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ORIGINAL PAPER

Health care service utilization of documented and undocumented hired farmworkers in the U.S.

Tianyuan Luo[1] · **Cesar L. Escalante**[1]

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Abstract
This article analyzes issues related to U.S. hired farmworkers' utilization of health care services and their specific choices among health care provider and health bill payment method options. Using data from the National Agricultural Workers Surveys for the years 2000–2012, this article employs propensity score matching and probit estimation techniques to examine the health care utilization of hired farmworkers. This study's results indicate that undocumented hired farmworkers are 10.7 and 3% less likely to use U.S. and foreign health care, respectively, compared to documented farmworkers. Health insurance is found to significantly increase hired farmworkers' use of U.S. health care by 22.3%. Notably, compared to their documented working peers, undocumented workers are much less likely to patronize private clinics. They are even less likely to rely on migrant health centers even when these providers are their most viable sources of health care service.

Keywords Health care utilization · Hired farmworkers · Undocumented immigrants · Foreign health care

JEL classification I10 · J43 · I14

Introduction

Efforts aimed at sustaining a healthy labor force would not only promote individual health but also ensure a productive labor force that supplies the needs of a growing economy. This is particularly true for the agricultural sector whose production activities are relatively more dependent on the quality and quantity of its labor force than other industries [1]. Several studies have pointed out that the strenuous, rigorous nature of farm work and its greater physical demands, prevailing working conditions on farms, and the workers' lack of health knowledge and information could have significant adverse effects on the health of hired farmworkers in the U.S. [2–5]. This study adds to these key factors by introducing the significantly low patronage rates of health care services among hired farmworkers compared to the average American population. Rose and Quade [6] found that only 50% of farmworkers in California availed themselves of health care services in 2005, which is 25% lower than the utilization rate estimated for the non-hispanic white population in the U.S. [7]. The disparity in health care patronage could possibly lead to serious public health issues as well as inflict severe damages to the $374 billion U.S. farm sector if no attention and definitive actions are taken to improve the health care use patterns of U.S. hired farmworkers.

It is important to examine the health care utilization decisions of hired farmworkers[1] in general as well as stratified categories of these workers according to their legal statuses and health insurance benefits. Using data from the National Agricultural Workers Survey (NAWS), this study examines the health care use decisions of U.S. hired farmworkers involving choices between domestic and foreign health care services and choices among available health care provider alternatives. This study aims to identify the impact of legal (immigration) status and health insurance on the use of health care services among hired farmworkers to provide

✉ Cesar L. Escalante
cescalan@uga.edu

[1] Department of Agricultural and Applied Economics, University of Georgia, 305 Conner Hall, 147 Cedar St., Athens, GA 30602, USA

[1] The modifier "hired" is used to distinguish skilled and unskilled farmworkers who are actually hired by farm businesses from family members and business owners who also work on the farm.

valuable insights and implications that could help to eliminate the disparities in health care service patronage among hired farmworkers.

The changing political regimes and environments in the U.S. can significantly influence an ordinary resident's decisions on health care use. Several policies aimed at providing paths for more legitimate foreign labor hiring mechanisms, such as continued efforts to improve current H-2A guest farm worker visa program guidelines, have been suggested to reduce the relative disadvantages in health care use experienced by undocumented workers. The agricultural sector has been a major employer of workers who lack legal authorization to work in the country [8]. Current legislation and policies governing health benefits and insurance coverage clearly establish that any resident's unauthorized presence in the country will restrict access and utilization of health care services. This study provides an empirical estimation of the gap in health care use between documented and undocumented hired farmworkers. Results indicate that undocumented hired farmworkers are 10.7% less likely to avail themselves of health care services compared to their documented peer workers. Thus, this study confirms that legal status difference contributes to the health care use inequality among U.S. hired farmworkers. Moreover, this article also implies that policies aimed at either the legalization of undocumented workers' immigration status or improving implementing guidelines of the farm guest workers' (H-2A) visa program will encourage more hired farmworkers to receive proper and more affordable health care services in the U.S.

Against the backdrop of the current Trump administration that tries to overhaul the health care program launched by its predecessor, the impact of health insurance on health care use decisions attracts even more considerable attention. Under the policies of the previous Obama administration, hired farmworkers' enjoyment of health insurance benefits had been restricted due to institutional obstacles, such as the Affordable Care Act (ACA) that requires only companies with over 50 employees to provide health insurance. The nature of labor demand in most farm businesses allows for the seasonal employment of many hired farmworkers that automatically precludes them from enjoying full-time employment status. Even when these workers' employment tenure approximates full-time levels, their employers are usually small farm businesses that do not usually require more than 50 employees. Such farm workers' plight is expected to worsen when President Trump succeeds in introducing further restrictive health care reforms (such as the repeal of the ACA, the possible cancellation of Medicaid coverage on certain segments of the lower income population, elimination of insurers' subsidies and new insurance procurement policies that may increase health costs). Given these developments, this study provides very timely analysis of the value of health insurance on farmworkers' health care use, as well as clarifying existing health care use patterns among hired farmworkers.

