An Instrument to Measure Musculoskeletal Symptoms Among Immigrant Hispanic Farmworkers: Validation in the Nursery Industry

J. Faucett, J. Meyers, D. Tejeda, I. Janowitz, J. Miles, J. Kabashima

Abstract

We report on the construction and psychometrics of a survey measure of musculoskeletal symptomatology for use with Spanish–speaking immigrant farmworkers. Survey development included focus groups with workers, forward and backward translations, and pilot testing. The final survey includes a body diagram and items about symptom severity, frequency, and duration and about self–treatment, medical care, and job tasks. We report on the initial test of the survey with 213 commercial nursery workers in Southern California. Fifty–five percent of the workers reported pain, with 30% reporting back pain, 21% reporting upper extremity pain, 19% reporting lower extremity pain, and 10% reporting neck and shoulder pain. A composite symptom score exhibited acceptable test–retest reliability ($r = 0.41$, $p < 0.01$) over the annual agricultural cycle. Greater symptomatology was associated with greater frequency of self–treatment ($r = 0.42$, $p < 0.01$), seeking professional health care ($t = 2.49$, $p < 0.05$), and exposure to high–risk jobs (OR = 2.1, $p < 0.05$, CI = 1.0 to 4.4), supporting the validity of composite score.

Keywords. **Musculoskeletal disease, Pain measurement, Agricultural worker, Ethnic groups, Mexican American, Literacy.**

The research work of the University of California Agricultural Ergonomics Research Center (AERC) focuses on reducing painful work–related musculoskeletal disorders (WRMSDs) in the agricultural industry by improving the ergonomics of workers' job tasks. The majority of farmworkers in the nation are immigrant workers from Mexico, and to a lesser extent, Central and South America and the Caribbean. Because of the unique characteristics of this Hispanic workforce, we

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reasoned that their ability to use standard outcome measures of pain and symptomatology, commonly developed using English–speaking clinical populations, would be limited. We report here on the construction, reliability, and validity of the survey developed for use with this group of workers.

Farmworkers

The national agricultural workforce is dominated by Hispanic workers, foreign and U.S. born, who account for 68% of all hired farmworkers (Mines et al., 1997). Because this workforce is characterized by low literacy, modest or absent English skills, and a minority group culture, NIOSH designates them as a Special Population at Risk. Most speak Spanish as a primary language, and fewer than 10% speak English (Villarejo, 1999). Most have little or no formal education, and 67% are totally or functionally illiterate (Villarejo, 1999). Three fifths of all farmworkers live below the poverty level, with annual incomes of less than $10,000 (Papademetriou, 1999). In California, farmworkers average $6 to $7 per hour and work about 1000 hours per year (Martin, 1998). Furthermore, access to bilingual health care is limited, and only 10% have some form of employer–provided health insurance.

Because of their cultural, linguistic, and low literacy characteristics, this group of workers tends to be isolated, reinforcing their values for hard work, traditional systems of health and healing, and family ties. Work is regarded as essential to life, pain is an inevitable part of work, and thus work–related injuries and illnesses are to be borne. The concept of prevention is accepted only with reluctance (Wilk and Holden, 2000). Communities of workers are not well integrated into the larger English–speaking community. Thus, public health surveillance and outreach activities are constrained, with the result that workers rarely understand their legitimate access to public health resources or their rights as workers (Anderson et al., 2000). Their utilization of organized systems of health care is also limited, and they are unfamiliar with routines such as health assessment and history taking that are common in U.S. clinical settings.

Agricultural jobs place these workers at high risk for injury. Of all occupational illnesses or injuries, WRMSDs are the most common outcome for farmworkers (Villarejo and Baron, 1999). AERC studies have reported rates for WRMSDs of 4% for agricultural nursery workers and 8% for vineyard workers (Meyers et al., 1997; Meyers et al., 1998), well above the rates targeted by the U.S. Public Health Service in *Healthy People 2000* (objective 10.2) of an incidence of no more than 60 per 100,000 workers (U.S. Department of Health and Human Services, 1990). It has been estimated that 43% of all reported non–fatal disabling injuries in California agricultural work are musculoskeletal sprains and strains (AgSafe, 1992). The leading WRMSD is back injury, estimated among vineyard workers, for example, at 41% of all strains and sprains. Furthermore, these figures are probably conservative; underreporting of injuries and pain among farmworkers is common. Claim filing, for example, is unusual in this group because of the oversupply of labor and resultant job insecurity, and cultural attitudes towards employer relationships, utilization of organized health care, and public assistance (Wilk and Holden, 2000). Only eleven states require full worker compensation coverage for farm employees.

