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Features

EMPLOYER PROVISION OF PERSONAL PROTECTIVE EQUIPMENT TO LATINO WORKERS IN NORTH CAROLINA RESIDENTIAL CONSTRUCTION

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ABSTRACT

Despite federal regulations requiring provision of personal protective equipment (PPE) without cost to workers in the United States, very little is known about whether immigrant Latino construction workers receive no-cost PPE from their employers, and the role that employer provision plays in regular use of PPE. This study used cross-sectional data from a community-based sample of 119 Latino construction workers in western North Carolina to document receipt of employer-provided PPE by construction workers, investigate sources of variation in the receipt of employer-paid PPE, and delineate associations of employer-paid PPE with workers' regular use of PPE. The results suggest that the residential construction subsector generally fails to provide workers with PPE at no cost, as is required by regulation. Analyses also suggest that recent immigrants are least likely to receive no-cost, employer-provided PPE, and that when employers do provide no-cost PPE, Latino construction workers are more likely to use it regularly.

Keywords: Latinos, construction workers, personal protective equipment, safety policy

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Construction is among the riskiest occupations. In 2010 the fatality rate for construction workers was 9.5/100,000 full-time workers as opposed to 3.5/100,000 workers across all occupational sectors [1]. Four out of every 100 full-time construction workers sustain an injury each year, while 150 per 10,000 full-time-equivalent workers experience a work-related injury or illness requiring time away from work [2]. Construction is consistently among the top five sectors in terms of injury, illness and fatality statistics. Workplace health and safety is a particular concern for immigrant Latino workers, both because there has been a substantial increase in the proportion of Latino workers in the construction industry recently [3], and because they experience an increased risk for occupational fatality and injury [4, 5]. Further, immigrant workers in the United States and around the world are believed to have substantial difficulty accessing occupational safety and health rights and entitlements [6, 7]. Appropriate and regular use of personal protection equipment (PPE) is an important strategy for reducing elevated occupational injury and illness incidence in the construction industry [8]. The Occupational Safety and Health Administration (OSHA) requires employers to reduce or eliminate hazards; however, the total elimination of hazards is challenging because of the transient nature of projects, overlapping activities, and lack of innovation in construction equipment. Consequently, although it was intended as a tertiary strategy in occupational safety, PPE is oftentimes used by construction contractors as a primary strategy. Nevertheless, consistent use of PPE contributes to better occupational health outcomes. Chi and colleagues' [9] meta-analytic results suggest that improper use of PPE is a significant predictor of falls through floor openings and from building girders. The presumptive value of PPE in protecting worker health is codified in the Code of Federal Regulations, which states:

> Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact [10].

Further, the regulation states that, "the protective equipment, including personal protective equipment (PPE), used to comply with this part, shall be provided by the employer at no cost to employees" [11]. There are exceptions and exemptions to this standard; for example, employers do not have to pay for non-specialty footwear, like steel-toed boots, provided the employer allows workers to wear the boots outside of work [12]. Similarly, employers are not expected to pay for everyday clothing (e.g., long-sleeved shirts) or ordinary items (e.g., hats, sunglasses).

Construction employers' compliance with this federal regulation, particularly in the small-scale residential sector, is unknown. Cattledge and colleagues [13] studied injuries among construction workers who did not use PPE and report that PPE frequently was not supplied, or that available equipment was inappropriate to the task or conditions. These findings parallel those from studies outside the construction industry. Whalley and colleagues' [14] study of farmworkers documented substantial deviation in compliance by farm owners and operators from OSHA's field sanitation standards and the Environmental Protection Agency's Worker Protection Standard. Although very little research has documented compliance rates with OSHA's requirement that employers provide employees with PPE without cost, available evidence suggests that employers, particularly small operators, are not following federal standards requiring employers to provide workers with basic PPE.