In this analysis, certain existing fallback mechanisms for obtaining health care services are also recognized. The federal Migrant Health Program (MHP), in 1962, and Community Health Center (CHC), in 1975, were set up by previous administrations specially to ensure financially and socially disadvantaged residents' access to some health services. However, there is still limited understanding on the use of these health care facilities among the hired farmworker population. Moreover, the impact of legal status, health insurance, and other demographic characteristics on the patronage of such fallback options has yet to be clearly determined empirically. This research contributes to the understanding of the use of migrant/community health centers and other health care providers (such as hospital and private clinics) among U.S. hired farmworkers. This study's results indicate that migrant health centers have been an important option well patronized by undocumented farmworkers. On the other hand, the availability of health insurance benefits would promote the use of private clinics among hired farmworkers but reduce the utilization of other publicly funded health facilities.

The remainder of this article is organized as follows. The subsequent section presents a background on the challenges experienced by U.S. farmworkers in their efforts to address their health care needs. The following sections present a description of the data set and the empirical framework for analyzing health care utilization decisions. These are followed by a section that summarizes and analyzes the estimated results while the final section presents conclusions.

Background

The provision of health care services is an urgent issue for hired farmworkers given the onerous and risky nature of farm work that entails, among other things, excessive physical demands, prolonged exposure to chemical inputs, more accident-prone operations, and mentally stressful tasks. Arcury and Quandt [2] have articulated such a claim through their contention that agriculture is one of the most dangerous industries in the U.S. Hoerster et al. [4] provide further supporting evidence by pointing out that farmworkers in the U.S. are more relatively burdened with serious illnesses that eventually translate to high mortality rates associated with incidences of cancer and injuries. Vallarejo [5] and Zahm and Blair [9] provide further evidence on the apparent linkage between chemical exposure in the farm workplace and a high prevalence of certain types of cancer among farmworkers. Meanwhile, the more rigorous nature of physically demanding tasks in farms could also result in more job-related injuries such as sprains, strains,

fractures, and other musculoskeletal injuries [10]. In addition to the physical tolls of farm work, hired farmworkers are also likely susceptible to developing serious mental or psychological stress problems [2]. Magana and Hovey [11] showed that an overall elevated level of depression and anxiety exists among Mexican migrant farmworkers in the Midwest. These adverse mental or psychological conditions could arise from the workers' worries about, among other factors, rigid work demands, poor housing conditions, and inadequately low family incomes. This finding is in line with the assertion made by Arcury and Quandt [2] and Vallarejo [5] that U.S. farmworkers are usually characterized by a low socioeconomic status reflected by their low incomes, poverty living conditions, and harsh working environments. Hired farmworkers in the U.S. face diverse challenges in dealing with their own health concerns and confronting the risks posed by their work environments [12, 13], and thus demonstrate a pronounced need for health care and treatment services. However, as will be shown next, their health care service use appears to fall short of their actual medical needs.

The U.S. farm sector has been a major employer of immigrants, including those who are undocumented that comprise over 50% of this category of workers [8]. It therefore follows that the industry's patterns of health care use intended for its hired farmworkers should largely cater to the needs of the majority of the suppliers of farm labor input. Several studies, however, indicate that immigrants (both adults and children) have lower health care utilization rates than natives in the U.S. Mohanty et al. [14] analyzed the health care expenditures of 2843 immigrants and 18,398 U.S.-born citizens. Their findings indicate that immigrants' per capita total health care expenditures are 55% lower than those incurred by U.S. citizens. Ku [15] provides additional empirical support to this contention that the health care costs incurred by immigrants are about 14 to 20% less than those of U.S. natives. Equivalently, his results suggest that the immigrants who make up 5% of the U.S. population are beneficiaries of only 1% of funds allocated for public health services.

The most recent existing health care reform that could affect the hired farmworker population is the Patient Protection and Affordable Care Act (ACA) that was carried out by the Obama administration in 2010. The ACA requires companies with over 50 employees to provide health insurance as part of the employee fringe benefit package. The ACA reform also provided the states, beginning in 2014, with options to expand Medicaid eligibility to cover adults who are under 65 years old, with annual personal incomes of up to $15,000 and without dependent children. As a result, hired farmworkers who meet those expanded eligibility requirements have become new qualifiers for health insurance coverage. However, these changes could only apply to documented workers.

There have been, however, some efforts made to alleviate the exclusion of undocumented workers from major health policies and legislative reforms. The federal Migrant Health Program (MHP) established in 1962 was designed to help vulnerable domestic farmworkers' families. In 1970, the MHP expanded its coverage to both seasonal farmworkers and migrant farmworkers. Five years later, a new program launched the Community Health Center model to provide medical services to underserved populations, including hired farmworkers in remote areas. Community/Migrant Health Centers offer access to all hired farmworkers regardless of immigration status [3]. Notably, even with the availability of such alternative health service providers, the undocumented immigrants' utilization rates of these facilities are considerably low. The Center for Disease Control and Prevention (CDC) reported that only 13% of hired farmworkers have actually accessed or used such federally funded migrant clinics [5]. This study provides further empirical evidence on this patronage trend and contributes to the literature by examining the impact of legal status and health insurance on the workers' choices among Migrant/Community Health Centers and other health care provider alternatives (such as hospitals and private clinics).

Data description

The data used in this article were obtained from the National Agricultural Workers Survey (NAWS), which is an individual micro-level cross-sectional data set collected from the general hired farmworker population in the United States. The data set includes information on demographic characteristics, health care choices and health status of worker respondents. The sample size of this study's data set comprises more than 28,000 hired farmworkers and is categorized into two groups according to their legal status: documented and undocumented workers. The documented workers' group is comprised of citizens and green card holders, but excludes working visa holders, such as H-2A workers, who are not explicitly identified in the NAWS data set. This article's time period spans from the start of the NAWS collection of health care utilization data in 2000 until the most recently available annual data for 2012. In addition, the data for farmworker's choice of health care providers are only available from 2007 to 2012.