Ergonomic Risk Factors for Fruit, Vegetable, and Horticulture Crops

The survey was initially tested with workers in the commercial nursery industry. Horticulture is the fastest–growing segment of U.S. agriculture, and between 1993

and 1997, the combined productivity of horticulture, fruits, and vegetables (FVH) crops increased 14% to 25% (Martin, 1998). In California, fully 60% of agricultural production consists of FVH crops (Papademetriou, 1999). FVH crops, however, require intensive cultivation by hand, increasing ergonomic risk factors for injury (Wilk and Holden, 2000). To perform this hand–intensive and often stooped labor, California alone employs more than 750,000 workers per year, accounting for an estimated 25% of production costs (Villarejo, 1999).

Ergonomic risks for WRMSDs common to FVH hand–cultivation and harvest are characterized by tasks that are intensively repetitive (e.g., a nursery worker may repot 300 plants per hour), require heavy lifting (e.g., bins of harvested grapes typically weigh over 50 pounds), involve awkward sustained postures (e.g., strawberry harvest requires stooped labor for long periods), or require the frequent use of force (e.g., hand–held cutting shears are used to prune vines and trees) (Janowitz et al., 1998; Meyers et al., 1997). AERC studies have shown that ergonomics principles and methods may be applied successfully to analyze and redesign agricultural tasks and tools (Janowitz et al., 1998; Meyers et al., 1997). Using ergonomic job analytic procedures, for example, AERC team members have shown that seven nursery tasks involve high risk factor exposures: making plant cuttings for propagation, handling cans (pots) for transport to field, in–field pruning, spacing (moving) cans in planting beds, in–field weeding, labeling plants before shipping, and loading/unloading trucks.

To document the extent of musculoskeletal pain among this Hispanic farmworker population, characterize the ergonomics risks in the industry, and test the outcomes of intervention technologies, the AERC team needed symptom survey methodology that was appropriate to their culture, language, and literacy levels in terms of both measurement and design validity (Jones and Kay, 1992; Marin and Marin, 1991; Vega, 1992). The aim of the current study was to develop a measure of musculoskeletal symptomatology for use in the agricultural industry and report on its psychometric properties using data from nursery workers.

Methods

The AERC team followed a cohort of permanent workers from large commercial nurseries (200 to 700 acres) in Southern California. All permanent field workers in three nurseries were invited to participate in a study about job–related ergonomics hazards that has been reported elsewhere (Janowitz et al., 1998; Meyers et al., 1995; Meyers et al., 1997). These workers included those who worked outdoors in the field or who transported potted plants around the nursery. Only propagation workers, that is, those who worked inside greenhouses or propagation sheds, were excluded. Two eligible workers declined to participate in the study. We report here on data obtained from a baseline interview about painful musculoskeletal symptoms and job tasks, and on data from a follow–up interview one year later.

Sample

Workers (n = 213) participating in the nursery study (see table 1) were primarily young adults (mean = 38 years, sd 12.6 yrs.) educated in Mexico (mean = 5 years, sd = 4 yrs.). For the most part, they had immigrated from the Guanajuato and Michoacan areas of Mexico. They spoke predominately Spanish, although a minority understood some English. A relatively stable workforce, 82% had been in the U.S. for more than

Table 1. Demographics for men and women participating in the study in Orange County, California, 1996.

	Men (n = 184)		Women (n = 27)			
	Mean (SD)	Min–Max	Mean (SD)	Min–Max	T–value	P–value
Years of age	38 (13)	18 – 69	39 (10)	25 – 65	0.63	n.s.
Years of formal education	5 (4)	0 – 16	5 (3)	0 – 11	0.77	n.s.
Years working in the US	13 (8)	0.25 – 43	17 (7)	5 – 30	2.54	< 0.05

five years, 50% had worked in the nursery industry for more than five years (mean = 8 years, sd = 7 yrs.), and 38% had worked in the nurseries under study for more than five years (mean = 6 years, sd = 7 yrs.). Those who had been in the U.S. for less than five years tended to be younger and new to the nursery business. We did not ask about their legal immigration status.

