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*The Well-Being of U.S. Farm Workers: A Look at Health**

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This paper examines the health of farm workers in the United States. Although farm workers constitute a small fraction of the overall U.S. workforce, their health is of special concern because of greater exposure to toxic chemicals, work-related injuries, and other occupational hazards. The U.S. agricultural sector is heavily dependent on hired farm workers who constitute about 30% of the agricultural labor force (farm operators and unpaid family workers comprise the other 70%). This dependence is likely to increase with the growth in more labor-intensive farm operations such as nurseries, fruit and vegetable farms, and dairy farms, and with the growth in the proportion of farm operators and their spouses seeking off-farm work.

This paper makes two distinct contributions to the literature on the health of U.S. farm workers. First, it provides a comprehensive look at farm workers' health by using a large set of health indicators, including overall health status, chronic health conditions, and obesity. While there is a growing epidemiological literature on the health of U.S. farm workers, much of it is focused on occupational and environmental risks specific to farm work and relies on regional or local data (Arcury and Quandt; Villarejo). Kamel et al. report on an effort to examine the health effects of pesticide exposure among farm workers in selected communities. The ongoing Agricultural Health Study, begun in 1993, investigates the effects of environmental, occupational, dietary, and genetic factors on the health of licensed pesticide applicators in Iowa and North Carolina. While these studies seek to provide better estimates of the incidence of

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injuries, cancer, and other health risks from farm work, little is known about the overall health and the prevalence of chronic health conditions among farm workers at the national level (Villarejo).

Second, although agricultural labor economists have long studied the well-being of farm workers, much of the focus has been on their employment, wages, and socioeconomic status relative to workers in other occupations (e.g., Mehta et al.; Runyan). Little attention has been paid to health, which is an important dimension of individual well-being. Concerns about the health of the U.S. population have been increasing due to the poor quality of diets, the rise in obesity, and the increase in associated health expenditures. By focusing on a wide array of health indicators and comparing health outcomes with those of workers in other occupations, this study contributes to a more comprehensive assessment of the well-being of farm workers.

This study is based on data from the 1997–2002 National Health Interview Survey (NHIS). The NHIS is a large-scale annual health survey that is the principal source of information on the health of the civilian, non-institutionalized, household population of the United States. To the best of our knowledge, only two studies have used NHIS data to examine the health outcomes in the agricultural workforce. Brackbill, Cameron, and Behrens used the 1986–1990 NHIS data to estimate the prevalence of selected health conditions and impairments among white male farmers. They concluded that pooling multiple years of NHIS data held promise for studying disease rates in small segments of the U.S. population. Fleming et al. matched the 1986–1994 NHIS data with records from the National Death Index to estimate the mortality rates among farmers and pesticide applicators. They did not examine other health outcomes. In this paper, we use the combined 1997–2002 NHIS sample to examine the health status of U.S. farm workers compared with construction laborers and with workers in all other occupations (all other workers).

Data and Methods

NHIS is a multi-purpose health survey conducted annually since 1957 by the National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention (CDC). NHIS data are collected through a personal household interview by Census interviewers. Each year's sample is representative of the civilian, non-institutionalized household population of the United States. The survey response rate has been consistently at or above 90% (National Center for Health Statistics).

The NHIS core questionnaire is revised every 10–15 years. The current core design was first implemented in 1997. The redesigned NHIS from 1997 onwards yields a family core that contains information on all persons in the family. The information includes sociodemographic characteristics as well as basic indicators of health status, including self-assessed health. In addition, one sample adult (eighteen years or above) from each family in the NHIS sample is selected randomly and information is collected from them in face-to-face interviews, yielding a sample adult core. This interview provides more detailed information on health conditions, health behavior, and health care access for the

sample adults. Annual NHIS samples with a common design can be pooled to generate representative samples of groups that form a small proportion of any given year's sample (Botman and Jack).

The employment status for the NHIS sample adults was determined if they reported working at a paying job, with a job or business but not at work, or working at a non-paying job in the previous week. From these individuals, farm workers were identified as "farm workers and other agricultural workers" with the Standard Occupational Classification (SOC) recode 29. For comparison, the remaining adults with an occupation recode were classified into two other groups: construction laborers (SOC recode 40), and all other workers. In the pooled 1997–2002 NHIS sample, 117,976 adults have a SOC recode. Of these, 2,026 were identified as farm workers, 900 were identified as construction laborers, and the remaining 115,050 constituted all other workers. After adjusting for sample weights, the share of workers in these three occupational categories works out to 1.55%, 0.75%, and 97.7%.