Panel (A) in Table 1 presents the dependent variables used in this study's models. The first set of dependent variables is the hired farmworker's binary choice in utilizing health care services in the U.S. and foreign countries. The variables "U.S. healthcare" and "Foreign healthcare" equal one if a hired farmworker used any domestic or foreign health care service, respectively, within 2 years prior to the interview. The summary statistics indicate that 51.4%

Table 1 Descriptive statistics of dependent and independent variables

Variable	Definition	Mean	Std. dev.
Panel (A): Dependent variables			
U.S. healthcare	Has used U.S. health care service in last 2 years = 1, otherwise = 0	0.514	0.500
Foreign healthcare	Has used foreign health care in last 2 years = 1, otherwise = 0	0.138	0.344
Healthcare provider			
Community health center[a]	Has used U.S. health care service in last 2 years and chose community health center = 1, otherwise = 0	0.252	0.434
Private clinic	Has used U.S. health care service in last 2 years and chose private clinic = 1, otherwise = 0	0.454	0.498
Hospital	Has used U.S. health care service in last 2 years and chose hospital = 1, otherwise = 0	0.172	0.378
Migrant health clinic	Has used U.S. health care service in last 2 years and chose migrant health clinic = 1, otherwise = 0	0.089	0.285
Other	Has used U.S. health care service in last 2 years and chose other health care service = 1, otherwise = 0	0.032	0.176
Panel (B): Independent variables			
Age	Age (years)	35.883	12.624
Years in the U.S.	Years stayed in the U.S. (years)	18.660	15.760
Documented	If documented immigrant = 1, otherwise = 0	0.495	0.426
Undocumented	If undocumented immigrant = 1, otherwise = 0	0.505	0.500
Single	If single = 1, otherwise = 0	0.334	0.472
Education	Years of education (years)	7.336	3.798
Speaking[b]	Level of English speaking proficiency (categories)	2.164	1.172
Reading[b]	Level of English reading proficiency (categories)	2.014	1.197
Farm workdays	Number of days working on farms	217.920	83.774
Total income[c]	Annual total income (categories)	7.666	3.483
Female	If female = 1, otherwise = 0	0.186	0.389
Asthma	Has asthma = 1, otherwise = 0	0.028	0.164
Diabetes	Has diabetes = 1, otherwise = 0	0.037	0.188
High blood	Has high blood pressure = 1, otherwise = 0	0.079	0.269
Tuberculosis	Has tuberculosis = 1, otherwise = 0	0.006	0.075
Heart	Has heart disease = 1, otherwise = 0	0.010	0.100
Urinary	Has urinary disease = 1, otherwise = 0	0.014	0.119
Other	Has other chronical diseases = 1, otherwise = 0	0.039	0.193
Mexican\American	If a Mexican\American = 1, otherwise = 0	0.063	0.242
Mexican	If a Mexican = 1, otherwise = 0	0.711	0.453
Chicano	If a Chicano = 1, otherwise = 0	0.006	0.078
Other hispanics	If other Hispanics = 1, otherwise = 0	0.044	0.205
Puerto rican	If a Puerto Rican = 1, otherwise = 0	0.009	0.093
Not hispanic	If not a Hispanic = 1, otherwise = 0	0.168	0.374

[a]EPHI denotes employer-provided health insurance

[b]Speaking and Reading are categorical variables that measure how well a farmworker speaks and reads English; proficiency categories are defined as follows: 1. Not at all, 2. A little, 3. Somewhat, and 4. Well

[c]Total income is a categorical variable representing one of 15 annual income classes defined as follows: 1 (under $500), 2 ($500 to $999), 3 ($1000 to 2499), 4 ($2500 to $4999), 5 ($5000 to $7499), 6 ($7500 to $9999), 7 ($10,000 to $12,499), 8 ($12,500 to $14,999), 9 ($15,000 to $17,499), 10 ($17,500 to $19,999), 11 ($20,000 to $24,999), 12 ($25,000 to $29,999), 13 ($30,000 to $34,999), 14 ($35,000 to $39,999), and 15 (over $40,000)

of hired farmworkers have used U.S. health care services while 13.8% of hired farmworkers have used foreign health care services. The workers' partial reliance on foreign health care services, even when health care services are locally available, could suggest either the workers' concerns about utilization due to prevailing legal restrictions on immigration and health policies or their deliberate decision to avoid patronage of such domestic services.

The other set of dependent variables shown in panel (A) captures the decisions of farm workers selecting among

health care provider alternatives. Health care provider options include community health centers, private clinics, hospitals, migrant health clinics, and other health service providers. Each health care provider dependent variable is constructed as a binary variable that equals one if a hired farmworker reports to have used the indicated health care provider the last time they needed health care services.

Among these health provider alternatives, private clinics appear to attract the largest group of workers (45.4%) while the other more affordable health service providers usually patronized by most residents registered relatively lower utilization rates.