Procedures

The development of the survey instrument consisted of three steps: (1) focus group discussions, (2) survey construction and translation, and (3) pilot testing and re–editing. We then examined the psychometrics of the resulting survey, inviting the entire sample of workers to participate in baseline and follow–up interview surveys. Informed consent for focus group and survey participants was obtained following group "tailgate" discussions about the study and individual question–and–answer sessions with study staff. The 20–minute symptom surveys were conducted at the worksite during working hours. Workers were not financially compensated for their time, but they did not lose wages because of their participation. Surveys were conducted in Spanish or English depending upon the worker's language preference and were administered by bilingual, bicultural interviewers following principles suggested by Marin and Marin (1991).

Step One: Focus Groups

To ensure that the symptom survey would be culturally and linguistically appropriate, we initially invited nursery workers to participate in 90–minute focus group discussions about key aspects of the survey design. Two men's and two women's groups, with six to eight members each, were held separately, as recommended by Marin and Marin (1991). A group facilitator and the third author (both Hispanic) conducted the groups in Spanish. The first author was also present to record non–verbal interaction and monitor the recording equipment. At the beginning of the focus group, investigators explained the purpose of the group, the procedures to be followed, the rationale for recording the session, and that all data would be kept confidential among research team members and not shared with nursery owners or supervisors. Group introductions and refreshments were offered to facilitate a comfortable environment for the discussions.

Symptoms are necessarily subjective and are defined as workers' self–reported experiences of musculoskeletal pain or discomfort (Larson et al., 1994). To best capture the workers' experiences of symptoms on a survey instrument, we posed several questions to the focus group members: (1) *How do workers in this setting describe their musculoskeletal symptoms?* (2) *Comment on whether your coworkers in the nursery could color the body diagram to indicate the location of their musculoskeletal symptoms. How many symptoms should we ask workers to color in on the diagram to capture the range of their musculoskeletal symptoms, and what*

colors should be used for each? Focus groups were presented with a copy of a blank body diagram. (3) *How easy would it be for your coworkers here in the nursery to use these four scales of pain severity?* Focus group members were presented with the Faces scale (Wong and Baker, 1988), a 100–mm visual analog scale (VAS), the verbal rating scale from the McGill Pain Questionnaire, and a 0–to–10 numerical rating scale. (4) *How do workers in your community commonly manage painful musculoskeletal symptoms at home and at work?* Participants in general appeared comfortable with the discussions and interested in providing information to the investigators. Following each session, tape recordings were transcribed and translated by Spanish–speaking assistants for analysis.

Analyses of the data transcribed from the focus group meetings indicated that the groups distinguished three types of painful musculoskeletal symptoms. The three types of symptoms nominated by the focus group members for inclusion on the survey were: (1) dull and aching pain, (2) sharp pain, and (3) numbness and tingling. For use with the body diagram, they selected blue for workers to indicate the first symptom, red for the second, and yellow for the third. Furthermore, focus group members and key informants reported that symptoms experienced by workers were preferentially called discomforts (*molestias*) in Spanish, while the Spanish word for pain (*dolor*) was reserved for symptoms that led to work loss and functional disability. The four symptom severity scales were scored based on the ranks given them by each focus group. The Faces scale was consistently ranked as the first or second choice for rating pain severity. The 100–mm VAS was consistently least favored across the four groups. Members of the groups generated a list of 39 Spanish descriptors that could be used to describe any type of musculoskeletal symptom or pain. They also generated a list of 26 self–treatments that might be used by coworkers, family members, and community members.

Step Two: Survey Construction and Translation

Following the focus groups, we constructed survey items and translated the survey. Focus group findings were used to develop a body diagram, identify the most useable measure of symptom severity, generate a checklist of symptom descriptors used to further define the three selected symptoms, and generate a checklist of self–treatments. Based on focus group comments, directions for completing the survey were designed to ask workers to report about their discomforts (*molestias*) as well as their symptoms (*sintomas*) of pain (*dolor*).