Even less is known about the provision and use of PPE by immigrant Latino construction workers. No data could be located describing whether Latino construction workers receive no-cost PPE from their employer. Nissen's [15] unpublished data suggest that Latino construction workers in medium- to large-scale construction enterprises are provided appropriate PPE without cost. They found that 98.6 percent of Latino construction workers in Florida who were employed on medium to large construction projects reported regular use of work boots, 89.7 percent reported regular use of protective eyewear, and 70.6 percent reported regular use of work gloves. Such high rates of regular use of these basic forms of PPE, to the extent these self-reported data are valid, suggest that employers are providing PPE without cost to employees. However there are no publicly available data on provision and use of PPE by immigrant Latinos in small-scale residential construction, perhaps the riskiest segment of the construction industry [16]. Using data obtained from a community-based sample of immigrant Latino workers employed in the residential construction industry in western North Carolina, this paper seeks to narrow current gaps in knowledge by describing the employer provision of PPE to immigrant Latino construction workers, documenting sources of variation in the receipt of employer-paid PPE, and delineating associations of employer-paid PPE with workers' regular use of PPE.

METHODS AND MATERIALS

The data for this study are from a broader project designed to determine the feasibility of using interactive voice response (IVR) technology to collect daily diary data from Latino residential construction workers. The original project involved several distinct data collection components, including a baseline interviewer-administered survey, a 21-day daily diary protocol wherein participants used a personal telephone to access an IVR program that elicited structured information about work experiences and health, and an

interviewer-administered follow-up interview three months after completing the baseline. This paper uses cross-sectional data from the baseline interviews.

Sample

Data were obtained from a non-probability sample of residential construction workers who self identified as Latino ($N = 119$). Participants were recruited in partnership with Hogar Latino (HOLA) of Wilkes County, a nonprofit organization that serves the Latino communities of Wilkes and surrounding counties in western North Carolina. HOLA staff recruited residential construction workers through a combination of techniques including known individuals within existing social networks, referral to others by enrolled participants (i.e., snowball recruitment), and referral by individuals outside the study. Eligible interviewers were identified across several counties of western North Carolina, a region of the country characterized as a "new settlement community" because of the sharp increase in Latino population since 1990 [17]. Persons included as participants were 18 years or older, Latino (self or parents born in a Latin American country, or self-identified as "Latino" or "Hispanic") and currently employed in construction full-time, which we defined as having worked 35 or more hours per week in construction during the past two weeks. There were no exclusion criteria or special considerations that precluded an individual from participating in the study, despite meeting inclusion criteria.

Data Collection

Data were collected using interviewer-administered survey questionnaires between September and November 2010. The questionnaire assessed stable attributes of the individual (e.g., age, gender, country of origin), occupational characteristics (e.g., primary tasks performed in construction), health history (e.g., presence of chronic conditions), multiple indicators of the organization of work (e.g., work control, psychological demands), as well as provision and use of several forms of PPE. The questionnaire took an average of 48 minutes to complete, and participants received a $15 incentive. All participants provided signed informed consent before any data was collected. Most interviews occurred in participants' homes. All recruitment and data collection activities were approved by the Wake Forest School of Medicine Institutional Review Board (FWA #00001435).

Questionnaire content was obtained from validated Spanish-language instruments without modification when available. English-only instruments and items developed for this project were translated into Spanish by a native Spanish-speaker. All items were then back-translated into English. Discrepancies identified in the back-translation were corrected through consensus and incorporated into both the Spanish and English versions of questionnaires [18].

Survey questionnaire data were collected by four trained interviewers. All interviewers were native Spanish-speakers. Training consisted of a thorough review of study purpose, screening and recruitment procedures, line-by-line review of the interviewer-administered questionnaires, and progressively more realistic practice interviews.

Measures

Personal Protective Equipment

Variables reflecting different aspects of PPE were constructed from self-reported responses to questions asked during the interviewer-administered questionnaire. Separate questions were asked as to whether the participant's employer provided eight specific types of PPE: eye protection (e.g., safety goggles, safety glasses or face shields), hearing protection (e.g., ear plugs, ear muffs), respiratory protection (e.g., dust masks or respirators), hand protection (e.g., non-slip gloves, heat/flame resistant gloves), special footwear (e.g., non-slip shoes, steel-toed footwear), head protection (e.g., hard hat), specialized hand tools (e.g., tools with soft or slip-resistant handles), and specialized material-handling tools (e.g., hand dollies). After each of the eight questions was asked, interviewers followed up each "yes" response by asking, "You indicated that your employer provided you {INSERT TYPE OF PPE}. Does your employer provide this without cost to you?" Participants who responded "no" to the question about the provision of PPE without cost were not probed further, so it is unknown if the employer charged employees for the PPE or if there was some other type of cost associated with receipt of PPE (e.g., intimidation, obligation).