Panel (B) in Table 1 presents the covariates included in the model. The choice of control variables in this study is based on Anderson's Behavior Model of Health Service Use. In general, health care utilization decisions can be affected by three categories of independent variables: enabling, need, and predisposing factors. Enabling factors include policy-related and structural change variables that may alter or modify the health care use behavior of hired farmworkers. These factors are represented in this analysis by variables capturing the worker's legal status, health insurance coverage, and income level. Need factors, such as indicators of chronic ailments, explain the reasons for using health care services. Predisposing factors define the ability of a hired farmworker to cope with existing health issues. These usually are socio-demographic variables, such as age, gender, marital status, and race, which are included in this analysis.

The average hired farmworker in this study's sample is 36 years of age and has stayed in the U.S. for about 18 years. The sample is distributed among the legal categories as follows: 49% as U.S. documented workers and 51% as undocumented workers. The latter figure is very close to the estimate of 55% reported by Martin [8]. Consistent with the self-selected immigration argument whereby healthier workers would have a greater tendency to migrate [16], statistics for this study's data set (with a larger proportion of undocumented workers) indicate a low incidence of chronic diseases (such as asthma, diabetes, and high blood pressure).[2] The better health status of farmworkers could partly explain their lower rate of health care service utilization.

In addition, this data set's average farmworker has spent approximately 7 years in school. Moreover, other studies have identified the language as a potential barrier that could affect health care access of immigrant workers [17–19]. This has been taken into account in this analysis by including categorical English speaking and reading variables that capture several levels of proficiency. The summary in Table 1 indicates that the average U.S. farmworker has a minimal speaking and reading proficiency in English.

Econometric and identification strategies

This study employs probit estimation techniques, supplemented by the propensity score matching (PSM) method, to investigate the probability of hired farmworkers utilizing health care services and health care providers. The basic model is constructed as follows:

$$\text{Healthcare}_{ir} = \alpha_0 + \beta X'_{ir} + \rho_r + \varepsilon_{ir}$$

Healthcare_{ir} equals one if a farmworker i in region r has utilized health care within last 2 years; it equals zero if otherwise. X'_{ir} includes other demographic variables controlled in the probit model. ρ_r are region fixed effects, and ε_{ir} is the error term.

Workers with better health conditions may be less likely to require health services while frequent visits to medical centers would promote favorable health conditions. This contention is explored by many studies, but the existing body of health economics literature provides little evidence to uphold the contention of a potential simultaneous relationship between health care utilization and health status [20]; Skinner et al. [21–24]. Following previous studies [17]; Devillanova [25], this article uses chronic disease variables as health status indicators. The dummy variables for chronic diseases in this study account for such health conditions as asthma, diabetes, high blood pressure, tuberculosis, heart diseases, urinary diseases and other diseases.

Moreover, the possible self-selection issue arising from the tendency of relatively healthier individuals being drawn to endure the physical demands and health risks of farm work can potentially cause biased estimates of the health care use differences between documented and undocumented workers. The estimation of causal relationship requires controlling for the bias of self-selection. Given the differing demographic profiles (such as age, education, and marital status) between undocumented and documented hired farmworkers, this analysis employs the PSM method to match individuals classified under the control and treatment groups.

In applying the PSM to mitigate the potential bias of self-selection, the following formulations are proposed. D_i is a variable indicating whether a farmworker is undocumented ($D = 1$) or documented ($D = 0$). The outcome variable of health care use is represented by Hi. The average treated effect on the treated (ATT) can be calculated as follows:

$$\Delta_{\text{ATT}} = E(\Delta|D = 1) = E[H(1)|D = 1] - E[H(0)|D = 1],$$

where $E[H(1)|D = 1]$ is the expected value of health care use for undocumented farmworkers; and $E[H(0)|D = 1]$ is the

[2] All the chronic disease dummy variables are classified under "need variables." Their marginal effects are not reported in the regression results table and are available upon request.

expected value of heath care use for undocumented farmworkers if they were not undocumented. The second part is a counterfactual and it cannot be observed.

To compute the average treatment effect on the treated sample, PSM is employed to construct the counterfactual from the group of documented workers. The control group of documented workers should be statistically equivalent to the treated group of undocumented workers, and individuals in these two groups should match on all observable covariates. However, the exact matching method may create the issue of the curse of dimensionality that may diminish the representativeness of the estimates. To resolve this, a matching on the propensity score that is calculated as the probability of falling into the treated group given other covariates could be used.

To ensure the reliability of the PSM estimates, conditional independence and the common support assumption should be satisfied. With these two assumptions, the $\Delta_{\text{ATT\_PSM}}$ can be estimated by

$$\Delta_{\text{ATT\_PSM}} = E_{P(X)|D=1}\{E[H(1)|D=1,P(X)] - E[H(0)|D=1,P(X)]\}$$

$P(X)$ is the propensity score calculated conditional on another covariate X that could affect the selection into the treatment, and the outcome. $P(X)$ can be obtained by a logit model and different matching algorithm, such as nearest-neighbor matching and kernel matching. A word of caution warns that PSM estimators do not eliminate bias due to selection on an unobservable variable. To explore whether the selection on unobservable factors should be a concern in estimation, a sensitivity test proposed by [26] is conducted to check whether the unobservable heterogeneity should be a concern in this study's estimation procedures.

All told, this study's empirical framework is designed to validate the following hypothesis:

As access to foreign health care is constrained by a worker's legal status, health insurance coverage significantly increases a constrained (undocumented) worker's access to regular domestic health services while inadequate or nonexistent health insurance benefits would increase a worker's access to publicly funded health care facilities specifically created to serve their needs.