The body diagram. The body diagram that resulted from the focus group discussions has front and back views of the body and uses blue to designate dull and aching pain; red to denote sharp, persistent pain; and yellow to highlight numbness and tingling (fig. 1). Scoring is done by laying a transparent plastic grid with 33 divisions over the two views of the body, divisions are then counted and scored as the extent of the body affected by symptoms. The body diagram can yield scores for each symptom type (by color) and each body region (e.g. upper limb, neck and shoulder, back).

Symptom severity and other symptom characteristics. The Faces scale was chosen as the method to evaluate severity for the final survey. It offers a range of 0 to 5 for scoring each of the three symptoms. Additionally, items were constructed to ask about how many days out of the last 30 days a subject experienced each symptom, how many days each symptom episode lasted, and whether the symptoms improved, worsened, or stayed the same on days off work. This last item offers an indication of whether the symptoms reported by the worker are in fact work related.

EL DIBUJO DEL CUERPO

Ahora, por favor use el dibujo del cuerpo marca los lugares donde ha tenido dolores agudos, dolores persistentes en sus musculos, huesos o nervios en los últimos 30 dias.

Marca con el color azul en regiones que Usted tiene un dolor sordo y que no se quita.

Marca con el color rojo en regiones que Usted tiene un dolor fuerte o agudo.

Marca con el color amarillo en regiones que Usted tiene hormigueo o adormecido.

Please use the body drawing to mark the places where you've had acute or persistent aches and pains in your muscles, bones, or nerves in the past 30 days.

Use blue to indicate the regions where you have persistent dull or aching pain.

Use red to indicate the regions where you have sharp pain.

Use yellow to indicate the regions where you have numbness and/or tingling.

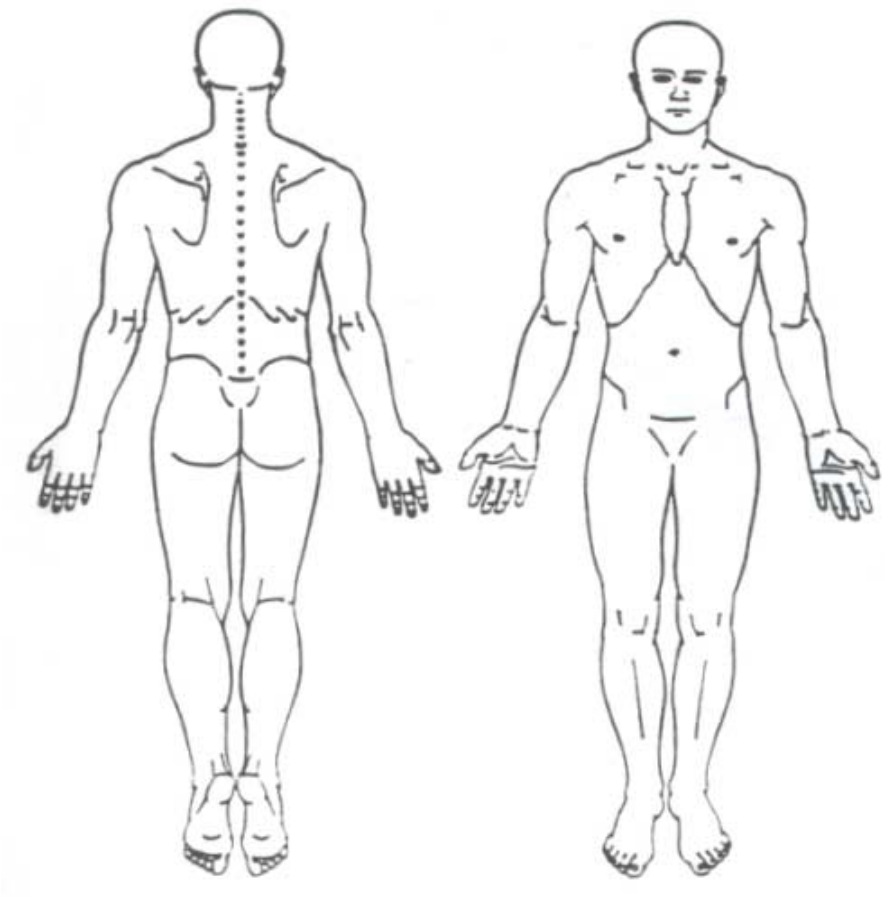

Figure 1. Body diagram used by workers to indicate their musculoskeletal symptoms.