It is important to keep in mind that in agricultural labor studies, there is no common definition of the term "farm worker" (Stallones). In particular, much of the epidemiological studies of farm workers' health focus on migrant, seasonal, and often undocumented agricultural laborers (Villarejo). The National Agricultural Workers Survey (NAWS) is specifically designed to reach this migrant and seasonal farm labor population. The SOC system used in NHIS does not differentiate migrant and part-time workers from year-round farm laborers. Also the NHIS sampling scheme may miss undocumented migrant workers who constitute more than half of the farm workers in the NAWS (Mehta et al.). However, to the extent that the NHIS farm worker sample represents non-migrant hired farm labor, this may be an advantage since little is known about the health of this population (Stallones).

Table 1 reports some key sociodemographic characteristics of farm workers, construction laborers, and all other workers. Farm workers are overwhelmingly male and tend to be younger than all other workers. They have lower educational attainment and lower household incomes compared with all other workers. Almost all construction workers are male. In other respects, they are demographically closer to farm workers than to all other workers. The proportion of Hispanics among farm workers (33%) is higher than the proportion of Hispanics among all other workers (10%). Based on the 1995–1999 Current Population Survey, McNamara and Ranney report similar proportions of Hispanics among farm workers (34%) and all other workers (9%). However, these estimates are considerably smaller than the 90% of farm workers who are Hispanic in the 1997–1998 NAWS (Mehta et al.). The farm worker population identified in the present study is socioeconomically better off than the farm worker population in NAWS. Forty-three percent of farm workers have family income below 175% of the poverty line according to the NHIS sample, compared with 61% below 100% of the poverty line in NAWS.

A number of health indicators related to chronic diseases, cancer, mental health, injuries, body pain, health insurance, health care access, and health habits, are available for NHIS sample adults. In this study, we focus on the prevalence of hypertension, cardiovascular disease, respiratory disease, cancer,

Table 1. Characteristics of workers, NHIS 1997–2002

Characteristic	Farm Workers	Construction Laborers	All Other Workers
		Percent	
Male	81.3	98.0	53.0
Age 18–24	22.3	22.4	13.1
Age 25–34	23.5	27.1	23.5
Age 35–44	25.3	26.2	27.9
Age 45–64	25.0	21.8	32.5
Age 65+	3.9	2.6	3.0
Non-Hispanic white	58.7	61.7	75.2
Non-Hispanic black	6.0	10.3	10.8
Non-Hispanic other	2.4	1.0	4.2
Hispanic	33.0	27.1	9.9
Less than high school	43.0	37.2	11.2
High school	29.7	39.9	29.1
More than high school	27.3	22.9	59.7
Income–poverty ratio < 175%	43.1	32.5	15.7
Income–poverty ratio 175–349%	31.7	40.3	29.3
Income–poverty ratio 350%+	25.2	27.3	55.0
Home ownership	78.9	85.9	89.0
N	2,026	900	115,050

diabetes, joint pain, neck pain, lowerback pain, functional limitation, body weight status, smoking, and self-assessed health status. Both the crude and age-adjusted prevalence of these conditions are reported. Crude rates are percent occurrence of the condition in an occupational category across all age groups within that category. Age-adjusted rates account for the effects of different age distributions within each category compared with a standard age distribution (Klein and Schoenborn). Age adjustment was done using the direct method with the five age categories reported in table 1.

Besides age, other socioeconomic factors may account for the differences in health outcomes between farm workers, construction laborers, and all other workers. To better understand their role, multivariate logistic regression models were estimated for self-assessed status of health, cardiovascular disease, respiratory condition, and overweight/obesity. Self-assessed health status was assessed on a 5-point scale from 5 for "Excellent" to 1 for "Poor." This variable is used extensively in health economics and epidemiological research as an indicator of an individual's overall health status. The cardiovascular disease indicator was defined as the occurrence ever of any of the following conditions: coronory heart disease, angia pectoris, heart attack, heart condition, heart disease, or stroke. Respiratory condition is defined as having been told by a doctor during the previous twelve months that the individual has hayfever, sinusitis, or chronic bronchitis. Overweight/obesity status was determined by

the body mass index (BMI) computed from self-reported height and weight. Following public health guidelines, individuals with BMI at or above twenty-five were classified as overweight/obese. Given the 5-point ordered scale, an ordered cumulative logit model was used for self-assessed health status. Binary (1/0) logit models were used for cardiovascular disease, respiratory disease, and overweight/obesity.