Empirical results

This section presents the results of the probit and PSM techniques applied to U.S. and foreign health care utilization models for hired farmworkers. Subsequently the PSM results on the workers' choices among different health care provider options are presented and then followed by an analysis of the workers' payment method decisions. Finally, an assessment of the matching quality of the PSM method is discussed.

Health care service utilization

Table 2 shows the marginal effect[3] of each variable obtained from the probit model for U.S. and foreign health care decisions in columns (1) and (3), respectively. Columns (2) and (4) report the impacts of two policy variables (legal status and health insurance) on health care use of hired farmworkers under the PSM method. PSM estimation is expected to ameliorate the biased estimation issue caused by self-selection into treatment. As can be gleaned from the results, the magnitude of the PSM estimates on health care use in the U.S. is larger than the result obtained in the probit model. The estimates for foreign health care use between probit and PSM are also different.

In Table 2, the estimate obtained for undocumented farmworkers' use of U.S. health care services reflected a significantly lower probability (10.7%), given that their characteristics were controlled. Undocumented farmworkers could possibly have limited information about the U.S. health care systems [4], lack of confidence in seeking U.S. medical treatment, or be overcome by fear of deportation once they have become more visible in the social scene through their dealings with health care providers [4]. Meanwhile, there are some legal restrictions in place that regulate these workers' access to many public benefit programs. The ACA provisions explicitly exclude the undocumented population from the list of beneficiaries of public health care programs.

The results in columns (3) and (4) indicate that, under the PSM method, undocumented hired farmworkers are less likely to use foreign health care by 3% compared to documented hired farmworkers. This finding is consistent with the reality that documented immigrants can easily travel abroad to receive medical treatment, while undocumented workers may find it riskier to return to their native countries because of anticipated difficulties in reentering the U.S.

The plots in Fig. 1 compare the probability of U.S. health care utilization for hired farmworkers across legal status. The left plot shows that documented workers have a higher probability of receiving health care in the U.S. at 61% compared to the rate estimated for undocumented workers (48%). The confidence intervals calculated for the two types of farmworkers validate the results in Table 2 establishing that the probability of using U.S. health care for undocumented hired farmworkers is statistically lower than that for documented workers.

The right plot indicates that the probability of utilizing foreign health care services has peaked at about 11% among documented workers while undocumented hired farmworkers again have registered the lower utilization rate of only 6%. The large gap in the patronage of both U.S. and foreign

[3] The coefficient results are available from the authors upon request.

Table 2 Probit model's marginal effects of determinants of U.S. and foreign health care utilization of hired farmworkers in U.S.

	U.S. healthcare Probit	U.S. healthcare[b] PSM[a]	Foreign healthcare[c] Probit	Foreign healthcare PSM
Undocumented	− 0.071***	− 0.107***	− 0.076***	− 0.03**
	(0.020)	(0.021)	(0.010)	(0.015)
Health insurance	0.190***	0.223***	− 0.023***	− 0.061***
	(0.016)	(0.007)	(0.008)	(0.005)
Age	− 0.001		0.002***	
	(0.001)		(0.000)	
Years in U.S.	0		− 0.002***	
	(0.001)		(0.000)	
Single	− 0.041**		0.005	
	(0.016)		(0.007)	
Education	0		0.003***	
	(0.003)		(0.001)	
English speaking	0.027*		− 0.022***	
	(0.015)		(0.007)	
English reading	0.064***		− 0.008	
	(0.015)		(0.008)	
Total income	0.024***		− 0.011***	
	(0.003)		(0.001)	
Female	0.358***		− 0.063***	
	(0.020)		(0.009)	
Observations	27,364	28,616	24,350	25,974
Year fixed effects	Yes		Yes	
Regional fixed effects	Yes		Yes	
Other covariates[d]	Yes		Yes	
McFadden R^2	0.261		0.198	

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

[a]PSM denotes the propensity score matching method

[b]US Healthcare is a dummy variable that equals one if a farmworker utilized any U.S. Health care service within 2 years prior to the interview and equals zero if otherwise

[c]Foreign Healthcare is a dummy variable that equals one if a farmworker utilized any foreign health care service within 2 years prior to the interview and equals zero if otherwise

[d]Other covariates include the number of days working on farms, chronic disease conditions (including asthma, diabetes, high blood pressure, tuberculosis, heart disease, urinary disease, and other), Hispanic origin (Mexican, Chicano, Other Hispanic, Puerto Rican, Not Hispanic). Robust standard errors are reported in parentheses. Models are weighted by the sample weight provided by NAWS