Further defining the three symptoms. A checklist was developed for use in the baseline survey that listed 39 symptom descriptors. The worker scored each descriptor using a three–point scale to indicate how well each of the descriptors characterized each of the three symptoms on the body diagram. These scores were used to rank the descriptors and validate the leading qualities that each symptom represented.

Self–treatments. To validate the symptom severity measure and to explore workers' self–care, a checklist of 26 treatments was generated. These represent three conceptual categories: pharmacological treatments, physical treatments, and home remedies. Pharmacological treatments included prescription and over–the–counter medications. Physical treatments included applications of heat and cold; bandages, splints, or corsets; and massage. We asked about back belts; however, because they are mainly used to prevent injury in this industry, we did not include them under physical treatments. Home remedies included herbal teas and salves, prayer, folk massage (*sobado*), and copper bracelets. Workers were asked to indicate how many days in the last 30 days they had used each type of treatment.

Translation procedures. Items and directions for completing the body diagram and survey were constructed in English and then subjected to forward and backward translation procedures. Lay and professional translators were used to assure that the final translation would reflect local vocabulary familiar to workers in the nursery and be usable in other settings by a variety of Spanish–speaking, low literacy workers.

Step Three: Pilot Testing

The Spanish language version of the survey was reviewed with two key bilingual informants in the nursery industry who offered comments about its usability among nursery workers. After minor editing, it was then tested with 10 nursery workers to see if they could comprehend it and use it easily. At this point, only minor additional editing was required to make the survey answers easier for the interviewers to record.

Psychometric Testing

We developed a composite score from the survey items to represent the worker's experience of painful musculoskeletal symptoms over the last month and examined its test–retest reliability and predictive validity. To determine the symptom composite score, a three–way cross product was computed using the sum of the regions marked by the worker on the body diagram for each symptom (e.g., all regions colored with red), the severity score for that symptom (e.g., using the Faces scale score for sharp pain), and the number of days out of the last 30 the subject experienced the symptom (e.g., for sharp pain). Finally, the cross product scores for all three symptoms (i.e., blue, red, yellow) were summed to obtain the final symptom composite score. The composite score allowed us to compare workers on their overall experience of musculoskeletal symptoms. The severity of symptoms for individual regions, such as the hand or back, may be computed similarly, using just those regions of the body diagram. A second summary score was computed from the list of self–treatments. The maximum number of days the individual used any self–treatment was computed for a subset of 10 commonly used self–treatments to determine an overall frequency score for self–care. The results of the psychometric analyses, using the baseline and follow–up surveys, are reported below.

We also planned to use the VAS to validate the Faces scale as a measure of symptom severity. The VAS and Faces scale severity items were randomly ordered, directions for their use were offered up to three times per worker, and an example for fatigue was given if the worker did not comprehend the directions the first time.

Results

Descriptive Results

The body diagram. Fifty–five percent (n = 118) of the workers participating in the baseline survey reported some type of painful musculoskeletal symptom, with 40% (n = 86) reporting aching, 7% (n = 15) reporting sharp pain, and 19% (n = 41) reporting numbness. Sixteen workers reported two types of pain, and four workers reported all three types.

Table 2 shows the distribution of symptoms by location for the total sample and by type and location for the symptomatic workers. The majority of workers reporting symptoms reported back pain, and the most common symptom, regardless of body location, was aching.

Symptom severity and other symptom characteristics. Table 3 describes the frequency, duration, and severity of the symptoms experienced by the workers. Episodes of sharp pain were longer than those associated with aching or numbness, consistent with workers' endorsement of "persistent" as a key descriptor of sharp pain. Sharp pain was also more severe than either aching or numbness. Furthermore, workers reporting sharp pain were more likely to state they experienced it every day (20% as compared to 11% for aching and 12 % for numbness).

Further defining the symptoms. The workers used the descriptors "tiring" and "sore" to describe each of the three symptoms. However, each symptom was also distinct from the other two by its association with unique additional descriptors, indicating that the symptoms represented different experiences for the workers. The descriptors ranked most highly for aching pain were: tiring (1st), sore (2nd), annoying (3rd), heavy (4th), shooting (5th), and throbbing (6th). Ranks are shown in parentheses. Sharp pain was described as persistent (1st), constant (2nd), and piercing (6th), in addition to tiring (3rd), sore (4th), and shooting (5th). Numbness was described as like crawling ants (*hormigueo*, 3rd), like it is asleep (*adormecimiento*, 4th), tingling (5th), and swollen (6th), in addition to tiring (1st) and sore (2nd).

