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The Impacts of Farm Work on Health: Analyses of the Hispanic Health and Nutrition Examination Survey¹

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Farmworkers long have been recognized as a disadvantaged group with a wide range of occupationally related health problems. A coherent picture of the major health problems faced by agricultural workers has begun to emerge. This study presents data from the Hispanic Health and Nutrition Examination Survey (HHANES) on the effects of ever having participated in farm work on health status. Thus, it provides the first national level perspective on the health of people who have participated in farm work with a focus on Hispanics. People with farm work experience considered themselves to be in worse physical health and had experienced more work-related disabilities than other Hispanics.

Farmworkers have long been recognized as a disadvantaged group with a wide range of occupationally related health problems (Steinbeck, 1939; McWilliams, 1939; Coles, 1967). However, it has only been recently that a number of publications with careful documentation of these problems have appeared (Johnston, 1985; Wilk, 1986; Sakala, 1987; Littlefield and Stout 1987; Rural Opportunities, 1988; Frisvold *et al.*, 1988). While considerable

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research is still needed to understand the relationship between the short- and long-term effects of the occupational hazards of farm work, a coherent picture of the major health problems faced by agricultural workers has begun to emerge.

This article presents data from the Hispanic Health and Nutrition Examination Survey (HHANES) on the effects of ever having participated in farm work on health status. Thus, it provides the first national level perspective on the health of Hispanics who have participated in farm work. This focus on Hispanics is particularly important since they are the ethnic group most heavily involved in agricultural labor in the United States. A study of the health of these workers is also important since migrant workers often are less organized and thus less able to advocate for occupational health and safety issues.

The recent review by Sakala (1987) and report by Wilk (1986) indicate that the consequences of pesticide exposure, poor field sanitation, work-related injuries, crowded living conditions, and sunlight exposure account for the major health problems of farmworkers. Agricultural work has one of the highest occupational mortality rates and injury rates of any industry, comparable to mining and construction and significantly higher than all other occupations. There are a variety of acute illnesses that are the specific results of occupational exposures, and a number of chronic conditions that are the result of long term involvement in farm work and the more general disadvantaged social position of farmworkers. An increase in psychological symptoms has also been identified as a consequence of the stress of farm work and labor migration (Vega, Scutchfield *et al.* 1985; Vega, Warheit and Palacio, 1985).

Across a number of studies of farmworkers, a similar list of frequent health problems emerges. Wilk (1986) cites dermatitis, injuries, respiratory infections, musculoskeletal ailments, eye problems, gastrointestinal problems, hypertension and diabetes as the major health problems seen at migrant health clinics. These problems are similar to those reported in studies in Florida, Idaho, Wisconsin and New York (Blewais *et al.*, 1977; Slesinger, 1979; Sakala, 1987). In addition to the problems listed above, a recent study in Colorado (Littlefield and Stout, 1987) identified dental problems, headaches and stress-related problems as significant concerns. A recent study of farmworker use of health services in New York, New Jersey, Ohio and Pennsylvania identified a similar list of health concerns both through interviews with medical providers at migrant health services and with farmworkers (Rural Opportunities, 1988).

Different health problems are associated with different forms of occupational exposure.² Acute pesticide exposure, particularly absorption through the skin from spraying and residues on plants, can cause eye problems, skin irritation and a variety of respiratory ailments (Schuman and Dobson, 1985). Dizziness and headaches are common symptoms of exposure to organophosphate pesticides (Wilk and Davis, 1986). More serious consequences of acute exposure, including death, are less well documented but reported in the literature (West, 1964). The long-term effects of pesticide exposure are very poorly understood and all publications on the issue call for more research into this urgent health question.

Exposure to sunlight, an occupational hazard particularly severe for farmworkers, can lead to heat stress, especially in the absence of adequate supplies of potable water. Cataracts and other eye problems also result from unprotected exposure of the eyes to ultraviolet radiation. Skin malignancies are also associated with long-term exposure to solar radiation.

Injuries, particularly to the back and the other parts of the musculoskeletal system, are a significant form of occupational morbidity associated with farm work. The rate of occupational injuries from farm work is second only to construction, and farm work has the highest rate of disabling injury of all occupational categories (Whiting, 1975; Wilk, 1986; Sakala, 1987).

Poor field sanitation and the lack of potable water underlie a number of health problems (Noble, 1987). High rates of gastrointestinal complaints and parasitism are associated with lack of potable water and sanitary facilities in the fields (Ortiz, 1980; Frisvold *et al.*, 1988). Pesticide exposures are made more severe because of the lack of adequate washing facilities in the fields and at farmworker residences.