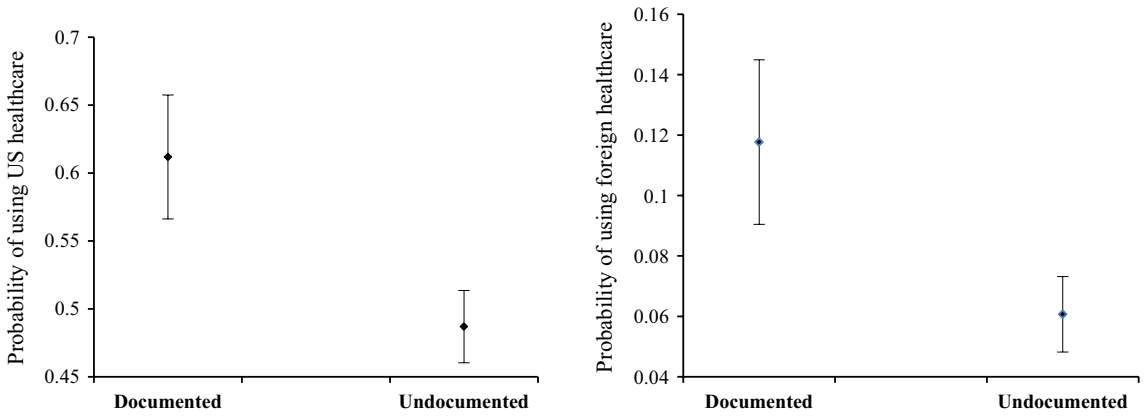

Fig. 1 Probability of U.S. farmworkers' health care utilization according to legal status

health care services between documented and undocumented immigrants in the farm sector shows that the lack of proper immigration documentation has indeed become a significant factor that hinders health care utilization for the majority of hired farmworkers.

Another important policy variable considered in this analysis is health insurance. The results establish a statistically significant and large impact of health insurance on the use of health care service in the U.S. and in foreign countries. Hired farmworkers with health insurance are 22.3% more likely to use health care in the U.S. Since having health insurance greatly increases the probability of using U.S. health care services, it would reduce the demand for health care services in foreign countries.

Health care provider decisions

Drawing upon the earlier results that undocumented farmworkers have a significantly lower likelihood of utilizing both U.S. and foreign health care resources than documented hired farmworkers, this analysis then extends to explore the choices of health care service provider by hired farmworkers. With their average lower socioeconomic stature, constrained mobility, skills endowment, and cultural practices and beliefs, immigrant workers may find themselves in a more disadvantageous position in accessing social resources [27]. This could impose significant barriers for them to use better quality medical services.

Table 3[4] reports the estimates of the impact of the independent variables for each health care provider. Based on the results under the PSM model, undocumented workers significantly differ from documented hired farmworkers in their patronage of migrant health clinics given their higher probability estimate of 3.6%. Moreover, undocumented hired farmworkers are 10.3% less likely to use private clinics compared to documented hired farmworkers. It may be recalled that in this study's sample, undocumented hired farmworkers have significantly lower incomes than documented workers. This may explain the disparities in using the health care services provided by private clinics and migrant health centers. Migrant health centers are federally funded and usually provide low-cost or even free medical services to low-income populations. However, private clinics are usually profit-driven and may charge much higher prices for the health care services provided, although the quality of their services may also be higher.

Moreover, health insurance is also found to have a large impact on the choice of health care providers for hired farmworkers. Farmworkers with health insurance register lower probability of patronizing community health centers, hospitals, and migrant health centers. Instead, these individuals' probability of using health care in private clinics is higher.

A closer scrutiny of the probability of choosing each health care provider is presented in Fig. 2. The private clinic is the most preferred health care option among farm workers. Even undocumented workers, who are usually more budget-constrained, have registered a 42% probability of visiting private clinics. Community health centers are also popular among farmworkers. Documented farmworkers have a slightly higher probability of patronizing such option at 25.57% compared to the rate registered by undocumented workers at 24.93%. The probability rankings for the two groups of users have been observed to be lower in the patronage of hospitals and migrant health clinics.

Health care payment methods

After exploring the health care use pattern of hired farmworkers, it is interesting to know the method of payment for the health care services obtained. This section evaluates the method of payment for the use of health care services by hired farmworkers.

Figure 3 shows that hired farmworkers, in general, have a high probability of paying for health care services using their own funds, with undocumented farmworkers registering the highest probability at 56%. For those without legal immigration status, the high probability of paying for health care using personal funds could be mainly caused by lack of health insurance. Workplace hazards and risks raise the health insurance premium significantly such that farmworkers could have been discouraged from purchasing any individual health plan (Sundaram-Stukel and Deller [28]. Besides, farmworkers also have an EPHI utilization rate at only 32.6%, which is considered low when compared to management and professional jobs that enjoy a rate of 89.4% (U.S. Census Bureau [29]. In addition, the undocumented workers' immigration status could inhibit them from using any public benefit programs such as Medicare. Recalling the trends shown in Fig. 2, undocumented workers have a high likelihood of using private clinics as these venues could be less strict or concerned about verifying identities and/or immigration status, although these providers may charge much higher fees than public health care providers. The combined effect of choosing private clinics with the out-of-pocket payment decision would only validate the reality of increased medical expenses and worsen the financial woes of both documented and undocumented hired farmworkers needing medical attention.

[4] Additionally, the simultaneous choices of health care provider selections are also analyzed under a multinomial logit model. Generally, the results of this model are similar to the findings as shown in Table 3. The results for this additional estimation are available from the authors upon request.

Table 3 Estimates of determinants of health care provider choices of hired farmworkers in the U.S.

