevention purposes or in anticipation of future needs. Farmers in this study appear to be more likely to use the health care system in response to a health problem as opposed to when they are healthy. Very little published research exists on health care utilization by farmers; however, one telling study from Australia found that outreach to farmers resulted in medical referral for 60% of men and 70% of women.²⁸

While further research is needed to understand farmer decision making around health care seeking, it is notable that other research has found that farmers tend to view health in terms of one's *ability to work* in preference to definitions such as "absence of pain" and "absence of major disease."²⁹ If the farm population in rural New York also views health in terms of the ability to work, it would not be at all surprising there would be a reluctance to engage with the health care system until illness or injury interferes with one's ability to work. Future research should explore farmer conceptions of health and wellness to explain the results found here.

Another result of interest was the fact that the farm population has similar overall health insurance coverage prevalence to the rural nonfarm population, but a much lower prevalence of employer-based insurance. This is in agreement with the previous research by Park et al in Iowa.¹⁶ While employer-based health insurance does not always provide greater benefits and lower deductibles, prior to the 2014 implementation of the Affordable Care Act, individually purchased health insurance was known to require the largest out-of-pocket payments, which

could be a disincentive to receive preventive care or to have a regular medical care provider.³⁰ Future research with a larger sample is needed to identify the specific characteristics of the agricultural population that can explain these differences.

Disease Status

There were few disease outcomes among farmers that were significantly different from the nonfarm population: only asthma, untreated COPD, and hypercholesterolemia. The only area in which elevated incidence is consistently found is respiratory disease, which corresponds to our study results.³¹⁻³⁵ There is currently ample research implicating both organic and inorganic irritants in the farm environment as the cause.³⁶⁻³⁸ In general, the literature is mixed on the question of whether farmers have better chronic disease outcomes than the rural population, or about the same.³⁹⁻⁴² The only other major potential disease source is farm chemicals (particularly pesticides), with some studies finding a connection between pesticide use and certain cancers, Parkinson's disease, and diabetes.⁴³⁻⁴⁷ However, these effects appear to be limited to the subgroup of farmers who regularly handles chemicals, and so it is not surprising that these diseases do not have higher incidence in this study of the general farm population.

Lifestyle and Screening Factors

While farmers still appear to exercise more (doing farm work) and smoke less, they do not obtain regular screening and vaccinations with the same frequency as the general rural population. It is possible that the negative effects of these behaviors on chronic disease prevalence are mitigated by the lower smoking and higher exercise rates among farmers. No single factor in the logistic models could explain associations with farm status. However, there could be socioeconomic or cultural influences. Unfortunately, this study was not able to measure such factors in order to better explain the difference in prevention behavior between farm and nonfarm rural populations.

Implications

It seems that whatever advantages may be conferred to the farm population in rural New York by an agricultural lifestyle are diminishing to the point where the population's health status is nearly indistinguishable from that of the nonfarm population. On the other hand, screening and other forms of secondary prevention lag significantly within the farm population, most notably with

having a regular health care provider. Overall, these data suggest that New York farmers are not only less engaged with their own health care than nonfarmers, but they are also less engaged than farmers in other regions of the United States.^{14,16,31} Although the study did not measure health care availability directly, it is very unlikely that differential access to care can account for these observed differences. This is because the entire 7-county study region is in the catchment area of a single integrated health care network.

The New York Center for Agricultural Medicine and Health has established a mobile health screening unit that can travel to remote rural locations where farmers and their families can easily access services. This study indicates that the most critically needed mobile services are blood pressure measurement, patient education and support for farmers with respiratory conditions, dental hygiene, referral and support in obtaining a regular primary health care provider, and encouragement of participants to obtain colonoscopy and Pap smear screening when appropriate. In addition, since many farmers reported having privately purchased health insurance, an insurance coverage review would be appropriate given the lower rates and greater coverage that may now be available with the implementation of the Affordable Care Act.

Limitations

These results must be interpreted with caution in light of the self-reported nature of the data, and in particular the difficulty of precisely measuring certain indicators such as smoking and physical activity. However, since this study is a comparison of 2 groups that are equally subject to these limitations, the differences between the groups are nonetheless noteworthy. The fact that farm exposure was measured using the survey response "worked in agriculture most of life" is also a limitation. Given that there could be a broad range of farm exposures within that definition, it would seem that the analysis would only identify large differences between farm and nonfarm populations. It must also be recognized that this comparison is as much about the agricultural population as a demographic group as it is about the effect of farm exposures themselves. This is because there is no way to control for all of the demographic differences between the 2 populations in the analysis without a much larger study.

Conclusions

While differences in disease status are found between farmers and rural nonfarmers only for a few conditions,

significant differences are widespread among prevention indicators. The agricultural population performs more poorly in having a regular medical care provider, obtaining dental care, and obtaining health screening, even when controlling for demographic differences. These are all areas where outreach and education can have an impact, if appropriate networks within the agricultural community are utilized.

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