In addition to the occupational health hazards outlined above, lack of access to health services due to high mobility, inadequate health insurance coverage, poverty and disadvantaged social status are all associated with poor health for farmworkers (Blewais *et al.*, 1977; Slesinger, 1979; Johnston, 1985; Littlefield and Stout 1987; Rural Opportunities, 1988). The synergistic effects of the occupational exposures with these social variables make farmworkers a population at high risk for health problems. This study examines the health consequences of these factors for Hispanics who have ever participated in farm work.

HISPANICS, MIGRATION AND FARM WORK

Hispanics have been actively involved in farm labor for decades. At some periods, migration from Hispanic countries for farm work has been encour-

² This section of the paper relies on the discussion by Sakala (1987) of the relationship between occupational hazards and particular health problems.

aged and facilitated by the U.S. government, such as the Bracero Program with Mexico and labor contracts with the Commonwealth of Puerto Rico (Bean and Tienda, 1987; Bonilla, 1986; Maldonado-Denis, 1980; Pedraza-Bailey, 1985; Portes and Bach, 1985). At other times and often concurrently, migrations have been unorganized and have reflected the lack of employment opportunities at home and the pull of jobs in the United States. Many Hispanics resident in the mainland United States have and continue to be actively involved in farm work as their primary occupation, as a survival strategy when other jobs are no longer available or as a way to supplement low incomes. Significant numbers of Hispanics have left farm work to work in the industrial and service sectors of urban areas with mixed success. Each group's history of migration has led to different opportunities and pressures to work in agriculture and other kinds of employment.

Many Mexican Americans have been living in what is now the southwestern United States since the sixteenth century and many more are recent immigrants from rural and urban areas of Mexico. There is considerable intragroup diversity in the length of residence in the United States (and the legal status of that residence) depending on family background, time of entry into the United States, and the permanence of residence. There are wide variations in educational level, occupational status and income among Mexican Americans. These differences are also reflected in language use and in the knowledge of and preference for use of Spanish and English. Another intragroup difference is residence in a rural or urban area, with some Mexican Americans actively involved in agricultural occupations, while others work in the services and industrial sectors of large cities such as San Antonio and Los Angeles. All of these factors lead to high levels of intracultural diversity among Mexican Americans. At the same time, Mexican Americans, because of their proximity to Mexico and because of the strong communities they have developed throughout the southwest, have a strong cultural base from which to reinforce their cultural identity. Mexican Americans continue to be the most active group in farm work of the Hispanic groups in the United States (Bean and Tienda, 1985).

Cuban Americans are concentrated in Miami, Florida, with other urban centers of population along the eastern seaboard. While some Cubans migrated to the United States prior to the Revolution in 1960, the establishment of a large Cuban community post-dates the Revolution. Much of the intragroup diversity among Cubans mirrors the different waves of emigration from Cuba. The first groups to leave in the 1960s tended to be more educated and professional than later waves of emigration. In addition, the first migrants were aided by the U.S. government to establish themselves in the United States with loans to start businesses and programs to aid the

transfer of their professional credentials (Pedraza-Bailey, 1985). Later migrants have not received such assistance. As a group, Cubans have the highest levels of socioeconomic status of all Hispanic groups. They also have the highest rate of retention of Spanish as their primary language. A salient feature of the Cuban social experience in the United States is the division of families between those who live in the United States and those who remain in Cuba. Farm labor is much less common for Cuban Americans. It is likely that a significant number of those reporting farm work experience had that experience in Cuba prior to migration. Farm work experience in the United States is most likely limited to more recent and more economically disadvantaged immigrants from Cuba.

Puerto Ricans in the United States are concentrated in the New York metropolitan area with significant Puerto Rican communities in other northeastern cities. In socioeconomic terms, Puerto Ricans are a disadvantaged group. Puerto Ricans are United States citizens and are free to move back and forth from the island of Puerto Rico to the mainland. The United States government has played an active role in controlling the economy of the island, including a major effort to industrialize the island starting in the 1960s, and there have been several attempts to make English the language of instruction in schools and of daily life. In cities like New York, there is now at least a generation of Puerto Ricans who have lived all of their lives on the mainland, many of whom use English as their primary language. Puerto Ricans on the mainland are highly urbanized and suffer similar stresses to other economically disadvantaged groups in U.S. cities. While Puerto Ricans have easier access to social ties on the island, their ties to an autonomous culture are more tenuous than either Mexicans or Cubans, because Puerto Rican culture has been more dramatically transformed by almost a century of American influence. Puerto Rican involvement in farm work on the mainland has been organized by government programs to bring workers to the vegetable and nursery farms of New Jersey and the tobacco farms of the Connecticut River Valley. Current residents of the New York metropolitan area with farm work experience either left farm labor to enter the industrial or service sectors of the urban economy or had some farm experience in Puerto Rico.