One categorical variable was created for each type of PPE, and individuals were classified into one of three mutually exclusive categories based on their responses to the PPE questions. "Not provided" is the category representing participants who reported the employer did not provide the specific PPE. The "provided at employee cost" category represents a "yes" response to the question about whether the employer provided the PPE, but a "no" response to the probe as to whether the PPE was provided without cost to the employee. "Provided at no employee cost" represents participants who reported their employer provided the specific type of PPE, and it was provided by the employer without cost. The necessity of various types of personal protective equipment is subject to substantial interpretation. We therefore organized the types of PPE into two major categories: "Basic" and "Exposure-Specific." Based on the presumption that use of safety glasses, hearing protection, hard-soled shoes or boots, and hard hats are basic for performing the vast majority of jobs on a construction site [19], we classified these types of PPE as "Basic," whereas the remainder were classified as "Exposure-Specific."

Use of PPE was assessed with a separate set of questions. To avoid responses that the worker felt were socially desirable, interviewers acknowledged to

workers that use of PPE was highly variable. Specifically, interviewers were instructed to say, "Workers sometimes tell us that they do not use protective equipment, even when it is available to them. Sometimes workers don't use protective equipment because it is uncomfortable, it makes the work harder, or they simply prefer not to use it." Once this statement was made, the interviewer proceeded to ask "How often do you use [type of PPE]?" for each of the eight types of PPE. Response options used a frequency-based response set that ranged from 1 ("none of the time") to 4 ("all of the time"). A dichotomous "regular use" variable was created for each type of PPE: individuals who reported "most of the time" or "all of the time" were coded one for regular use, other responses (i.e., "none of the time" and "some of the time") were coded zero, reflecting non-regular use.

Personal and Occupational Characteristics

Age was measured in years and categorized to create similar age bands while ensuring adequate cell size in age category (i.e., < 28 years, 29-38 years, and > 39 years), and educational attainment was assessed based upon the grading system used in Latin American countries (i.e., Primary, Secondary, Preparatory, and University) and categorized into "Primary or less," "Secondary," and "Preparatory or higher." Country of origin was obtained and classified as either "Mexico" or "Other." Years in the United States was assessed and categorized into < 7 years, 8-15 years, and > 16 years.

Participants were classified into one of three construction trades: framers, roofers, or general construction. Individuals were classified as being a framer if they were usually involved in building or assembling floors, walls, or roofs using lumber or light gauge metal framing at least three days per week. Participants were classified as roofers if they were usually involved in applying roof shingles, removing existing roof shingles, applying hot roofing tar or built up roofing, or carrying roofing materials onto a roof at least three days per week. Individuals who self-identified as being a general construction worker and did not meet the definition of "framer" or "roofer" were classified as being a general construction worker. Precarious employment was measured with a single question asking "which statement best describes your work arrangement in construction" with three response options: "I am a construction contractor or subcontractor and do trades work myself," "I have worked for the same contractor or subcontractor for three months or longer," and "I have worked for several contractors or subcontractors during the past three months." Individuals who reported working for several individuals in the past three months were coded one for precarious employment; all others were coded zero. Finally, participants were asked if they had ever completed an apprenticeship in any construction trade.

Analysis

Descriptive statistics are reported as frequencies and percentages for categorical variables. Due to the small cell sizes created by cross-classification necessary for making comparisons, Fisher's Exact Tests were carried out in order to investigate differences in no-cost provision of PPE by personal characteristics. Likewise, Fisher's Exact Tests were used to examine differences in regular use of PPE by no-cost, employer provision of PPE. All descriptive statistics and analyses were generated using SPSS v19.0.