The NHIS data are collected using a complex sample design involving multi-stage sampling with stratification and clustering. Sampling weights and design information provided with the data have to be used in order to obtain unbiased estimates and to make statistically valid population inferences (National Center for Health Statistics). This is accomplished in the present study using the SUDAAN software for all estimation and hypothesis testing.

Results

Table 2 reports crude and age-adjusted prevalence of selected health conditions among farm workers, construction laborers, and all other workers. For most indicators, age-adjusted prevalence rates are higher than crude prevalence rates, reflecting the fact that the age distribution is tilted toward

Table 2. Prevalence of selected health conditions by occupational category

	Farm Worker		Construction Laborer		All Other	
Health Indicator	**Crude**	**Age-Adj.**	**Crude**	**Age-Adj.**	**Crude**	**Age-Adj.**
			Percent			
Hypertension	13.64	18.70	12.13	17.80	16.45	21.00*
Cardiovascular disease	5.55	7.65	4.33	6.37	6.96	9.64*
Respiratory disease	8.17	7.92	5.65	6.65	9.60	9.59**
Cancer	2.19	4.03	0.63	1.64**	3.88	5.82**
Diabetes	2.50	3.48	2.09	3.87	3.41	4.61**
Respiratory condition	13.97	13.64	10.59	11.76	22.56	22.24***
Joint pain	23.11	26.79	24.90	29.37	27.09	29.51**
Neck pain	11.37	12.35	11.56	12.75	13.74	13.32
Lowerback pain	26.85	28.67	25.57	25.52	26.07	25.88*
Functional limitation	18.80	22.61	14.54	17.81**	21.98	25.43**
Obese	19.33	19.33	22.14	22.21	21.12	20.77
Overweight, not obese	37.81	40.84	41.20	44.83	36.32	37.20**
Current smoker	30.02	27.91	35.50	32.20*	24.93	23.06***
Self-assessed health status						
Excellent/very good	67.47	63.19	68.23	64.54	72.98	70.52***
Good	24.42	27.17	25.55	26.90	21.98	23.56***
Fair/poor	8.12	9.63	6.22	8.56	5.04	5.92***

Note: The asterisks indicate significant difference in age-adjusted prevalence of the condition between farm workers and the respective occupational category; ***$p < 0.01$; **$p < 0.05$; *$p < 0.1$.

younger adults in the occupational categories compared with the standard age distribution for adults (eighteen years and above) in the United States. Farm workers have lower age-adjusted prevalence of the six chronic diseases—from hypertension to respiratory condition—compared with all other workers. Construction laborers have prevalence rates similar to farm workers, although the incidence of cancer is lower. While the occurrence of joint pain is three percentage points lower among farm workers compared with all other workers, the occurrence of lowerback pain among farm workers is three percentage points higher than among all other workers.

The 19% age-adjusted obesity prevalence among farm workers is not statistically different from obesity among the two other occupational categories. However, the age-adjusted prevalence of overweight (not obese) is higher among both farm workers and construction laborers compared with all other workers. Twenty-eight percent of farm workers are current smokers, which is five percentage points higher than among all other workers. Among construction laborers, smoking is even higher (32%). Only 63% of farm workers report being in excellent or very good health, compared with almost 71% of all other workers. At the other end of the self-assessed health scale, nearly 10% of farm workers report being in fair or poor health compared with 6% of all other workers.

Table 3 reports odds ratios and their 95% confidence intervals for covariates regressed on self-assessed health status, cardiovascular disease, respiratory condition, and body weight status (overweight/obese). The results suggest that there are strong health gradients for age and socioeconomic status. Health declines with age and improves with income and education. Significant racial and ethnic disparities in self-assessed health and overweight/obesity are evident. Non-Hispanic blacks are 42% more likely, and Hispanics are 16% more likely, to be in a lower self-assessed health category compared with non-Hispanic whites. Women have poorer health outcomes than men, except for weight status. Smoking increases the odds of being in a lower self-assessed health category than non-smokers. Smoking also worsens cardiovascular and respiratory outcomes, although smokers tend to have lower body weight. These results are in agreement with previous findings on the influence of socioeconomic status and smoking on health outcomes.