METHODS

Hispanic Health and Nutrition Examination Survey (HHANES)

The data for this study of the health effects of participation in farm work come from the Hispanic Health and Nutrition Examination Survey

(HHANES). The Hispanic HANES, which was conducted between 1982 and 1984, consists of a medical history, a physical examination and several other health measures designed to identify significant pathology for samples of 7,462 Mexican Americans in the five southwestern states, 2,834 Puerto Ricans in the New York area, and 1,357 Cubans in Miami, Florida. While the Hispanic HANES includes individuals from 6 months to 74 years of age, the present analysis is based on Mexican American, Cuban American and Puerto Rican adults (20 years and older). These data are, to date, the best available on the physical health of large representative samples of Hispanics in the United States (*see* National Center for Health Statistics, 1985, for the details of the development of the survey, the translation of the instruments and the conduct of the physical examination). The determination of Hispanic ethnicity is based on a self-identification as Mexican, Mexican American or Chicano in the southwest; Puerto Rican or Boricuan in the New York City Area; and Cuban or Cuban American in Miami. The developers of the HHANES purposely avoided exploration of migration issues because they were concerned that this would discourage participation of large numbers of Hispanics. The Hispanic HANES contains considerable sociodemographic information on the individual and economic information on his or her family. In addition, respondents are given the choice of faking the interview in English or in Spanish. Preliminary analyses revealed that language of interview is an excellent behavioral measure of degree of acculturation and ethnic identification (Angel and Guarinaccia, 1989; Guarinaccia *et al.*, 1989).

Measure of Farm Work Participation

The measure of farm work participation used in this study is the response to question L1: "Have you ever done farm work, either paid or unpaid? Some examples of farm work are working with crops or animals and supervising other workers on farms or orchards" (National Center for Health Statistics, 1985:243). In response to this question, 1,681 (41%) Mexican American adults, 253 (21%) Cuban Americans and 226 (10%) Puerto Ricans reported ever having participated in farm work.

This is a very gross measure of farm work experience and the results of the following analyses should be interpreted cautiously. This measure of farm work participation neither specifies the kind of farm work nor the length of involvement in agricultural labor. The results of our analysis are likely to be conservative since we combine people with limited farm work experience and those actively involved in intensive farm work as annual migrant laborers.

While more specific questions about farm work are asked in the HHANES interview, these only refer to involvement in farm work in the past year. Only 5 percent of Mexican Americans and less than one percent of Cuban Americans and Puerto Ricans sampled are currently engaged in farm work. For most analyses, the small number of respondents produce analyses that would be neither meaningful nor stable. However, for Mexican Americans, it was possible to compare those involved with farm work in the past year to those with and without prior farm work experience for some of the analyses. The sampling frames of the HHANES focus on urban dwellers in the northeast and in Miami, excluding rural workers living in southern New Jersey and in rural Florida.

Analytic Strategies

The data analysis strategies in this article are necessarily exploratory. The first stage involves bivariate analyses using chi square and analysis of variance procedures. Differences are identified between those who have ever worked on farms and those who have no farm work experience on several social and health status indicators. The models are presented separately for each ethnic group.

In the second stage, we develop a series of multivariate models using three health measures as dependent variables: 1) self-assessed health; 2) number of self-reported chronic conditions; and 3) reports of work-related disability. The predictor variables include sociodemographic characteristics and farm work participation. They are entered into each regression equation to assess the relative contribution of farm work participation to health (*see*, Appendix for the coding of variables used in the regression analyses).

RESULTS

Sociodemographic Characteristics

Hispanic Americans, particularly Puerto Ricans and Mexican Americans, experience significant disadvantage in terms of standard socioeconomic measures. However, there are important subgroup differences among Hispanics. One important source of intergroup difference emerges when comparing the sociodemographic background of people with farm work experience to persons with no farm work experience.

Cuban Americans tend to be older than either Mexican Americans or Puerto Ricans and there are no differences in average age between Cuban Americans with and without farm work experience. This is likely to reflect the quite different histories of migration of the three Hispanic groups. The

rates of marriage among Puerto Ricans are lower than the other two Hispanic groups, and there is no significant difference between people who had or had not worked in farm labor. This reflects the higher rate of family disruption among New York area Puerto Ricans. Puerto Ricans also report lower incomes than the other groups and have no differences between farm workers and those without farm work experience. Again, this reflects the particularly disadvantaged status of Puerto Ricans on the mainland compared to other ethnic minority groups. Cuban Americans were much less likely to be interviewed in English than Mexican Americans or Puerto Ricans. This reflects the recency of migration of Cuban Americans, the older average age of this group, and the Hispanic character of Miami where daily life can easily be carried out in Spanish.