RESULTS

Nearly half the participants (47.1%) were aged 29-38 (Table 1); on average, they were 31.7 years of age (*SD* = 7.6). Most had little formal education; over one-third (*n* = 44) reported a primary education or less (equivalent to 6th grade in the United States) while nearly half (*n* = 50) reported having up to a secondary education (equivalent to 9th grade in the United States). Most participants (76.5%) reported being from Mexico, but nearly one-quarter of the sample was from Central American countries (primarily Honduras and Guatemala). Nearly one-half of participants (48.7%) reported being in the United States 8 to 15 years: the mean time in the United States was 9.7 years (*SD* = 6.0).

Table 1. Personal and Occupational Characteristics of the Sample of 119 Individuals

	N (%)[a]		*N* (%)[a]
Age		Years in the United States	
≤ 28 years	42 (35%)	≤ 7 years	44 (37%)
29-38	56 (47%)	8-15 years	58 (49%)
≥ 39 years	21 (18%)	≥ 16 years	17 (14%)
		Construction trade	
Educational attainment		Framer	26 (22%)
Primary or less	44 (37%)	Roofer	35 (29%)
Secondary	50 (42%)	General labor	58 (49%)
Preparatory or more	25 (21%)		
		Precarious employment	
		No	88 (74%)
Country of origin		Yes	31 (26%)
Mexico	91 (77%)		
Other	28 (24%)	Apprenticeship[b]	
		No	91 (77%)
		Yes	26 (22%)

[a]Percents may not sum to 100 because of rounding.
[b]Two missing cases.

Nearly one-half of the sample (n = 58) was classified as a general construction laborer, while less than one-third (n = 35) was classified as roofers and the remainder as framers. Over one-fourth of the sample (n = 31) was classified as having precarious employment. Approximately one-fifth of the sample (n = 26) reported having completed an apprenticeship. The type of apprenticeship completed by participants is not known, but was likely completed in another state prior to coming to North Carolina.

A substantial percentage of workers reported that PPE was not provided by their employer (Table 2). Looking first at "basic" forms of PPE, one-third of workers reported their employer did not provide eye protection, and two-thirds said their employer did not provide hearing protection. Nearly four in ten workers said their employer did not provide hand protection, and over half reported their employer did not provide footwear. Over one-third of the sample said their employer did not provide head protection. Turning to "exposure specific" forms of PPE, approximately one-half of workers reported their employer did not provide respiratory protection. Over one-quarter of workers reported their employer did not provide specialized hand tools, and 38 percent reported their employer did not provide specialized material handling tools.

Table 2 provides two perspectives on the provision of PPE without cost to workers. First, it provides a population perspective where the basis of comparison is the entire sample. From this perspective, employers infrequently provided no-cost PPE to workers, and when it was provided without cost, it was commonly "exposure-specific" PPE. Over half the sample reported that their employer provided specialized hand tools and material handling devices without cost to workers (see "%[a]" column under "Provided at no employee cost"). Half the workers reported that employers provided no-cost eye protection; otherwise, less than half the sample reported that their employer provided each of the other types of PPE at no cost. The most serious violation of the no-cost rule was in footwear: only 8 percent of workers reported their employer provided this PPE without cost.

The second perspective reflects the conditional provision of PPE; that is, if PPE was provided to workers, how frequently was it paid for by the employer? In this perspective, the denominator used to calculate percentages was the number of workers who reported having the specific type of PPE provided by their employer. When PPE was provided by the employer, in all but two types (hand protection, foot protection), 70 percent or more of workers said the PPE was provided at no cost (see far right column of Table 2). The three central columns of Table 2 report the small but non-negligible number of workers who were provided PPE by their employer but with cost to the worker. Again, the most serious violation of the no-cost rule was in footwear: 83 percent of those who said their employer provided footwear (36% of the total sample) reported the provided PPE had a cost to the worker. Otherwise, about one-third or less of employees who said their employer provided other types of PPE reported having a personal cost associated with that PPE.