	Community health centers[a]		Private clinics		Hospitals		Migrant health clinics		Others[b]	
	Probit	PSM	Probit	PSM	Probit	PSM	Probit	PSM	Probit	PSM
Undocumented	0.003	0.056	− 0.046	− 0.103***	0.012	0.004	0.009***	0.036***	0.006	0.003
	(0.031)	(0.037)	(0.038)	(0.036)	(0.021)	(0.015)	(0.003)	(0.006)	(0.026)	(0.027)
Health insurance	− 0.143***	− 0.173***	0.158***	0.210***	− 0.019	− 0.016**	− 0.002	− 0.018***	− 0.007	0.003
	(0.026)	(0.014)	(0.031)	(0.013)	(0.019)	(0.007)	(0.003)	(0.004)	(0.021)	(0.016)
Age	0.001		0.003		− 0.003***		0		0.001	
	(0.002)		(0.002)		(0.001)		0.000		(0.001)	
Years in U.S.	− 0.002		0.002		0.001		0.000**		− 0.002	
	(0.002)		(0.002)		(0.001)		0.000		(0.001)	
Single	− 0.044*		0.021		− 0.006		0.002		0.024	
	(0.026)		(0.032)		(0.019)		(0.003)		(0.022)	
Education	− 0.005		0.004		− 0.001		0		0.003	
	(0.004)		(0.005)		(0.003)		0.000		(0.004)	
English speaking	0.009		− 0.027		0.035*		− 0.001		− 0.017	
	(0.023)		(0.034)		(0.018)		(0.002)		(0.026)	
English reading	− 0.012		0.028		− 0.038*		− 0.002		0.038	
	(0.023)		(0.032)		(0.020)		(0.003)		(0.026)	
Total income	− 0.001		0.01		− 0.002		− 0.001**		− 0.002	
	(0.005)		(0.006)		(0.003)		0.000		(0.004)	
Female	0.038		0.061*		− 0.031		− 0.001		− 0.059***	
	(0.027)		(0.035)		(0.021)		(0.003)		(0.022)	
Observations	5345		5345		5345		5345		5345	
Year fixed effects	Yes		Yes		Yes		Yes		Yes	
Regional fixed effects	Yes		Yes		Yes		Yes		Yes	
Other covariates[c]	Yes		Yes		Yes		Yes		Yes	
McFadden R^2	0.07		0.065		0.064		0.205		0.035	

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

[a]Huber–White robust standard errors are reported in parentheses

[b]Other healthcare providers include traditional healers, emergency room services, chiropractor, dentist, and other health care providers

[c]Other covariates include the number of days working on farms, chronic disease conditions (including asthma, diabetes, high blood pressure, tuberculosis, heart disease, urinary disease, and other), Hispanic origin (Mexican, Chicano, Other Hispanic, Puerto Rican, Not Hispanic). Models are weighted by the sample weight provided by NAWS

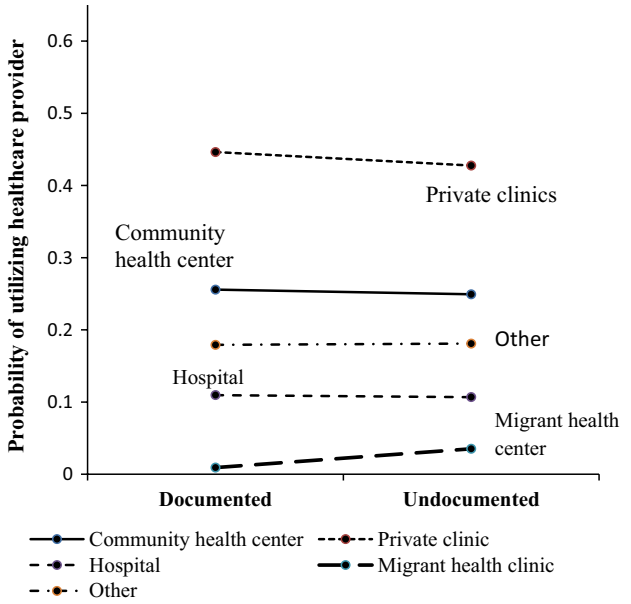

Fig. 2 Probability of selection of health care providers for farmworkers by legal status

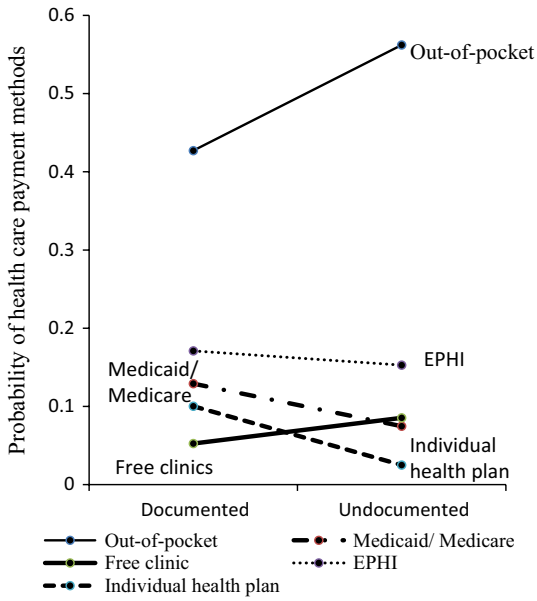

Fig. 3 Probability of health care payment methods used by farmworkers

The second most prevalent payment scheme is the EPHI method, although this option's probability is less than half of the estimate obtained for out-of-pocket payments. Moreover, an even smaller portion of farmworkers would use Medicaid/Medicare and individual health plans to pay for health care services. The lack of available public health benefit programs for farmers in the U.S. largely increases their financial burden as well as health risks. To promote the physical health and financial welfare of farmworkers in the U.S., more efficient and effective farmer-targeted health programs are needed in order to relieve farmworkers of such financial and economic burdens associated with their health demands. As a matter of fact, the U.S. government could draw some guidance from other countries that have designed special insurance and pension programs for the benefit of their own agricultural workers.