Overall, Hispanics with farm work experience tend to be older, male, less educated, poorer and less likely to speak English well than other members of their reference group (see, Table 1). One source of support that is more common among those with farm work experience is marriage. These differences suggest that having been employed in farm work is associated with lower socioeconomic status. With the data available in the HHANES, it is not possible to ascertain whether farm work led to lower socioeconomic status or whether those who were already disadvantaged entered farm work as one of a limited number of employment options.

For those Mexican Americans who had been involved in farm work in the past year, the indicators of socioeconomic disadvantage are more pronounced. Current farmworkers are much more likely to have low incomes and are less likely to report high incomes than either those with previous farm work experience or no involvement in agricultural labor. Current farmworkers were also more likely to take the interview in Spanish, indicating both more recent migration and lower levels of education. The general pattern that emerges is that those currently involved in farm work are the most disadvantaged, followed by those with previous farm work experience. Those without farm work experience have higher levels of education and income.

Health Status Measures

Those who have worked in farm work tend to report worse health than Hispanics who have no farm labor experience (see, Table 2). Given the lower socioeconomic status of those with farm work experience, it is difficult to separate the negative effects of farm work from the vicissitudes of poverty on poor health. As stated previously, poverty and farm work are likely to have synergistic, rather than independent, effects on health.

TABLE 1
SOCIODEMOGRAPHIC CHARACTERISTICS OF HISPANICS EVER PARTICIPATING IN FARM WORK (% OF CATEGORY)

	Mexican American		Cuban American		Puerto Rican	
	Farmwork	No Farmwork	Farmwork	No Farmwork	Farmwork	No Farmwork
Mean Age	41.8	38.7 ^b	46.9	46.9	47.0	41.1 ^b
Sex						
Male	62.8	36.8 ^b	76.6	36.2 ^b	66.7	35.1 ^b
Female	37.2	63.2	23.4	63.8	33.3	64.9
Marital						
Married	75.6	71.1 ^b	77.3	68.6 ^a	56.0	50.5
Other	24.4	28.9	22.7	31.4	44.0	49.5
Mean Yrs Education	8.1	9.6 ^b	9.1	10.7 ^b	7.7	9.8 ^b
Income						
<4,999	10.6	8.4 ^b	13.6	6.7 ^b	18.6	18.7
5-14,999	40.4	36.2 ^a	37.4	32.1	46.4	42.0
15,000 +	49.0	55.4 ^b	49.1	61.2 ^b	35.0	39.3
Language						
English	54.7	63.3 ^b	18.8	18.4	31.1	43.5 ^b
Spanish	45.3	36.7	81.2	81.6	68.9	56.5
N	1,428	2,648	229	931	193	1,413

Notes: Differences reported are based on the use of chi-square or t-test.

^a $p < 0.01$.

^b $p < 0.001$.

TABLE 2
GLOBAL HEALTH ASSESSMENTS OF HISPANICS EVER PARTICIPATING IN FARM WORK (% OF CATEGORY)

Physician's Assessment	Mexican American		Cuban American		Puerto Rican	
	Farmwork	No Farmwork	Farmwork	No Farmwork	Farmwork	No Farmwork
Excellent/Very Good	84.6	84.8	60.6	65.8	41.7	54.4 ^b
Good	11.4	11.2	35.6	29.2	43.6	34.4
Fair/Poor	4.0	4.0	3.9	4.9	14.7	11.2
N	1,186	2,189	180	694	163	1,123
Self-assessment						
Excellent/Very Good	26.4	30.8 ^c	23.6	35.4 ^c	19.0	27.0 ^a
Good	32.5	36.0	41.9	39.5	28.2	28.0
Fair/Poor	41.1	33.2	34.5	25.0	52.8	45.1
N	1,428	2,647	229	931	195	1,438
Work-related Disability						
Yes	17.0	10.6 ^c	13.2	12.9	28.6	14.9 ^c
N	1,427	2,644	227	928	192	1,431
Mean CES-D	7.3	8.1 ^c	5.2	5.8	13.0	13.1
N	1,134	2,103	168	655	164	1,125

Notes: Differences reported are based on the use of chi-square or t-test.

a p < 0.05.
b p < 0.01.
c p < 0.001.

Except for Puerto Ricans, physicians assessed people's health as being quite good and found few differences between those with and without farm work experience. This table also shows that physicians' assessments of health revealed few differences between those with and without farm work experience. On balance, the physicians evaluated Mexican Americans and Cuban Americans as being in good health while Puerto Ricans with farm work experience were in poorer health. Even when considering Mexican Americans currently involved in farm work, the physicians evaluated their health as excellent or very good at similar levels to other Mexican Americans. Overall, physicians reported the health of Hispanics to be excellent or very good, although self-reports of their health were more likely to be good or fair (Angel and Guarnaccia, 1989).