Table 2. Location of three types of musculoskeletal pain reported by agricultural nursery workers in Orange County, California, 1996.
(Note: some workers reported more than one location or type of pain.)

Location of pain	Proportion of total sample (N = 213) reporting pain in each location, percent (number)	Proportion of symptomatic workers (n = 118) reporting pain in each location		
		Aching, percent (number)	Sharp Pain, percent (number)	Numbness, percent (number)
Back *(sacroiliac to mid–scapula)*	30% (71)	49% (58)	8% (9)	4% (5)
Upper extremity *(hands to lower margin of deltoid)*	21% (44)	19% (22)	2% (3)	20% (24)
Lower extremity *(hips to feet)*	19% (40)	16% (19)	5% (6)	14% (17)
Neck and shoulders *(mid–scapula to 2nd vertebra, including deltoids)*	10% (22)	14% (16)	5% (6)	2% (2)
Any location	55% (118)	73% (86)	13% (15)	35% (41)

Table 3. Frequency, duration, and severity of three types of musculoskeletal symptoms reported by agricultural nursery workers in Orange County, California, 1996.

	Aching (n = 86)			Sharp Pain (n = 15)			Numbness (n = 41)		
	Mean	Median	SD	Mean	Median	SD	Mean	Median	SD
Number of days experienced out of the last 30 days	7.9	4.0	8.2	13.2	9.0	11.1	6.3	5.0	7.2
Number of days of the last episode	1.5	1.0	1.9	6.1	2.0	9.8	1.4	1.0	1.3
Severity for the last 30 days	2.2	2.0	0.7	3.3	3.0	0.7	2.0	2.0	0.6

Self–treatments. Workers reporting musculoskeletal symptoms used self–care approaches significantly more frequently ($t = 4.35$, $p < 0.01$) than those reporting no symptoms, and this finding held true for all three categories of treatment. The top quartile of symptom reporters, for example, used self–care treatments 11 days out of the last 30, whereas the same quartile of non–reporters used self–care treatments only 1 day over the same time period. Nonetheless, there was wide variation in the use of many individual treatments.

Symptom reporters tended to use pharmacological treatments (mean = 3 days, sd = 6 days) and home remedies (mean = 3 days, sd = 9 days) more frequently over the last 30 days than physical treatments (mean = 2 days, sd = 6 days). For symptom reporters, prayer was distinctly important. Workers reporting aching pain, for example, used prayer (mean = 2 days, sd = 7 days) as often as prescription or non–prescription medication, while those reporting sharp pain used prayer (mean = 10 days, sd = 15 days) more often than any medication. By comparison, asymptomatic workers used prayer infrequently (mean = 0.5 day, sd = 4 days).

Psychometrics of the Composite Symptom Score

The test–retest reliability of the composite symptom score was estimated by examining the correlation between the baseline and follow–up scores one year later for 108 people whose jobs were unchanged over the year. The Pearson Product Moment correlation for these two composite symptom scores was found to be moderate and significant ($r = 0.41$, $p < 0.01$), and thus satisfactory considering the time elapsed.

The predictive validity of the composite symptom score was evaluated by examining several correlates. First, we examined the association between the composite symptom score and the summary treatment score, assuming that self–treatment would be undertaken more frequently by subjects with greater symptomatology. The correlation between the number of days of treatment undertaken by subjects during the last 30 days was found to be significantly associated with their symptom scores ($r = 0.42$, $p < 0.01$). A similar correlation was found for the treatment and symptom scores on the follow–up survey ($r = 0.33$, $p < 0.01$), suggesting consistency over time. Additional support for predictive validity was evidenced by the fact that 32 workers who sought professional health care in the preceding year for injuries reported significantly higher composite symptom scores ($t = 2.49$, $p < 0.05$) as compared to those who had not sought such help.