Table 2. Prevalence of Employer-Provided Personal Protective Equipment (PPE) by Type of PPE

	Not provided	Provided at employee cost			Provided at no employee cost		
	N (%[a])	*N*	%[a]	%[b]	*N*	%[a]	%[b]
Basic personal protective equipment							
Eye protection (e.g., safety goggles, safety glasses, or face shields)	39 (3%)	21	18%	26%	59	50%	74%
Hearing protection (e.g., ear plugs or ear muffs)	78 (66%)	7	6%	17%	34	29%	83%
Hand protection (e.g., non-slip gloves, insulated gloves, or heat flame-resistant gloves)	46 (39%)	25	21%	34%	48	40%	66%
Special footwear (e.g., non-slip shoes, steel-toed footwear) [2 missing cases]	65 (55%)	43	36%	83%	9	8%	17%
Head protection (e.g., hard hats, plastic helmets, colored hats, or helmets with lamps)	45 (38%)	22	19%	30%	52	44%	70%
Exposure-specific personal protective equipment							
Respiratory protection (e.g., dust masks or respirators) [1 missing case]	63 (53%)	9	8%	16%	46	39%	84%
Specialized hand tools to avoid awkward postures and painful motions (e.g., tools with soft, slip-resistant, or anti-vibration handles) [1 missing case]	34 (29%)	7	6%	8%	77	65%	93%
Specialized material handling tools to make it easier to move heavy loads (e.g., hand dollies, boxes or crates with handles)	45 (38%)	5	4%	7%	69	58%	93%

[a]Denominator is total sample ($N = 119$), unless there is missing data as noted in table in square brackets.
[b]Denominator is number of individuals reporting the PPE is provided by the employer (119 minus number reporting not provided).

Receipt of no-cost, employer-provided basic PPE differed by personal characteristics (Table 3). Several differences were associated with age: a lower percentage of workers aged 28 years or younger compared to older workers received no-cost, employer-provided eye ($p < 0.10$), hearing, or hand and head ($p < 0.10$) protection. Receipt of no-cost employer-provided basic PPE did not differ by worker educational attainment. Worker country of origin was associated with types of PPE; a lower percentage of workers from Mexico than those from Central America received no-cost hand ($p < 0.10$) and head protection. Years in the United States was associated with several forms of PPE: a lower percentage of recent immigrants (i.e., those in the United States less than seven years), compared to those who have been in the United States longer, received no-cost, employer-provided eye, hearing, and head protection.

Receipt of no-cost, employer-provided PPE was consistently associated with regular use of "basic" forms of PPE (Table 4). A greater proportion of workers who received hearing protection at no personal cost reported regularly using

Table 3. Receipt of Selected No-Cost, Employer-Provided Personal Protective Equipment by Personal Characteristics

	Eye *N* (%)	Hearing *N* (%)	Hand *N* (%)	Foot *N* (%)	Head *N* (%)
Age					
≤ 28 years	15 (36%)[a]	6 (14%)[b]	11 (26%)[b]	3 (7%)	14 (33%)[a]
29-38	31 (55%)	18 (32%)	23 (41%)	6 (11%)	25 (45%)
≥ 39 years	13 (62%)	10 (48%)	14 (67%)	0 (0%)	13 (62%)
Educational attainment					
Primary or less	20 (46%)	14 (32%)	19 (43%)	3 (7%)	19 (43%)
Secondary	26 (52%)	10 (20%)	17 (34%)	3 (6%)	19 (38%)
Preparatory or more	13 (52%)	10 (40%)	12 (48%)	3 (13%)	14 (56%)
Country of origin					
Mexico	43 (47%)	23 (25%)	33 (36%)[a]	8 (89%)	35 (39%)[b]
Other	16 (57%)	11 (40%)	15 (54%)	1 (4%)	17 (61%)
Years in the United States					
≤ 7 years	14 (32%)[c]	4 (9%)[c]	13 (30%)	2 (5%)	12 (27%)[b]
8-15 years	36 (62%)	23 (40%)	26 (45%)	5 (9%)	32 (55%)
≥ 16 years	9 (53%)	7 (41%)	9 (53%)	2 (12%)	8 (47%)

[a]Distribution differs ($p < 0.10$) based on Fisher's Exact Tests.
[b]Distribution differs ($p < 0.05$) based on Fisher's Exact Tests.
[c]Distribution differs ($p < 0.01$) based on Fisher's Exact Tests.