The levels of self-assessed health are strikingly different from those of the physician. Current or former farmworkers report their health as fair or poor at relatively high rates and their self-reports of global health status are consistently worse than those without farm labor backgrounds. Mexican Americans currently involved in farm work reported worse health than those who had ever worked in farm jobs (50% of the current group reported their health as fair or poor as compared to 40% of the group who had ever participated in farm work).

Mexican Americans and Puerto Ricans with farm work experience also report much higher levels of work-related disability. Disability was measured by the response to the following question (#J40): "Have you ever changed your job, stopped working or made any changes in your household because of a disability or health problem?" (National Center for Health Statistics, 1985:241). Those Mexican Americans currently involved in farm work reported more disability than those who had never worked in agricultural labor, but less than those with a history of farm work experience. This finding further strengthens the association between farm work and work-related disability.

In this sample as compared to other studies, farm work experience did not correlate with an increase in depressive affect (Vega, Scutchfield *et al.*, 1985; Vega, Warheit and Palacio, 1985). In the HHANES, all respondents were asked to fill out the Center for Epidemiologic Studies Depression Scale (CES-D), which is a symptom checklist containing twenty common symptoms of depressed affect. The CES-D works best as a measure of distress or demoralization, rather than as a diagnostic criteria for depression. For Mexican Americans, farm work participation correlated with fewer depression symptoms.

Respondents were also asked to report whether they suffered from a wide range of chronic health problems (Table 3). Significant differences were

TABLE 3
CHRONIC CONDITIONS REPORTED BY HISPANICS EVER PARTICIPATING IN FARM WORK (% OF CATEGORY)

	Mexican American		Cuban American		Puerto Rican	
	Farmwork	No Farmwork	Farmwork	No Farmwork	Farmwork	No Farmwork
Tuberculosis	3.1	2.5	0.9	0.4	0.5	2.4
Anemia	14.6	19.4 ^c	17.0	20.8	22.5	24.7
Diabetes	7.8	5.9 ^a	3.9	4.3	8.2	7.5
High BP	23.7	20.6 ^a	31.0	29.5	36.4	31.0
Gallstones	9.4	9.1	4.8	10.0 ^b	8.2	7.0
Emphysema	1.0	0.6	1.3	1.3	2.0	1.5
Bronchitis	3.8	5.3 ^a	5.7	5.5	10.8	9.5
Rheumatic Fever	1.9	1.6	2.2	1.1	5.1	2.5 ^a
Rheu Heart Dis	0.6	0.4	1.3	0.3	2.6	1.2
Heart Murmur	3.4	4.3	4.4	2.7	6.2	6.6
Heart Failure	1.2	0.8	0.4	1.5	7.2	3.1 ^b
Heart Attack	2.4	1.4 ^a	2.6	2.7	6.7	2.7 ^c
Kidney Problem	12.3	12.2	22.3	14.1 ^c	16.9	10.9 ^a
Cirrhosis	0.6	0.6	0.4	0.4	2.6	0.7 ^b
Hepatitis	2.0	2.3	7.0	7.6	2.0	2.6
Yellow Jaundice	1.7	1.4	4.4	3.3	1.5	1.0
Stroke	1.3	0.8	1.3	0.3	1.5	0.8
Glaucoma	0.7	0.8	1.8	0.9	1.5	1.3
Cataracts	4.8	2.7 ^c	6.1	5.2	7.7	4.0 ^a
Goiter	0.5	0.8	0.0	1.3	0.0	0.6
Thyroid	2.8	3.2	0.9	2.7	0.5	2.4
N	1,428	2,648	229	931	195	1,439

Notes: Differences reported are based on the use of chi-square.

^a $p < 0.05$.

^b $p < 0.01$.

^c $p < 0.001$.

found between those with and without farm work experience for several of the more common and severe health problems. For Cuban Americans, kidney problems were considerably more frequent among those who had worked in farm work than those who had never done agricultural labor. Wilk (1986) associates kidney problems in farmworkers with the lack of adequate sanitation and potable water facilities. Urinary retention, due to the lack of accessible toilets and the pressures of work, and dehydration, related to lack of drinking water in the fields, contribute to infection and damage of the kidneys. Puerto Ricans with farm work experience also reported higher levels of kidney problems.

Among Mexican Americans, diabetes, high blood pressure and heart attacks were all more common among those with farm work experience. Puerto Ricans also showed higher rates of high blood pressure and heart attacks in the farmworker group. Both pesticide exposure and heat stress have been related to heart disease and heart attack (Wilk, 1986). Diabetes and high blood pressure are more common among socially disadvantaged and older individuals. These disorders are likely to be the product of the interaction of farm work exposures, low socioeconomic status and older age.