To further assess predictive validity, we evaluated the degree to which the symptom scores predicted which workers were in high–risk jobs, as characterized by task ergonomics. Nursery jobs associated with repotting plants at a conveyor belt (canning) and moving them from one site to another (spacing) require highly

repetitive lifting and twisting and bending of the back as well as pinching and grasping of pots. These jobs were identified as high–risk jobs using ergonomic checklists and other forms of evaluation (Janowitz et al., 1998). Symptomatic workers proved twice as likely to be in one of these high–risk jobs (OR = 2.1, $p < 0.05$, CI = 1.0 to 4.4).

Additional Analyses

Gender comparisons. Chi square tests indicated that men (n = 184) and women (n = 27) did not differ in terms of the frequency with which they reported symptoms overall nor the distribution of their symptom reports across the three types of symptoms. Student's t–test also indicated that they did not differ in terms of their composite symptom scores. Considering the entire body diagram, symptomatic women reported significantly more widespread aching than men (women: mean = 3.65 sites, sd = 2.67; men: mean = 1.91 sites, sd = 2.04; t = 2.56, $p < 0.05$), but not more extensive sharp pain or numbness. Considering the four specific regions of the body, women reported significantly more neck and shoulder symptoms (women = 22%, men = 8%, $chi^2 = 5.2$, $p < 0.05$) but did not differ for the other three regions.

Visual Analog Scale. We originally planned to use the VAS to examine the validity of the Faces severity scale, but this proved problematic. Focus group members suggested that the VAS would pose difficulty for the nursery workers and, in fact, we found that only 28% of the workers who reported aching using the Faces scale could comprehend how to use the VAS well enough to complete it. Furthermore, the correlation between the Faces scale and the VAS for these symptomatic workers was very low (r = 0.05, ns).

Final revision. As a result of this study, we have developed a final version of the Spanish–language symptom survey. Subjects are first asked to complete a body diagram, with front and back views, using up to three colors to indicate the painful symptoms they experience. After finishing the body diagram, they are then asked about the severity, frequency, and duration of each of the symptoms they have colored on the diagram and about medical care. To identify whether the symptoms may be work–related or not, an item is included that asks whether the symptoms improve on days off work. Finally, a list of self–treatments is reviewed with them, and they are asked to indicate how many days in the last month they have used each type of treatment. The final survey also includes demographic items and items about the job tasks performed by the worker.

Discussion

Ergonomic risk factors for occupational musculoskeletal injuries and disorders of the back and upper and lower extremities are common in agriculture. Reviews of the literature on back injuries and low back pain (Andersson, 1982; Frymoyer, 1988; Pope, 1989; Parniapour et al., 1990; Garg and Moore, 1992) indicate that heavy physical work, repeated lifting, and twisting are consistently associated with greater risk. Reviews of the literature also identify repetitive wrist and finger movements, forceful hand contractions, extreme wrist flexion or extension, pinch grip, contact stress at the base of the palm, and vibration as risk factors (Armstrong and Chaffin, 1979; Gerr et al., 1991; Erdil et al., 1994; Kelsey and White, 1980; Armstrong, 1986;

Moore, 1992). Such activities and factors are especially common in the hand–cultivation of FVH commodities.

The Bureau of Labor Statistics has reported that the number of work–related musculoskeletal disorders of the back and extremities is increasing faster than any other occupational illness category. In 1980, these disorders comprised 18% of all reported cases of occupational illness, increasing to 38% of that total by 1989. In 1989, the number of cases was more than six times the 1980 rate. The Bureau of National Affairs (1991) estimates that there are 22.4 million cases of back pain in the United States, about half of which are thought to be caused by a work activity or an on–the–job injury. Work–related musculoskeletal disorders of the back and the upper and lower extremities also account for a majority of workers' compensation dollars. Low–back pain is the most frequently cited cause of disability in persons aged 45 or younger (Andersson, 1982), results in more time lost from work than non–back injuries (Clemmer et al., 1991), and independently accounts for a significant portion of workers' compensation costs (Spengler et al., 1986; Webster and Snook, 1990). A review of workers' compensation records for 26 states, for example, revealed that 20% of claims were filed for back injuries (Klein et al., 1984).