Matching quality assessment

This section verifies the performance of the PSM method in creating a good counterfactual for the treated group (undocumented farmworkers and farmworkers with health insurance).[5] As explained earlier, the reliability of PSM estimates largely depends on conditional independence (CIA) and the common support condition. The satisfaction of the common support condition can be examined by checking for the presence of adequate overlap between documented and undocumented hired farmworker populations when using the PSM estimation. The region of common support selected by the PSM estimation for the treatment of legal status ranges between 0.00012 and 0.9796. The region of common support selected by PSM estimation for the treatment of health insurance status ranges between 0.0837 and 0.8544. Both common support ranges suggest adequate overlap to ensure reliable estimated treatment effects.

Next, a balance test (two-sample *t*-test) is conducted to check whether the CIA is met in estimating the counterfactual group. A balanced condition helps to evaluate whether a good counterfactual group has been created that is similar to the treated group in several important characteristics. The results of these two procedures show that all independent variables are balanced after matching while some of the variables are not balanced before matching. PSM estimation eliminates the differences between documented and undocumented farmworkers as well as the differences between farmworkers with and without health insurance coverage.

Moreover, to address the concern that the PSM estimates may be sensitive to the choice of matching algorithm, in addition to nearest-neighbor matching, a kernel matching method is applied to evaluate the impacts of legal status and health insurance. The estimated effects of legal status and health insurance using a kernel matching algorithm are similar to those using the nearest-neighbor matching method. The estimates remained consistent when another type of matching algorithm was applied.

[5] Detailed results of all matching quality assessments (tests) are available from the authors upon request.

Finally, a test is conducted on an important identification issue of PSM assuming that self-selection into treatment is based only on observable variables but not unobservable covariates. The estimation of PSM may be biased if certain unobservable characteristics determine the selection into treatment. To test this crucial assumption, the Rosenbaum bound test (r-bound test) suggested by [26] is employed. The r-bound test indicates the strength of an unobservable variable in influencing the selection process. The null hypothesis for the variable of legal status is that there is an underestimation of treatment effect and the null hypothesis for the health insurance variable is that there is an overestimation of treatment effect. As can be seen, the PSM estimation on both legal status and health insurance status are robust to unobservable variables. The significance level of less than 1% means that the assumptions of overestimation or underestimation are soundly rejected.

Conclusion

This article investigates several facets of the health care utilization issue among farmworkers of varied legal statuses. The empirical issues addressed include the determinants of the farmworkers' overall utilization of health care services, their specific choices among several health care provider options, and their choices of the method(s) of payment for settling bills for their health care treatments. This study also provides a validation of the countervailing impact on health care access of health insurance coverage and the alternative patronage of federally funded community centers when the latter benefit is nonexistent or inadequate.

This article's results indicate that undocumented hired farmworkers have a statistically lower probability of using health care compared to documented workers. This is easily attributed to, among other things, their undocumented status, limited English speaking and reading proficiency, and low average income. Moreover, the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 policy and other similar restrictive policies adopted by federal and local governments would further limit the health care service utilization of immigrant hired farmworkers.

This study has also established that foreign health care service alternatives are also not fully exhausted by undocumented hired farmworkers, whose utilization probability rate is significantly lower than those estimated for other groups of documented hired farmworkers. This discrepancy can be attributed to the undocumented immigrants' concerns about enhanced border patrol policing activities and heightened implementation of worksite immigration control enforcement policies led by U.S. Immigration and Custom Enforcement (ICE), usually in collaboration with local police authorities in recent decades. Furthermore, private clinics and community health centers were identified as the two most popular health service providers for all hired farmworkers. Notably, compared to their documented working peers, undocumented workers are much less likely (10.3%) to patronize private clinics. They are even less likely (3.6%) to rely on migrant health centers even when these providers are their most viable sources of health care service.

These health provider choices can be linked to the options for settling health care bills available in varying degrees to the different farmworker categories. Health insurance benefits increase a worker's access to health care by 22.3%. As documented workers' health benefits are ensured by existing federal mandates, employers are not legally bound to provide their undocumented workers with such fringe benefits, except for compensation benefits for job-related injuries (30, 31). Thus, for workers with constrained access to health insurance and public welfare benefit programs (outside the community/migrant health centers), personal (out-of-pocket) funds are used to pay for health care services obtained. Under this condition, the financial strain of allocating some portion of the limited household disposable income of immigrant hired farmworkers, especially the undocumented category, would compel the workers to either forcibly limit or postpone their health care service demands. In both cases, deterioration in the health status of farmworkers could adversely affect the productivity and viability of the farm industry.

This article thus draws attention to the need for a re-examination of existing restrictions on health care use by immigrant hired farmworkers as well as the effectiveness of promoting the public safety net services in the U.S. The farm sector continues to rely on immigrant workers to supply labor inputs for the more taxing farm tasks shunned by domestic residents with a wider range of employment options. As this trend of immigrant labor dependence persists, it is, therefore, imperative to assist the farm sector in ensuring the demands of health care from hired farmworkers are met for the sake of maintaining a healthy, able, and reliable workforce that can supply the economy with its growing needs.

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