Both Mexican Americans and Puerto Ricans with agricultural labor histories report higher rates of cataracts. Long-term, unprotected exposure to ultraviolet radiation from sunlight is associated with the development of cataracts. This is a significant problem for farm laborers who work long hours in the sun and are rarely provided with eye protection (Sakala, 1987).

Cirrhosis of the liver is also reported more frequently by Puerto Ricans with farm work experience. Excessive alcohol consumption is the most common cause of cirrhosis, although pesticides have also been shown to cause liver damage. While social isolation of male workers is a common problem for all farmworkers and a frequent cause of alcohol abuse, Puerto Rican migrant workers may be at particular risk because they have historically come alone from Puerto Rico to the northeastern United States to work on one farm from early spring to late fall (Bonilla Santiago, 1986:17). The pattern for many Mexican American workers who migrate has been to travel as family groups. While less has been written about Cuban farmworkers, one could surmise that their travels to agricultural areas in southern Florida would be a relatively short distance from the Miami area and would allow for frequent returns home.

The HHANES also included a physical examination in which current serious or life-threatening conditions were recorded using standard diagnostic groupings (in this case the ICD-9 system). While physicians reported fewer health problems than did respondents in their self-reports, the pattern

of physician diagnoses follows closely the self-reports of chronic conditions identified above (Table 4).

Mexican Americans with at least some farm work participation have more endocrine problems than Mexican Americans with no farm work experience. This reflects the high rates of diabetes reported in Table 3 and the higher rates among former and current farm laborers. In comparing former and current Mexican American farm laborers, there were no significant differences in either self-reported or physician-diagnosed conditions. The findings from the physical exam for Puerto Ricans are less clearly related to self-reports of chronic conditions and more difficult to interpret. The confluence of neurologic and respiratory impairment may relate to pesticide exposures, particularly organophosphates commonly used on fruit trees in the northeast. We must note, however, the lack of specificity of the farm work experience and diagnosis variables which makes this connection quite speculative.

Effects of Farm Work Participation on Health Status

To summarize the analyses of the effects of farm work participation on the health status of Hispanics in the United States, we employed a series of regression analyses. As dependent variables, we predicted self-assessed health status; total number of self-reported chronic conditions; and reports of work-related disability for each ethnic group (Table 5). The independent variables included several sociodemographic factors, primarily used as controls, and previous participation in farm work.

In these equations, there is a fairly consistent association between age, socioeconomic status and health. The older a person was, the more likely he or she was to report worse health status (that is, to self-assess his or her health as fair or poor); to report more chronic conditions; and to have a work-related disability. Hispanics with low incomes experienced especially poor health and had a strong likelihood of work-related disability. Women reported worse self-assessed health and more chronic conditions than men in all Hispanic groups. These findings reproduce the consistent relationships between social status and health reported in the literature.

For Mexican Americans and Puerto Ricans, the two groups most involved in farm labor in the United States, farm work participation is significantly associated with work-related disability and was one of the strongest predictors of this health variable. Independent of age and socioeconomic status, farm work did not contribute to worse self-assessed health for these groups. Current farm work experience for Mexican Americans did not contribute to any of the regression equations, indicating that the negative health consequences of farm work measurable in the HHANES are more likely to

TABLE 4
PHYSICIAN DIAGNOSES OF HISPANICS EVER PARTICIPATING IN FARM WORK (% OF CATEGORY)

Diagnosis	Mexican American		Cuban American		Puerto Rican	
	Farmwork	No Farmwork	Farmwork	No Farmwork	Farmwork	No Farmwork
Infectious	0.1	0.3	0.4	0.4	0.5	0.2
Neoplasm	1.0	0.6	0.0	0.1	0.0	0.5
Endocrine	7.3	5.7 ^a	2.6	3.6	5.6	5.3
Blood	0.1	0.1	0.0	0.0	0.5	0.0 ^b
Mental	0.0	0.2	0.0	0.0	2.0	0.6 ^a
Nervous	1.5	1.3	0.4	1.1	5.6	2.4 ^a
Circulatory	10.5	9.1	14.0	11.2	12.8	10.2
Respiratory	0.5	0.6	0.9	0.6	6.2	3.3 ^a
Digestive	0.8	0.6	0.0	1.3	2.0	1.9
Genitourinary	0.6	1.1	0.9	0.6	1.0	0.6
Skin	0.1	0.2	0.0	0.5	0.0	0.2
Musculoskeletal	2.0	1.4	0.4	0.8	4.1	2.9
Congenital	0.2	0.3	0.0	0.0	0.0	0.0
N	1,428	2,652	229	931	195	1,439

Notes: Differences reported are based on the use of chi-square.

^a $p < 0.05$.

^b $p < 0.01$.