These trends have prompted NIOSH and others to place growing priority on research to control musculoskeletal disorders. In 1997, California Occupational Safety and Health Administration promulgated the nation's first workplace ergonomics standard aimed at repetitive motion injuries and included agriculture as a regulated industry. AERC research has demonstrated that ergonomic principles and techniques can be employed successfully in agriculture to control these risks and evaluated by assessing musculoskeletal outcomes (Janowitz et al., 1998; Meyers et al., 1995; Meyers et al., 1997). The history of symptoms such as pain, numbness, and stiffness, and eventually weakness, constitutes the most commonly used clinical criteria for diagnosing these soft tissue disorders, depending on the type of disorder and body location (Gerr et al., 1991; Rempel et al., 1992). Therefore, reliable instruments to measure symptoms are important for clinical assessment, medical surveillance, and intervention research.

In the case of immigrant Hispanic farmworkers, however, a wide variety of social factors including culture, literacy, and language pose barriers to the reporting of symptoms and injuries to employers and health care providers (Villarejo and Baron, 1999; Wilk and Holden, 2000). We have worked with members of this population to develop a Spanish–language symptom survey that is brief to administer and offers a scoring system that demonstrates good reliability and validity for use with these workers.

Use of the survey in this study demonstrated that musculoskeletal symptoms were common among agricultural nursery workers. Over 50% of the workers reported musculoskeletal symptoms, and for many those symptoms recurred or persisted over time. Furthermore, symptom severity was higher among those workers who sought professional care for injuries, suggesting that the survey may be used to identify early indicators of injury. Finally, the severity of the workers' symptoms corresponded to the ergonomic risks of their work tasks. These findings suggest that health care providers should inquire about musculoskeletal problems when treating agricultural workers and should assess the ergonomic risks associated with their work tasks. Furthermore, engineering, administrative, and behavioral interventions such as redesigned tools, redesigned jobs, and worker ergonomics training should be implemented to reduce these work–related and preventable symptoms.

We have also demonstrated several problems with the use of standard methods to assess pain in this population. Workers in the focus groups rejected use of the visual

analog and numeric scales as too difficult or obscure for their coworkers to comprehend and use. In fact, only a minority of the workers who reported aching pain using the Faces scale could complete the VAS. Most of the workers reported minimal formal education, and it may be that basic arithmetic or mathematics training is needed to comprehend the VAS and numeric scales. Other researchers have suggested that the Hispanic culture and Spanish language of these workers do not promote a quantitative approach to measuring symptoms (Baer, 1996), and the appeal of the Faces scale may derive from its greater affectivity and more basic conceptual level.

Furthermore, Hispanic workers preferred to label their symptom experiences as *molestias* (bothersome discomforts) rather than use *dolor* (frank pain), perceiving that they were able to work, had not experienced major functional impairment in their life roles, and were not suffering illness. Others have previously reported these attitudes towards function and illness among Hispanic immigrants (Baer, 1996). In fact, many workers acknowledged the use of analgesia and multiple self–care approaches to pain management while denying painful symptoms. Thus, we found that items about self–treatment were a valuable addition to the symptom survey. Finally, workers' responses may have been facilitated by offering three types of symptoms (aching, sharp pain, and numbness) on the survey as suggested by the focus groups. Direct translations from English into Spanish of surveys that evaluate only pain (*dolor*) may not adequately capture the experience of musculoskeletal symptoms among Hispanic farmworkers.

The composite score does not lend itself as well to clinical work with individual patients as it does to outcomes evaluations of intervention research or program design. The score for sharp back pain, for example, may be the same as for persistent hand numbness. Instead, the score provides an overall evaluation of symptoms that can be readily compared among populations. Nonetheless, the body diagram with its specific directions, the Faces scale and the other items used to characterize symptoms, and the self–treatment list may be of benefit to clinicians who serve the population of immigrant farmworkers.

Pain is a universal human experience, endured by nearly everyone regardless of culture or ethnicity. Nevertheless, the manner in which the experience of pain is expressed, shared, or masked is unique to the cultural group. Assessment to identify early indicators of musculoskeletal injury or responses to treatment will be enhanced by using approaches that are appropriate for the language, literacy, and culture of the worker population. Furthermore, efforts to reduce WRMSDs in agriculture and to control related ergonomic risk factors will require health outcome measures that are reliable and valid for use with the group under study. AERC researchers have developed a measure of musculoskeletal symptomatology for use with Hispanic farmworkers and tested it among nursery workers. Further testing of the survey is currently being extended to Hispanic vineyard and field agricultural workers throughout California. There is a need to develop similar measures for other groups of immigrant workers.

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