Turning to the main results of interest, inferences about the differences in health outcomes between farm workers and all other workers are somewhat different when the effects of sociodemographic characteristics besides age are taken into account. Farm workers (and construction laborers) are more likely to be male, younger, less educated, low income, and be a smoker compared with all other workers. After adjusting for these differences, farm workers' self-assessed health status is not significantly different from that of all other workers. While farm workers are about 4% more likely to be overweight/obese than all other workers on an age-adjusted basis (table 2), they are 25% less likely to be so on a multivariate adjusted basis (table 3). Farm workers are less likely to have a respiratory condition compared with all other workers. However, unlike in the age-adjusted case, the multivariate-adjusted odds ratio suggests no significant difference in the occurrence of cardiovascular disease between farm workers and all other workers.

Table 3. Multivariate logistic regression results for selected health indicators: Odds ratio (95% confidence interval)

Covariate	Self-Assessed Health[a]	Cardiovascular Disease	Respiratory Condition	Overweight/Obese
Age	1.045 (1.039–1.054)	1.024 (1.010–1.037)	1.062 (1.053–1.071)	1.119 (1.110–1.128)
Female	1.185 (1.154–1.217)	1.101 (1.036–1.169)	1.779 (1.710–1.851)	0.411 (0.397–0.425)
Non-Hispanic black	1.418 (1.349–1.490)	0.800 (0.723–0.884)	0.798 (0.747–0.853)	1.842 (1.749–1.940)
Non-Hispanic other	1.279 (1.185–1.381)	0.628 (0.509–0.775)	0.682 (0.612–0.760)	0.476 (0.429–0.529)
Hispanic	1.157 (1.100–1.216)	0.616 (0.549–0.691)	0.618 (0.576–0.662)	1.354 (1.128–1.436)
High school	0.738 (0.699–0.779)	0.999 (0.891–1.121)	1.123 (1.048–1.204)	1.009 (0.951–1.071)
More than high school	0.523 (0.496–0.550)	1.107 (0.992–1.234)	1.390 (1.295–1.492)	0.859 (0.812–0.909)
Income 175–349% FPL	0.737 (0.705–0.771)	0.864 (0.791–0.943)	1.043 (0.984–1.105)	0.991 (0.944–1.041)
Income 350%+ FPL	0.504 (0.481–0.529)	0.802 (0.736–0.874)	1.004 (0.945–1.067)	0.875 (0.832–0.920)
Home ownership	0.942 (0.904–0.982)	0.868 (0.791–0.954)	1.010 (0.960–1.064)	1.084 (1.032–1.138)
Smoker	1.575 (1.527–1.625)	1.090 (1.018–1.167)	1.076 (1.033–1.120)	0.715 (0.691–0.740)
Family size	0.950 (0.941–0.960)	0.968 (0.947–0.989)	0.992 (0.980–1.004)	1.058 (1.046–1.071)
Farm worker	0.955 (0.861–1.060)	0.972 (0.742–1.272)	0.783 (0.645–0.950)	0.749 (0.661–0.849)
Construction laborer	0.805 (0.680–0.952)	0.787 (0.524–1.183)	0.627 (0.457–0.860)	0.885 (0.721–1.087)
Chi square[b]	2936.9	1506.8	824.1	371.9

[a]Estimates are odds of being in a health category $\leq$k, where k = 1,. . .,5 with 1 = poor and 5 = excellent.
[b]Chi square is distributed with 22 degrees of freedom (df) for self-assessed health status and 19 df for the other indicators.
Note: All regressions included age squared and dummy variables for region (Midwest, South, and West) as additional covariates.

Discussion

The findings of this study suggest that, adjusted for age and socioeconomic status, farm workers are not in worse health compared with workers in other occupations (other than construction work). In some respects, such as body weight status and respiratory conditions, they are in better health compared with all other workers. These findings, however, have to be cautiously interpreted for three reasons. First, as noted earlier, the farm worker population identified in this study likely underrepresents seasonal and migrant farm worker population identified in other studies of farm labor. Therefore, our results cannot be generalized to all farm workers. Second, this study does not take into account the likely bi-directional causality between occupational choice and health. While occupation may affect health outcomes, health may influence employment in a particular occupation as well. This may be particularly true of occupations requiring physical labor, such as farming and construction work. This study does not sort out these causal pathways. Rather, it presents a snapshot of the health status of the current farm worker population as identified in the NHIS data. Third, although farm worker population may be in as good or better health compared with all other workers, they may have lower access to health care, which could impair their future health status. This is a topic for future study.

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