Table 4. Association of Employer-Provided Personal Protective Equipment (PPE) with Employees' Self-Reported Regular Use of PPE, by Type of PPE

Employer provides PPE without cost to worker	Self-reported regular use of PPE: No *N* (%)	Self-reported regular use of PPE: Yes *N* (%)	*p*-Value	Odds ratio (95% CI)
Eye				
No	45 (75%)	15 (25%)	0.169	1.8 (0.8–3.9)
Yes	37 (63%)	22 (37%)		
Hearing				
No	85 (100%)	0 (0%)	0.000	1.4 (1.14–1.76)
Yes	24 (70%)	10 (29%)		
Hand				
No	56 (79%)	15 (21%)	0.000	4.1 (1.8–9.1)
Yes	23 (48%)	25 (52%)		
Foot				
No	63 (59%)	44 (41%)	0.000	11.5 (1.4–94.9)
Yes	1 (11%)	8 (89%)		
Head				
No	51 (76%)	16 (24%)	0.000	3.9 (1.8–8.5)
Yes	23 (45%)	28 (55%)		

hearing protection relative to those whose employers did not provide hearing protection at no cost to workers (including workers reporting their employer did not provide hearing protection). Similar associations were observed for no-cost employer provision and regular use of hand protection, specialized footwear, and head protection. The odds ratios estimating the magnitude of these associations ranged from 1.4 to 11.5; however, the 95 percent confidence intervals of these estimates were wide given the small sample. It is also noteworthy that a substantial proportion of workers do not regularly use the hearing, hand, and head protection, despite the fact it is provided without cost by their employer.

DISCUSSION

Increasing workers' regular use of PPE is an important, albeit last-resort strategy for reducing elevated rates of occupational injury, illness and fatality in

the construction industry [8]. The regular use of PPE is particularly important for the growing immigrant Latino workforce because rates of injury, illness and fatality are elevated among Latino construction workers relative to non-Latino construction workers [3-5]. Recognizing that complete elimination of hazards is not possible on most construction projects for many reasons, OSHA requires employers to provide sanitary and reliable PPE without cost to workers wherever work-related activities are capable of causing injury or impairment [10].

This study makes several contributions to the construction safety literature. The results suggest generally poor compliance, by employers in residential construction, with OSHA regulations requiring employers to provide PPE to workers without cost, and these results are consistent with the belief that immigrants have difficulty accessing occupational safety and health rights and entitlements [6, 7]. Estimates from our sample indicate that, at most, 50 percent of workers received eye, hearing, and head protection from their employer without cost. Although there can be ambiguity over which forms of PPE are essential, safety glasses, hearing protection, hard-soled shoes or boots, and hard hats are basic for performing the vast majority of jobs on a construction site [19]. No parallel data could be located to which we could compare our results. However, Nissen [15] reported that 93 percent of immigrant Latino construction workers working on medium- to large-scale projects in Florida reported that their employer *required* the use of a harness at all times. If we assume that required harness use reported by Nissen's study participants was supported by an employer-provided harness, our estimates of employer-provided, no-cost PPE are substantially lower. However speculative, the lower rates of employer-provided no-cost PPE in this study, relative to Nissen's study of workers on medium to large construction projects, is consistent with the notion that data reporting and adherence to OSHA regulations are likely to be particularly problematic in small-scale residential construction [16].

Our results also contribute to the literature by documenting specific risk factors associated with a lack of employer provision of no-cost PPE. We found that younger construction workers (i.e., those under the age of 28), and those who have been in the United States for fewer than seven years were less likely to receive no-cost employer-provided PPE than older workers and those who have been in the United States for longer periods of time. Together, these results suggest that recent immigrants in the construction industry are at greatest risk for not receiving no-cost PPE from their employers. Directly comparable data in the construction workforce, again, could not be located; however, these results are consistent with Nissen's [15] results indicating a difference in worker access to Material Data Safety Sheets by length of time in the United States. It is also consistent with research among Latino farmworkers. Whalley and colleagues [14] reported that younger farmworkers and those who worked in agriculture for fewer than 8 years were more likely to experience potential

violations to migrant housing violations. Similarly, Robinson and colleagues [20] reported that farmworkers without a temporary work permit (H2A visa) were more likely to be recent immigrants and more likely to report minimum wage violations by their employer. Collectively, our results and that of previous work suggest that, while all immigrants have difficulty accessing worker protections and entitlements [6, 7], the challenge may be especially high for recent immigrants.