TABLE 5
REGRESSIONS PREDICTING HEALTH STATUS OF MEXICAN AMERICAN, CUBAN AMERICAN AND PUERTO RICAN ADULTS

Variables	Mexican American			Cuban American			Puerto Rican		
	Self-assessed ^a	Conditions ^a	Disability ^b	Self-assessed ^a	Conditions ^a	Disability ^b	Self-assessed ^a	Conditions ^a	Disability ^b
Age	0.13 ^c	0.21 ^c	0.04 ^c	0.18 ^c	0.13 ^c	0.01 ^c	0.23 ^c	0.18 ^c	0.03 ^c
Female	0.06 ^c	0.11 ^c	0.15	0.14 ^c	0.02	0.10	0.11 ^c	0.07 ^d	-0.21
Married	0.00	0.00	-0.11	0.05	-0.01	-0.37	-0.01	-0.05 ^c	-0.02
Education	-0.26 ^c	0.09 ^c	0.04 ^c	0.24 ^c	0.01	-0.04	-0.15 ^c	0.05	0.04
Low Income	0.09 ^c	0.08 ^c	0.56 ^c	0.10 ^c	0.10 ^c	0.85 ^d	0.16 ^c	0.14 ^c	1.29 ^c
Middle Income	0.14 ^c	0.06 ^c	0.30 ^d	0.11 ^c	0.09 ^d	0.73 ^c	0.15 ^c	0.08 ^d	0.82 ^c
Spanish Interview	0.11 ^c	-0.02	-0.10	0.05	0.00	0.10	0.08 ^c	0.02	-0.05
Farm work	0.01	0.02	0.61 ^c	0.12 ^c	0.05	0.07	0.02	0.08 ^c	0.78 ^c
R ²	0.20	0.06	0.06	0.21	0.03	0.03	0.21	0.06	0.06
N	3,657	3,631	3,655	1,039	1,025	1,034	1,488	1,465	1,479

Notes: ^a Standardized regression coefficients.

^b Logistic regression coefficients.

^c $p < 0.05$.

^d $p < 0.01$.

^e $p < 0.001$.

be the result of the cumulative effect of several years of farm labor, rather than the result of immediate exposures. For Puerto Ricans, farm work experience is associated with reports of more chronic conditions. Farm work participation is related to poor self-assessed health status for Cuban Americans. For Cubans, the more limited experience in farm work may result in more acute conditions that influence self-assessments of health, but not chronic conditions and disability. For Cuban Americans, there were few overall differences between those with and without farm work experience.

The most important results of these analyses are the strong relationship between farm work participation and work-related disability. This finding has both important substantive and policy implications. While there are not large differences between those with and without farm work experience in the kinds of conditions reported, there is a greater likelihood that people who have done farm work will change their work status as a result of poor health. This is probably attributable to both the strenuous nature of farm work and the greater severity of similar health conditions when exacerbated by farm work exposures. Both of these issues require more detailed study of current farmworkers and former farm laborers with disabilities. The study of Frisvold and colleagues (1988) indicates that respiratory conditions, but not gastrointestinal or muscular problems, greatly increase the likelihood that farmworkers receive unemployment compensation. Further research is needed on the kinds of health problems and the patterns of these problems which lead to work-related disability. For farm workers and their advocates, this finding further heightens the need for enhanced disability protection for farm workers and better protection against the disabling consequences of such work.

DISCUSSION

People with farm work experience consider themselves to be in worse physical health and have experienced more work-related disability than other Hispanics. While it is clear that this impoverished health status is the synergistic effect of age, low socioeconomic status and participation in farm work, some of the specific health problems reported suggest serious long-term consequences of the occupational and environmental exposures associated with agricultural labor discussed in the introduction of this article. Our findings point to the particular concerns Hispanics with farm work experience have with kidney problems, diabetes, high blood pressure, heart attacks, cataracts and liver disease. Farm work is most clearly associated with work-related disability as a result of potentially greater severity of such conditions for people who have worked in agriculture.

This study has significant limitations that temper conclusions based on the data presented. The farm work variable is not well operationalized in terms of either the type or duration of work in agriculture. This makes our results suggestive but not conclusive, as people with limited farm work experience are looked at together with those who have participated in agricultural labor for several years. Disability is a general self-report measure with all of the associated limitations of this kind of variable. Information on the nature of the disability and the timing of its effect on labor force participation cannot be ascertained from this data set. It is clear that both the physician assessments and self-reports indicate that those who have participated in farm work experience worse health. Finally, the retrospective nature of the study and the focus on chronic or currently acute problems means that many of the common health effects of farm work (such as dermatitis and symptoms like headaches and dizziness) do not appear in this study.