Latino construction workers' regular use of PPE might be increased if employers provided that equipment without cost to workers. Our results indicated that no-cost employer provision of hearing, hand, foot and head protection was associated with regular use of those forms of PPE. These associations need to be interpreted cautiously because of imprecision due to the small sample, and the fact that a substantial proportion of workers did not use PPE regularly despite having it provided at no cost by their employer. Nevertheless, our findings reinforce the importance of having PPE available to workers to encourage its use, which may in turn contribute to reductions in occupational injury and illness.

Strong policy implications cannot be drawn from a single small, regional study. However, if our findings are replicated by more definitive research, they foreshadow several issues and implications for policy. The most apparent policy implication is the obvious need for greater enforcement of OSHA regulations requiring employers to provide no-cost PPE. Of course this is a challenging task in small-scale residential construction because many states do not require contractors to register or obtain licensure: this makes tracking and monitoring their activities extremely difficult. Therefore, an important step in better enforcement of the no-cost PPE regulations is the development and implementation in every state of a licensure standard, for all construction contractors who pay two or more workers, that effectively captures all individuals and businesses involved in small-scale residential construction. An important accompanying policy is the linking of specific construction projects with contractors and sub-contractors, perhaps at the stage of issuing building permits. Comparable licensure standards across states and linkages between construction projects and the contractors hired to implement projects would enable tracking and inspection of small-scale residential contractors' adherence to occupational safety regulations, and it would provide a potential tool for imposing sanctions on non-adherent contractors. Another policy implication is consideration of possible incentives to contractors to provide workers with no-cost PPE. One strong possible incentive is the provision of tax credits for all expenses pertaining to the provision of PPE to workers, which could be used to directly offset contractors' tax burden. One final policy implication is the apparent need to inform immigrant workers of their right to expect and request no-cost PPE. The creation and dissemination of block grants to public health departments or immigrant-focused service

organizations could be valuable for educating immigrant workers about the protections they are entitled to, and for creating a worker demand for PPE.

The contributions and policy implications of this study must be considered in light of its limitations. First, the generalizability of study findings is unknown because the sample was small, regional, and recruited using non-probability methods. The results of this study should therefore be viewed as tentative until they are replicated by research using a larger, more representative sample of workers. Next, since there was no non-Latino comparison group, it is not clear if the experiences observed in this study are specific to Latinos in residential construction, or whether they reflect experiences of workers in this subsector more broadly. Comparative research is needed to determine if there are ethnic differences in the provision of PPE by employers, and workers' use of PPE, in this subsector of residential construction. Finally, there are limitations to our measures of PPE. The self-reported nature of our measures of both receipt of PPE from the employer and actual use makes them subject to reporting bias. It is possible that employers had PPE available to workers, but the participants did not know it was available. Additional research using samples of employers would provide an important complement to research conducted with workers to discern actual adherence to federal regulations surrounding the provision of no-cost PPE. Finally, our assessment of PPE is incomplete. Fall restraint equipment, such as harnesses with functional tethers and anchors was missing from the list of PPE that we questioned.

Limitations notwithstanding, the results of this study make an important contribution to the construction safety literature. Our results suggest that many residential construction contractors employing immigrant Latino workers do not comply with OSHA's regulations requiring employers to provide workers with PPE at no cost. Our results also provide suggestive evidence that recent immigrants are less likely to receive no-cost, employer-provided PPE, and that employer provision of no-cost PPE may promote more regular use by Latino construction workers. If corroborated by more definitive studies on the topic, our results suggest that greater enforcement of OSHA regulations mandating employers to provide no-cost PPE to all workers, the provision of tax credits to incentivize contractors to provide PPE to workers, and public health initiatives to inform immigrant workers of employers' obligation to provide PPE all may play a role in reducing the occupational health disparities borne by Latino construction workers.

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NOTES

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