With these limitations in mind, some broad conclusions can be drawn by linking the data in this study with reports from other recent studies of the health of agricultural workers. Field sanitation and potable water are critical issues for which there are now basic federal legislation (Noble, 1987). Kidney and other genitourinary problems would be significantly improved by good field sanitation, adequate breaks to use lavatory facilities, and supplies of potable water to prevent dehydration. This conclusion is further supported by the findings of Frisvold *et al.* (1988) that lack of field sanitation on agricultural job sites increased reports of gastrointestinal disorders by 60 percent. Pesticide exposure needs to be significantly reduced and pesticide education is imperative to prevent the long-term effects of pesticide exposure on the development of cancer and on the neurological and reproductive systems of farmworkers. Protection from heat stress and sun exposure through appropriate clothing, eye protection and provision of potable water in the fields will help reduce negative effects on the circulatory system and prevent damage to eyes and skin. These problems are all areas of concern to farmworkers and their advocates, most thoroughly presented in the report by Wilk (1986).

Access to good quality health care that is sensitive to the particular needs of agricultural workers has been a key issue in migrant worker health advocacy and legislation (Johnston, 1985). Dealing with chronic problems like diabetes and hypertension require crucial contact with health services, continuity of care, health education and access to health care through insurance coverage. The data in the HHANES do not allow for the study of health service utilization during the specific periods when respondents were involved in farm labor. However, Hispanics have been generally described

as underutilizers of health care, and this would more likely be true of farmworkers, particularly during intense periods of farm labor. While there exists a network of federally-funded migrant health centers, their number and range of services are limited. When farmworkers seek care, they frequently use emergency rooms where providers may not be sensitive to the particular occupational health issues faced by farmworkers (Rural Opportunities, 1988). Thus, more provider education and a more comprehensive health care system for farmworkers is needed to deal with acute problems and prevent more chronic illnesses from developing.

Another important issue in the health of agricultural workers is their disadvantaged socioeconomic status. In addition to improved wages and worker compensation for overtime and seasonal employment, improving the educational level of farmworkers is a critical issue. The low levels of educational attainment of farmworkers influence their life chances in a number of ways, including access to alternative and higher paying employment, more knowledge about health threats and preventive measures, and better ability to advocate for themselves in the health care system and other arenas. The problems of poverty and inadequate education are compounded by often difficult legal status problems and the pressure to migrate to obtain sufficient work and income. Recent efforts at immigration reform have not adequately addressed the problems and needs of migrant farmworkers. A clear understanding of the myriad of factors that influence the health and well-being of farmworkers is called for in future research.

APPENDIX

MEASUREMENTS AND THEIR CATEGORIES

Variables	Categories
Independent	
Age	Continuous (range = 20-74)
Sex	1 Female 0 Male
Marital Status	1 Married 0 Not married
Education	Continuous (range = 0-17)
Low income	1 Income less than \$4,999 0 Otherwise

APPENDIX
(continued)

Variables	Categories
Middle income	1 Income between \$5,000-\$14,999 0 Otherwise
Language of interview	1 Spanish 0 English
Farm Work Experience	1 Ever done farm work 0 Never done farm work
Dependent	
Self-assessed Health	1 Excellent/Very good 2 Good 3 Fair/Poor
Chronic Conditions	Total number of self-reported chronic health problems (range = 0-17)
Disability	1 Changed work due to disability from a health problem 0 Did not change work

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CONFERENCE REPORTS

International Manpower Flows and Foreign Investment in Asia

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This conference, organized jointly by Nihon University and the East-West Center (University of Hawaii) brought together researchers, policy-makers and a small number of representatives of transnational corporations from within and outside the Asian region to evaluate the relationship between the flows of human resources and capital around the region. The conference examined both "traditional" worker migration, the migration of high-level manpower, permanent migration movements and the clandestine migration of illegal workers, an issue of growing concern in the region. In this context the location of the conference in Tokyo was most appropriate.

The Asian-Pacific region includes some of the world's largest and most rapidly growing economies. The response of the region's interdependent economic system to pronounced spatial inequalities has been to set in motion a combination of international resource flows. These include the movement of capital in the form of direct foreign investment and joint venture investment, generally from the more developed to the less developed countries within the region. Important to this conference, this flow of investment capital within and into the region has been accompanied by high-level manpower movements. The conference persisted in using this term, despite the growing feminization of international migration. Also included in the international resource flows within the region is a significant level of "low-level manpower migration," principally in domestic service, which is a response to differentials in earnings and employment opportunities within the region. While low-level manpower migration within the region is numerically much greater than high-level manpower migration which accompanies direct foreign investment and joint venture investment, the high-level manpower migration is nonetheless important because of its significance for economic, social and political relations within the region. Thus, labor and capital mobility within the Asian-Pacific region are both a